Nordic Innovation

Systemic innovation compass

Nordic Smart Mobility and Connectivity

Acknowledgements

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Disclaimer

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About Nordic Innovation

Nordic Innovation is an organisation 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.

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Foreword

In our role as an enabler and a catalyst of innovation at the Nordic level, and in our quest to translate political visions into tangible actions, we need to fully understand what it takes to create successful projects and scalable concepts and solutions. Failing and risk-taking are core components of innovation, yet we need to see change and we need to see a rapid shift towards sustainable mobility to reach the 2030 milestone and the Nordic Vision 2030 of becoming the world's most integrated and sustainable region. Hence, we need to rig for success.

We face complex and systemic challenges in our time. However, as this report concludes, the linear model upon which innovation processes and projects are often built, might not be suitable for present challenges. Consequently, we have increased our focus on systemic innovation and transformation at system level. As pointed out by this report, we stand to gain from more flexibility, adaptability and by involving representatives from the various levels of our complex mobility systems. Complex challenges are difficult to address through established innovation methods alone, and often projects and pilots fail in their scaling ambitions. When we are unable to grasp and handle the full complexity, barriers for implementation and scaling are not dealt with.

The Systemic Innovation Compass is a framework and a repository of ideas where future Smart Connectivity and data sharing projects in mobility can be rooted. Moreover, this report:

- Is an introduction to systemic innovation;
- shows the possibility for addressing mobility and logistics in a systemic way;
- presents a way forward for establishing a systemic mindset and systemic innovation.

There is a notion that data and data sharing will be instrumental in establishing the Nordic region as a frontrunner in sustainable mobility. When applying a systemic approach, we are once again reminded that data sharing and digital solutions are not the end goal in themselves; we need to transform with a purpose and with joint ideas of what a desirable future of mobility should look like.

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February 2024

Nordic Innovation

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Chapter 1:
Introduction

Background

About the project

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[1]. The project will contribute to the programme'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 aims 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.

1 https://www.nordicinnovation.org/mobility

At the same time, the Smart Connectivity project aims 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 which has supported Nordic Innovation 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 mobility research.

About this report

The aim of this report is to:

- Set out an ambition and a direction for innovation in mobility and logistics in the Nordics;
- Detail areas in which there is good potential for innovation and impact in mobility and logistics. These areas for innovation were the subject of a call for project proposals, launched by Nordic Innovation in December 2023;
- Showcase an approach to innovation that is systemic and can live on after this project has eneded.

The report is structured in 5 chapters:

Chapter 1 introduces principles, values and approaches that form the conceptual basis for the project.

Chapter 2 outlines the importance of investigating the future for innovation projects, and outlines six visions that describe how the future of mobility and logistics could look like in 2030.

Chapter 3 takes us through the results of a broad participatory process that has gathered insight about the most pressing challenges of the two sectors.

Chapter 4 describes hotspots for innovation which can be leveraged for impact by the industry.

Chapter 5 raises important raises important questions and concepts which should be discussed further in order to tackle the challenges described in chapter 4 and realise the potential for innovation described in this report.

This report also builds on the knowledge gathered in the "Current State report"[2], which was published together with the call for project proposals. While that report aims to portray a picture of what the current challenges and opportunities are in regard to connectivity for mobility and logistics, this report is focused on how to make that insight actionable.

The systemic approach

A necessary change of mindset

Nordic ambitions are set high: we are aiming at a transformation of the mobility and logistics systems in order to achieve a more sustainable and integrated region. That means transforming the way innovation is approached as well.

There is an ongoing exploration of how to innovate in systems, i.e. acknowledging that the linear way of innovating does not work in complex situations and for transforming systems. Even though systems thinking and systems innovation are not new, such an approach has not been taught in our school systems and are not commonly practiced. This means that in order to get groups of people - or ecosystems - to work systemically, we have to take the time to explore and understand how systems work and how to lead systems change.

Otto Scharmer and his colleagues at the MIT Sloan School of Management describe a journey that actors aiming for systems transformation must go through. His "Theory U"[3] is a broad approach for reflecting on previous patterns, sensing where one currently stands, and finally embracing, planning, and enacting change. According to this way of thinking about systems change, it is important to start by asking ourselves what patterns are currently being repeated.

Several initiatives in mobility and logistics have been funded over the years[4]. In addition to that, several other innovation initiatives are being funded regionally, nationally and within EU frameworks. During

2 https://www.nordicinnovation.org/2023/nordic-smart-connectivity-current-state

3 https://www.u-school.org/theory-u

4 https://www.nordicinnovation.org/2023/nordic-smart-connectivity-current-state

the pre-project phase, a vast landscape of projects and pilots was identified. Despite good results, they fail to scale after initial funding has ended. There are often overlapping goals and ambitions spread out over several projects, which leads to lost opportunities in terms of creating synergistic effects between them. Knowledge is also not easily shared among these initiatives. In many cases the innovation focus of projects might be overly technical. In the end, the Nordic perspective falls through the cracks of local and regional processes.

This situation clearly invites us Wto think differently about how to prioritise, fund and govern innovation across the Nordics. This is a change in mindset that needs to be pursued. In order to do that, four possible changes in mindset could be important to transforming the sector:

> **"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 center."**
>
> Jim Hackett, Ford CEO

1. Technology-driven vs purpose-driven: aiming for social, environmental, and economic impact

There is no question that the mobility and logistics sectors need to undergo a significant transition towards a more sustainable state. In the public discourse, technological solutions such as electrification are front and center. Vehicle electrification is a step towards reducing reliance on fossil fuels.

However, in recent years it has become evident that other aspects such as limited energy resources, evolving international relations, and changes in global value chains must be considered. Electrification of vehicles also introduces new challenges in other systems, such as the electrical grid's capacity to handle the widespread electrification of both private and commercial vehicles, a problem already evident in Europe.

Another concern is the reliance on rare-earth materials and global value chains, with 80% of batteries currently produced in China. While the EU and the Nordic region aim to localise battery value chains, significant progress is needed. While these developments are underway, the question remains: is it possible to electrify within planetary boundaries or should we rethink mobility altogether?

This transition of mobility and logistics is intertwined with other societal shifts happening in the Nordic context such as urbanisation and an aging population. Countries like Norway, Sweden, and Finland - known for their long distances and sparsely populated areas - heavily depend on private cars for transportation of people and goods. The growing urban areas in the region also demand more efficiency, with mounting issues related to traffic and pollution.

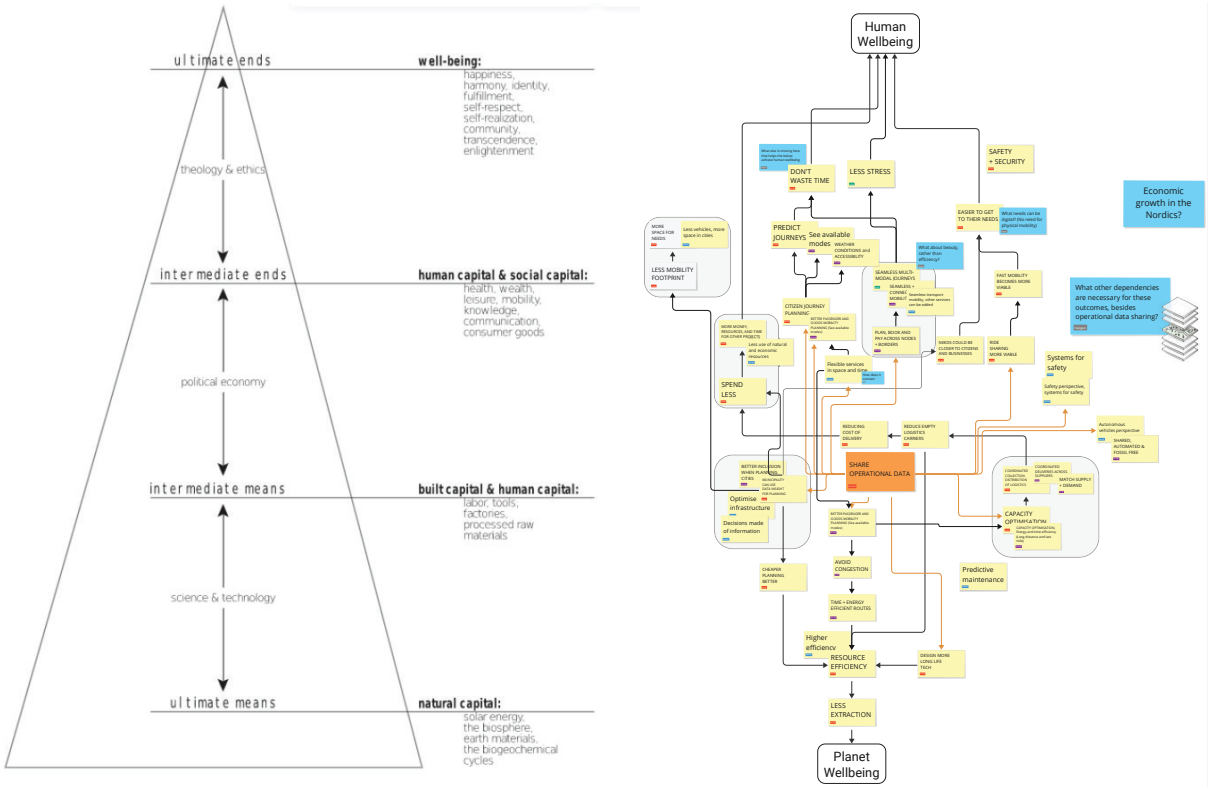


Figure 1: on the left, Donella Meadows' suggested framework for sustainable development indicators. On the right, how the framework was applied to develop project specific criteria for impact.

Coupled with other possible new technological developments such as automation, this creates a scenario of many new challenges. Emerging mobility and logistics solutions should aim at preserving Nordic values, such as equality, justice, and trust. Lastly, the transition needs to be economically viable. It is necessary to increase Nordic added value, create new jobs and enable innovators to thrive.

All of these aspects are equally important. While evaluating where to support innovation[5], it is important to keep an eye on them and choose areas and opportunities which allow us to make progress on all fronts. While technology development must play a role in achieving economic, environmental, and social impact, it cannot be the only focus. Technology should play its part together with testing new business models, demonstrating operational viability, designing policy and regulations, etc.

5 https://donellameadows.org/archives/indicators-and-informationsystems-for-sustainable-development/

2. Acknowledging the complexity of the mobility and logistics sectors through systemic thinking

When discussing mobility and logistics, the very large scale, as well as the hyperlocal must be considered. These sectors do not exist in a vacuum, they respond to various aspects such as the economic life of a place or region, citizens' attitudes towards public services and mobility in general, the infrastructure available, the ability to connect and share data, the regulatory landscape, local culture and behaviours, and even the way climate is changing. These different aspects can be regarded as layers in a complex system.

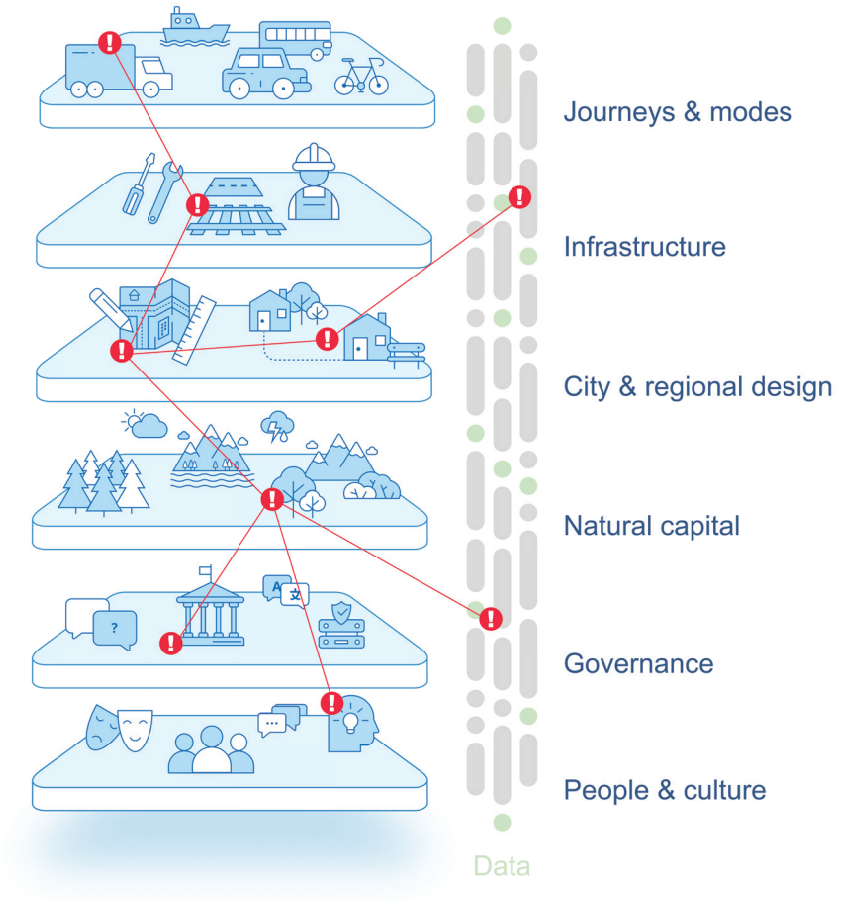


Figure 2: the diagram on the left represents the many different layers in mobility and logistics systems. The system fails when there are ruptures across layers.

From the perspective of systemic innovation, it is established that in highly complex interwoven systems what happens in one layer will impact the others. For example, challenges in the infrastructure layer where mobility and logistics data is produced and shared are connected to how people experience mobility services and availability of modes, to regulatory issues and even to how cities are planned and designed.

Mobility and logistics research and innovation projects that do not consider the interdependence between these layers tend to face difficulties in scaling. In order for innovation to scale, it is important to consider mobility and logistics more systemically: In which layer does

the project operate in? What are the relationships with other layers? What are the relationships with other projects? Who are the different stakeholders? What can be added or removed to change the system's overall behaviour? What are the conditions that incentivise or hinder innovation? At what points do we have leverage to intervene and create positive ripple effects across layers in the system?

3. Building common understanding of where we are and what we are aiming for

To better understand how this complexity is enacted today, this project has relied on tools and methods from systemic design to map, describe and visualise these different layers and their interconnections.

These system maps (see more in chapter 3) were created with basis on interviews with stakeholders, observations, and secondary research. The maps have been presented back to stakeholders and iterated based on their feedback. The maps helped facilitating constructive discussions with stakeholders in both mobility and logistics, contributing to creating a representative picture of the current state of the system.

However, agreeing on the current challenges and opportunities in the system is just one step. It is also important to create a common vision for how this system can evolve in the future. For this, foresight methods were employed to describe a vision of the future which incorporates input from industry stakeholders to define a strategic direction. The visions do not provide a complete roadmap to how to get there. They serve as lighthouses, which show the direction to move towards. These visions have been iterated on with stakeholders and serve as one of the parameters used to evaluate possible innovation projects.

4. Collaboration and co-production are key leverage points to tackle systemic challenges

Since disruptions can happen across multiple layers in a system, it is important to bring together all the stakeholders that have a role to play in possible innovative initiatives; large-scale commercial players, SMEs, public service organisations, local and national public management and regulators, private researchers and academia; many of these actors might already have collaborated in different ways; projects, programmes, missions, networks, clusters, and ecosystems are all collaborative platforms.

