

NORDIC SMART CONNECTIVITY

Current state



Nordic
Innovation



ACKNOWLEDGEMENTS

We would like to express our sincere appreciation to all respondents from research, public authorities and companies who have provided input to this report.

DISCLAIMER

This publication is part of the work facilitated by Nordic Innovation. The authors are responsible for its content.

ABOUT NORDIC INNOVATION

Nordic Innovation is an organization under the Nordic Council of Ministers. Nordic Innovation aims to make the Nordics a pioneering region for sustainable growth and works to promote entrepreneurship, innovation, and competitiveness in Nordic business.

Demos Helsinki

Halogen

Rambøll Management Consulting

RISE

TABLE OF CONTENT

1	Introduction – why this report?	3
1.1	Nordic Smart Connectivity	5
1.2	About this report	5
1.3	Insight and information gathering	6
1.4	The way forward	6
2	Data as a driver for Smart Connectivity	8
2.1	The role of EU and data	9
2.2	Data and smart connectivity	12
2.3	Key take aways	15
3	Overview of the areas of Nordic Mobility	16
3.1	Personal Mobility Overview	16
3.1.1	Trends in personal mobility	17
3.1.2	Challenges in personal mobility:	21
3.1.3	Opportunities in personal mobility	21
3.2	Road and Traffic management Overview	22
3.2.1	Data challenges and opportunities	23
3.2.2	Country nuances	23
3.2.3	Key take aways	24
3.3	Logistics Overview	25
3.3.1	Challenges	26
3.3.2	Role of data & connectivity	29
3.3.3	Key take aways	32
4	Summary	33
5	Appendix - Catalogue of relevant projects	35



Chapter 1

INTRODUCTION

Why this report?

The aim of the Smart Connectivity initiative, run by Nordic Innovation, is to facilitate innovation and change within the transport sector through, e.g. establishing a Nordic data space for data sharing across the sector, within and across national borders. The objective is to make it easier for Nordic companies to share data to optimize operations and contribute to a more climate-efficient and profitable transport sector.

Policy makers currently rally to the notion of a “twin transition” - ‘green’ and ‘digital’¹, taking advantage of the rapid development of data driven innovation to achieve sustainability. In an era marked by rapid urbanization and an ever-expanding global

population, the dynamics of personal mobility, road and traffic management, and logistics have evolved at an unprecedented pace. This report present snapshots of the current state of these interconnected domains, uncovering not only innovative digital solutions, but also multifaceted challenges that define the introduction of digital technology and data driven business models in the transport sector.

Lastly, the insights contained in this report provide the baseline for the process of defining prioritized areas for innovation in both mobility and logistics. This process will be documented in the ‘Systemic Innovation Compass’, to be published shortly after this one.

¹ See e.g. Muench, S., Stoermer, E., Jensen, K., Asikainen, T., Salvi, M. and Scapolo, F., Towards a green and digital future, Publications Office of the European Union, Luxembourg, 2022, doi:10.2760/977331, JRC129319.



At some point we would have a mobility bill just like a cell phone bill. You'd use different services and then pay up at the end of the month.

Ole Harms

CEO, VAVIVA/VW Group

1.1 Nordic Smart Connectivity

The Nordic Smart Connectivity project has been running since August 2022 and is part of the larger “Nordic Smart Mobility and Connectivity” programme within the Nordic Innovation portfolio.² The project will contribute to the program’s goals of speeding up the transition to sustainable mobility in the Nordic region by changing the way people and goods move through collaborative innovation initiatives. The aim is to make the Nordic countries worldwide leaders in sustainable mobility. The programme hopes to have impact on two focus areas; on a societal level – with sustainable, secure, energy-efficient, and decarbonised mobility – as well as on an individual level, contributing to seamless, integrated and people-centric mobility, enhancing quality of life, accessibility, flexibility and creating value for people.

At the same time, the Smart Connectivity project hopes to make data sharing easier for Nordic mobility companies to optimise operations and thus contribute to sustainable mobility and increased competitiveness for Nordic companies.

These are ambitious goals, which hint at a transformation of the Nordic mobility sector and presuppose that connectivity and data sharing have a part to play in it. Therefore, this project aims to provide a systemic, future-fit perspective on how connectivity can play a role in the sustainable transformation of the mobility sector in the Nordics.

The consortium working in the Nordic Smart Connectivity project consists of four partners: Demos Helsinki from Finland, with expertise in foresight; Halogen from Norway, with expertise in design and innovation; Rambøll, with representation across the Nordics and represented by the Norwegian office, with management consulting expertise; and lastly, RISE from Sweden, with expertise in research.

1.2 About this report

The aim of this report is two folded:

1. Present an **overview of different domains** within **smart connectivity**. This means that we will investigate:
 - a. Three domains within smart connectivity; “personal mobility”, “logistics” and “road and traffic management”
 - b. Data as such, and within the domain of smart connectivity
2. Present some of the **overall challenges** found so far, specific, and generic, and that will form a basis for the next step in this project, namely, to prioritize the areas for the calls that test the systemic model that this project is based upon.

² <https://www.nordicinnovation.org/mobility>

1.3 Insight and information gathering

Since September 2022, DemosHelsinki, Halogen, Rambøll and RISE - the consortium - has performed information gathering, synthesising and analysis from various sources. The starting point was the Smart Connectivity pre-study on viable options for investing the program budget, delivered to Nordic Innovation from Steerlink Partners in August 2022. From this, the consortium has identified and reached out to a broad array of stakeholders through individual interviews and workshops, as well as desktop research.

This report is built on knowledge gathered and synthesised from many diverse sources. The consortium has invited close to one hundred stakeholders³ around the Nordics to share their insight, and we executed workshops on different topics throughout the project period. In addition, desktop studies have been performed, as well as building on the domain knowledge and experience that is found within the consortium itself.

Workshops were arranged under the headlines of the different workstreams Research, Current- and Future State. Interviews have followed a semi-

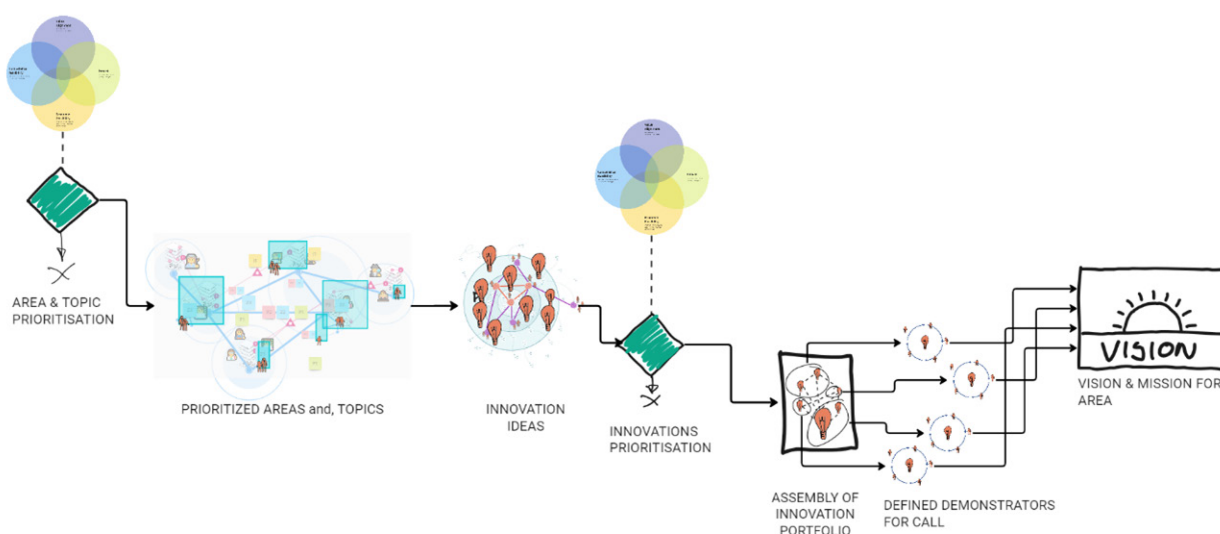
structured format to enable the stakeholders to speak as open and freely as possible, recognizing that we have had to been open and flexible throughout the project.

1.4 The Future State

The insights gathered in this report provide the basis for a process in which we moved from the current challenges identified in mobility and logistics towards a call for project proposals. Stakeholders from the industry were invited to a participatory process to determine which areas hold the most opportunities for innovation and should be prioritised. Ideas for innovation around these prioritized areas were outlined and connected as thematic innovation portfolios. Based on the project's own impact and feasibility criteria as well as the Future Visions developed co-creatively with the industry, we have elected a few of those to form the basis of a call for project proposals. Learnings from this process can ultimately be applied to other areas of mobility.

The results from this process were documented in the Future State report, which will be published soon after the publication of the call for project proposals.

Figure 1: Project method



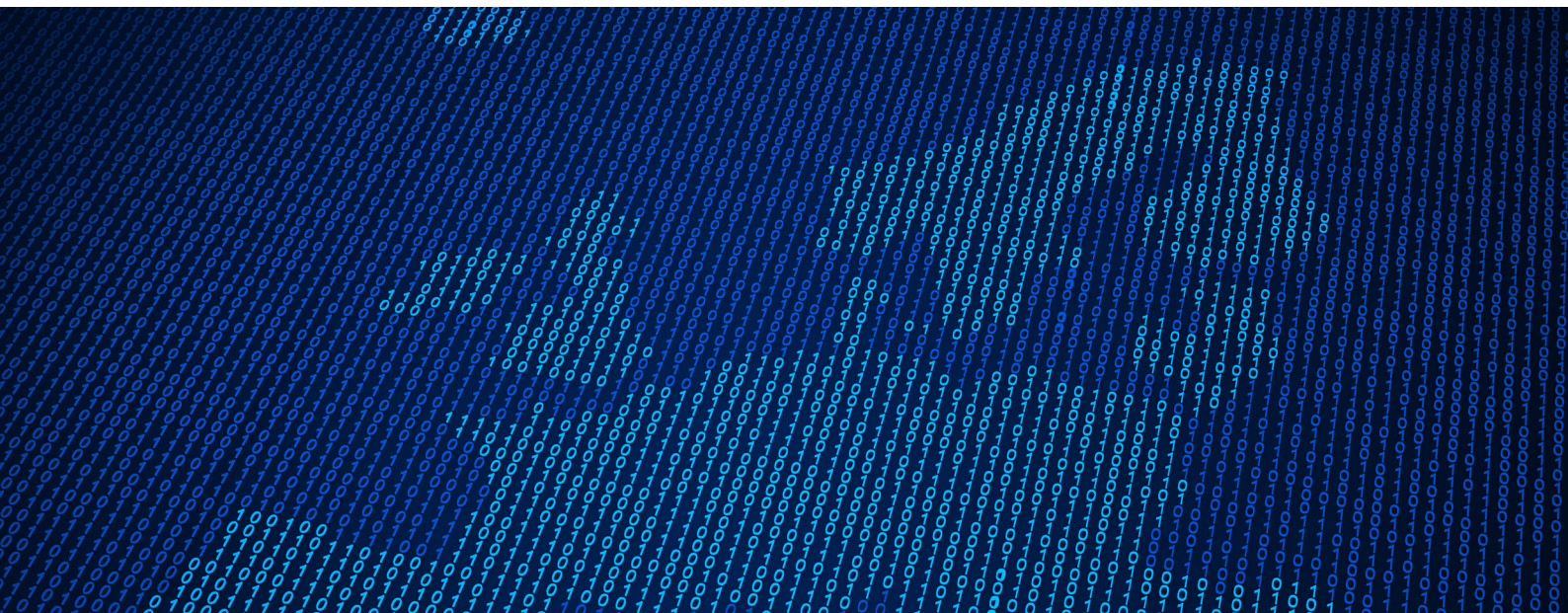
³ See this report's annexes for a list of organizations involved in the project.



For the first time in a century, we have mobility technology that won't just incrementally improve the old system but can completely disrupt it... A total redesign of the surface transportation system with humans and community at the centre.

Jim Hackett

CEO, Ford



Chapter 2

DATA AS A DRIVER FOR SMART CONNECTIVITY

Increasingly, data is used to enhance the collective capacity to respond to grand societal challenges, including mobility of goods and people. In particular, the digitalisation of public organisations' information systems and public services has increasingly made data sources available to a broader public. At the same time, private actors collect an ever-increasing amount of data through IoT devices used by their customers.

Data-driven innovation concerns both the private and public space, and data itself has been referred

to as both “the new oil”¹ and a ‘social good’.² New data driven business models are explored by incumbent firms as well as start-ups while several interest groups, support organisations, and projects across the world explore how these data may generate growth and/or serve public interest by informing decision-making, generating new scientific insights, and resolving policy issues or enhancing public service delivery.³

Relevant data for solving complex social challenges are often stored across different private and public actors that collect them with different goals and

¹ An oft used phrase, generally credited to mathematician Clive Humby in 2006

² Farmer, J., McCosker, A., Albury, K. and Aryani, A., 2022. Case Studies of Data Projects. In *Data for Social Good: Non-Profit Sector Data Projects* (pp. 27-62). Singapore: Springer Nature Singapore.

³ European Commission. 2020. “EU DATA STRATEGY.”

reasons. Therefore, it has been suggested that implementing data for socially relevant outcomes primarily requires the collaboration of actors from different sectors (private, public, and not-for-profit), pooling their knowledge, resources, and competences.