Bringing this multitude of actors together is no easy feat. Relationships are built over time with a lot of effort. Therefore, it is important to make use of existing platforms for collaboration. These platforms can be seen as the starting point for new collaborations to emerge.

New platforms need a clear purpose to exist. The ones built around industry actors could find purpose in tackling mutually beneficial business cases, with a shared vision for impact. In other cases, a platform could be centered around a societal mission that is open enough so that both public and private stakeholders can play a role in pursuing innovation towards impact.

In both situations, once a common benefit is identified, work can be structured in different ways. Sharing knowledge about goals, ongoing initiatives and resource usage is a task that should be centered in the core of these platforms. This kind of organising activity is often called orchestration. It is the role of orchestrators to make sure that platforms learn and adapt continuously, incorporate new resources and deliver tangible results.

Working in collaborative ways can be complex. Given the complexity of mobility and logistics, innovation projects should aim to be resilient, systemic and collaborative.

Chapter 2:
Setting direction towards the future we want

A process for envisioning the future

As stated by systemic innovation methodology[1], the formation of a shared vision is one of the cornerstones of a transformation project. It contributes to engaging stakeholders, building ownership, and formulating the elements of a desired future. For the Smart Connectivity project this means conducting foresight activities that lead to a vision - or in this case a set of vision statements for connected Nordic mobility and logistics.

1 https://www.halogen.no/playbook-for-systemic-innovation/systemic-innovation

According to this methodology, in order to achieve transformation in systems, an understanding of the current state and an idea or visualisation of the future state we aim to transform is necessary. With these two points in time as anchors, stakeholders in an innovation process can discuss what is the optimal way to traverse from the current situation to the desired future. This process enables us to identify places to intervene that can be operationalised through a set of activities in a portfolio. Envisioning the future is an important part of a systemic innovation process.

It is also important to consider that systems are not static. They consist of technological, organisational and even living systems which constantly evolve and adapt. The future vision(s) therefore needs to be adaptive and has to be revised and changed as the future unfolds. This should imprint an adaptive quality to a portfolio of interventions as well, as long as orchestrators of innovation take the time to zoom in and out of processes to understand the context as it changes around them.

The starting point for the visions created in this project is the vision adopted by the Nordic Council of Ministers and the Nordic prime ministers in 2019, stating that "The Nordic Region will be the most sustainable and integrated region in the world by 2030".

The task for this project was to illustrate the vision from the point of view of mobility and logistics: how would these systems look in the world's most sustainable and integrated region in the year 2030?

2030 is just around the corner. It is important to plan for innovation using a timeframe that allows ambition as well as actionable plans. A too short timeframe creates stress and can be challenging to agree upon, while far away visions do not provide enough anchoring for gathering stakeholders in an innovation ecosystem.

The envisioning process

The visions were created in close collaboration with Nordic stakeholders during envisioning workshops, which took place both online and offline during the spring 2023. The cornerstone of the process was the formulation of futures states and visions.

Future states

Future states are images of a certain point in time in the future. They are a way to understand and illustrate changes in the world in the coming years and serve as the end point of a certain scenario. They are especially useful in combining various tensions and trends and describing their combined impacts. In this project, the future states were utilised to illustrate the wider global operational environment,

where Nordic mobility and logistics systems operate. Future states were caricature-type future pictures, showcasing possible changes to which the system should react. Future states were not meant as deliverables on their own, but as tools to be used in reflections on what would be desirable and undesirable features of the Nordic mobility and logistics systems.

These future states were built using a method called "futures table"[2]. A futures table is a tool for imagining radical futures and exploring the largest uncertainties. It consists of several trends described with various alternative development directions. Each trend forms a variable with potential development directions being their values. The variables were chosen through a horizon scanning exercise. The idea was to identify phenomena that would have an impact on the development of smart and connected transportation systems in the Nordics.

Future states are created by combining these variables, so that each future state gets one value. Futures table produces future states which are purposefully polarised to allow discussing meaningful alternative development directions. By showing these differences it is possible to identify meaningful changes and discuss trends, events, technologies, behaviour changes, and changing values that hint towards a certain direction. Three alternative future states were developed, which were then utilised in the vision workshop.

Vision workshop

The aim of the foresight activities was to co-create a desirable future vision for the Nordic mobility and logistics systems and form alignment amongst the stakeholders. To do that, an online workshop for Nordic stakeholders was held in April 2023. The stakeholder group consisted of researchers, industry representatives and public officials.

During the workshop, the three future states developed previously were presented, and participants evaluated what they would mean for the mobility and logistics systems. The reasoning for utilising future states was to alleviate the participants from the present and enable identifying alternative development pathways. Participants were asked to identify which features of the three future states would be desirable regardless of how the future will unfold. These features highlighted during the workshop formed the basis for continued vision work.

Formulating the visions

Vision formulation was done by the project consortium. The visions described various principles, both technical and value-based, which

2 https://demoshelsinki.fi/2015/03/13/from-five-year-plans-to-alternative-futures-7-ways-to-be-smarter-about-the-future/

would form the Nordic mobility and logistics systems of the future.

The vision is quite open-ended and focuses mostly on the systems as such, leaving out some phenomena to which mobility and logistics are linked to. The features it describes are meant to be guiding principles, and even though they are defined as desirable, they can be challenged as various societal changes happen. In other words, they should not be read as definitive descriptions of the future.

Figure 3: project members working on the initial draft of the visions.

There are multiple societal changes that would be preferable in terms of ecological and social sustainability which are left out from these visions because they fall out of the direct scope of the project. For example, the vision does not take into account the possibility of reduced consumption, which would have direct implications for logistics. It also leaves out the opportunities for tighter intertwining of transportation and energy systems and infrastructures.

The vision was further defined with stakeholders on two occasions: in a live workshop at the ITS European Congress 2023 in Lisbon and a follow-up online workshop aiming towards identifying possible missions based on the visions.

A vision for mobility and logistics in the Nordics in 2030

The vision process led to six vision statements that together make up the vision used in this project. The visions presented below should be seen as starting points and should be improved upon by innovators as they see fit.

Vision - Multimodality at the core of the system

The mobility and logistics systems are based on multimodality. These systems suggest the best mode for each purpose and make it easy for people to travel sustainably. Sustainable choices are not limited to passenger mobility; if it makes more sense to move goods and services closer to people rather than moving people themselves, the system suggests so.

Trip chains are enabled by adaptive booking and service packages, which take individuals' mobility needs into account. Data-sharing enables real-time information about various mode choices and emerging changes while travelling. Mobility as a Service (MaaS) operators can provide trip chains covering the whole Nordic region and even beyond.

In urban areas, node-based trip chains are smooth, and with new services offered, peak hour travelling spreads more equally between the morning and afternoon. In sparsely populated areas, new services combining delivery and service rides help to overcome car-dependency.

Vision - Sustainability is the key priority

Development of mobility and logistics systems are done based on sustainable development goals, accessibility and decreasing environmental harm being the key priorities. In urban areas, actions are taken in order to reallocate space from road transportation to people.

Emission cuts are emphasised in all actions. Besides electrifying vehicles, emissions are cut by decreasing the share of trips made with cars. Emissions are also calculated when planning new infrastructure. Return on investments is not only calculated only in terms of money, but also in terms of carbon emissions. If emissions caused by construction are greater than those achieved with changing travel habits, investments are deprioritised. New mobility services help us make the most of existing infrastructure.

Equality is a core principle of Nordic societies, and it is reflected in the transportation system. While new mobility services are concentrated in urban areas, no areas are left behind. Improving accessibility and tackling transport poverty, including the harm caused by traffic in and around cities, is another key principle in developing mobility and logistics systems throughout the Nordics, and this attracts investments and innovations.

Vision - Seamless logistic nodes

Freight transportation is organised around transport nodes and hubs of different sizes. Real-time tracking of freight enables just-in-time transfers in these nodes and increases the efficiency of the whole delivery process, while reducing emissions.

In urban areas, incoming freight is sorted in city hubs, where freight is transferred to smaller delivery units, both motorised and non-motorised. Logistics nodes are even more important over long distances. In harbours, airports, terminals and railway stations, data sharing enables optimising of the operations of both the node and transport operators, as well as better utilisation of existing infrastructure.

Price models for deliveries are separated according to the need; urgent and fast shipping is possible but costly, while non-urgent deliveries take more time.

Vision - Data opens new opportunities

The Nordic countries are frontrunners in collecting and utilising mobility data (e.g., vehicle data) for enabling data-based travel chains and nudging for sustainable mobility behaviour. Real-time data solutions offer information e.g., on the emissions, enabling monitoring of the system and reacting quickly to the risks and new opportunities. In addition, increased data flow enables the managing of shared vehicles and agile transportation regulation and policy, as well as the empowerment of users to take responsibility for their mobility choices by increasing the visibility of the impact of these choices.

The transportation system in the Nordics offers a good testbed to pilot use cases for mobility data sharing e.g., via building digital twins of the mobility in the region, compatible with European and international platforms.

Vision - Invisible systems work smoothly

The Nordic mobility and logistics systems are based on an integrated and ubiquitous data infrastructure. Systems work smoothly (such as GSM roaming), and users are able to enjoy smooth and de-fragmented services. Interoperability testing carried out in the region addresses the legal and administrative barriers of integrated systems. Standardisation and interoperability have been enhanced by involving the European-wide data spaces. This enables cross-border data sharing and creation of services.

Digitalisation helps in arranging contractual matters in a convenient way, increasing cooperation between actors. Trust enables us to do things in a new and more efficient way. Transactions between actors take place automatically, just when needed.

Vision - Innovations are done together

Data transfer between sectors - including between public and private - and domains enable new kinds of mobility innovations such as combinatory innovations in other contexts. Coherent research and innovation funding strengthens the active innovation ecosystems in the regions enabling decentralised innovations and open-source models. Innovations are born in the active ecosystem focusing on solving the relevant challenges and orchestrated by the public sector. The emphasis on Nordic collaboration opens markets for new innovations and inspires big players to grasp new opportunities.

Adaptive systemic visions vs. missions

The innovation scene is changing as an understanding that our linear way of running projects and doing innovation is not always sufficient starts to develop. New concepts and new theories have been developed to tackle that. One example of this is the EU's Mission approach. The EU's organising of the Missions is linear, i.e. they set up mission boards and innovators can apply for traditional project grants. The difference is in how the mission is governed and lead by bold, measurable goals.

Systemic innovation on the other hand is based on emergence, i.e. allowing ideas and initiatives to surface as the future unfolds around us. A systemic approach makes it possible to see the systems more holistically and intervene in places where it makes sense to innovate at that particular time, taking into account that the system is constantly moving and adapting. This means that a vision, in contrast to EU's missions, has to be adaptive and change together with the system.

Chapter 3:
Overview of data and connectivity for mobility and logistics

The landscape for data and connectivity internationally

Throughout the last years, there has been increased focus on raising the capability of players in the sector to handle and make use of the growing amount of mobility and logistics data. The expected potential for data to positively affect decision making, to lead to the production of new knowledge and innovation, and to improve service delivery is high.

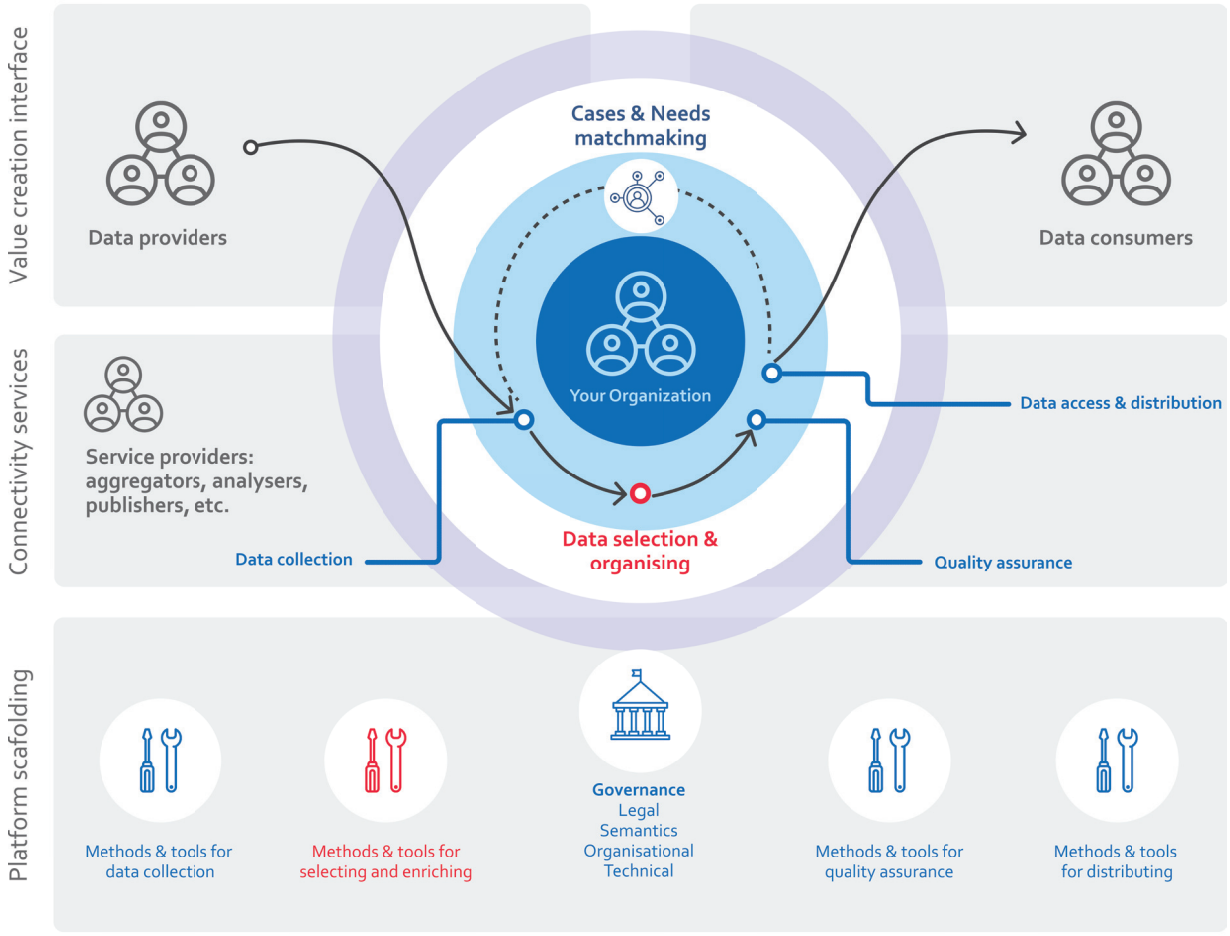


Figure 4: a visualisation of the main building blocks of well-functioning platforms or data spaces for sharing and using mobility or logistics data, according to input from stakeholders.

Data is produced and collected by a multitude of actors in the sector, in increasingly large quantities. Several approaches have arisen to enable data sharing and connectivity: niche communities with focus on specific interests and use cases exchange data privately, while industry-wide approaches attempt to create a free-flowing, harmonised market for data. In response to the last, actors are competing in the market of ideas for the winning architecture for platforms that can enable such flow of data.

The concept of *Data Space* has also been expanding, as a type of

platform that is often decentralised and loosely connected based on common principles. However, the same problem appears: different applications of the concept compete for wider adoption. As a result, a chaotic situation starts to form, with multiple different architectures and approaches to implementation existing at the same time.

To attempt governing this, there has been a myriad of regulations, mappings and gathering of different data sources and their properties in the last two decades. There seems to be a common understanding that even though several European legislative and non-legislative initiatives have been introduced in this period, the potential of data has not yet been realised. The PrepDSpace4Mobility[1] report "Towards a common European mobility data space Perspectives, recommendations and building blocks" on topics regarding the European Mobility Data Space, points to several possible reasons:

- Data source gaps and overlaps
- Business and funding models
- Governance framework
- Legal considerations
- Technical grounding
- Data interoperability
- Data sovereignty and trust
- Data value creation capabilities

The different building-blocks for mobility and logistics data spaces can be developed, arranged, and implemented in different ways. It could be argued that the national implementation, which forms the basis of the governance framework from the different legislative initiatives, is sub-optimally coordinated.

Lastly, it was observed that while it is important to pursue solutions for the scaffolding of these platforms, what is crucial for more data to be shared and utilised is to find use cases grounded in actual needs. In this way, stakeholders can see and realise benefits for their organisations while also pursuing a societal benefit. These use cases need to make sense for multiple stakeholders at the same time, providing opportunities for collaboration around data. Understanding, mapping, and sharing knowledge about such use cases can be a game-changer, allowing ecosystems to naturally coalesce around them.

1 https://mobilitydataspace-csa.eu/

Passenger mobility data overview

There are 3 types of mobility data this report focuses on:

- Infrastructure data (Maps, rules, assets)
- Mobility data (routes, timetables, traffic volumes ticket prices, etc)
- Conditions and real time data (Weather, construction, Incidents)

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 regulations with detailed specifications[2]:

- 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)
- MDMS (Multimodal Digital Mobility Services) - not implemented

The potential for sharing mobility data is promissing. However:

- Sufficient quality is needed to be useful (referring back to a functional data value chain)
- Sufficient quantity of data per type of mobility data to reach a critical mass to make it worth it
- Data needs to be standardised sufficiently to be interoperable
- More driven by public actors and regulations, therefore higher potential for industry-wide solutions.

Logistics data overview

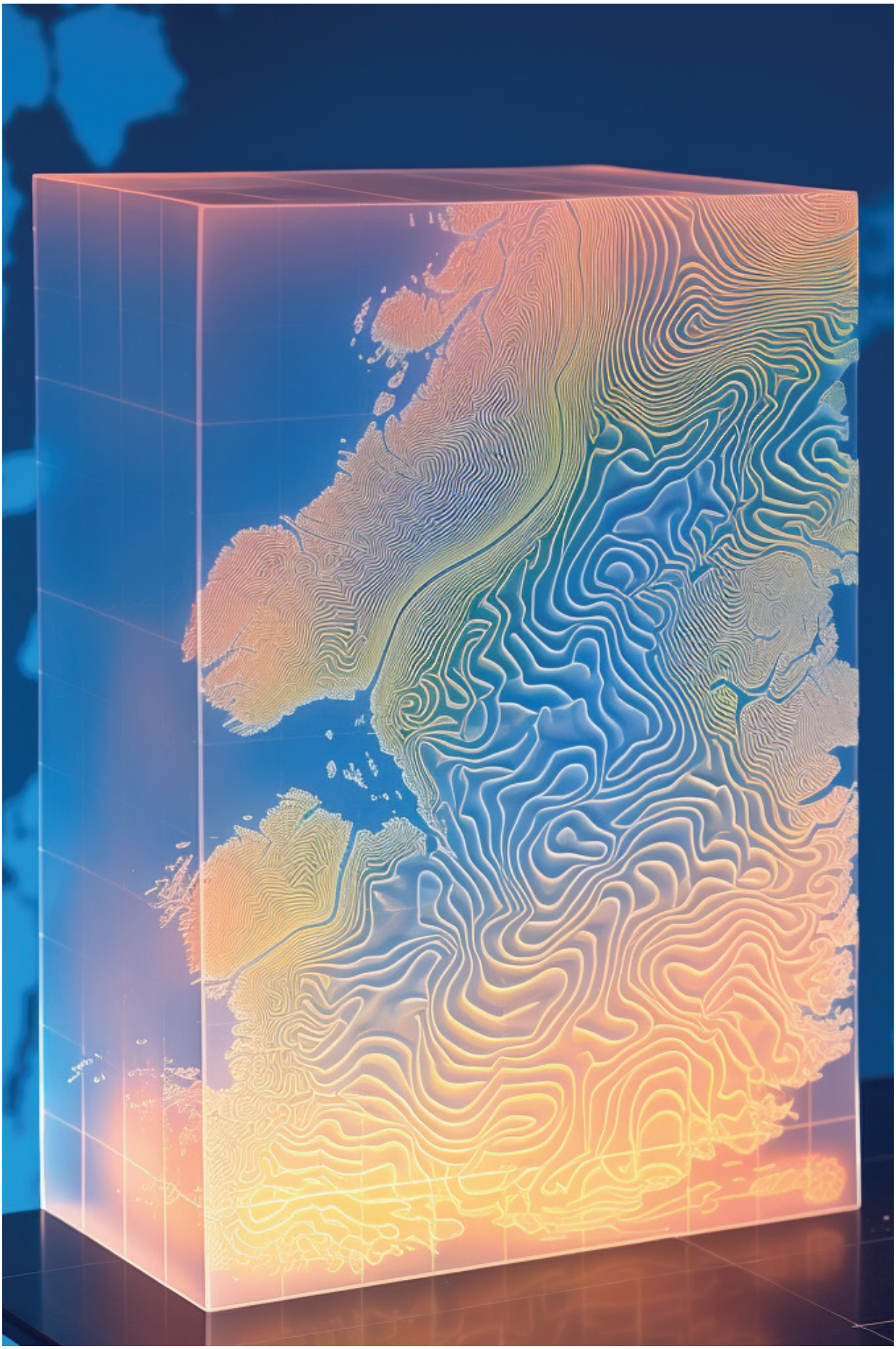
Throughout the logistics value chain, there are many opportunities for sharing data and increasing connectivity. In the Nordics, there is a prevalence of maritime shipping connecting the region to global supply chains, in conjunction with truck freight to feed the vast distances of the region. In the other direction, heavy industry ships cargo such as wood and ore via rail to ports to be exported worldwide.

Increased data sharing and connectivity can enable more sustainable and efficient outcomes in and out of ports. Collaborative Supply Chain visibility platforms are being developed to increase traceability of cargo end-to-end, as well as improve situational awareness and increase efficiency. These kinds of initiatives are welcomed by port authorities who see the benefit of improving efficiency in their operations, transport producers who see benefits in increased efficiency and lower environmental footprint, as well as cargo owners who are looking for ways to account for Scope 3 emissions (indirect emissions not controlled by reporting organisation).

When it comes to road freight throughout the Nordics, it is important to consider the Electronic Freight Transport information (eFTI) EU regulation[3], which dictates that a platform be established for seamless cross-border freight utilising electronic transmission of consignment notes (e-CMR). These would enable faster and/or automated cross-border freight. These platforms should be able to exchange data with the European Maritime

2 https://transportportal.atlas.vegvesen.no/en/gen/its/

3 https://eur-lex.europa.eu/EN/legal-content/summary/electronic-freight-transport-information.html



Single Window (EMSWe)[4] environment for multimodal cargo, and each country should organise their own national access points for accessibility of data.

As heavier electric and/or autonomous freight is expected to hit the European roads soon, data about the impact on infrastructure should be considered. Data about transports can also be valuable to optimise routes or enable restrictions.

When freight approaches urban areas for last mile deliveries, transport data can be valuable in enabling better placement and design of consolidation centres, as well as collaborative approaches to last-mile delivery (resource sharing, time slot allocation, placement of white-label delivery boxes, among other collaborative solutions). Transport data, however, is owned by commercial actors and highly valued as an asset, as this data can be used to build machine-learning and other kinds of algorithms for optimising routes and deliveries.

Lastly, while personal mobility can benefit from centralising public authorities that provide mobility services, the landscape for logistics is led by commercial actors and therefore more fragmented.

Figure 5: participatory workshop at the ITS European congress, in May 2023.

4 https://eur-lex.europa.eu/EN/legal-content/summary/european-maritime-single-window-environment.html

Connecting the needs for data with the needs of mobility and logistics as a system

As mentioned in the introduction, it is important not to focus solely on data. In order for data to be valuable it needs to be analysed, put into a context, and be utilised. Because of that, the project has carried out a series of interviews and workshops with mobility and logistics stakeholders to understand the context of their operations, the challenges they see when it comes to increased connectivity and data sharing, as well as the opportunities for change. More than 70 stakeholders from the industry were engaged in the process.

The insights gathered throughout these interviews and workshops have been summarised in two visualisations, which attempt to represent the mobility and logistics value chains as systems. These visualisations convey relationships between causes and effects, bottlenecks or leverage points which could be regarded as potential foci for innovation. It is important to note that these visualisations are meant to be snapshots of a system at a given point in time. They are not definite representations of these systems, instead they serve the purpose of supporting discussions between stakeholders, help achieve consensus, and trigger new ideas and insights.

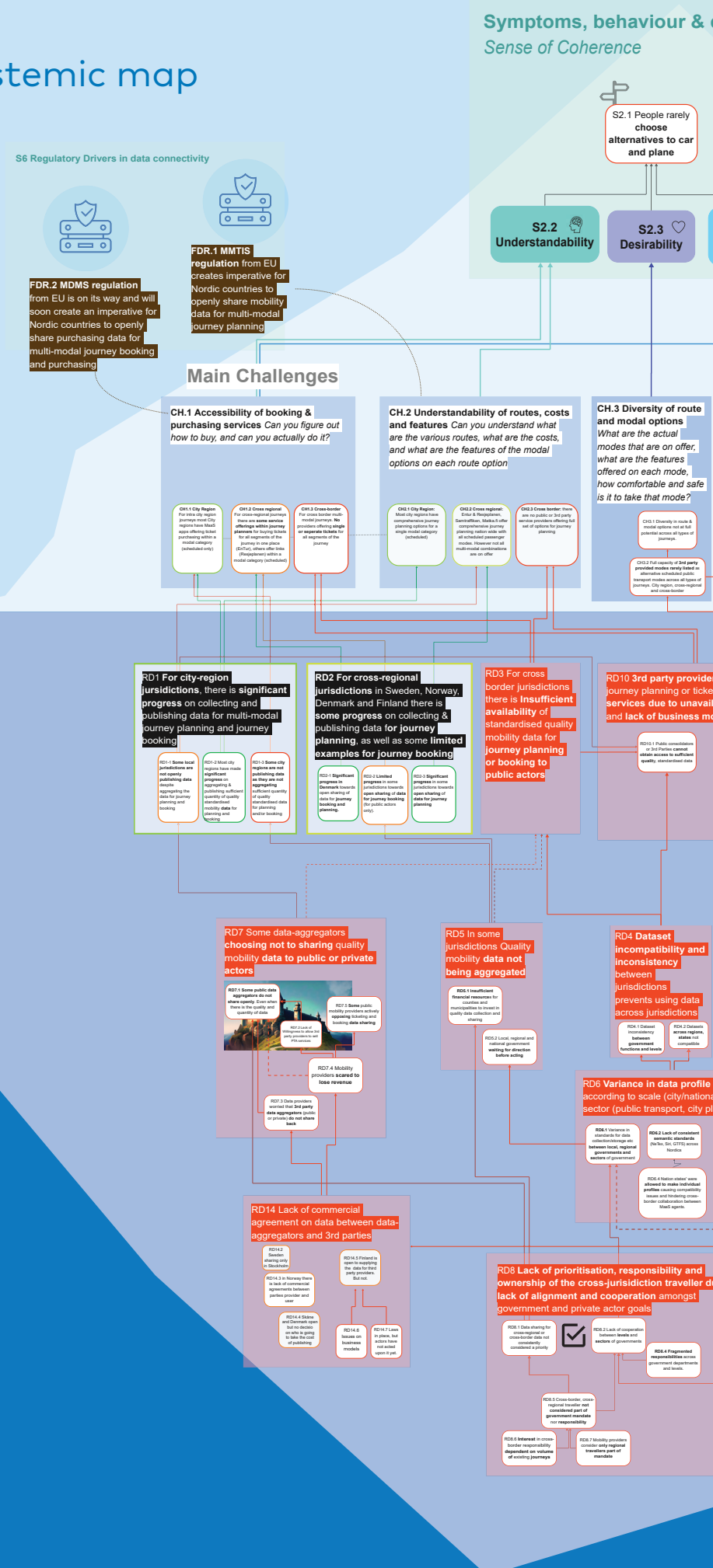
These pictures - or systemic maps, as they will be referred to further in this report - have been exposed to stakeholders in workshops and have been iterated with their feedback. The following sections will detail the findings from this process.

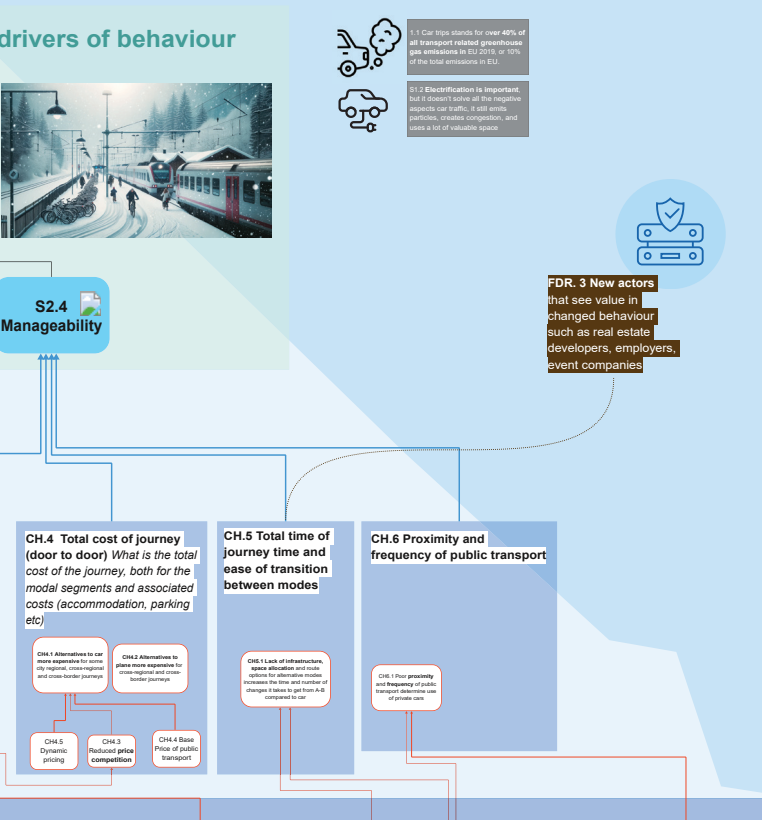
Systemic picture of current passenger mobility challenges

One of the core deliverables is an understanding of the system and corresponding challenges and root drivers. To better understand the various challenges and root drivers, the insights have been connected with an iceberg-structured "cause and effect" diagram based on systems thinking.

The analogy of an iceberg is used to understand this cause-and-effect diagram of the main challenges facing passenger mobility in the Nordics. Like an Iceberg which has 90% of its volume below the water surface, it is typical that most issues happen due to invisible underlying root drivers. The main challenges are the problematic symptoms of the mobility landscape in the Nordics.

Passenger mobility systemic map





What we can observe

Root drivers

Figure 6: systemic map used during the insight phase of the project, describing surface-level issues in mobility and deeper, root-drivers that influence them.