The mobility sector is no different and the potential for digital transformation for increased sustainability using mobility data as a foundation carries high hopes in private and public sectors alike.

2.1 The role of EU and data

Data has for many years and from most national and international political spheres been described as a key component in solving existing challenges, as well as laying the ground for economic and social growth, better public service providing and more.

In its introduction to the European strategy for data, the European Commission (EC) states that the economic impact of data is huge, and that most economic activities will depend on data within a few years (2021⁴).

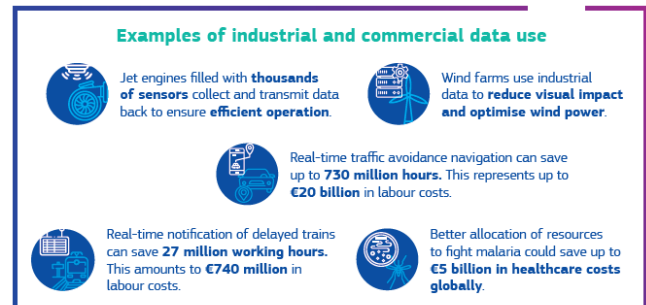
The European Commission continues:

“The value of the data economy of EU27 was almost €325 billion in 2019, representing 2.6 % of GDP. The same estimate predicts that it will increase to over €550 billion by 2025, representing 4 % of the overall EU GDP (Source: Final Study Report: The European Data Market Monitoring Tool). In this future scenario, Europe makes progress in the investment and deployment of independent data infrastructures and digital resources, also leveraging the new Horizon Europe and Digital Europe Programs. This means Europe reaches a high level of technological sovereignty.”

It is no coincidence that several of the examples chosen by the EC in the illustration above are related to connectivity and mobility. The future of smart mobility and connectivity will obviously be driven by data, like many of the areas of digital

transformation. The EU’s data strategy recognises that data is an essential source for economic growth, competition, innovation, and job creation. It is the basis for a general progression in and of our society.

Figure 2: Examples of industrial and commercial data use



Source: *Shaping Europe’s digital future – Building a data economy- Brochure*

Since the strategy was adopted in 2018, the European Commission has proposed several political and regulatory initiatives on the processing, sharing, use, further use, and reuse of data, all to release the potential of different types of data and to create a common European data space.⁵

The EU has pushed forward a combination of policies and initiatives they believe are key to unlock the potential of mobility data, and thus supporting digital and green transformation. The European strategy for data relies on a set of complementary actions:

- Setting clear and fair **rules on data access**, use and governance across sectors.
- Investing in next-generation **tools and infrastructures** to store and process data.
- Joining forces to build a European federated **cloud capacity**.
- Deploying common and interoperable **data spaces** in key sectors to help pool, share and re-use data.
- Developing **competences** by investing in digital skills, data literacy and capacity building in SMEs.

⁴ <https://digital-strategy.ec.europa.eu/en/library/building-data-economy-brochure>
⁵ <https://digital-strategy.ec.europa.eu/en/policies/strategy-data>

These policies form a cross-sectoral legislative framework for data, such as:

- General Data Protection Regulation (GDPR - adopted)
- Open Data Directive (ODD - adopted)
- Data Governance Act (DGA - adopted)
- Data Act (DA – not adopted)
- Interoperable Europe Act (IEA – not adopted)

In addition to these, there are several other regulations, including the Artificial Intelligence Act, a new European identity framework (eIDAS 2.0) and the availability of digital services across national borders (SDG). In addition to the general regulations mentioned above, several initiatives deriving from or related to these regulations are focused on a specific domain, including a European Mobility Data Space, one of nine sector specific data spaces.

To achieve continuous and interoperable services in Europe, the EU ITS Directive (2010/40/EU) instructs the EU/EEA member states to establish a National Access Point (NAP) to make open road and transport data available. In addition to the regulation itself, the ITS Directive gives the European Commission the authority to define delegated regulations⁶ with detailed specifications:

- Delegated regulation 885/2013 – Information services for safe and secure parking
- Delegated regulation 886/2013 – on the provision, where possible, of road safety-related minimum universal traffic information free of charge to users (SRTI)
- Delegated regulation 962/2015 – on the provision of EU-wide real-time traffic information services (RTTI)
- Delegated regulation 1926/2017 – on EU-wide multimodal travel information services (MMTIS)

The National Access Point Coordination Organization for Europe - NAPCORE – has been

set up to coordinate and harmonize more than 30 mobility data platforms across Europe. With the exception of Iceland, all Nordic countries has one or more NAPs. The Quality and quantity of data can vary from NAP to NAP.⁷

There are also several other projects, initiatives, etc. that are tasked with mapping of data. In the mobility-domain, the PrepD4Space-project is of particular interest as they are researching and exploring such ecosystems across the continent to get an extensive overview of the current European landscape.⁸ Clusters of data can be both geographically, e.g., NAPs or other national data-repositories, or on topics.

Despite all the different initiatives throughout the last two decades, developed and delivered based on a unified and unilateral perspective on the importance and potential of data, we are still looking for ways to achieve the main goal: to bring data to the centre of our digital transformation in a systemic way.

The overall picture is that there is enough data to make any transformation possible, and that the challenge for releasing the potential in data lies elsewhere. These could be related to other issues such as:

- **Semantic** (what a particular point of data means in a specific context and database)
- **Regulatory**
- **Technical**
- **Administrative**

We see that the issues relating to the data that is already existing, could be that they might not be available in the right quality, the right format, or that (re)use is challenged by different regulatory obstacles, or not being made available do to more culturally related reasonings (data from public entities data) or because of copyright, IP, business secrets, competition law, contractual arrangements etc. (data from private entities).

In addition to the regulations and mapping

⁶ <https://transportportal.atlas.vegvesen.no/en/gen/its/>

⁷ <https://napcore.eu/description-naps/>

⁸ <https://mobilitydataspace-csa.eu/inventory/>

initiatives, some informants mentioned procurement as an issue in relation to data. Procurement is an important tool for Public Sector to also steer markets, in addition to acquire different products (both goods and services). This could for instance be when products procured by the public comes with sensors (IoT), gathering data for numerous reasons.

Example:

A hospital has a tank of fuel for generators

1. A sensor in the tank sends a signal when the fuel has dropped to a certain level
2. Based on the signal, a description of the fuel is linked into a shopping basket
3. In ex. There are 10 suppliers of fuel who have qualified under the Dynamic Purchasing Scheme
4. A request is sent out to the X suppliers with a generic description and the desired quantity
5. The suppliers associated with the DPS complete an offer
6. The hospital imports the offers and automatically validates them and chooses a winner
7. Orders are sent out to the selected supplier, they confirm and deliver
8. The supplier sends an invoice with the order number attached.
9. The hospital matches the order with the invoice and makes a payment

As this example shows, access to sensor-data could assist Public Sector to make services offered more effective, the procurement process itself simplified, and both otherwise improved.⁹

We see that the many initiatives, both on regulation, general and specific, as well as mapping, geographically or sectoral, so far have not enabled the release of data's full potential. This could lead to a conclusion that more governance, insurances of quality and more levelled and coordinated implementation of regulation could be needed. This could lead to more semantically interoperable data sources, making them more easily accessible. These issues are also a focus e.g., at the NAPCORE Mobility Data Days that was arranged 9 November 2023, when topics such as "Improving National Access Point interoperability through harmonisation of their Level of Service" and "A roadmap or the alignment and harmonisation of NAPCORE-related data exchange standards" are discussed.¹⁰

⁹ The Data Act introduces measures that enable users of connected devices to access the data generated by these devices and by services related to these devices. Users will be able to share such data with third parties, boosting aftermarket services and innovation. Simultaneously, manufacturers remain incentivised to invest in high-quality data generation while their trade secrets remain protected.

¹⁰ <https://napcore.eu/mobility-data-days-2023/>

2.2 Data and smart connectivity

All digitalisation is dependent on data, and its value has been characterized as the key driver of the digital economy and the amount of mobility data is growing rapidly. For instance, while adoption rates of digital vehicle telematics services grew slowly to around 20% for quite some time,¹¹ the automotive sector is now poised for an accelerated development. As new vehicles roll off the assembly lines, a growing part of the global vehicle fleet is 'connected'. Digital double-sided markets are becoming commonplace, connecting producers and consumers of mobility services for goods and people, generating vast amount of data on mobility patterns around the globe. Indeed, most activities involving companies, authorities or citizens can produce digital data if a device or application can be used to capture it.

As opposed to oil, data is unlike a physical commodity or service and capturing the value of data is an inherently difficult task. Data can be seen as non-rival, excludable, synergetic, easy to scale, and having externalities and low specificity.¹²

Data is inherently non-rival as it can be accessed and used by any number of actors, bandwidth permitting. However, access is often made exclusive by means of business models or regulation. Data tends to increase the amount of data by implication¹³ as data analyses, data interpretations, and data-driven algorithms tend to increase the total amount of data over time. Dynamic pricing algorithms - for a ridesharing service, for instance - that adapt pricing to changes in demand, improves from previously gathered data. The more data about demand changes available, the better the fine-tuning of the algorithm.

Not all activities provide equally important data

for all purposes, but data generated and collected by one person or company may be of great use for someone else or could increase in value if combined with data from somewhere else. Any piece of useful data can be viewed as a highly malleable and non-specific complimentary asset¹⁴ potentially forming an essential component of a digital mobility service that can be shared by an infinite number of users. Valuations of data need to be understood in terms of their use as they do not produce actual value until analysed and utilized purposefully. This involves a chain of non-trivial activities often involving many organisations and discrete data sources. While technical and mathematical principles have been suggested for the evaluation of data for a certain analysis and use,¹⁵ many potential challenges are more related to business issues or organisational culture.

There is a rapidly growing ecosystem of organisations, public and private, collecting mobility data for various purposes – to aggregate and sell it as such or to analyse it and sell that analysis as a service of some sort in a data driven business model.¹⁶ Analytics can be described as a combination of one or more of descriptive, predictive, and prescriptive analytics activities.¹⁷ As an example, various types of traffic information can be analysed in several ways to gain different types of progressively more advanced capabilities. A descriptive analysis would aspire to accurately determine and describe the current state of the traffic system. This is a key activity with all actors as a main purpose of all traffic management is generating concurrent 'situational awareness' of the current state of the traffic system. A predictive analysis would attempt to accurately forecast a future state of the traffic system. This ranges from interpretations of effects of planned changes such as road works to advanced queue detection

11 Dharani, S., Isherwood, T., Mattone, D., and Moretti, P. 2018. "Telematics: Poised for Strong Global Growth," McKinsey Center for Future Mobility).

12 "Measuring the value of data and dataflows", OECD Digital economy papers, December 2022 No. 345

13 Yoo, Y., Henfridsson, O. and Lyytinen, K., 2010. Research commentary—the new organizing logic of digital innovation: an agenda for information systems research. *Information systems research*, 21(4), pp.724-735.

14 see e.g. Rosemann, M., Anderson, M. and Lind, M., 2011. Digital complementary assets, and Reimsbach-Kounatze, C., 2021, March. Enhancing access to and sharing of data: striking the balance between openness and control over data. In *Data Access, Consumer Interests and Public Welfare* (pp. 25-68). Nomos Verlagsgesellschaft mbH & Co. KG.

15 Lawrence Neil D.. 2017. Data readiness levels. arXiv preprint arXiv:1705.02245 (2017)

16 Hartmann, P., Zaki, M., Feldmann, N. and Neely, A., 2014. Big data for big business? A taxonomy of data-driven business models used by start-up firms.

17 Roy D, Srivastava R, Jat M, Karaca MS. A Complete Overview of Analytics Techniques: Descriptive, Predictive, and Prescriptive. In: Jeyanthi PM, Choudhury T, Hack-Polay D, Singh TP, Abujar S, editors. *Decision Intelligence Analytics and the Implementation of Strategic Business Management*. Cham: Springer International Publishing; 2022. p. 15-30.

analysis. Finally, prescriptive analytics seeks to accurately gauge the optimal action to take in each traffic situation. This ranges from adaptive route calculations for the individual drivers to a potential systemwide optimization of the behaviours of all partaking vehicles and passengers.