The main problematic symptom that explored is that people continue to choose private modes with negative impacts to collective transport mode alternatives. This is a problem because car trips stand for over 40% of all transport related greenhouse gas emissions in EU 2019, or 10% of the total emissions in EU. While electrification is important, it does not solve all the negative aspects of car traffic: cars still emit particles, creates congestion, and uses a lot of valuable space.

Passenger journeys can involve single or multiple modes of transportation. The types of modes include:

Scheduled:
Typically, scheduled modes are the ones where passengers subscribe to offers by buying tickets to pre-established time slots in a certain route. Classical examples are trams, trains, airplanes, buses and intercity buses. Ticket prices for some of these can be dynamic, which can hinder Sense of Coherence.

On-demand:
Traditionally, taxis were the dominant form of on-demand transportation. With the explosion of Uber, other car-ride offers have appeared. The public sector has also entered this domain, with certain demand-responsive transport (DRT) offers, where scheduled rides are out of cover.

To encourage the use of more sustainable modes of travelling, alternative modes must be made more effective and convenient for people. The Sense of Coherence (SOC) model gives us insight on why cars and planes are still preferred choices in some cases and what we must address if we are to transition away from private modes with associated negative impacts as the preferred options.

The model is based on research for understanding how to get people to take action that builds their physical and mental health and it says that all elements of SOC - **Understandability, Desirability and Manageability** - need to be present to motivate a change of action. Consequently, in the realm of passenger mobility for people to choose sustainable actions, such as alternative modes of transportation for their travel, those actions need to be understandable, manageable, and desirable. All three elements must be present.

The diagram was structures to show how the various challenges that we discovered in our insight contribute to people continuing to choose the car and plane over alternative options to get from A to B.

The challenges are detailed as follows and affect the three elements of SOC as can be seen on the top of the systemic map:

- Accessibility of payment (Understandability and Manageability)
- Understandability of routes costs and features (Understandability)
- Diversity of route and modal options (Desirability)
- Total cost of journey from door to door (Manageability)
- Total time of journey and ease of transitions between modes (Manageability)
- Proximity and frequency of alternative mode options (Manageability)

These challenges are being influenced by what are called root-drivers. These root drivers are the often invisible aspects that affect how people choose to travel. They can have positive or negative effects on the challenges mentioned above, and usually offer the greatest leverage to influence them.

Further, the current state of these challenges will be described in detail, as well as explaining how each challenge is connected to both driving the SOC elements but also being driven by various root drivers.

Accessibility of purchasing

This means ensuring that individuals understand how to pay for their chosen modes of transportation and providing convenient options for payment methods. Accessibility is what enables people to easily access and utilise sustainable transportation options, aligning with the SOC's concept of manageability.

> **"[There is] a lot of precise data on Rejseplanen, but no ticket information"**
>
> Mobility workshop participant

Current state of accessibility of purchasing:

In the Nordics, city regions (CH1.1) have generally succeeded in implementing Mobility as a Service (MaaS) applications that provide straightforward ticket purchasing for scheduled transportation modes. This has significantly eased the process for intra-city travellers. However, cross-regional travel (CH1.2) is experiencing a mixed state of progress. While services like EnTur facilitate ticket purchases for most journey segments in one place, other platforms offer limited options, usually just links within a scheduled transport category. Cross-border journeys (CH1.3) face greater challenges, as there is no unified ticketing system available, forcing passengers to endure a fragmented and not user-friendly experience of purchasing separate tickets for different journey segments.

Root drivers of current issues:

Underpinning the generally good state of most city-region jurisdictions in terms of the accessibility of booking and purchasing services is the significant progress on collecting and publishing data for multi-modal journey planning and journey booking (RD1-2). These jurisdictions have effectively harnessed local Mobility as a Service (MaaS) apps that facilitate ticket purchasing within a modal category, which is scheduled only. However, some challenges persist due to issues such as certain city regions not effectively aggregating sufficient quality data (RD1-3), which can create gaps in the information available to users, affecting the ease of booking and journey planning.

Cross-regional jurisdictions show a mixed state. Some jurisdictions are making limited progress in collecting and openly sharing booking data (RD2-2), which contributes to an 'okay' status in terms of service accessibility. Passengers in these Nordic cross-regional jurisdictions may find some journey booking services, but these are not comprehensively available for all segments of the journey. In contrast, Denmark's cross-regional jurisdiction is noted for its significant progress (RD2-1) in the collection and sharing of data for both journey planning and booking. This indicates a more advanced stage of development where passengers can enjoy a more seamless experience when planning and booking their travel across different regions within the country.

When it comes to journey booking in cross-border jurisdictions), travellers encounter difficulties due to the lack of a single place to purchase and book tickets. This is primarily caused by the insufficient availability of standardised and quality mobility data (RD3) necessary for integrating journey planning and booking systems across countries. Without cohesive data sharing, passengers must manage separate tickets for each segment of their multi-modal journeys, leading to a fragmented and very unfriendly user experience.

Unpacking the root driver issues underlying inadequate journey booking and planning services in the Nordic passenger mobility system, we begin with the challenge of insufficient standardised quality mobility data for cross-border journey planning or booking. This is directly driven by the issue of dataset incompatibility and inconsistency between jurisdictions (RD4), creating barriers to the seamless integration of mobility data across borders.

Indirectly, the insufficient availability of standardised and quality mobility data is also affected by quality data not being aggregated in som jurisdictions (RD5) and some data aggregators choosing not to share quality data to public or private actors (RD7). RD5 contributes to the problem through the insufficient financial resources and governance directional constraints that prevent effective data aggregation. Meanwhile, RD7 exacerbates the issue with some data aggregators' reluctance to share quality mobility data, which would be crucial for enriching cross-border data resources.

Turning our attention to the limited progress in some cross-regional jurisdictions towards the open sharing of booking and planning data, it is clear that RD5 is a driving force here as well. The financial and governance directional limitations captured by RD5 result in an inconsistent data landscape, which in turn impedes the development of comprehensive booking and journey planning systems.

Looking at the difficulty city regions face in aggregating sufficient quality data for journey planning, the influence of RD5 is seen once again. The challenges of resource allocation and the establishment of data-sharing standards are central to why these regions cannot accumulate the high-quality data needed for a standardised planning framework.

Finally, where some local jurisdictions are not sharing data is influenced by the hesitation or refusal by some data aggregators to openly share quality mobility data. This restricts the potential for any cross-regional actors to offer journey booking systems, even when they have the capabilities to do so. This reluctance from data aggregators forms a significant barrier to cross-regional and cross-border journey booking services.

The variance in data profile standards (RD6) is directly influenced by the lack of cooperation between levels and sectors of government. This disconnection directly undermines efforts to standardize data profiles, as collaborative efforts are crucial for aligning data standards across different governmental scales and sectors involved in public transport and city planning.

The varying data needs between actors (RD9) indirectly affects the variance in data profile standards. The different data needs at city and national levels, as well as the non-aligned objectives of municipalities, contribute to the difficulty in establishing a uniform approach to data standards. The lack of a common data framework hinders the development of consistent data profiles that would facilitate cross-jurisdictional planning and operations.

Insufficient financial resources is a driven by the lack of consistent prioritisation of data-sharing beyond the local jurisdiction, which denotes a deeper issue of the cross-regional, cross-border traveller not being considered a part of the government mandate, nor responsibility. This priority gap has led to insufficient financial and structural resources being allocated for data aggregation and standardisation efforts.

Furthermore, the issue of regional and national governments waiting for direction before acting is also driven by the lack of cooperation between levels and sectors of government. This is driven both by the lack of the cross-regional cross-border travellers being considered a responsibility, which could otherwise be a driver for collaboration, and the fragmented nature of government sectors and levels.

Lastly, the reluctance of some public data aggregators to share quality data, is directly affected by the lack of prioritising cross-regional, cross-border mobility data sharing, which in turn is due to the deeper issue of the cross-regional, cross border traveller being considered no-ones responsibility. This hesitance can be attributed to the broader issue of lack of cooperation between levels and sectors of governments. Without a cohesive strategy and a sense of shared responsibility, there is little incentive for data aggregators to contribute to a unified data ecosystem, which is essential for robust and efficient mobility services.

Understandability of routes, costs and features

This means providing clear and comprehensive information on routes, distances, departure/arrival times, durations, and costs associated with different modes of transportation. This empowers individuals to make informed decisions about their travel options, aligning with the SOC's concept of understandability.

> **"Passengers understand their local region but need to build up understanding from scratch of [the] neighbour region."**
>
> Mobility workshop participant

Current state:

In the Nordic region, the understandability of routes, costs, and features- essential components of effective journey planning - varies by jurisdiction.

Turning the attention to city regions, there has been commendable progress in journey planning, enabling users to understand their travel options with relative ease. This is largely thanks to significant advances not all modes that are possible are offered on the various cross-regional journey planning services in the Nordics. This inconsistency is due to some regions not fully leveraging the available data for all modes while others have

in collecting and publishing multi-modal journey data. Travellers in these areas benefit from robust MaaS platforms that offer comprehensive information on routes, costs, and transportation features within a single scheduled category.

progressed substantially in data aggregating and sharing. Thus, passengers are met with a spectrum of journey planning tools for each region, each offering a different user experience and not covering all multi-modal combination offerings.

As we look at cross-regional travel the landscape becomes more varied. While there are services like EnTur, Rejseplanen and Matka.fi offering extensive journey planning features,

The complexity escalates for cross-border travel, where no public or third-party service providers offer a complete set of journey planning options. The primary root driver here

is the insufficient availability of standardised quality mobility data to other public actors and the unavailability of data to third parties and a lack of viable business models for offering journey planning services.

This absence of quality standardised data hampers the ability of service providers to obtain datasets that work across national jurisdictions and hence impedes the planning of journeys across national borders. Without a unified platform, travellers often resort to cobbling together fragments of information from various sources, leading to a fragmented and challenging planning process. This situation is pushing cross-border travellers towards more straightforward, albeit less sustainable, travel options such as cars or planes.

In summary, city regions demonstrate commendable advancements in journey planning and cross-regional services and, in spite of their varied stages of development, have reached a pivotal point. They have accumulated enough momentum to stand as viable services, ripe for further development. This critical mass signifies that with targeted efforts to harmonise application and data sharing, these services can quickly scale and improve. Cross-border travel remains the most complex, with significant gaps in standardised data affecting the understandability of routes, costs, and features for travellers and a systemic avoidance of responsibility for cross-regional and cross-border travellers.

Root drivers:

Diving deeper, we observe that city-region jurisdictions are not openly publishing data due to a distinct choice to not share - even when data-aggregation is taking place. This choice impacts the availability of quality data for actors other than the data-aggregator, thus affecting the efficacy of journey planning services that could be offered by actors other than the data-aggregator actors.

Similarly, the issue of city regions not openly publishing data is due to the underlying root driver of insufficient aggregation of quality mobility data. This is due to insufficient finances and resources to collect, aggregate and publish quality data that can be utilised and the lack of coordinated data collection standards causing local, regional and national governments to wait and see before starting to collect and aggregate. This leads to data gaps in some city regions, which in turn results in data-gaps at the cross-regional level (which aggregate the city region data). Hence affecting the comprehensiveness of journey planning platforms.

For cross-border jurisdictions, the insufficient availability of standardised quality mobility data for journey planning or booking stems from several intertwined factors. The direct driver is the dataset incompatibility and inconsistency between jurisdictions, which prevents the use of harmonised data across borders. This incompatibility is further driven by the variance in data profile standards, highlighting the differences in data collection and sharing protocols between city and national levels, as well as public transport and city planning sectors.

Indirectly, the insufficient availability of quality data is also influenced by the reluctance of some data aggregators to share their data, which withholds valuable cross-border journey information from the public domain. Moreover, the broader issue of data not being aggregated effectively within some jurisdictions contributes to the lack of quality data available for cross-border journey planning services, as there is insufficient data quantity and quality available for such initiatives.

A number of underlying root drivers expand on the fact that some data-aggregators are choosing not to share quality data. This reluctance is due to data sharing not being considered a priority, having a principle that they do not want to share unless third parties who will use the data also share back, and

a lack of willingness to allow third parties to sell public transport tickets due to the fears of losing customers, and therefore revenue. Consequently there are some public mobility providers who are actively opposing the Multimodal Digital Mobility Services (MDMS) regulation from the EU, which was a regulatory framework that would push public transport actors to openly publish quality mobility data.

The fact that public data-aggregators are choosing not to share data is primarily targeted at private 3rd party actors, and the reasons vary. The unwillingness to share data is rooted in a broader systemic problem: data sharing is not consistently considered a priority across jurisdictions. This is driven by the fact that the cross-border cross regional traveller is not considered part of the government mandate, nor responsibility.

This lack of mandate leads to insufficient cooperation between departments and levels of government, affecting both the standardisation of data profiles and the urgency of aggregating quality data. The lack of responsibility for the cross-regional, cross border multi-modal traveller is partially due to the interest in cross-border responsibility being dependent on the volume of existing journeys, not the future potential and the fact that some public transport providers only consider regional travellers to be part of their mandates.

Additionally, the issue of cross-border, cross-regional journey data not being consistently considered a priority, is also exacerbating the issue of financial constraints and hindering the aggregation of quality mobility data. Without adequate standardisation, regional and national governments end up waiting for guidance or consensus before acting. The insufficient cooperation is not only driven by the lack of responsibility for the cross-border, cross-regional traveller, but is also being driven by the reality that there are varying data needs at the city and national levels.

This is because city data is more complex than national mobility data, and therefore the national needs are not aligned with needs of individual municipalities. RD9 is driving the variance in standards, as national actors are often the first to aggregate data, due to their resources, but these standards end up not being suitable for all the data needs of the city. This situation is made worse by the fragmented responsibilities across the government departments and levels, which stifles decisive action and alignment in data strategies.

To improve journey planning and mobility in the Nordic region, it is crucial to tackle these root drivers. This involves promoting open data sharing, enhancing cooperation across government sectors, and establishing clear priorities and responsibilities for data management. Only through such concerted efforts can the region move towards a more integrated and user-friendly transportation network.

Diversity of route and modal options

This means offering a wide range of multimodal combinations that cater to different needs, preferences, and travel purposes. This diversity of options enhances the sense of choice and control, aligning with the SOC's concept of desirability.

State of diversity in route and modal options:

There is a recognition that the diversity in route and modal options is not at its full potential across all types of journeys. Although a variety of transportation modes exist, the full spectrum of these options is not always presented or preferred in journey planning tools, limiting travellers' awareness of available choices.

The full capacity of third-party (private operators offering public journeys) modes is often underutilised. These modes are listed as alternative choices but are not consistently integrated as preferred options in public journey planners. This leads to a situation where the

actual variety and accessibility of multimodal travel options are not fully leveraged in journey planning platforms.

The underrepresentation of third-party modes in journey planning directly influences the issue of reduced price competition. If alternative modes are not fully integrated and visible to users, there is less incentive for pricing strategies that could make alternatives to private journeys more competitive. This lack of competition can contribute to the perception and reality that alternatives to traditional car and plane journeys are more expensive when considering the total cost from door to door.

Root drivers of modal and route option diversity:

These challenges are intrinsically linked to the struggle of third-party mobility providers to have their services included and selected in public journey planners. Consolidator apps often prioritise scheduled public transportation services, which can overshadow the availability and visibility of alternative modes. This issue is compounded by the difficulty these providers face in generating revenue, as their services may not be as prominently featured or integrated within the journey planning systems.