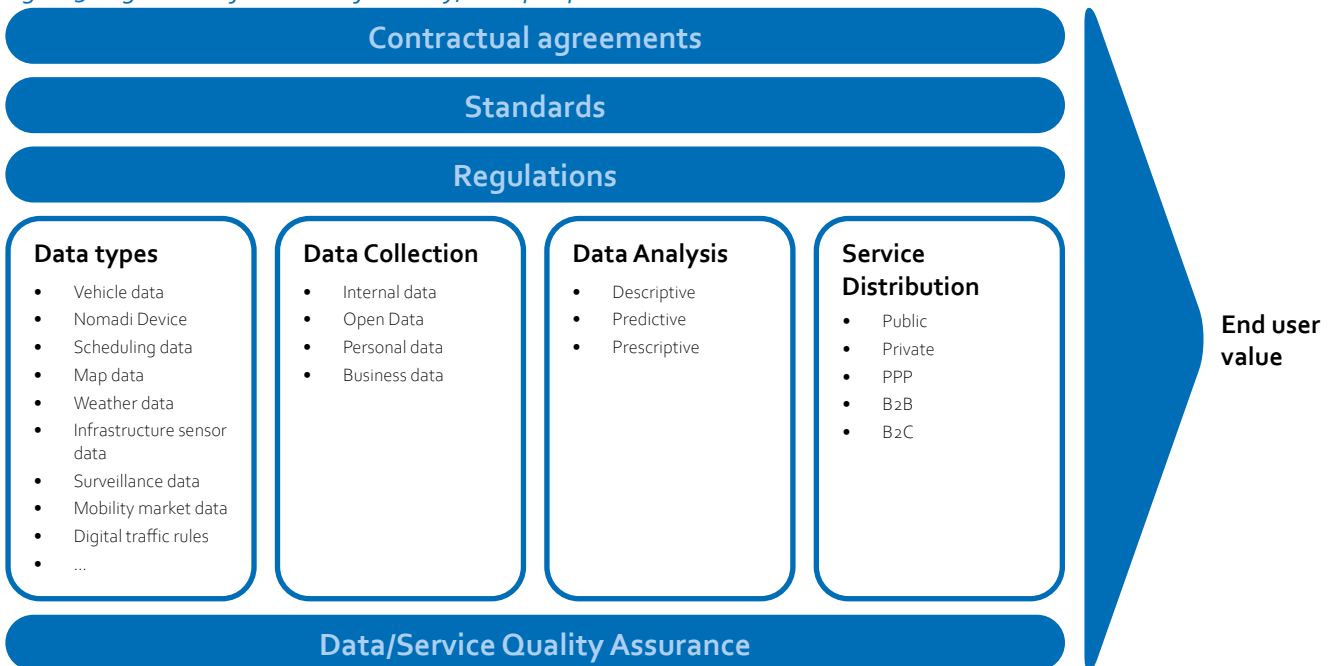
In sum, a digital transformation of mobility will entail several elements such as the sources and types of data, the means of collecting and aggregating that data, a purpose driven analysis of data, and a means of satisficing incentives and delivering end results to users. To facilitate this, contractual agreements are needed between all parties, semantic¹⁸ and meta¹⁹ data standards will make sharing more efficient, regulations will put necessary limits on what can be shared with whom or promote or make mandatory certain types of data sharing. Finally, quality assurance is a very important yet inherently difficult part of

multi-party data driven services.²⁰

As an example, the unrealized value of vehicle data has been thought immense for quite some time. Highly influential McKinsey consulting has put the figure at above 700 Bn USD.²¹ Most car manufacturers have increased the number of sensors and data points in their cars, but the current rhetoric is that they might not be the best suited to make full use of that data and its potential. Companies such as Streetlight Data, INRIX, HERE, Mobileye, RoadMedic, and HaaS Alert, Dynamics and Tactile Mobility have been aggregating, analysing, and distributing vehicle data for a wide range of specialized niche applications for years. Still, vehicle manufacturers retain branded data driven services and occasionally sell data or data driven services to external users themselves.²²

At the same time, there is pressure from the EU

Figure 3: Digital transformation of mobility, data perspective



¹⁸ For example expressed in so called "ontologies", which is a way of showing the properties of a subject area through describing its various components and how they are related.

¹⁹ Put simply, metadata is data that give information about other data.

²⁰ See e.g. Rudmark and Andersson for a study of quality management in open data based mobility services: Rudmark, D. and Andersson, M., 2021. Feedback loops in open data ecosystems. IEEE Software, 39(1), pp.43-47.

²¹ <https://www.mckinsey.com/~/media/mckinsey/industries/automotive%20and%20assembly/our%20insights/monetizing%20car%20data/monetizing-car-data.ashx> for one example of how vehicle data is presented.

²² E.g. Mercedes car data is used by the Netherlands for various purposes <https://www.government.nl/latest/news/2022/03/29/data-from-intelligent-connected-vehicles-contribute-to-safer-road-traffic>

to acquire and open up use of vehicle data for e.g. safety related features such as the e-call²³ service and the more generic 'Safety related car data' initiative.²⁴ More recently, the EU has embarked on an ambitious path to create a multitude of 'data spaces' for various sectors, among which is found a mobility data space initiative currently starting up.

In terms of trends, several recent developments point to a consolidation of the market. In recent years, two new data aggregator startups, UK-based Wejo and Israeli Otonomo attracted a lot of capital from various sources including venture and the vehicle industry incumbents (Wejo had renowned owners such as GM, Microsoft, Volkswagen and Palantir). However, failing to generate viable streams of revenue, Wejo was recently delisted while Otonomo was acquired by Urgently, a U.S.-based provider of digital roadside and mobility assistance technology and services, after losing 95% of its value.²⁵

In the same vein, an extensive and open survey among self-declared European mobility data

sharing ecosystems has been performed by the EU-funded PrepD4Mobilitydata initiative show that data ecosystems use a variety of different reference architectures and combine elements from more than one model. There is consensus among the data from partaking ecosystems that common data models and APIs for syntactic and semantic harmonization of data, i.e. common data standards on various levels, are a core requirement. However, the perceived need for analytics, marketplace services and accounting of data access and transactions within the data sharing environment are 'mixed'.²⁶

Thus, while the perceived needs of more semantic interoperability of data is currently at the top of the agenda, support for business models for aggregation and distribution of data is not. This means that it is currently not possible to accurately predict what will be the focus of the European Mobility data space initiative and indicates that future effort should likely target semantic standards and related issues.

Figure 4: Examples of mobility data sharing of various types across sectors

	Commercial Data Aggregators	Private Public initiatives	Mandatory data sharing	Service (Dis)intermediators
Niche			 	 
Sector	    	 	 	  
Multi sector	"Hyperscalers"			

23 https://europa.eu/youreurope/citizens/travel/security-and-emergencies/emergency-assistance-vehicles-ecall/index_en.htm

24 https://www.dataforroadsafety.eu/images/Documenten/FINAL-Data_For_Road_Safety_Technical_Documentation_v1.05.pdf

25 <https://www.calcalistech.com/ctechnews/article/bkooveym6i>

26 <https://www.eiturbanmobility.eu/400-data-sharing-ecosystems-exist-within-the-eu-in-the-mobility-sector/>

DATA AS A DRIVER FOR SMART CONNECTIVITY

2.3 Key take aways

- Mobility data is constantly growing in terms of sources, quantity, and heterogeneity.
- Mobility data valuation is complex and highly contextual.
- Mobility data needs to be analysed and utilised to generate value.
- Making use of mobility data requires at the very least 1) a set of prerequisite activities along a value chain, 2) adherence to regulations, 3) contractual agreements, 4) data and interface standards as well as 5) quality measures and activities.
- Successful mobility data collection and sharing is happening in and between business and public sectors in niched applications.
- As the EU gears up in an ambitious plan for wide scope data aggregation, while private initiatives with similar scope are failing, it is currently difficult to assess how the private and public mobility data aggregation landscape will develop in the short to medium term. Perhaps the EU will succeed in creating wide ranging mobility data spaces. Perhaps only more narrow niched applications will succeed.
- Despite all the different initiatives on making more data accessible, there is still much potential. This needs to be addressed through more focus on quality of data, the semantics of data as well as the overall data governance.
- The implementation of data regulation needs to be more coordinated in our region.
- In addition to regulation and mapping, public procurement is an effective tool for governments. This means a bigger focus on access of or ownership to data through procurement of goods and services.



Chapter 3

OVERVIEW OF THE AREAS OF NORDIC MOBILITY

3.1 Personal Mobility Overview

This overview of personal mobility focuses on services, new, shared, and integrated mobility services, and the role that data sharing plays and can play, while the vehicles themselves, i.e., connected cars and electrification, is only covered briefly.

Demand for personal mobility is the expression of underlying needs of accessing places, functions, and people. This means that we through different kinds of solutions that can influence both the demand – if, when and where we go – as well as how we do it. Personal mobility adds a complicating factor compared to the transport of goods: free will. People are not rational and do not necessarily make the best decisions. This means the bar for solutions that aim to change behaviours is very high. They need to be very accessible, attractive,

easy to use and priceworthy – all attributes of the private car, perhaps except for the last one. The private car typically solves all everyday mobility demands, but for many good reasons society is moving away from the car centric paradigm, but doing so means that we need to offer other good solutions. And these solutions often rely on a wide set of data.

In terms of sustainability, the target is to decrease the need to own and use cars in favour of using shared services, public transport, biking walking or not travel at all.

Car trips stands for over 40% of all transport related greenhouse gas emissions in EU 2019, or 10% of the total emissions in EU. Electrification is important, but it does not solve all the negative aspects of car traffic, it still emits particles, creates congestion, and uses a lot of valuable space. A car

also uses up a lot of resources and perhaps most importantly: Owning a car means that using it will always be the first choice considering the relatively low margin cost once the investment is done and that it stands there waiting for you.

Generally, there are two ways we can address the challenge of limiting emissions and use of resources from transport. We can make the transport system more effective, i.e., by optimizing the way supply meets demand, we can make society more transport-effective, also working with the need to transport people and goods. A more effective transport system is a special case of a more transport-effective society. Public transport, shared cars and integration of services are examples of the first, and the 15-minute city concept, based on proximity, is an example of the second.

Data – collecting, sharing, aggregating, analysing, and operationalizing – is key to support a more sustainable and multimodal lifestyle. It will help users to make the best choices and be informed of disturbances, it will help service providers to optimize their operations, it will help cities and other authorities in their planning and in their implementation of regulations. In most cases, data reporting (one way flow), is sufficient for cities' purposes, while services need real time sharing of data, including transactions.

But even with a perfect ecosystem of data, not much will change without viable business and collaboration models and governance. Besides traditional shared mobility services such as fixed public transport, taxis, and rental cars, and despite their promises, most new shared services, as well as the integration of them, are still marginal, phenomena.

3.1.1 Trends in personal mobility

The international public transport organisation UITP has categorised mobility solutions based on if they are for collective or individual use and if they are for public or private access. This overview briefly describes the status of micro mobility, car sharing, demand responsive transport (especially AV-based), MaaS as well as mobility hubs and rural mobility (the two last not part of the diagram).

Micro mobility

In 2022 there were 750 000 shared kick-scooters and bikes in Europe, that were used for 485 million trips. Electric kick-scooters made up almost two thirds of the number of vehicles and more than half of the trips. Interestingly, the usage per vehicle was the highest for station-based bikes and the lowest for free floating bikes.¹

Much can be said about kick-scooters, how they were introduced in

¹ Fluctuo, European shared mobility index, 2023

cities and if they contribute to more sustainable cities or not. Those who use them love them. The ones who do not use them dislike them. But from a business and data perspective they are very interesting.

Kick-scooters – and to some extent ride hailing services such as Uber or Lyft – are unique among new mobility services that there is both demand and willingness to pay for. They are even profitable in some cities. The ease of finding and using them is the most important factors. Kick-scooter services are also heavily data driven and the only large-scale implementation of geofencing so far. Furthermore, through the MDS (Mobility Data Specification, initiated by City of Los Angeles), operators openly share most of the operational data with cities, typically through companies that offer easy to use dashboards. Together with the operators, cities can set fixed or provisional “fences” for speed, parking, time, and operational areas, thus implementing regulations almost instantly.

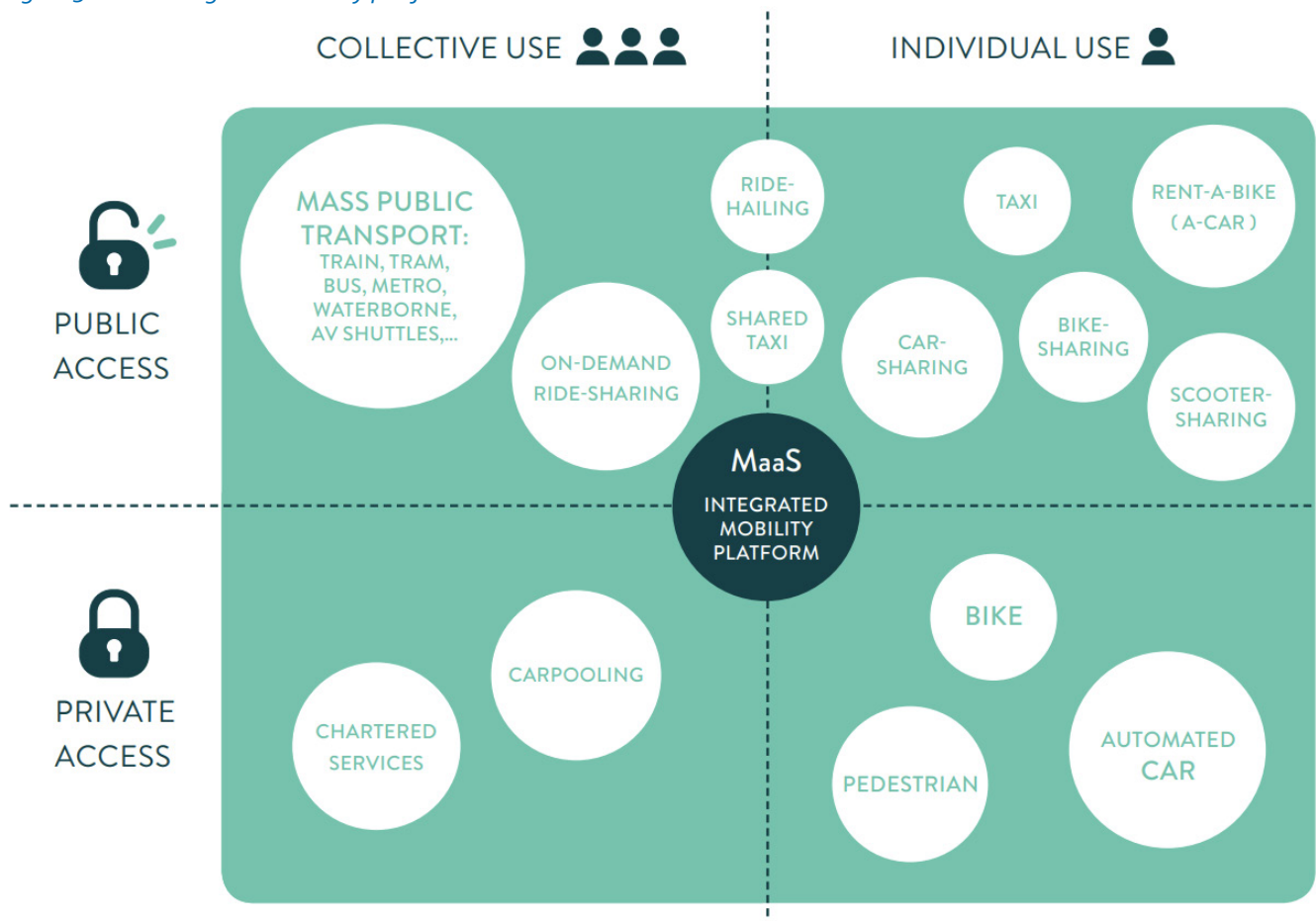
Kick-scooter services have also intensified work in the field of curb-side management – who should have access to public spaces, where, when and under which conditions? That will require more digitalisation and in the case of more dynamic regulations two-way sharing of data between cities – and many types of operators and other stakeholders. Cities and vehicles need to be able to speak to each other.

Car sharing

In many aspects, the situation for car sharing is the opposite that of kick-scooters: The demand is quite low, as is the willingness to pay – at least that is needed to cover the cost for the operator. Free floating services requires a full-scale implementation in a city from day one. As for kick-scooters they must be “everywhere” to be relevant.

Free-floating car sharing services also rely heavily on data, although mostly within their own systems. Studies show very small or no impact on

Figure 3: MaaS integrated mobility platform



Source: UITP

car ownership from free floating services. Many people joining station-based services, on the other hand, tend to get rid of their car. The best way to limit car ownership is thus to offer very good access to cars. Station based car services can also grow organically, something that has led to a much more fragmented market with many smaller companies that don't have the resources to share data and to be integrated in to a MaaS-service.

There are differences between the countries. So called peer-to-peer car sharing is a little bit more widespread in Denmark and Norway than Sweden and Finland. Car sharing services in general suffers from low usage, low accessibility, low profitability, and low scalability.²

Demand Responsive Transport (DRT)

DRT is the digital system supported extension of fixed public transport in time and geography. Instead of running big buses in the capillary part of the network, people will order their transport from home or a real or virtual bus stop to their destination or a real or virtual bus stop. DRT is also suitable for off-peak hours in more urban settings. As opposed to Uber or new robotaxi services, DRT is part of the public transport system and tariff scheme and can be integrated with special services for elderly and disabled.

One of the first DRT services was the Helsinki Kutsuplus launched in 2013, and a more recent example is the X-line in the small town of Säfte in Sweden. A regular (slow) bus was replaced with DRT and the ridership went from less than 50 per week to 500 for the same cost. There are several companies offering the systems needed to book, drive, and optimise the service, but still DRT is mostly implemented on a small scale or as pilots. In most cases the cost per trip is equivalent to that of a taxi trip which makes most authorities reluctant to scale up.

According to public transport operators, the only way to make DRT happen in a large scale is to get rid of the driver. Ruter, the public transport operator of the Oslo region, has taken the lead in

integrating the technology of robotaxis into public transport. In the spring of 2024, they will deploy 15 fully autonomous cars without safety driver and operating at regular speed limits in Groruddalen, north of Oslo. It is a pilot, but Ruter has already created a separate department, planning a large-scale implementation.

Autonomous public transport means not only solving the need for data of self-driving vehicles, but also integrating with all legacy systems for operation, information, ticketing etc. of public transport.

Mobility-as-a-Service (MaaS)

MaaS relies extensively on data integration to generate environmental and societal impact. The goal of MaaS is to make it easier to always find and use the "best" mode of transport. This will increase accessibility and at the same time limit the need of owning and using a car. Successful MaaS operators would also act as aggregators, break down silos and create a more coherent mobility ecosystem, both in terms of data sharing and business standards.

MaaS is typically implemented as an app, offering the possibility to plan, book and pay for many different services, including public transport. It can be single trip-oriented, or subscription based.

Since the first real pilots and term was coined in 2013, there have mostly been more pilots and the implementations so far are relatively limited when it comes to users and usage. Two good example is the MaaS Global with the commercial service Whim with its main market in Helsinki and BVG with the public service Jelbi in Berlin. Compared to the volume of public transport ticket sales in direct channels, but also compared to all bookings made directly in taxi- or kick-scooter apps, what is being sold through MaaS-apps are hardly measurable.

Still, we are early in the developments and integrating mobility is far more complex than integrating film or music. The cost of integrating information and bookings through a diverse and non-standardized set of actors, in many cases local, creates of course a high barrier, but the concept

² see e.g. Snapshot of the European car-sharing market (mckinsey.com)

also needs to show that it can create enough value for both the users and the suppliers to pay for the development and operation of the services. Just collecting “all” services in a city in to one app does not seem to be a strong enough value proposition, especially for residents that already know their way around – that counts for the bulk of the trips. In the end, it will be the actual services that make up the MaaS services that count. Bad shared services mean a bad MaaS service.

This said, new EU-directives, could increase and standardise the access to data from many players which in turn will lower the cost of integration and thus making more business models viable.

According to Gartner Group (Figure 6, in Swedish), shared mobility is in the Valley of disillusion on their hype curve, which with a few exceptions is an adequate conclusion.

Mobility hubs

A mobility hub is a physical place where a user can change between different modes, it can be everything from a bus stop with a bike-sharing station to a Metro or railway station with buses, taxi stops, shared cars, kick-scooters etc. Germany leads the European mobility hub-scene, but the concept is being tested and implemented in most

countries.

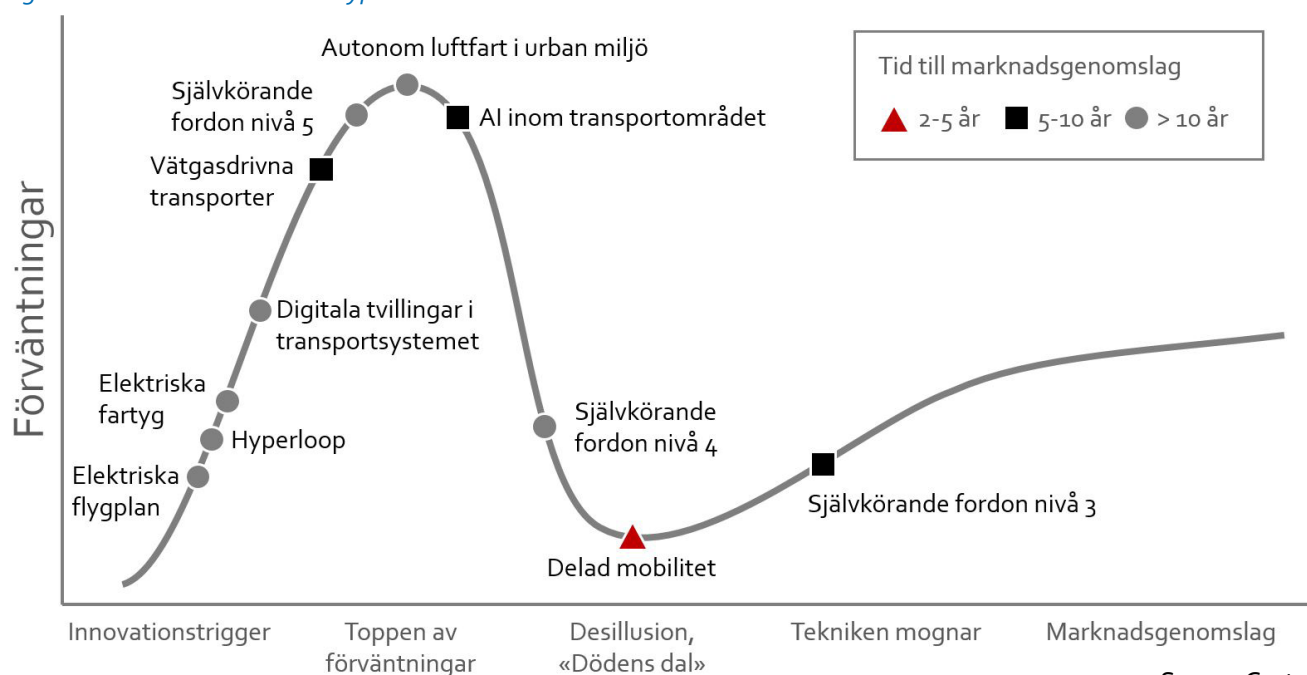
A mobility hub is physical, but it requires sharing of data. All mobility service operators need access to public space, that means that a city can demand both reporting and sharing of data as part of a granting access through license, procurement or rent. They can also require the operators to use digital local traffic rules and regulations and thereby direct managing the traffic.

Rural mobility

Most focus has been on urban mobility where the most obvious gains are found in terms of less congestion, lower levels of emissions and better use of space. Urban areas, with more people and shorter distances, is also more interesting for commercial services.

In rural areas, it is not so much about decreasing car ownership as it is to offer good accessibility for those who already live outside urban areas or those who want to move there. The business case is not finding new revenue streams for commercial actors, but rather implement more cost-effective solutions for regions and other public stakeholders. Whether it is DRT solutions (top down) or providing digital solutions for local mobility eco systems (bottom up), it will be based on data and connectivity.

Figure 6: MaaS on the Gartner Hype Curve



Source: Gartner



3.1.2 Challenges in personal mobility

- Lack of viable business model
- Lack of incentive for service providers to share data and business, and a perceived risk of cannibalisation and losing customer relations
- The need for collaboration between public and private actors, two type of organisations with sometimes very different agenda and conditions.
- Mobility is local – hard to find common denominators for applying more general technical and business solutions
- Different political levels – also different structure in the Nordic countries
- There is more data than what is currently being asked for, given the factors above.
- Different culture, including openness to share and how to do business.

3.1.3 Opportunities in personal mobility

- All the new or updated EU-directives can be a game changer since it targets all necessary stakeholders, bypassing national and regional gatekeepers.
- Standardisation, e.g., the Dutch TOMP-standards + GTFS etc.
- Digitalized traffic rules
- Roaming
- Account based ticketing (ABT) and ID-based travel
- New payment concept (shared mobility wallet etc)
- New actors that see value in changed behaviour such as real estate developers, employers, event companies etc.
- More proactive cities demanding and using data to build more sustainable cities.
- AI: We will see AI help operators to optimize their operations, to automatize customer support, traffic management etc., and it is not unlikely we will see AI-based travel agents.

3.2 Road and Traffic management Overview

Lack of sufficient funds for road maintenance is a growing problem in several parts of Europe, the Nordics included.³ Increased traffic volumes and heavier vehicles are two reasons for the deterioration of road infrastructure, and ways are sought to mitigate adverse effects to the system through improved maintenance and traffic management methods, often data based.

Traffic Management is a term used in a variety of businesses and transport modes. Rail operations would be unthinkable without a well-functioning centralized traffic management, modern air transport as well. However, in the road transport sector there are several public and private actors that perform what they define as traffic management. The result is a decentralized arena, with overlapping concerns and sometimes conflicts of interest. First, an important public actor is the police who have far reaching authority to perform tactical traffic management yet lacks mandate and capabilities for long term strategic traffic management. Further on, there are private bus operators, haulers, Public Transport Administrations, Public Transport Operators, and Taxi companies among many. All focus their attention on their fleets to ensure smooth operations using the means at their disposal. Besides the information services provided by the traffic authorities and municipalities, and the operations optimizations performed by private fleets, a number of private service providers, such as TomTom and Google Waze cater for generic navigation support to end users and transport professionals alike. Providing fast and efficient routes for the individual user is their main service.

The potential need for real-time traffic information will most likely increase dramatically with the rise of automated driving. Vehicle-to-infrastructure solutions and increased sensor data from vehicles could enhance traffic management, but companies have been reluctant to share data. The availability

of data on road traffic, roadblocks, and accidents is relatively good, but collecting information on emergency response vehicle routes could further improve operational services. The issue of data ownership in the telematics data sector remains contentious, with vehicle manufacturers dominating but facing slow spread and use of data.

Data plays a crucial role in traffic management, providing information on traffic volumes, weather conditions, and road maintenance. Open data from national authorities is available and regularly updated, offering benefits for navigators and other applications. However, dependencies and challenges exist in data aggregation and sharing between different sectors and stakeholders. Finland has a long tradition of providing open traffic data through the Digitraffic database, covering road, maritime, and railway traffic information.⁴ The database is focused on national transport networks and lacks complete data from cities. Denmark and Norway also provide safety-related traffic information and live traffic data, while Sweden collects data from various sources, private as well as public, and distributes it to private service providers, media and other public entities via a host of internal systems and databases.