A significant technical barrier also exists due to the lack of integration and interfacing between private on-demand or unscheduled modes and public scheduled modes. Without seamless integration, the desirability and practicality of using these alternative modes decreases, impacting their adoption and the overall diversity of the transport ecosystem.

Third-party mobility providers struggle to have alternative modes included and chosen in public journey planners (RD11), is rooted in several underlying root drivers.

One significant driver of RD11 is the fear of revenue loss among mobility providers. These providers are cautious about sharing their data, which could potentially empower competitors if the shared data reveals insights into profitable routes or customer behaviour. This fear is not unfounded, as increased data transparency could lead to more intense competition, possibly driving down prices or diverting customers to other services.

Compounding this issue is a lack of cooperation between the public and private sector mobility actors and providers, which is symptomatic of a broader reluctance within the industry to work together towards common goals. This lack of cooperation can partly be attributed to the same concerns over revenue loss that affect individual mobility providers. The competitive nature of the transport sector often leads to a protective stance over proprietary data and customer relationships.

The concerns about losing revenue also contribute to a resistance to collaborate. Companies may fear that by collaborating, they could inadvertently give away competitive advantages or diminish their market share. This creates a cyclical problem where the lack of collaboration hinders the integration of alternative mobility modes into public journey planners, which in turn could foster a more competitive and diverse transportation market.

In essence, RD11 is a multifaceted issue where the reluctance to share data, driven by concerns over revenue and competitive positioning, leads to a stagnation in the diversity of transportation options offered to the public.

Breaking this cycle requires addressing the underlying fears of revenue loss and fostering an environment where data sharing and cooperation are seen as opportunities for growth and improved service delivery, rather than threats.

Addressing these root drivers requires a multifaceted approach. It necessitates improving the visibility and integration of third-party modes in journey planning tools, fostering a more competitive environment, and enhancing the interface between various transportation modes to truly offer a diverse range of travel options that are desirable and accessible to all users.

Total cost of journey (door to door)

Ensuring that the overall cost of alternative modes, including multi-mode journeys, is clear and transparent. This enables individuals to make cost-effective decisions and understand the financial benefits of sustainable transportation, aligning with the SOC's concept of understandability.

In the Nordic region, the total cost of travel from door to door, represents a significant challenge for travellers. Alternatives to private individualized journeys often come with a higher price tag, particularly for journeys that span city regions, cross-regional areas, and international borders. This can skew the decision-making process, leading travellers to favour personal vehicles or flights over alternative options.

A key contributor to this situation is dynamic pricing, which adjusts the cost of public or private collective transport based on demand, time, and other variables. During

peak travel times, this can result in fares that rival or exceed those of private modes, thereby diminishing their attractiveness.

Compounding the issue is the lack of price competition within the transportation sector. With fewer operators offering viable routes between destinations, there's little pressure to offer lower fares, which tends to keep the costs of alternative travel modes high. This is especially true for third-party services, which often lack the visibility and preferred placement in journey planners that traditional transport modes enjoy.

The foundational fares for public transit, or the base price of public transport, are also a pivotal factor in journey cost. High starting fares for public transit can set the tone for an expensive journey, especially when additional charges for using multiple modes and ancillary costs such as accommodation and parking are factored in.

Moreover, the rarity with which the full capacity of third-party provided modes is listed as an alternative in journey planners exacerbates the issue. Without adequate representation, these options fail to exert the competitive pressure necessary to influence pricing.

In summary, the total cost of a journey in the Nordic region is influenced by more than just the sum of its modal segments. It is shaped by pricing strategies, the competitive landscape, and how alternative transport options are presented to travellers. For Nordic mobility to advance, it is essential to find a balance that ensures sustainable and efficient travel options are not only available but also competitively priced and easily accessible for all travellers.

Journey time, number of changes and ease of transitions

In the Nordic region, reducing the total journey time and smoothing the transitions from door to door remains a key opportunity for improvement. The current collective transport systems encounter infrastructural challenges that impede the efficiency of multimodal travel. A central issue is the lack of infrastructure, space allocation, and route options for alternative modes, which increases the time and number of changes it takes to get from point A to point B compared to travelling by car.

The challenges of journey time and transitions are compounded by; planning policies that prioritise cars and the underrepresentation of third-party provided modes. Third party modes have the potential in some cases to offer more direct and diverse routes.

The prioritisation of cars is evident in the allocation of space on urban roads and parking locations, often at the expense of dedicated pathways for other modes that could otherwise provide more efficient travel options. This car-centric approach to space allocation is compounded by the generally insufficient quality and quantity of infrastructure available for alternative modes, such as public transit, cycling, and walking.

Financial investments in transport infrastructure further reflect this car preference, with roads for cars receiving greater financial resources than multimodal infrastructure. The resulting imbalance diminishes the development and maintenance of facilities that are essential for efficient intermodal transfers, such as transfer hubs and integrated ticketing systems.

Moreover, city planning often prioritises private car travel over people and communities, which can lead to urban sprawl and hinder the ability to develop compact, walkable neighbourhoods that support a range of transportation options. Political incentives and standards reflect this prioritisation, failing to provide the necessary support for initiatives aimed at fostering sustainable mobility. This is further entrenched by a car-centric mindset that persists within both policy-making and the public consciousness,

resisting changes that would elevate the role of public and alternative transportation modes.

As a result of these challenges, travellers are frequently left with few viable options but to rely on private vehicles (RD12). The compounding effect of these sub-challenges creates an environment where the convenience and speed of car travel continue to overshadow the potential benefits of a diversified and sustainable transport network. Addressing these root drivers is crucial for the Nordic region to advance toward a more integrated, efficient, and sustainable transportation system that encourages travellers to embrace a variety of mobility options.

Proximity of nodes and frequency of departures

This means designing urban environments where public transport modes and alternative options are easily accessible within a convenient walking distance. This reduces barriers to using sustainable modes of transportation, aligning with the SOC's concept of manageability.

Ensuring sufficient frequency of public transportation services to provide viable alternatives and minimise waiting times improves the convenience and reliability of sustainable transportation, aligning with the SOC's concept of desirability.

"When public transport infrastructure is more than 500m away and less than 10 departures per day, people choose the car."

"Car ownership is dependent on access to public transport"

"For some, price is not important. Distance to the bus is important."

Quotes gathered during mobility workshop

In the Nordic region, the challenge of enhancing the proximity and frequency of public transport (CH.6) is closely linked with broader planning policies and the struggle for public transport to compete with private vehicles outside of densely populated areas (RD13).

Public transport utility is directly impacted by urban sprawl, where stops and services are too far away from residences, compelling travellers to favour the convenience of cars. This issue is a byproduct of urban planning that allocates more space for roads and parking, often at the expense of efficient public transport infrastructure.

The situation worsens in rural and less densely populated areas. Here, public transport faces a challenging battle with the car, as the infrequency of services and the insufficient critical mass of passengers reduce its viability as a practical alternative. Without the demand to justify frequent services, and with distances between stops often vast, the car or plane becomes the default choice for interregional travel.

To address these issues, the Nordic region needs to realign its urban development to support more compact, connected communities that naturally lend themselves to efficient public transport networks. This change would help public transport offer a more competitive alternative to car travel, both within and beyond urban centres.

Systemic picture of current logistics challenges

After a series of interviews with logistics stakeholders, a good amount of data was gathered. In order to make sense of it, the logistics value chain was then visualised in a simple diagram: on one end goods suppliers; on the other customers; in the middle, first mile, ports, hubs, and last mile; throughout, different vehicles and modes are used to transport goods.

This diagram was used to pinpoint which areas stakeholders had more insight on. As a result of this exercise, three areas came into focus: from hub to hub, from hub to last mile, and the vehicle level. We expanded each of these areas in more detail.

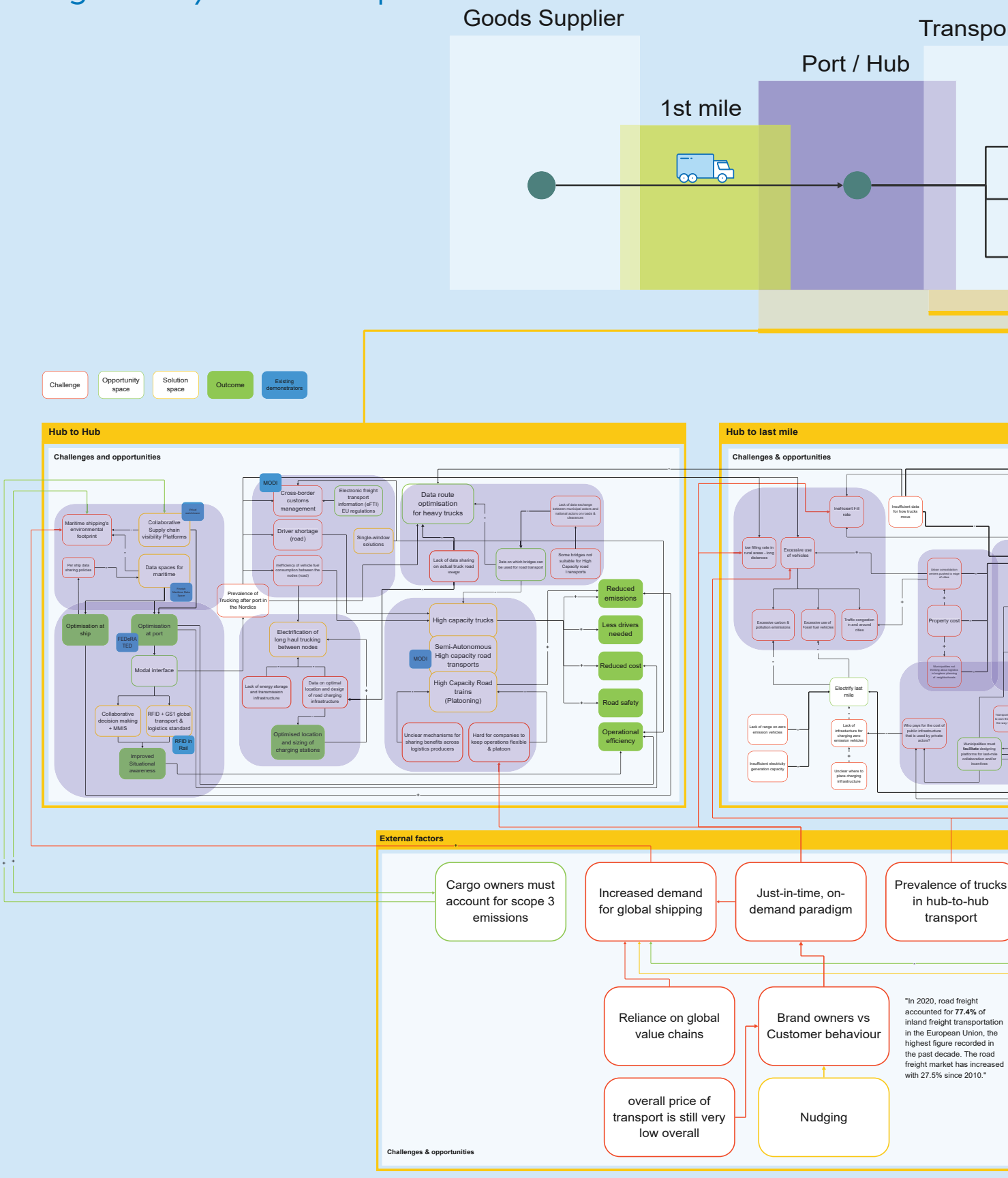
Inside each of these three areas, we have plotted challenges, opportunities, solutions, outcomes, and existing projects and/or demonstrators. Each section is made out of several cause-and-effect loops, where challenges, opportunities, solutions, and outcomes influence each other either positively or negatively. Below these three areas, external, high-level societal trends and developments which can influence the logistics value chain as root drivers were also outlined. Below, each section will be detailed further and some of the most relevant spots will be highlighted, according to the involved stakeholders' opinions:

Breakdown by area - root drivers:

Above is an overview of the root drivers for logistics. These factors have framed this study and influence the different challenges and opportunities in several parts of the value chain.

One example is the weight of inland freight transportation (light and heavy trucks plus rail) of goods in Europe (74% in 2020) in the logistics

Logistics systemic map



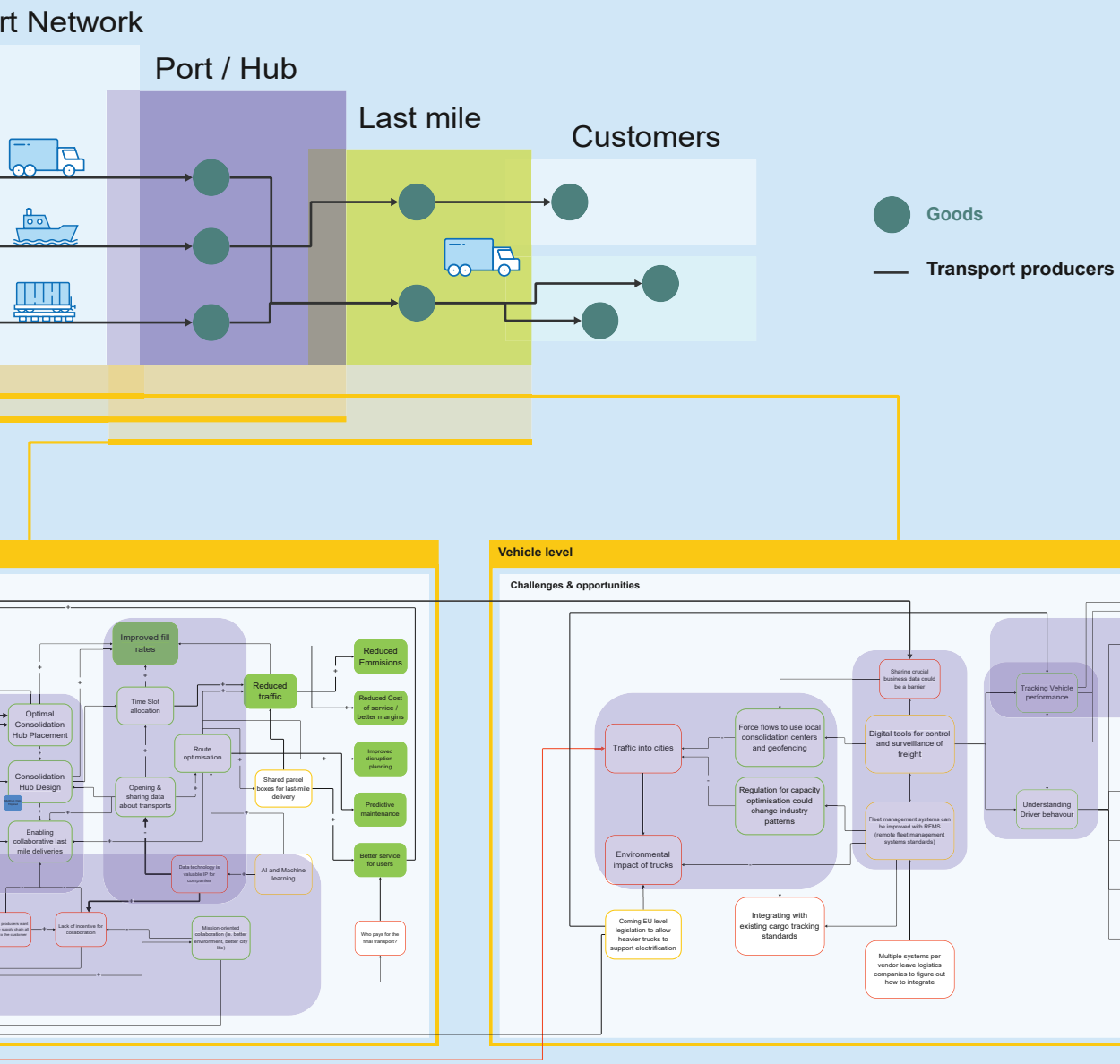


Figure 7: systemic map used during the insight phase of the project, describing surface-level issues in logistics and deeper, root-drivers that influence them.

mix has given us a strong focus on hub-to-hub and last-mile. Freight accounts for a third of transport emissions. Additionally, customer behaviour is an important driver for the sector. Retail customers are used to very low transport prices and have increased the usage of logistics services during the Covid pandemic. Commercial customers are also used to a just-in-time, on-demand paradigm, forcing transport producers to operate at ever faster speeds. All of these factors contribute to an increased demand for global shipping, putting stress on Nordic ports and hubs.

There are opportunities to reduce the demand of freight when it comes to incentivising more localised production of goods, in conjunction with technologies such as 3d-printing for commercial applications. Another possible solution which can influence demand is regulations that could demand products to be designed with longevity and repairability in mind. Some examples of such regulations already exist nationally, but far-reaching EU-level ones coming into effect are yet to be seen.

Breakdown by area - from hub to hub:

The second part of our logistics map starts with one big challenge: The environmental footprint of the maritime industry in the Nordics. The region's growing reliance on global value chains drives this challenge. At the same time, cargo owners are increasingly more preoccupied with being able to account for Scope 3 emissions (the result of activities not owned or controlled by the reporting organisations).

A few initiatives bet on the role of data to help address this challenge: on one side, you have Collaborative Supply Chain visibility platforms. In these platforms, transport nodes and producers are equipped with the capabilities to share and consume data, using pre-determined governance structures that allow multiple platforms to co-exist and interact. There are two good examples of work groups that have been exploring these concepts; the FEDeRATED[5] project has explored the many building blocks necessary for such platforms and built substantial knowledge using a Living Labs methodology; the other is the Virtual Watchtower Network (VWT)[6], a closer-to-market application of some of the high-level concepts explored by FEDeRATED. Both these projects have a strong footing in the Nordics and take existing international standards as premises as much as possible. On the other side, you have data spaces that are developed with the maritime industry in mind. One leading example of this is the Finnish Maritime Data Space. Funded by SITRA, the project aims at creating value "by reconciling different interfaces and services. It is about building a soft infrastructure based on trust, agreements, and common rules."[7]. The project is being built

5 https://www.federatedplatforms.eu/index.php

6 https://virtualwatchtower.org/

7 https://shorturl.at/mOR08

with Gaia-X framework in mind, hoping to make it able to interact with other European data spaces more easily. They are also built with a concept of openness, where the data ecosystems created will be open to all who are willing to participate.

In both cases, the aim is to optimise operations at port and ship, provide better situational awareness to involved parties, as well as have a positive impact in emissions. In both cases, what is currently needed is more experiences with real use-cases, where real world challenges should emerge. While these different platforms could co-exist in theory, it is important to test out how they interact. In this sense, collaboration is the keyword. How can stakeholders gather around these platforms, with the aim of improving their own outcomes as well as contributing to the establishment of a functioning data sharing environment?

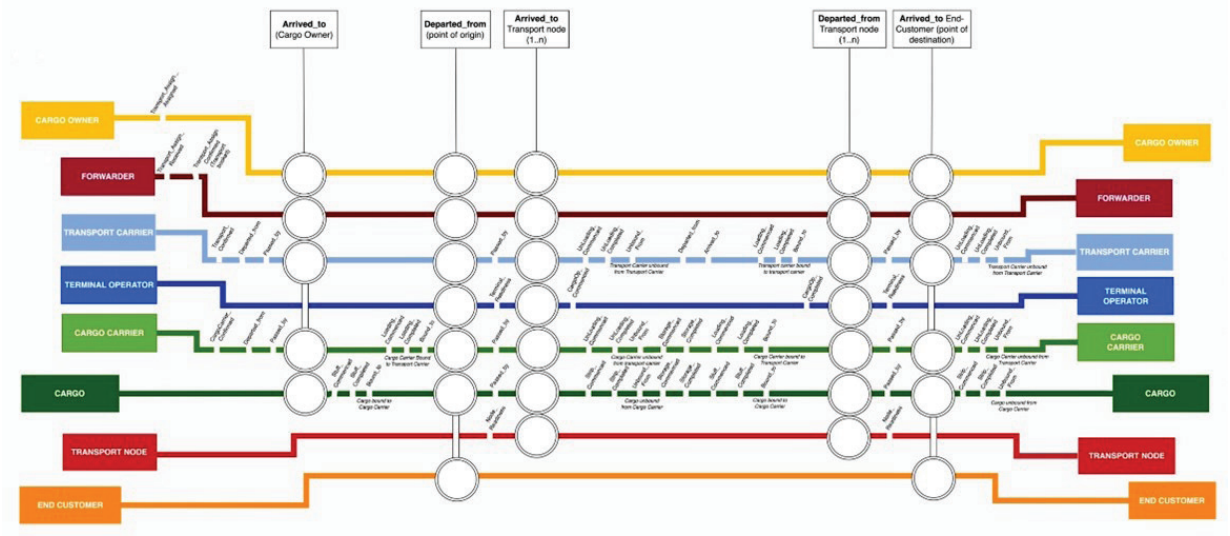


Figure 8: VWT's "metro map" provides the data sharing logic common for all participants of the platform (source: vwt.org)

Once goods arrive in Nordic ports, they are forwarded to their final destinations by rail or trucks. This modal interface provides an opportunity for optimisation in line with what we have discussed previously. But there are also challenges and opportunities going towards the next hub in the supply chain. Firstly, there are opportunities to improve cross-border traffic with the adoption of the EU's Electronic freight transport information (eFTI) regulation. This could enable more efficient transport, as well as being an important building block in a fully automated, electric road freight supply chain. These automated transports can have improved performance on the road, using techniques as platooning, as well as improved driving performance by gathering of in-vehicle data, route optimisation or even geofencing of transports to specific parts of the transport network.

While these visions exist, there are several hurdles for it. Electric trucks are heavier. This means the road infrastructure needs to support their

load. As heavier trucks enter the road network, more wear and tear occur. Infrastructure conditions data should be made available and kept updated. In addition, the charging infrastructure is not in place to support truck electrification in the Nordics. Data about transports could be valuable to plan for optimal charging station placement, as well as the energy load required. Lastly, there are still challenges to level 5 autonomous driving (Autonomy can drive a vehicle in all conditions, according to SAE taxonomy for levels of driving automation[8]; ongoing projects such as MODI still have a heavy focus on level4). And while there are benefits for platooning, it is hard to operationalise these configurations in a fast-changing, dynamic environment such as road freight.

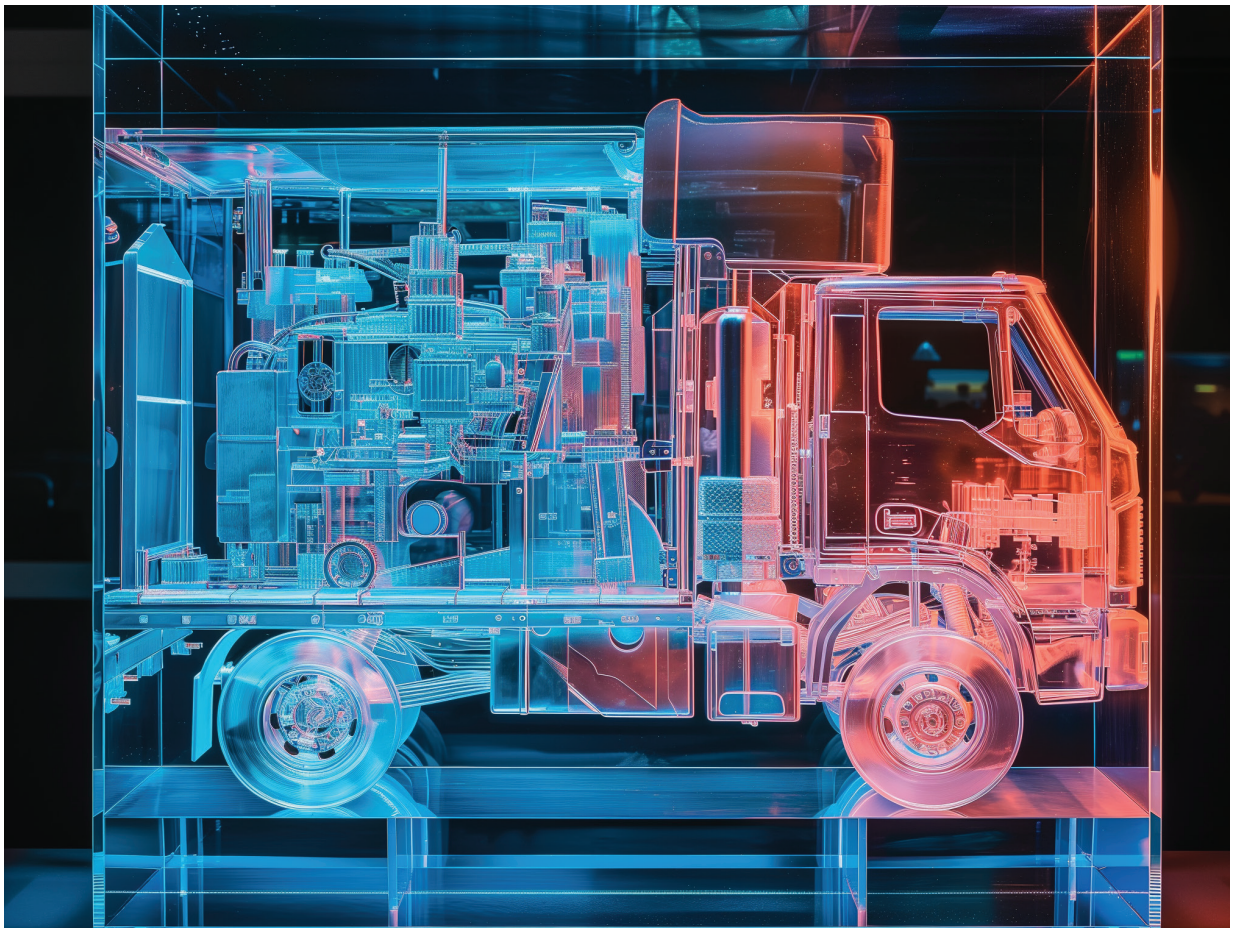
Aiming to address some of these issues, the Norwegian road authority is leading efforts to establish a national strategy for automated road transport , taking into consideration needs for technological and industrial development, prioritisation of investments and usage of resources, regulation and establishing collaborations across sectors and industries. This strategy can serve as a good example of coordinating efforts towards enabling a more efficient and sustainable road freight paradigm. It remains to be seen how collaborations emerge in this process, and which use cases the industry will gather around.

Breakdown by area - from hub to last mile:

As goods move from ports and hubs into villages, towns, and cities several issues appear. Influenced by root drivers such as the low level of investment in rail infrastructure development, a large number of trucks flow into populated areas. In rural areas, the challenge is an inefficient fill-rate with big environmental footprint. In bigger cities, this inflow of vehicles creates traffic, noise, emissions, and particle pollution.

In response to that, some opportunities can be explored. Consolidation hubs in big Nordic cities can be optimally placed. Their design could also be improved, involving transport producers in sharing resources and using space in the most efficient way possible. Lastly, the concept of a collaborative last-mile delivery paradigm could be explored. This means that transport producers and cities collaborate to provide the most optimal last-mile solution to citizens. This would involve route optimisation, time slot allocation and sharing of resources. For all of these opportunities to come to fruition, data about transports is a requirement. It would allow city planners to optimally place new consolidation centres with efficient designs that enable collaboration.

8 https://www.sae.org/blog/sae-j3016-update



However, one of the big barriers for this to happen is indeed data about transports. Commercial transport producers regard data as an invaluable asset in a technological race to produce the best knowledge and the best services. Each company invests heavily in their data strategies, in designing their own algorithms for route optimisation, as well as technologies for sorting packages, to optimise fill rates, etc. On top of that, each company sees a value in being the brand behind the last-mile delivery.

When it comes to optimally placing new consolidation centres, the lack of data about transports is not the only hindering factor. Property prices inside of cities is sky high, pushing these centres towards the peripheries, and thus, increasing the traffic problem. And while transports are often regarded in city planning and zoning processes, they are not prioritised in the face of other requirements.

With all of these challenges, the collaborative last-mile delivery paradigm seems distant. In order to change this, a highly focused effort would need to be spearheaded by municipalities, involving commercial actors in the process of finding use-cases which are mutually beneficial. Municipalities can contribute by setting ambitious social and environmental agendas, while providing incentives to encourage participation.

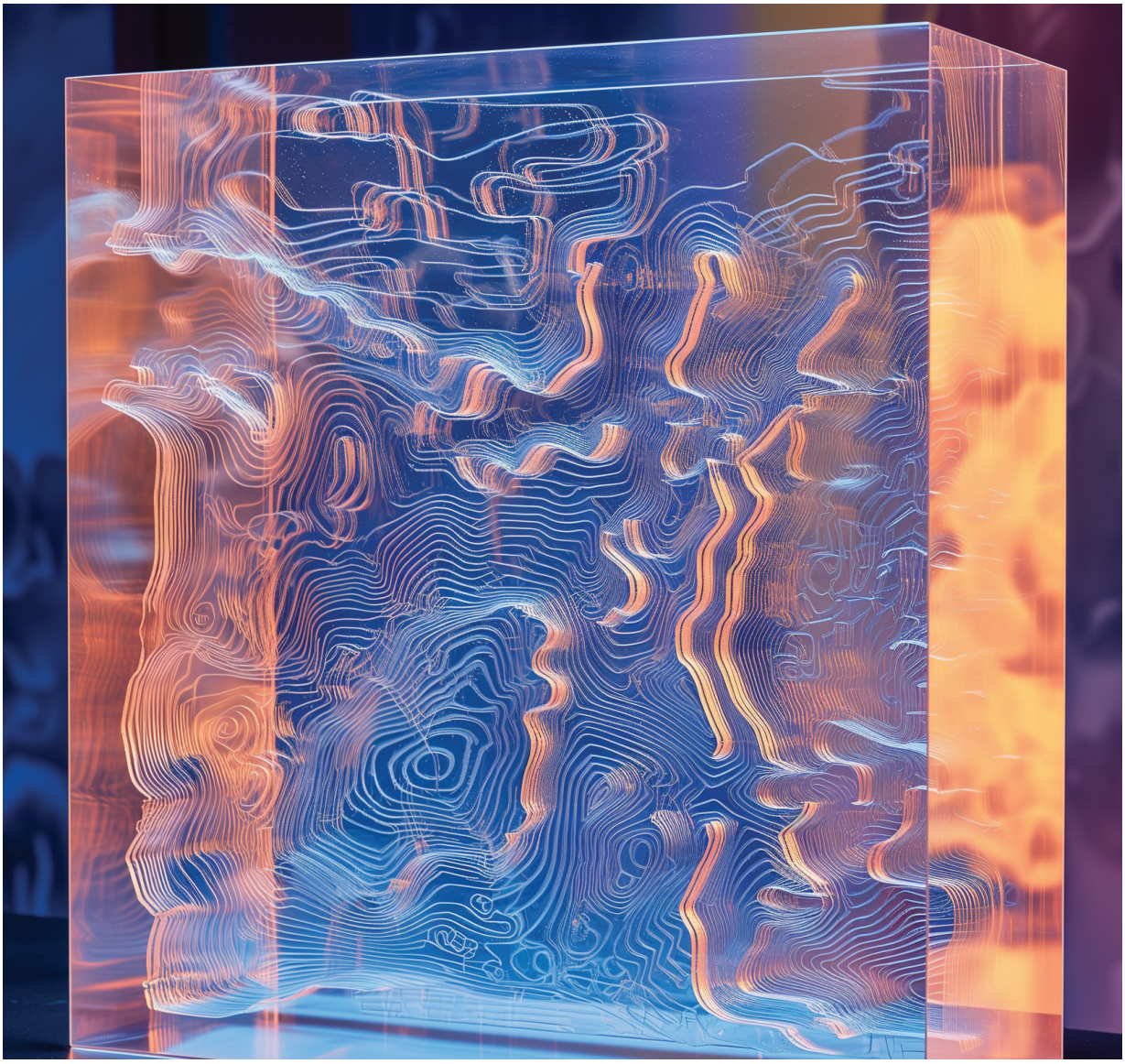
Breakdown by area - vehicle level:

Trucks operating in the transport network both generate and consume data. The data they produce can be useful for transport companies that can track vehicle performance through fleet management systems. These systems aggregate data and generate good insights for understanding driver behaviour and improving performance, reducing environmental footprint and increasing road safety. However, logistics companies often have fleets made up with several vendors, leaving them to figure out how to integrate fleet management systems themselves. There are opportunities to a wider adoption of Remote Fleet Management Systems Standards, which would enable better integration between different systems.