In the Nordics, gaps in traffic data availability include the lack of data from city road networks, as cities are responsible for their own roads. Data quality and granularity is also lacking in many ways as more advanced services and analyses require more than current datasets and management processes can manage. Efforts are being made to encourage cities to share their data through platforms like Digitraffic.⁵ In terms of past and current projects, Fintraffic⁶ is collaborating with Google Waze to provide traffic volume and travel time information for digital screens in the Helsinki Metropolitan Region.⁷ The Swedish Trafikverket are also utilizing Waze, but only as a stand-alone complement at traffic management centres. While the national road networks in the Nordic countries are well-covered with open data, there

³ https://www.trafa.se/globalassets/rapporter/2022/rapport-2022_2-godstransporter-och-konkurrenskraftens-utveckling.pdf

⁴ <https://www.digitraffic.fi/en/>

⁵ <https://www.digitraffic.fi/en/>

⁶ <https://www.fintraffic.fi/en>

⁷ <https://www.fintraffic.fi/en/news/help-avoid-traffic-jams-fintraffic-road-will-be-utilising-wazes-real-time-congestion-alerts>

is a need for more comprehensive data on traffic situations within cities. There are gaps in terms of data coverage and quality for various types of application.

3.2.1 Data challenges and opportunities

Traffic and road management relies on data about traffic volumes, weather conditions and road conditions. On the national level, the Nordics have well-functioning data management in place. In some cases, e.g., with traffic volumes, the data updates (automatically) in real time, but usually by private entities, such as INRIX or Google. Data is collected and provided openly by national authorities, and some can be utilised for e.g., external vendors of navigation services.

Data about traffic volumes is collected by many private companies (e.g., smart phones, navigators, and vehicles) as well. As an example, there are some initiatives to establish two-way sharing practices between different sectors, for example Google Waze has established Waze for cities -program to enable this.⁸

If automated driving gains popularity, the need for real time traffic information will become more critical than what it is today potentially necessitating e.g., vehicle-to-infrastructure solutions, which enable direct communication between vehicles and traffic signals. Demonstrations have been developed and evaluated in this regards, and European standards (C-Roads) have been developed, but this is still in early stages of development.

The increasing number of sensors installed in vehicles, especially in automated vehicles, will increase the amount of data about traffic networks. Companies have been reluctant to share data, but observations about for example road condition, would be beneficial for public authorities, so they could optimize maintenance operations. In Sweden, Trafikverket recently purchased services from Mercedes Benz Sverige, NIRA Dynamics and Universes to enable improved road maintenance based on commercial vehicle data. Other relevant data available covers live road traffic data,

roadblocks, and information about accidents quite well.

Collaborative Traffic Management (CTM) is a new concept that strives to alleviate challenges of potentially conflicting interests of navigation services trying to find quickest routes for their customers, and traffic authorities trying to balance flows on the aggregated level by enabling a 'win-win-win' for citizens, private service providers and authorities alike. The concept was proposed by the TM 2.0 forum and tested in the Socrates 2.0 CEF project in several pilots across Europe. The Swedish project Samverkande Trafikledning followed these developments and related them to the current Swedish traffic management practice. Challenges stated in these projects was primarily related to difficulties in establishing a viable incentive structure for data sharing.

Currently, there are initiatives probing increased surveillance to enable the safe use of longer and heavier vehicles than allowed today. In Sweden, there have been several projects showing how heavy vehicles, utilizing geofencing can be passively monitored by authorities, or even actively speed controlled to avoid excess wear and tear of infrastructure. One key dataset of crucial importance to such schemes as well as vehicle automation is improved digitalization of traffic rules. Today, data on e.g., placement of traffic signs or bridges is lacking in quality and cannot be used as a foundation for compliance control. There are also unresolved issues of governance models for this kind of new active road traffic control, although there are ongoing investigations.

3.2.2 Country nuances

Finland has a long tradition of providing open traffic data. Fintraffic is responsible for maintaining Digitraffic database, which consists of road, maritime and railway traffic information and can be utilized through various APIs. Road traffic data consists of e.g., traffic volumes and speed, weather and road conditions and traffic announcements. The data is utilized for example by navigators. The train data consists of schedules, locations,

⁸ <https://www.waze.com/live-map/>

and wagon combinations. The maritime data has information about marine warnings, harbours schedules and vessel locations. Database also includes the metadata.

The issue with this database is that it only covers information about the national transport networks. It lacks complete data from cities. This is mainly because cities are responsible for their own road networks. There are some initiatives to include data about city road network. For example, Fintraffic is encouraging cities to share their data through Digitraffic and provides model clauses for contracts, giving recommendations for information models, data formats and interfaces and providing data distribution channels towards navigation services and applications.

The Danish Road Directorate (DRD) offers safety related traffic information and other live traffic information such as ongoing and planned roadworks and events, as well as traffic flow data for specific areas.⁹ DRD also provides information

about planned events and changes. Similar data is also provided by Danish municipalities. It is provided through the National Access Point.

The Norwegian Public Roads Administration's Traffic Data API contains traffic data from public roads in Norway. Traffic data is registered in traffic registration points from around the country on state and county roads, and some points are located on municipal roads.¹⁰

All available data are on an aggregated level, where one hour is the shortest time interval. Vehicle by vehicle data is not available to the public.

The Swedish transport administration (TRA) operates in a similar fashion collecting data from roadside ITS systems and other sources, including purchases from private firms.¹¹ The TRA then distributes data via APIs and the DATEX data format to private service providers who use this data in their apps used by private drivers etc.

3.2.3 Key take aways

- The Nordics have well developed traffic and road management relying on a growing range of data to manage traffic and infrastructure maintenance.
- Roadtraffic is a mode with a wide spread of expanding public, private and public-private data driven services for management and maintenance.
- Road and traffic data is dependent on a complex concerted combination of private, national, and local municipality efforts to help collect data and control data quality.
- Autonomous road vehicles will likely need data of far better quality than what is currently available, and this will place new requirements on the current ways of collecting and ensuring quality of data.
- Selected segments of Nordic road traffic may become subject to more direct digital control, for instance via regulated "Intelligent Access" - geofencing of e.g. heavy transports into specific sections of the road network.

⁹ <https://en.vejregler.dk/>

¹⁰ <https://dataut.vegvesen.no/en/dataset/trafikdata/resource/g68a10a7-f704-4cd7-9795-de69e8cad2bc>

¹¹ <https://bransch.trafikverket.se/en/startpage/>

3.3 Logistics Overview

A sustainable freight industry is vital for our society. In 2020, road freight accounted for 77.4% of inland freight transportation in the European Union, the highest figure recorded in the past decade.¹² The road freight market has increased with 27.5% since 2010 and some 1,764 billion kilometres were driven in 2019. High demands on transportation of goods are related to shoring practices. Small European traditionally export oriented open economies like the Nordics are particularly reliant on complex supply chains.¹³

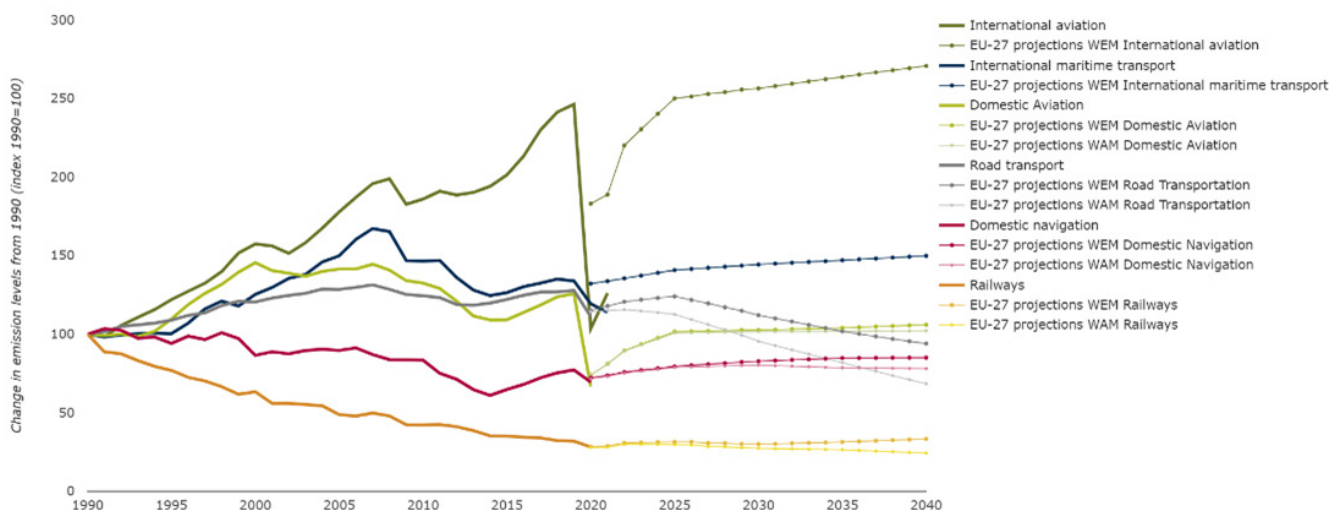
While there was a sharp break during the Covid19 pandemic, greenhouse gas emission figures have rebounded.¹⁴ However, the re-emergence of geopolitics at the top of the political agenda and exposed issues with critical supply chains during the pandemic could accelerate changes in outsourcing behaviours and transport patterns.¹⁵

While transports are increasing, there are simultaneously shortages of critical labour. Data from industry associations show that the shortage

of heavy truck drivers is widespread in Europe, with a shortage of 400,000 in the EU. The IRU forecasts a worst case scenario of a 50% unfilled truck driver positions by 2026.¹⁶ In road logistics, the focus is currently on electrification and automation to decrease emissions. In the short time perspective, modal shift, and the use of heavier and longer vehicles (high-capacity transports or HCT¹⁷) can improve energy efficiency.¹⁸ Electrification efforts have primarily focused on specific components within the transport system, but broader innovation is needed at both the vehicle and system levels. Effective planning, supported by data and updated systems, is crucial for achieving sustainable road transport solutions.

The maritime shipping industry faces the challenge of transitioning to greener fuel alternatives to reduce emissions. However, the high costs of greener fuels and the slim profit margins of shipping companies pose obstacles to this transition. Improved connectivity and data sharing can enhance operational efficiency by optimizing ship routes and speeds, leading to reduced fuel

Figure 6: Greenhouse gas emissions from transport in the EU



Source: EEA (<https://www.eea.europa.eu/ims/greenhouse-gas-emissions-from-transport>)

12 Eurostat. "Freight transport statistics - modal split." <https://ec.europa.eu/eurostat/>

13 Alajääskö, P., 2009. Features of International Sourcing in Europe in 2001-2006. Statistics in focus, 73, p.2009.

14 <https://www.eea.europa.eu/en/topics/in-depth/road-transport>

15 [https://www.europarl.europa.eu/RegData/etudes/STUD/2021/653626/EXPO_STU\(2021\)653626_EN.pdf](https://www.europarl.europa.eu/RegData/etudes/STUD/2021/653626/EXPO_STU(2021)653626_EN.pdf)

DHL. "Truck Driver Shortage in Europe." <https://dhl-freight-connections.com/en/business/truck-driver-shortage-in-europe/>

16 IRU Intelligence Briefing nov 2022, "The truck driver profession in Europe: access and attractiveness"

17 See e.g. the project Duo2 <https://duo2.nu/>

18 Lindqvist, D., Salman, M. and Bergqvist, R., 2020. A cost benefit model for high capacity transport in a comprehensive line-haul network. European Transport Research Review, 12(1), pp.1-12.

consumption and emissions. The conservative nature of the industry and limited innovation funds are additional barriers. Nevertheless, Nordic ports provide a collaborative environment for testing and scaling solutions, which can eventually have a global impact.

In the maritime industry, operational data exchange can lead to better environmental outcomes and improved business potential. Initiatives such as the Finnish Maritime Data Space aim to establish technical frameworks and governance models for data sharing, promoting standardization and interoperability.¹⁹ The availability of data and connectivity is also essential in road logistics, enabling better planning, optimization, and regulatory compliance. Cross-border collaboration and initiatives like the Trans-European Transport Network (TEN-T) provide opportunities for innovation and development in the logistics sector.²⁰

3.3.1 Challenges

Maritime shipping

The EU's Emissions Trading Scheme (ETS) is set to be extended to the shipping industry. This provides even more urgency to tackle one of the main challenges in the sector: being able to transition to greener fuel alternatives to curb emissions.

Shipping traditionally operates within small margins of profits (2021 saw an unprecedented spike in freight rates due to a crisis in global supply chains, but margins are already coming back to normal). Shipping companies are pursuing better ways to keep profitability up during this transition: greener fuels are often more expensive than fossil fuels. This transition has cascade effects across the whole value chain, from building to operation.

The search for operational efficiency can benefit greatly from improved connectivity and data sharing. This involves gathering data from port

authorities around timeslots, availability in port and documentation to better plan ship routes and optimal speeds as well as docking; slower ships burn less fuel, in turn reducing emissions (some estimates point to a 20 to 30% reduction in emissions by reducing ship speeds); Less time waiting in ports also mean they can spend more time sailing, reducing costs with personnel.

Efficiency gains can also be achieved in the operation of ports. Ports are well suited as enablers for the supply of renewable energy to transport actors.²¹ However, besides the establishment of necessary infrastructure, this would require strengthened coordination and incentives among the involved actors.²² Digital maturity among harbours is still generally low and much effort is spent quality assuring unreliable data, clearly indicating a potential for efforts to increase collaboration via digital service platforms.²³

By having more data about ship journeys, port authorities can better plan for the use of space as well as loading and unloading operations. Further, by integrating road logistics for the continuation of cargo in their systems, port authorities can also optimize truck traffic, crane operations, offloading of cargo out of ports, etc. The potential for automating parts of the value chain is big. Full electrification and automation of maritime shipping in the Nordics is still a long way out – despite promising cases like Yara Birkeland²⁴ – but with a more extensive database around the use of resources this can become easier to plan for.

This optimal scenario can face barriers. For starters, the shipping industry can be quite conservative. Smaller players tend to have a “wait and see” attitude to innovation, while bigger players are expected to show the way forward. There are limited funds for innovation, and finding the optimal governance to accelerate maritime connectivity innovation in the Nordics can be a challenge. However, there are upsides. By pursuing innovation in Nordic ports,

19 <https://www.sitra.fi/en/articles/using-data-to-ease-maritime-transport-congestion-and-reduce-emissions-at-ports/>

20 https://transport.ec.europa.eu/transport-themes/infrastructure-and-investment/trans-european-transport-network-ten-t_en

21 https://bransch.trafikverket.se/contentassets/6d1bf828ce6a44679bd638471fa5egao/rapport-regeringsuppdrag_grona-sjofartskorridorer_2018-932612.pdf

22 https://bransch.trafikverket.se/contentassets/6d1bf828ce6a44679bd638471fa5egao/rapport-regeringsuppdrag_grona-sjofartskorridorer_2018-932612.pdf

23 [https://fudinfo.trafikverket.se/fudinfoexternwebb/Publikationer/Publikationer_005701_005800/Publikation_005764/Hamnen%20som%20digital%20nod_slutrappport%20\(2021-09-30\)%20TRV%202020%2050902.pdf](https://fudinfo.trafikverket.se/fudinfoexternwebb/Publikationer/Publikationer_005701_005800/Publikation_005764/Hamnen%20som%20digital%20nod_slutrappport%20(2021-09-30)%20TRV%202020%2050902.pdf)

24 <https://www.yara.com/news-and-media/media-library/press-kits/yara-birkeland-press-kit/>

international and local companies collaborate in a safe environment where they can test and evolve solutions and when these are mature, they can ultimately attempt to scale worldwide.

Sense of urgency can also be an issue: while in some smaller Nordic ports there is a perception that we have “enough time and space” to handle these issues currently, in other parts of the world (in Rotterdam or Hamburg, for example) some of these innovations are seen as crucial to keep shipping working at all.

Lastly, these advancements presuppose that data generated by different stakeholders is easily available and standardized for interoperability. Initiatives to help such developments, such as the RISE initiative “Virtual Watchtower” are already underway. The impact of these currently ongoing initiatives remains to be seen.

Road logistics

One way of reducing emissions in road transportation is using heavier and longer vehicles (so called high-capacity transports, or “HCT”) than permitted today. Concepts for heavier and longer vehicle combinations are overall more energy efficient ($\text{CO}_2/\text{kt}^{\text{km}}$ and $\text{energy}/\text{kt}^{\text{km}}$).²⁵ Depending on their configuration, they could also cause increased wear on roads and bridges.

Currently, there are ongoing tests and research on the electrification of all types of road freight transports. Limitations in energy storage place demands on both infrastructure and availability and changes in transport patterns. There are clear indications that current applications of electrification are based on ‘component innovation’.²⁶ That is, change of a limited subset of components within an existing overall system architecture. This applies to vehicles (driveline) as well as overall transport arrangements (distances, loads, times, etc.). Understanding how such concepts can cater to multiple transportation niches requires understanding of not only the individual subsystem (the vehicle), but also how

it interacts with the surrounding socio-technical system. At the overall system level, existing planning processes must be adapted to enable more complex and changing arrangements. Asghari and Al-e²⁷ summarize the state of the art with the fact that most studies in “Green vehicle routing” focus on a limited number of factors. More specifically, often on individual vehicle and driver performance or on route optimization. In sum, the current move towards more sustainable road transport solutions will necessitate new types of planning long term (e.g. the optimal geographic location of new charging locations for heavy vehicles), as well as short term (e.g. new processes and priorities for planning routes and time windows). All of this requires data as well as updated planning support systems, both at transport companies and at road authorities, e.g., about infrastructure - such as which bridges can be used for heavy transports, where can longer transports charge batteries etc. With more and more municipalities adopting low or no-emission zones, this also becomes a concern of municipal traffic management.

Another current driver for increased access to transport related infrastructure data is automation. Even as hopes of an imminent adoption of SAE level 5 autonomous²⁸ heavy transports are slowly becoming more nuanced, the importance of good quality reliable infrastructure data is likely a key factor. Whereas such data exists in e.g., the “Nordisk Vägdatas”, or “NVDB”, the quality and coverage of that data is dictated by a distributed process involving individual municipalities reporting and maintaining data in the individual countries. This process has led to data quality issues preventing any applications reliant on high levels of accuracy. A process to enhance the NVDB is currently underway.

One way of viewing transport inefficiency is through the lens of vehicle fill rate. In the past decade or so, a lot of attention has been focused on so called “horizontal” collaboration setups for all manner of freight, though recently mostly focusing

²⁵ <https://www.ecoloop.se/wp-content/uploads/2021/11/HCT-City-forstudie-slutrapport-200930.pdf>

²⁶ Henderson, R.M. and Clark, K.B., 1990. Architectural innovation: The reconfiguration of existing product technologies and the failure of established firms. *Administrative science quarterly*, pp.9-30.

²⁷ Asghari, M. and Al-e, S.M.J.M., 2021. Green vehicle routing problem: A state-of-the-art review. *International Journal of Production Economics*, 231, p.107899

²⁸ J3016_202104: Taxonomy and Definitions for Terms Related to Driving Automation Systems for On-Road Motor Vehicles - SAE International

urban transports. These initiatives have often had a data sharing component as the consolidation and rerouting of current multiparty supply chains is at the centre of attention. While there are successful examples of such applications, there are numerous examples of failed attempts.²⁹ One clear issue is the reluctance of sharing crucial business data to essentially competing freight firms. Another is the added cost of the handling necessary when consolidating freight flows.

A current data driven development affecting the road freight industry is the advent and expansion of third-party digital double-sided markets.³⁰ These actors provide a rudimentary platform connecting transport buyers and transport operators, in a pattern superficially reminiscent of Uber. As these actors operate at a level above the actual planning and execution of transports, they might become the conduit of new forms of data sharing in the transport industry.

Lastly, it is important to look at this in the light of cross-border freight. All these trends and challenges come together in roads across Nordic borders. The reliance of the region on road logistics is still very high. With trucks covering parts of journeys that otherwise have no other good alternatives, it is important to pursue solutions that can function across major and minor corridors.

Micro-logistics or last mile

Urban areas increasingly suffer from traffic congestion, pollution, noise, and low effectiveness from transports.³¹ Transports are critical to the functions of a city, and municipalities are turning to new radical solutions to improve conditions, including

implementing Low Emission Zones.³² The city of Stockholm is currently examining introducing a similar regulation by 2023.³³ One way of alleviating some of these problems is urban freight consolidation.³⁴ The intention of such initiatives is to identify freight transports with low fill rates and group them with other less-than-truckload consignments to manage more freight with less total distance driven. There are several trials and successful implementations in many cities around the globe and initiatives including 'urban consolidation centres and cargo bikes for last mile delivery are present in many Nordic urban environments. However, success is far from granted as such initiatives are frequently troubled by a lack of long-term business viability and shifting degrees of support from stakeholders.³⁵ Cities frequently do not have an authority responsible for freight transport issues³⁶ and it is frequently viewed as a private industry with little regulation.³⁷ Local authorities are also subject to political 'short-termism' and contradictions within policy objectives.³⁸ A frequent success factor in efforts to consolidate freight in cities is to base the effort on a steady, often public sector, flow of goods and/or put financial incentives in place. A less common method would be putting local restrictions in place, forcing goods to flow through consolidation centres.

Aerial drones is a rapidly developing technology that could be used for last mile delivery in the Nordics. However, while there is considerable attention by commercial and public research, cases are currently focusing on niche high value goods and larger drones with higher capacity lags farther behind both technologically and in terms of regulations.³⁹

29 Sternberg, H., Linan, I., Prockl, G. and Norrman, A., 2022. Tragedy of the facilitated commons: A multiple-case study of failure in systematic horizontal logistics collaboration. *Journal of Supply Chain Management*, 58(4), pp.30-57.

30 E.g. <https://nshift.com/>

31 Browne, M., Allen, J., Nemoto, T., Patier, D., & Visser, J. (2012). Reducing social and environmental impacts of urban freight transport: A review of some major cities. *Procedia-Social and Behavioral Sciences*, 39, 19-33.

32 <https://urbanaccessregulations.eu/low-emission-zones-main>

33 Miljözon klass 3 - Stockholms stad (trafik.stockholm)

34 Anderson, S., Allen, J., & Browne, M. (2005). Urban logistics—how can it meet policy makers' sustainability objectives? *Journal of transport geography*, 13(1), 71-81.

35 Dablan, L. (2007). Goods transport in large European cities: Difficult to organize, difficult to modernize. *Transportation Research Part A: Policy and Practice*, 41(3), 280-285.

36 Zunder, T.H. and Nicolás, I.J., 2004. Urban freight logistics in the European Union. *European Transport\Trasporti Europei*.

37 Crainic, T.G., Ricciardi, N. and Storchi, G., 2004. Advanced freight transportation systems for congested urban areas. *Transportation Research Part C: Emerging Technologies*, 12(2), pp.119-137.

38 Hull, A., 2005. Integrated transport planning in the UK: From concept to reality. *Journal of transport Geography*, 13(4), pp.318-328.

39 <https://beta.transportstyrelsen.se/globalassets/global/publikationer-och-rapporter/luftfart/obemannade-luftfartyg-i-sverige--bilaga.pdf>

3.3.2 Role of data & connectivity

Digitalisation is a major driving force in the freight transport sector. There are several strong global trends of various types of data sharing, aggregation and/or analysis. This non exhaustive list predominately deals with increasing the transparency of operations between parties in a freight chain for various purposes.

Blockchain Technology: Blockchain has been gaining traction for its potential to enhance transparency and security in supply chain and freight management. Piloting cases are used for tracking shipments, verifying authenticity, and automating smart contracts for payments. There are several global technology actors, specialized technology providers and logistics companies pursuing such blockchain applications.⁴⁰ In terms of Nordic influence, Maersk, one of the world's largest shipping companies, partnered with IBM to create TradeLens, a blockchain-based platform for global trade. TradeLens intended to help supply chain actors track the movement of goods, share documents, and streamline processes, reducing paperwork and delays. Depending on how it is implemented, blockchain solutions can be quite expensive to run, and early successful cases were therefore predominately found in high value goods. As an example, Everledger uses blockchain to track the provenance of high-value goods, including luxury items and wine. This can help prevent counterfeiting and ensure the authenticity of products during transportation. While some initiatives remain, particularly those that track high cost goods, many have been discontinued apparently failing to deliver the necessary benefit. As an example, in 2023 the TradeLens venture was discontinued by Maersk.⁴¹

Artificial Intelligence and Machine Learning: US IT giants are currently focusing heavily on AI and largely forming the emerging technology through internal R&D as well as acquisitions. Indicatively, what used to be "Google Research" is now called "Google AI". China has recently adopted an ambitious goal to become the world leading player in AI by 2030.⁴² Applications of AI and machine learning are increasingly used by transport organizations for predictive analytics, demand forecasting, route optimization, and predictive maintenance. These technologies can help reduce costs and improve efficiency. Global logistics firms such as DHL are investing heavily in centralized AI capability to optimize internal routes and put it into use in the Nordics.⁴³

Digital Freight Marketplaces: There is a growing host of third-party intermediary digital platforms connecting shippers and carriers

⁴⁰ See https://www.wto.org/english/res_e/booksp_e/blockchainanddlt_e.pdf for an overview of companies, applications and underlying technologies.