The data generated by vehicles is also used by vehicle producers to improve their designs, offering new services and smartness. And as municipalities such as Helsinki prove to design city mobility digital twins, data about vehicles can also be seen as an important element in having a good overview of traffic in and out of cities. However, there are currently barriers to a wider collection of vehicle data for other purposes, such as for enforcing geofencing, planning of new infrastructure and maintenance of the current, mainly due to privacy concerns.

Further, there are opportunities for logistics companies to better adopt and utilise existing cargo tracking standards, improving how they interact with data spaces and supply chain visibility platforms. GS1 standards coupled with RFID tracking technologies are some examples of systems that could help logistics companies to better comply with these initiatives, closing gaps in the flow of data through the value chain. One example of this is how RFID has been used to track cargo that is travelling through rail networks across the Nordics. The FEDeRATED project has also been exploring this topic, and there is a potential for these learnings to be applicable to road freight as well.

Chapter 4:
Where to intervene in the mobilty and logistics systems



A compass for innovation

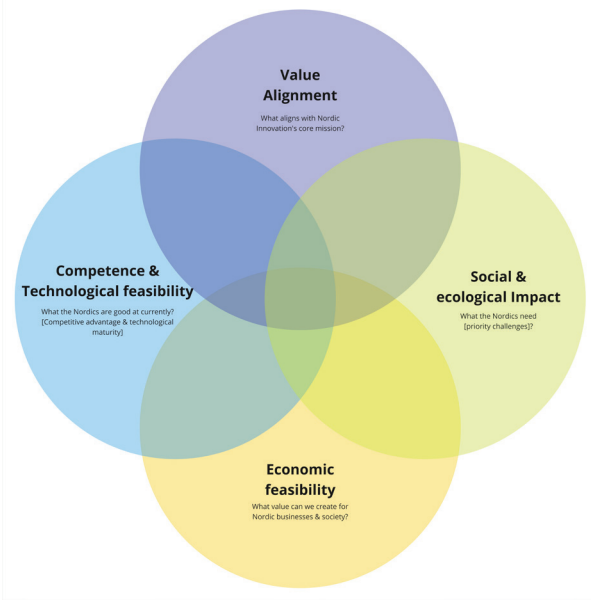
With so many challenges in mobility and logistics, it can be a daunting task to select where to pursue innovation. Where to intervene in the Nordic mobility and logistics systems? What sort of impacts can we expect from pursuing different paths? How can we avoid some of the pitfalls of previous cycles?

Deciding on which direction to follow, the work of identifying potential for innovation should involve the actual innovators, the stakeholders which are part of the system and are involved in innovation processes themselves. It is also important to develop criteria for assessing the impact of innovations and to what degree they are feasible. Lastly, by making innovation hotspots visible, we can start to share this knowledge, making it possible for others to pursue these opportunities.

Developing a set of criteria for assessing impact and feasibility of innovation

After spending time understanding the complexity of mobility and logistics together with industry stakeholders, many ideas for interventions and potentials for innovation start to crystallise. At this point, the systemic design methodology recommends that project stakeholders start to develop their own criteria for evaluating what are ideas worth pursuing.

Establishing these criteria is done early in a project. Based on Nordic Innovation's mission and the visions for the future of mobility and logistics developed in this project, a few criteria started to take shape. It was clear that innovations should not only focus on technology, but they should consider technology as an important aspect towards positive social and technological impact.



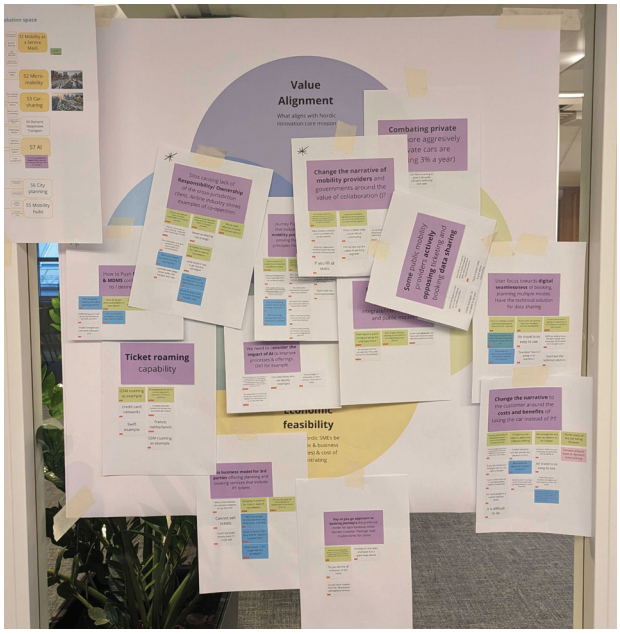
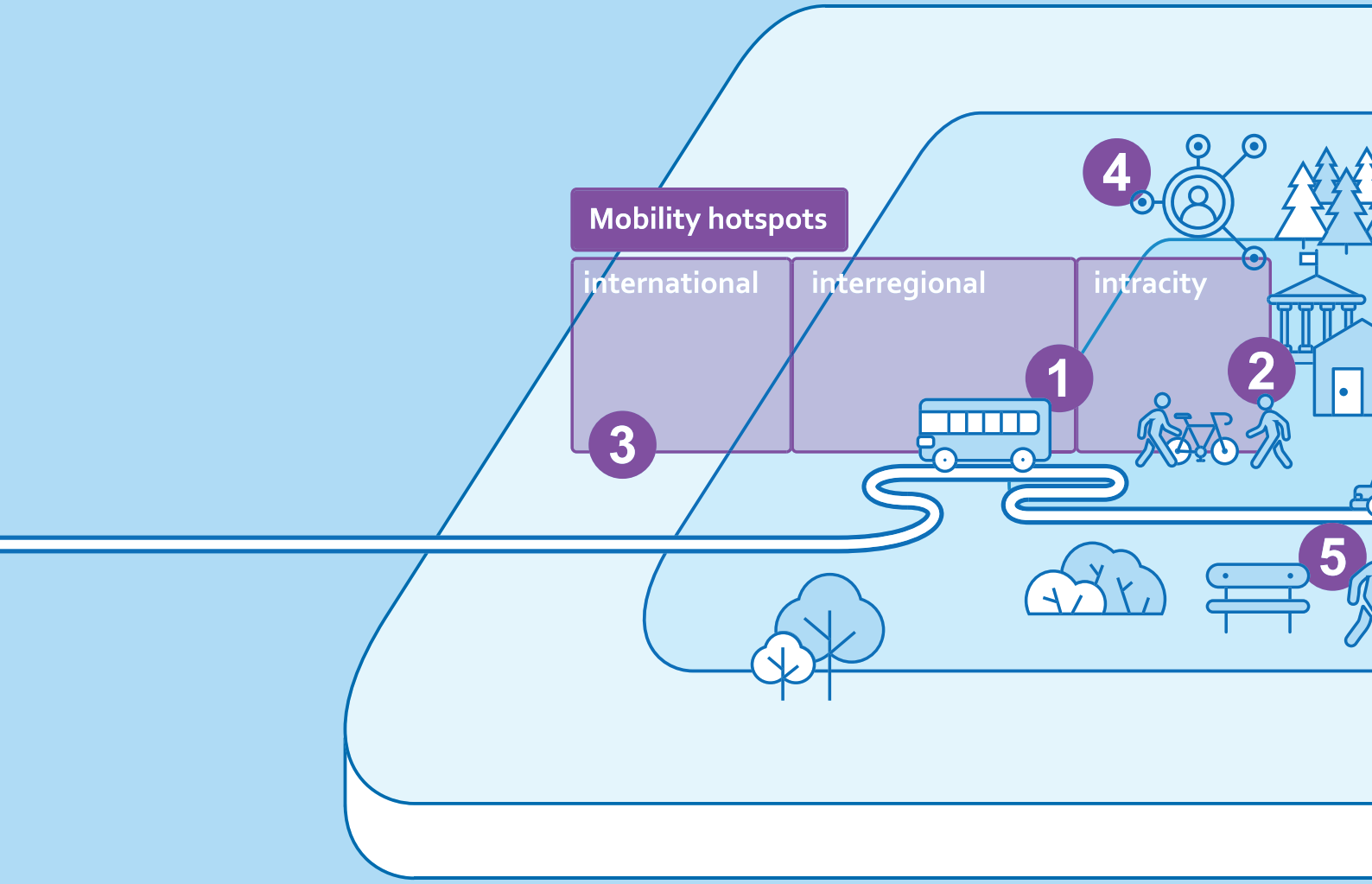


Figure 9: Tools developed to asses impact and feasibility, in use during workshop session.

It was also important that ideas for innovation are not placed in a distant future; innovations should be economically feasible as well as technologically, and the competence to execute them should exist.

These criteria were used in a workshop settings to identify hotspots for innovation that hit the mark on as many points as possible.

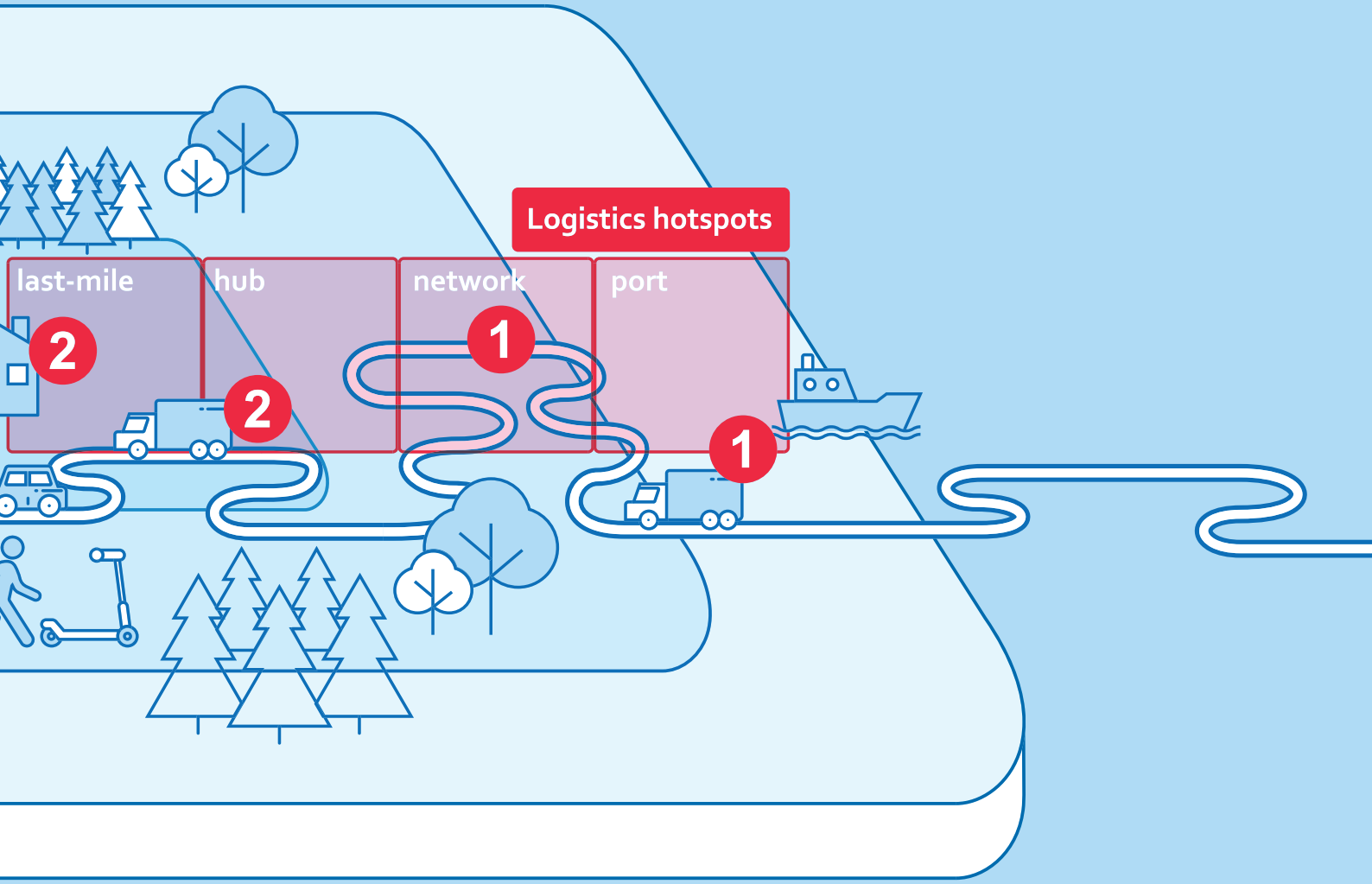
Furthermore, a tool was developed to incorporate the criteria and it can be used for the scoring of projects.



Identifying hotspots for innovation in mobility & logistics

After discussing the potential impact and feasibility of different ideas, it is time to describe hotspots for innovation.

This was done by engaging once again with stakeholders in the sector, exposing the systemic maps detailed in chapter 3 as well as the future state visions detailed in chapter 2. Armed with a solid understanding of the current challenges and a vision for the future, areas that have high potential for innovation were then identified.



The hotspots are a consolidation of highly relevant challenges, opportunities, systemic leverage points and ideas for intervention. They describe an area in which, according to industry stakeholders, there is high potential for innovation that can have a tangible impact on the mobility and logistics sectors.

It is important to note, however, that these hotspots are not yet portfolios of innovation. They offer a starting point, from which networks and ecosystems can gather around and detail in-depth what knowledge they have around these issues, which kinds of innovation initiatives can be designed to tackle each hotspot, how to measure success, how to fund each initiative, etc. In other words, stakeholders should take this content and make it theirs, responding to the context they are insert in.