⁴¹ <https://maritime-executive.com/article/maersk-and-ibm-abandon-blockchain-tradelens-platform>

⁴² <https://www.mckinsey.com/capabilities/quantumblack/our-insights/the-next-frontier-for-ai-in-china-could-add-600-billion-to-its-economy>

⁴³ DHL recently spun off a startup called Greenplan <https://greenplan.de/>

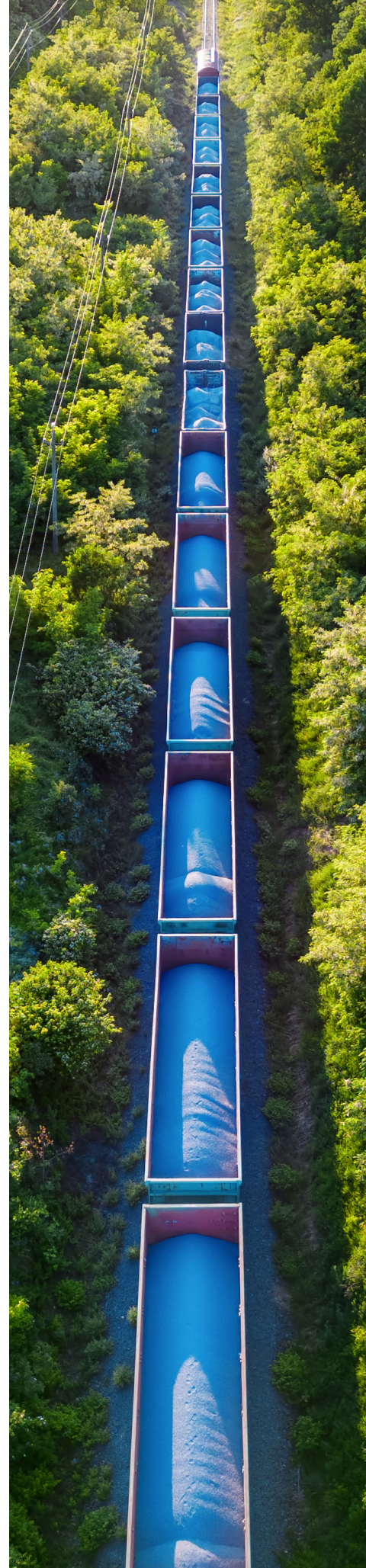
more efficiently. These two-sided markets typically provide real-time visibility into available transport capacity and pricing of several competing transport organizations and streamline the transport booking process. A well-established player in the Nordics is nShift. US players include Flexport and Uber Freight to name but a few.

Autonomous Vehicles: Currently, there are successful implementations of automated trucks, but these are specialized and confined to specific sites – such as e.g., mines, conforming to SAE level 4. More open applications of autonomous transport vehicles are taking place, some notable Nordic examples being the Volvo Vera concept and the Einride vehicles. Recently, the EU passed regulation facilitating testing and market introduction of autonomous vehicles, but true market introduction of SAE level 5 trucks in open traffic remains a future vision. There have been several attempts at truck platooning: utilizing drag-efficiencies by driving technology enabled trucks very close to generate fuel efficiencies. Whereas such effects exist, they have not been proven profitable enough to warrant the cost of development and management of the required vehicle automation. A recent study explored the viability of semi-autonomous truck-convoys with only the lead vehicle driven by a human and the others following. Besides interest from Truck manufacturers, independent 3rd party solutions have been under development and trials recently. However, a recent report lists several potential obstacles from operations, business and regulatory domain that would have to be solved before realizing its market potential.⁴⁴ Tech start-up Locomotion specialising in the area was recently sold after laying off 70% of its staff.

Regulatory compliance: There is a steady growth of digital tools for sharing freight information among supply chain partners as well as authorities across modes and borders. Increased control and surveillance of transport is an increasing demand from road authorities. Primarily to increase the knowledge of how heavy transport affects infrastructure wear and tear, as well as to increase road safety. For instance, in Italy transports requiring special permits are mandated to use a digital application that delivers specialized navigation assistance, real-time surveillance and traffic management communications. Similar systems are being discussed in the Nordics. In Sweden, the Traffic authority is currently investigating how to implement similar technology. Several pilots have investigated how heavy transports can be passively geofenced into certain permitted parts of the road network, and even actively controlled by automatically limiting top speed across bridges.⁴⁵

⁴⁴ Rylander, Andersson, Andersson, "On the viability of autonomous follower truck platoons", ITC World Congress, Lisbon 2023

⁴⁵ E.g. the projects "Tjälade vintervägar", <https://bransch.trafikverket.se/om-oss/aktuellt-for-dig-i-branschen3/aktuellt-for-dig-i-branschen/2023-02/ny-teknik-oppar-for-tyngre-lastbilar-pa-tjalade-vintervagar/> and "Smarta Urbana trafikzoner", <https://www.diva-portal.org/smash/get/diva2:1709425/FULLTEXT01.pdf>



Another area of interest is cross-border customs management. Applications using the EDI data format are widely used to transmit data to customs authorities. Most countries have adopted so called single window solutions, enabling all contact with relevant authorities in one application, thereby simplifying the process.⁴⁶ Recently, customs management is beginning to become an integral application of many commercial blockchain technology vendors.⁴⁷ The EU are currently advancing the Electronic freight transport information (eFTI) Regulation establishing the legal framework for electronic information exchanges between the economic operators and the Member States authorities on the movement of cargo in the European Union.⁴⁸ The information concerned is that required by the EU and national legislation to prove compliance with EU and national rules on the movement of goods by rail, road, inland waterways and air. This digital transformation of freight transport in Europe aims to benefits both operators and authorities amounting to reduced administrative costs in transport and logistics of EUR 27 billion over the next 20 years, according to European Commission estimates.

Collaborative Supply chain visibility Platforms:

Digital platforms are increasingly used to facilitate collaboration between stakeholders in the supply chain, allowing for better coordination, reduced bottlenecks, and smoother operations. Most Enterprise resource planning (ERP) systems vendors offer such functionality to customer firms. Recently, there has been interest in coordinating parallel supply chains with multiple consignees. One such Nordic-related initiative is Virtual Watchtower, where parties can relay information of importance to other organizations.⁴⁹

In the maritime sector, operational data can be a game-changer in achieving better environmental outcomes as well as improved business potential. Ships, ports, lorries, and other maritime services must be able to exchange operational, non-

sensitive data. According to interviewees, there is data available (in other words, there is no shortage of data), as well as many software solutions by different vendors which help stakeholders to better understand and optimize parts of the value chain. The challenge now is to “coordinate and put this to use in everyday life”, according to interviewed sources.

The Fenix project has inquired actors in the sector in which areas standardization would benefit logistics companies: transport documents, asset management, locations, visibility, and cross-border procedures have been identified by half of the study participants as good candidates for better, industry-wide standards.⁵⁰

One initiative is on its way to establish a Finnish Maritime Data Space.⁵¹ This data space is concerned with facilitating a governance model and establishing a technical framework. Its structure is like that of an innovation ecosystem, where use cases are defined so that stakeholders can see mutual benefits, and the needs for data are identified around them. The work in this project has been kickstarted by The Finnish Innovation Fund, Sitra, identifying already existing networks and ecosystems in the maritime sector which are mature enough to undergo such activities: “start where you can and move fast”.

This data space is establishing standards for interoperability & data quality. Data needs to be labelled and should “speak the same language”. Smart services can help with semantic issues & contextualization. This means that more stakeholders can join in, regardless of local standards and with less overhead. In terms of accessibility, data should be shared easily via APIs. The Gaia-X framework provided a good starting point for the data space, presenting “a set of policy rules, labelling criteria, a framework of trust and an architecture framework that enables the portability, interoperability and connectivity of infrastructure, applications and data and the delivery of services,

⁴⁶ See e.g. https://unece.org/fileadmin/DAM/cefact/single_window/sw_cases/Download/Sweden.pdf for a brief explanation of the Swedish implementation

⁴⁷ <https://worldcustomsjournal.org/Archives/Volume%2014%2C%20Number%201%20%28Apr%202020%29/1897%2001%20WCJ%20v14n1%20Yaren.pdf>

⁴⁸ <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32020R1056>

⁴⁹ <https://smartmaritimene트워크.com/2022/03/29/virtual-watch-towers-for-supply-chain-visibility/>

⁵⁰ <https://fenix-network.eu/research/>

⁵¹ <https://www.sitra.fi/en/articles/using-data-to-ease-maritime-transport-congestion-and-reduce-emissions-at-ports/>

according to and aligned with European values and norms.”⁵²

Sitra has defined 12 principles for building data-sharing projects. Some of these principles - decentralised, open, sovereign, and interoperable with other data spaces - guide the development of the Finnish Maritime Data space as well. According to them, the incentive to open and decentralize data is inherently tied to the ability to cooperate, shifting from traditional value creation towards value created and captured in networks and ecosystems. It is also crucial that initiatives like these are compliant to European data protection laws, meeting or exceeding those requirements.

As for connectivity, when ships are not in coastal areas data is exchanged via satellite. Currently, costs for satellite data transmission are extremely

high. This means that there is a need for good understanding of what data needs to be transmitted in real time, what data can be sent in batches, and when it should be transmitted for it to be effective enough.

In some ways, the maritime sector is quite advanced when it comes to cooperation and co-development of new solutions. Large organizations such as the International Maritime Organization (IMO) embed in the sector a mindset of standardization and compliance to international agreements.⁵³

However, the challenge here is to identify truly Nordic use cases for maritime logistics which can gather existing networks and ecosystems around them, as well as governance models to fund and orchestrate innovation.

3.3.3 Key take aways

- From a pandemic low, transports are increasing, incurring corresponding increases of negative externalities such as greenhouse gas emissions.
- Driver shortages is a lasting trend in Europe as well as in most of the developed world.
- Digitalization in logistics is currently mostly effective in delimited data sharing and transparency for specific partners - private or public, with specific and limited purposes.
- There is ongoing experimentation and new initiatives with more general “data spaces” including guiding governance principles.
- Regardless of mode, vehicle automation is currently effective in enclosed production, such as mines, whereas mass adoption of e.g., self-driving trucks SAE level 5 is not imminent.

⁵² <https://www.sitra.fi/en/articles/twelve-principles-for-value-creation-at-ecosystem-level-through-data-sharing/>

⁵³ <https://www.imo.org/>



Chapter 4

SUMMARY

The transport sector is a substantial part of the economy of all developed nations and the ongoing digitalization is increasingly part of the everyday activities of citizens, authorities, and companies in societies across the globe. This report has provided current snapshots of these developments relating to the Nordic transport sector.

While the digital transformation of mobility has been profound in many ways, this report shows some of the sociotechnical complexity inherent in any effort towards achieving a sustainable twin transformation of the sector.

Summing up the key takeaways from the preceding sections, the following page presents some key insights to guide further innovation in the area.

- Mobility data is constantly growing in terms of sources, quantity, and heterogeneity.
- Mobility data valuation is complex and highly contextual since data needs to be analysed and put to context and utilised to generate value. Making use of mobility data requires at the very least 1) a chain of value adding activities, 2) adherence to regulations, 3) contractual agreements, 4) data and interface standards, and 5) quality management.
- Several wide scope data sharing ventures and large applied projects and pilots in the transport sector have failed to provide value and scale beyond early stages in recent years.
- Simultaneously, successful mobility data collection and sharing is happening in and between business and public sectors in more niched applications.
- The implementation of data regulation needs to be more coordinated in our region.
- Public procurement is an effective tool for governments. This means a bigger focus on access to or ownership of data through procurement of goods and services.
- Several pilots and projects have shown a shortage of viable business models in both personal mobility and logistics including a lack of incentive for suppliers to share data and business, risking customer relations and incurring the resulting coordination cost among business actors.
- The Nordics rely on a growing range of data to manage traffic and infrastructure maintenance including many public, private and public-private data driven services for management and maintenance.
- Road and traffic data is dependent on a complex concerted combination of private, national, and local municipality efforts to help collect data and control data quality. Low quality infrastructure data is a challenge for future development of viable autonomous road vehicles and more.



Chapter 5

APPENDIX

Catalogue of relevant projects

One of the starting points of this project, is the fact that many projects, pilots and other initiatives do not continue, scale up or live on in any way after the project period is over. There could be several reasons for this, including that the projects never were intended to surpass their project period. Other times, it could be that the scope, narrative, procurement description or other factor was not presented.

The pre-study to this project listed several innovation initiatives with an emphasis on transport and mobility data sharing and analysis. We have added to this list several additional projects, with the same selection rationale including a preference for Nordic involvement. In sum, we find that the reflections made in the pre-study holds well:

- A typical project can have a budget of 10-30 million EUR and have as many as 40 partners.
- Many of the EU-funded projects are focused on creating different variants of information sharing platforms.
- As previously noted, there is a pattern of attempting to lower a presumed problematic coordination- and/or transaction cost with some form of data sharing scheme.
- Such a scheme is technically validated/demonstrated in a project pilot. These are called demonstrators, living labs etc.
- Once the project is finished, the pilot ends and is perhaps used as input in a new proposal.
- The participating organisations have gained new knowledge, but not transformed their way of working.
- They are occasionally also meeting and exchanging ideas and views during the project which might lead to things happening outside the project.

AEOLIX - Architecture for EurOpean Logistics Information eXchange

H2020 | 2016-2019

<https://aeolix.eu/>

AEOLIX - a collaborative project focused on developing a platform for logistics information exchange across Europe. The project focus was to establish an open and standardized framework to enable interoperability between logistics systems and stakeholders. By facilitating seamless data sharing and collaboration among actors in the supply chain, the AEOLIX platform aimed to enhance efficiency, visibility, and sustainability in logistics operations.

AEOLIX validate and demonstrate its collaborative logistics ecosystem through various living labs. These living labs are located in different parts of Europe and cover nine TEN-T corridors.

Two Living labs in Nordics (Sweden)

AEOLIX work continues in FENIX-project.

FENIX - A European Federated Network for Information eXchange in LogistiX

EU: Connecting Europe Facility | 2019-2023

<https://fenix-network.eu/>

FENIX aims to develop the first European federated architecture for data sharing in the logistics community. It enables interoperability between existing and future platforms for shippers, logistics service providers, mobility infrastructure providers, cities, and authorities. The project originated from the recommendations of the European Commission's Digital Transport and Logistic Forum (DTLF) to create a network of platforms for data exchange among transport and logistics operators.

FENIX has three main objectives: establishing a network of transport and logistics actors for information sharing, demonstrating feasibility and benefits through national pilots, and implementing the EU corridor community building program. The project focuses on optimizing the Trans-European Transport Network (TEN-T) and aims to reduce costs and greenhouse gas emissions.

FENIX includes 11 pilot sites across 9 TEN-T corridors to test and showcase the achieved interoperability capabilities.

FENIX 2.0

<https://fenix-network.eu/fenix-2-0/>

The FENIXNetwork project consortium prepares for its sequel FENIX2.0, a joint initiative to set and maintain FENIX specifications in order to allow platforms to share data, including cross-border harmonization and interoperability.

FENIX2.0 is a non-profit organization being a federative network of platforms. It federates companies, helping them to adapt their IT platforms in order to enable data sharing in the form of digital corridor information systems serving the European logistics community.

FEDeRATED

EU: Connecting Europe Facility | 2019-2023

<https://www.federatedplatforms.eu/index.php>

The FEDeRATED project is an initiative to contribute to the establishment of a viable federated network of platforms for data sharing in the freight transport and logistics domain at EU level (and beyond). The main objective is to enable a smooth and effective public involvement with logistic chains for the execution of public duties.

The 15 FEDeRATED partners are executing 23 Living Labs, including pilots in Nordics.

CORE - "Consistently Optimised Resilient Secure Global Supply-Chains

FP7 | 2014 -2018

<https://www.cross-border.org/project/fp7-project-core>

CORE - large European research project involving around 70 partners. It aimed to demonstrate that supply

chain security and trade facilitation can be balanced by applying innovative concepts. The project focuses on four main areas: end-to-end supply chain security, global visibility of security risks, real-time optimized supply chain solutions, and new supervision models for secure supply chains. CORE aims to maximize the efficiency of global trade transactions while enhancing transparency and security in supply chains. It involves demonstrations with different trade requirements and aims to provide practical solutions within the current legislative framework.

Inter-Core

EU: Connecting Europe Facility | 2016-2020

<https://intercor-project.eu/>

InterCor (Interoperable Corridors) - a European project, which aims to connect C-ITS initiatives of four participating Member States, the C-ITS Corridor in the Netherlands (connecting the Netherlands with Germany and Austria), the French corridor of the SCOOP@F project, the British corridor London-Dover and C-ITS initiatives in Flanders, while also making the connection to the C-Roads platform. The InterCor project plans to deliver seven interoperable C-ITS services across the European corridor network, providing seamless continuity and serving as a test bed for current and future deployments in Europe. The project aims to enable vehicles and related road infrastructure to communicate data using cellular networks, wifi ITS-G5 communications and their hybrid combination on C-ITS corridors. The overall goal is to achieve safer, more efficient and more convenience mobility of people and goods.

RIS COMEX

EU: Connecting Europe Facility | 2016-2022

<https://www.riscomex.eu/>

RIS COMEX a CEF funded multi-Beneficiary project aiming at the definition, specification, implementation and sustainable operation of Corridor RIS Services following the results of the CoRISMa study. The project area covers altogether 13 different European countries having 14 partners joined their forces under the coordination of the Austrian Waterway Administration viadonau with the common goal to realize Corridor RIS Services. Two systems EuRIS (European River Information Services system) and CEERIS (Central and Eastern European Reporting Information System)

SELIS - Shared European Logistics Intelligent Information Space

H2020 | 2016-2019

<https://selisproject.eu/>

SELIS, aimed to deliver a platform for pan-European logistics applications. The project embraces various logistics perspectives to create a cohesive agenda for pan-European Green Logistics, fostering operational and strategic business innovation.

Leveraging EU intellectual property from over 40 projects, SELIS aimed to create proof-of-concept Common Communication and navigation platforms for logistics applications. These platforms are deployed in eight living labs, representing key logistics communities.

SMART-RAIL: smart supply chain oriented rail freight services

H2020 | 2015-2018

<https://smartrail-project.eu/>

The SMART-RAIL project - a collaboration among 19 research and commercial partners in Europe with

the aim of enhancing rail freight services for shippers. The project focuses on improving reliability, lead time, costs, flexibility, and visibility in the European rail freight system. By integrating existing and new knowledge from various parts of the system, SMART-RAIL seeks to support collaborations across the European market, fostering innovation and operational optimization. As one of the lighthouse projects of SHIFT2RAIL, it aligns with the program's objectives.

SMOOTH/ Smoovit

VINNOVA | 2019-2023

<https://www.vinnova.se/en/p/smooth---system-of-systems-for-sustainable-urban-goods-transport/>

This project gathered the city of Gothenburg, Volvo, several logistics service providers and research institutes in a quest to find a viable combination of local regulatory support, logistical plan, environmental analysis and businessmodel for collaborative distribution of last mile goods via suburban hubs (SUCCs) and a cityhub for last meter distribution via cargobikes. A technical demonstrator was developed, but is currently not in use. The project put forward principles for designing systems of systems in sociotechnical settings displaying similar traits.

STM Sea Traffic Management

<https://www.seatrafficmanagement.info/>

Sea Traffic Management connects and updates the maritime world in real time, with efficient information exchange. Through data exchange among selected parties such as ships, service providers and shipping companies, STM is creating a new paradigm for maritime information sharing offering tomorrow's digital infrastructure for shipping

The concept of Sea Traffic Management has been developed during EU-financed research and innovation projects with a number of European partners within academia, governmental bodies and the industry. STM is still an active community.

STM Validation Projects

EU | 2015-2019

The STM Validation Project aimed to demonstrate the STM concept in large-scale test beds in both the Nordic and Mediterranean Seas. Several ports and other partners from SE, NO, DK and FI were involved.

Port Collaborative Decision Making (Port CDM)

<https://www.seatrafficmanagement.info/activity-item/activity-1-port-collaborative-decision-making/> | <https://www.ipcdmc.org/>

Port-CDM aims to increase the efficiency of port calls for all stakeholders through improved information sharing, situational awareness, optimized processes, and collaborative decision making during port calls.

SeaSWIM (System Wide Information Management)

<https://www.seatrafficmanagement.info/developers-forum/seaswim-overview/>

SeaSWIM aimed to facilitate data sharing using a common information environment and structure (e.g. the Maritime Cloud) to ensure interoperability of STM and other services.

Transforming Transport

H2020 | 2017-2019

<https://transformingtransport.eu>

The Transforming Transport project had the goal of showcasing the impact of Big Data on the mobility and logistics market. It aimed to validate the feasibility of using Big Data to transform transportation processes and services, resulting in increased operational efficiency, enhanced customer experiences, and the emergence of new business models. The project focused on seven pilot domains crucial to the European mobility and logistics sector, including Smart Highways, Sustainable Vehicle Fleets, Proactive Rail Infrastructures, Ports as Intelligent Logistics Hubs, Efficient Air Transport, Multi-modal Urban Mobility, and Dynamic Supply Chains

MODI

Horizon Europe | 2022-2026

<https://modiproject.eu/>

The MODI project aims to improve logistics chains by introducing connected, cooperative, and automated mobility (CCAM). It focuses on resolving barriers for SAE L4 CCAM vehicles in confined areas and on public roads along the corridor from Rotterdam to Oslo. The project emphasizes coordination to integrate CCAM into existing logistics operations, enhancing efficiency for companies and enabling smart traffic management. Five use cases are explored, assessing what is currently possible with SAE L4 technology and identifying areas for improvement. The project also develops business models showcasing the profitability of CCAM adoption and involves a consortium of industry partners, research institutions, and stakeholders along the corridor.

5 use cases, including Nordic.

MOVE21

H2020 | 2021-2025

<https://move21.eu/>

MOVE21 aims at transforming European cities and their surroundings into smart zero emissions nodes for mobility and logistics.

Demonstrators that substantiate:

Zero emission and climate resilient solutions: different types of mobility hubs, integrated transport services, and new governance models and methods.

Combined technological and non-technological innovations: potential barriers and impact, reference architecture for goods and passengers transportation, new business and collaboration models, and policy integration. Mainly targets increased livability in cities related to social cohesion.

Living labs, including in the Nordics

SHOW - SHared automation Operating models for Worldwide adoption

H2020 | 2021-2023

<https://show-project.eu/>

SHOW aimed to support the deployment of shared, connected and electrified automation in urban transport, to advance sustainable urban mobility.

During the project, real-life urban demonstrations took place in 20 cities across Europe including integration of fleets of automated vehicles in public transport, demand-responsive transport (DRT), Mobility as a Service (MaaS) and Logistics as a Service (Laas) schemes.

Included 69 partners from 13 EU-countries collaborating with organizations from the US, South Korea, Australia, China, and other countries. Nordic Pilot sites.

IMOVE

H2020 | 2017-2019

<https://imove-project.eu/>

IMOVE - project to advance and promote Mobility as a Service (MaaS) schemes in Europe, with the goal of establishing a "roaming" service for users across the continent. The project focused on improving MaaS at an operational level and its underlying business model, specifically targeting transnational transit.

IMOVE solutions will be tested in four European Living Labs, one in Nordics. IMOVE will also pilot roaming services for MaaS at a cross-border European level.

PrepDSpace4Mobility

EU CSA | 2022-2023

<https://mobilitydataspace-csa.eu>

PrepDSpace4Mobility aims to contribute to the development of the common European mobility data space by mapping existing data ecosystems, identifying gaps and overlaps within, and proposing common building blocks and governance frameworks found in existing data space architectures. The actions are carried out by a project team comprised of leading experts from the private and public mobility sectors, with key competencies in mobility, economics, and digital technologies. Jointly, they are supporting a new European era of mobility data sharing, centered around the principles of trust, interoperability, and sovereignty, where data can be made available, accessed, and securely exchanged across Europe. PrepDSpace4Mobility represents a vital pillar for the future deployment of a single market for mobility data.

NOMAD

Nordic Innovation | 2019-2023

<https://nomadmobility.org/>

The Nordic Open Mobility and Digitalization (NOMAD) project aims to enable seamless mobility using several modes of transportation across the Nordics. The project will introduce a market enabler framework of technology and business practices for Mobility as a Service (MaaS) and other smart mobility services. Viability of the open framework will be demonstrated through practical MaaS roaming pilots involving several MaaS operators in the Nordics.

ODIN - Open Mobility Data in the Nordics

Swedish Transport Administration and the Swedish Innovation Agency | 2019-2022

<https://nordicopenmobilitydata.eu/>

Samtrafiken i Sverige AB, the Swedish Transport Administration, Fintraffic OY, Helsinki Regional Transport, Entur AS and the Norwegian Railway Directorate

The ODIN project aims to accelerate and coordinate the work necessary to create a unified market within the mobility sector in the Nordics. In the ODIN project, the Nordic actors within public transport come together to make high-quality open data available, stimulating new mobility services. ODIN brings together the leading and nationally responsible actors from Sweden, Norway, Finland, and Denmark in the field of open public transport data. The collaboration has three main objectives:

- Lowering barriers for developers of mobility services at a Nordic level.
- Leveraging upcoming EU regulations to increase the attractiveness of the Nordic market.
- Creating conditions for the Nordic region to serve as a living lab for new mobility services.

NordicWay

EU: Connecting Europe Facility | NordicWay (2015-17) | NordicWay 2 (2018-20) | NordicWay 3 (2019-23)

<https://www.nordicway.net>

The NordicWay projects is a series of initiatives aimed at promoting intelligent transportation systems (ITS) and cooperative mobility solutions in the Nordic region.

NordicWay 2 and NordicWay 3 are C-ITS pilot projects that aims to enable vehicles, infrastructure and network operators to communicate safety hazards and other information from roads in the Nordic countries between stakeholders.

The projects target key areas such as connected vehicles, automated driving, harmonized traffic management, and the integration of different modes of transport.

Connecting: Control Towers for Autonomous Vehicles

Nordic Innovation | 2020-2022

<https://www.nordicinnovation.org/programs/connecting-control-tower-autonomous-vehicles>CONNECTING: Control Tower for Autonomous Vehicles | Nordic Innovation

The project aimed to demonstrate the benefits and business models of a «control tower» model and validate the potential of the concept.

The goal of the project is to develop protocols and software for connecting to and remote operating fleets of self-driving vehicles from different manufacturers. It is in the best interest of the society as a whole that we develop a system which is capable of handling remote control and sending missions to all types of automated vehicles, rather than manufactures develop proprietary systems incapable of handling other vehicles than their own.

The Connected Ship

Nordic Innovation | 2019-2021

<https://theconnectedship.net/>

The Connected Ship project aims to create a digitalization platform on board ships that combines technology and experiences from smart city projects with maritime industry control systems. The goal is to prepare ships for future interaction with smart society systems such as harbours, trucks, cargo, passengers, and other smart micro-systems.

Nordic+ Mobility Ecosystem

Nordic Innovation | 2023-2026

<https://www.nordicinnovation.org/programs/nordic-mobility-ecosystem>

The aim of this project is to establish a permanent network for mobility that goes beyond 2030 for current and future mobility projects and initiatives.

In the short term, Nordic+ Mobility Ecosystem aims to get the best out of Nordic know-how and its potential through constant work and branding to increase cooperation through various networking and communication activities and methods.

The Nordic+ Mobility Ecosystem will help achieve the Council's goals by innovating and demonstrating ITS (Intelligent Transportation Systems and Services), and cross-mode and cross-border data-sharing in the Nordic region.

Nordic+ Mobility Ecosystem aims to enhance the Nordic mobility and transport ecosystem's strategic cross-border collaboration to foster integration, competitiveness, and sustainability.