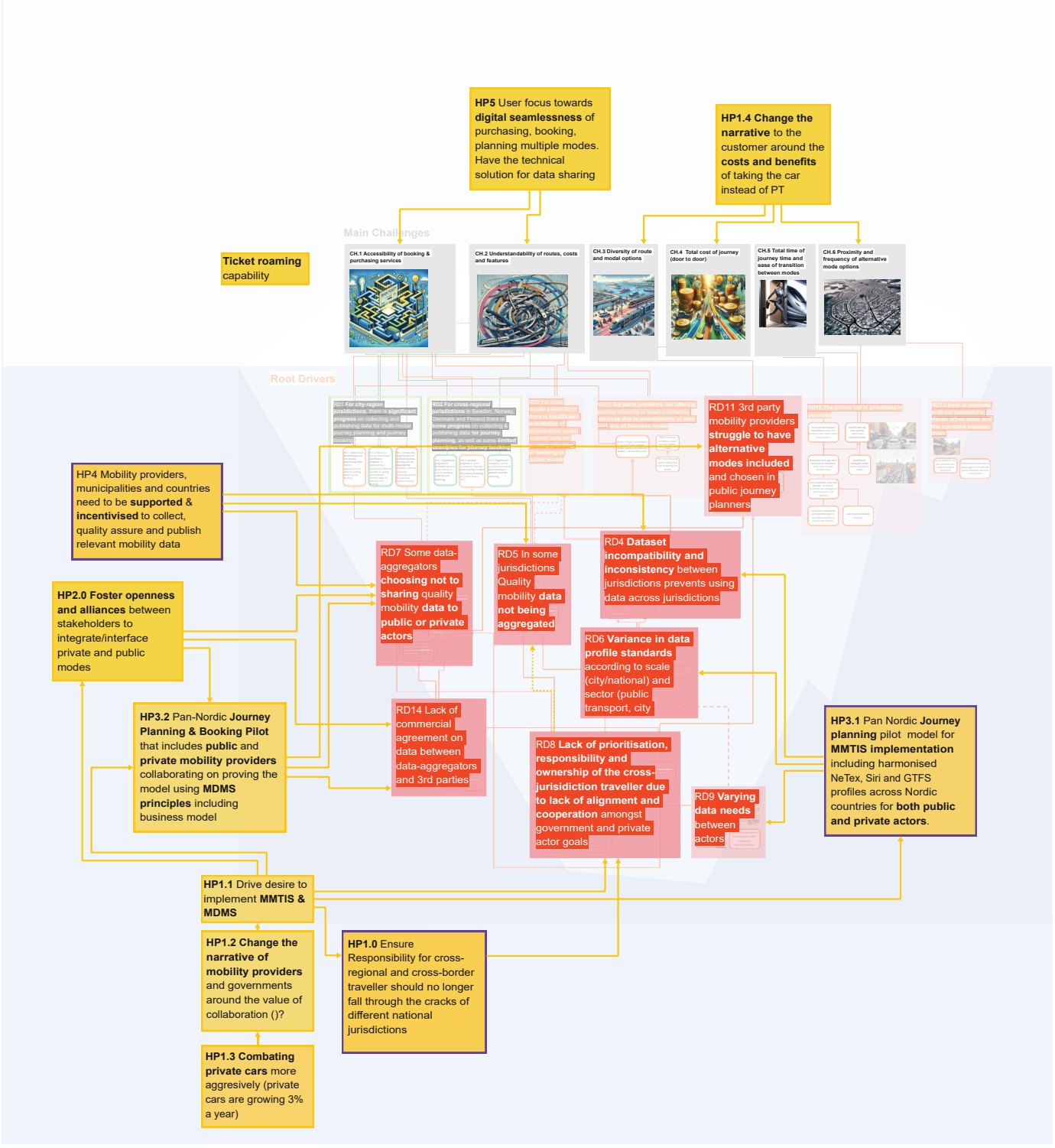


Figure 10: Hotspots in yellow, and how they are connected to root-drivers of main challenges in the mobility system.

Hotspots for passenger mobility

In seeking to improve the Nordic mobility system with a focus on data-sharing and connectivity, targeted intervention in specific areas can maximise impact and feasibility. The key areas identified for intervention include enhancing the accessibility of purchasing services and improving the understandability of routes, costs, and features. Addressing these areas necessitates tackling various root drivers detailed earlier.

Testing out a Pan-Nordic Model for MMTIS and MDMS Implementation

A pivotal step identified is the development and validation of a Pan-Nordic model for the implementation of the Multimodal Travel Information Services (MMTIS) regulation by the EU. This regulation mandates all EEA countries, including the Nordics, to share mobility data for multi-modal journey planning. Tackling this involves addressing the root driver issues of dataset incompatibility and inconsistency, the variance in data standards, and the varying data needs between city and national actors. While initiatives like ODIN have advanced addressing these issues, the envisioned Pan-Nordic journey planning service, which integrates public and private actors, has yet to be realised, partly due to delays caused by the pandemic. However, a collaborative effort led by EnTur explores the application of MMTIS principles across Nordic and Baltic countries. The project serves as a notable example recognized by industry stakeholders on how these principles can be extended within and beyond the Nordics.

Following the MMTIS initiative, there is a recognised necessity for a testing arena for concepts or solutions that incorporate cross-border journey purchasing and booking services within the Nordics, reflecting the MDMS (Multimodal Digital Mobility Services) regulation principles. Any concept or solution should aim to test the viability of business models that accommodate both public and private service providers for Pan-Nordic journeys in real-life operational settings, targeting issues encompassed in Root Drivers 7, 11, and 14 (see illustration on previous page).

Fostering Openness and Alliances Between Private and Public Actors

To support the conditions for testing concepts and solutions, fostering openness and forming alliances between public and private mobility providers (HP2.0) is crucial. Collaboration between public actors, and between public and private actors will contribute to collectively growing the market for seamless cross-border travel and to encourage the adoption of shared mobility principles.

Driving Desire to Implement MMTIS and MDMS

Moreover, a shift in mindset is necessary to propel the adoption of MMTIS and MDMS across the Nordics. Cultivating a collective will among a broad spectrum of stakeholders is essential to ensure that journeys crossing regional and national borders are facilitated smoothly, without being hindered by jurisdictional silos. This initiative would benefit from a concerted effort to drive openness and build alliances within the mobility sector. Encouraging a critical mass of public and

private actors to commit to working together in co-development of tests, concepts and solutions will help prove the feasibility of providing cross-regional and cross-border services, and developing a strong case showing that these services should not be overlooked in spite of jurisdictional discrepancies that cause actors not to take responsibility for the cross-regional, cross-border traveller.

Collaborative Growth in Mobility: Shifting from Market Competition to Collective Expansion

Changing the prevailing narrative among mobility providers about the value of collaboration can shift the focus from competing for a larger market share to growing the market collectively. This shift in perspective can be inspired by successful collaborative models like the Amadeus system in the aviation industry. This system is an example of private, competitive actors seeing the value of collaboration and data-sharing that streamlined planning, purchasing and booking of flights in the aviation industry across jurisdictions and flight service providers for the traveller. Mobility providers, both private and public, could coalesce around a common mission to grow their market share of collective journeys relative to journeys taken by private, individual modes that have a negative impact in the needs for materials and infrastructure (e.g: private cars). It is important to tackle this issue together.

Reframing Transport Choices: Steering the Customer Narrative Towards Collective Mobility Benefits

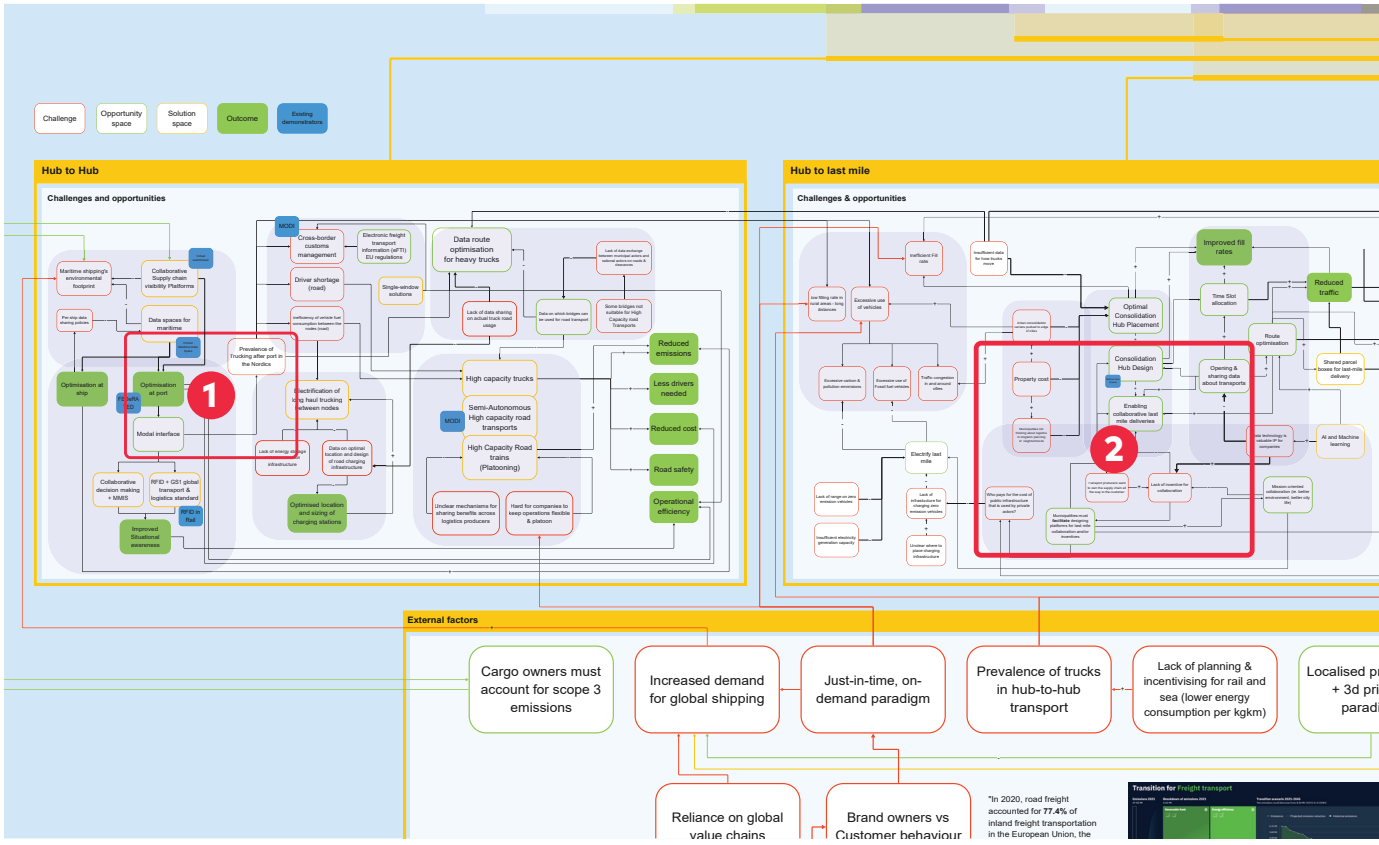
Alongside altering provider perspectives, it is equally important to reshape the narrative for customers, emphasising the advantages and potential cost savings of choosing collective transport over private, individual journeys. This narrative shift should align with the broader mission of increasing the collective transport market share. It is not an easy feat. Providers need to work together with authorities to make their offerings more attractive in relation to private individual journeys. This would require broad collaboration and deep understanding of the behaviours and needs of users.

Supporting Data Collection and Quality Assurance

To materialise these ambitions, there is an undeniable need for concrete support and incentives for mobility providers and governmental bodies to engage in robust data collection, quality assurance, and publication. Establishing a comprehensive data aggregation process is one challenge; having the necessary resources to execute it is another. To counteract claims of adequate data sharing, a 'traffic light' evaluation system is suggested to assess and ensure compliance with necessary critical mass of types of mobility data needed for journey planning, purchasing, and booking services and not just compliance of limited mobility data to data collection and publishing standards.

User-centered journey planning, purchasing and booking

Ultimately, the aforementioned hotspots serve as a foundation for conducting tests and develop concepts and solutions that validate the Pan-Nordic implementation of MMTIS and MDMS. These initiatives should be designed to offer digitally seamless, user-centric services that facilitate the planning, purchasing, and booking of journeys, incorporating multiple modes and transcending jurisdictional boundaries. While the technical infrastructure for data sharing may already be in place, there is a pressing need to address the interconnected challenges of journey purchasing, booking, and planning to achieve a truly integrated Nordic mobility system.



Hotspots for Logistics

Figure 11: Hotspots (in red) as they are connected to different areas in the logistics system.

Optimising operations at port with trucks in focus

There is a prevalence of truck freight picking up goods that arrive at port, towards their next destinations throughout the Nordics. As described before, ports can be great places for innovation. Since there are already several initiatives creating a positive landscape for connectivity and data sharing in maritime shipping, we can use this modal interface to better integrate trucks into supply chain visibility platforms, by better

adoption of international cargo data standards and using state-of-the art tracking technologies.

Not only does that open the space for optimisation at port, with better situational awareness, better loading/unloading procedures, and less congestion and wait times, but it also opens the possibility for better understanding of the flows of goods inside the road network. Data about goods flowing through roads can be used to by road authorities to control access (e.g.: customs, geofencing of areas) and to plan for infrastructure. It can also be used by regions and municipalities to understand traffic flows in and out of cities, to better plan for logistics infrastructure, design efficient corridors and implement low-emission zones. Lastly, more information about goods flowing by trucks would allow goods owners, commercial actors, and consumers to better understand the impacts of their logistics decisions.

A barrier for this would be changing the mindset of road freight companies about sharing this kind of data. It might seem like a complicated endeavor technically, as well as a challenging economic decision when it comes to sharing operational data. However, there are currently many examples of how this can be done, and players in the industry who are ready to assist logistics companies to take the next step. More about these examples can be seen in the "Current State Report".

In all these cases, collaboration between goods owners, logistics companies, state actors and research organisations should be pursued, in order to identify common goals and benefits, use cases that can trigger demonstration in real operational environments, and to make sure new developments consider international best practices for interoperability.

Enabling a collaborative last mile paradigm

In a scenario where demand for logistics services is at an all-time high, towns and cities across the Nordics are looking to rationalise last-mile deliveries, hoping to curb traffic, noise levels and environmental pollution. However, with data about transports locked into proprietary silos, smartness is regarded as value added by commercial actors.

We see a potential for incentivising more data-sharing about transports. With more data about transports available, it would be possible to design systems for time slot allocation, route optimisation and fill-rate optimisation between commercial last-mile actors. This data could be used to plan for and install white-label, unbranded shared parcel boxes in city areas and to better design urban consolidation centres (both their inside operations as

well as their placement in city areas). Data about transports can also be used by large-scale customers to optimise the demand side, by better understanding when to order and how much in order to reduce cost and negative impact.

On the one hand, it seems like municipalities might have the better end of the deal: they get to influence routes according to their parameters, get valuable data for planning and achieve their own impact goals. On the other hand, commercial last-mile actors see a challenge in openly sharing their valuable intellectual property. The way to mediate these two perspectives is by investing in a challenge-based innovation approach, where a societal mission is put forward by state actors, with incentives for commercial actors to participate.

There needs to be an open discussion on what use cases this collaboration should be aiming to solve for, so that commercial actors can find a place to start. It is important to start small, prove value and grow as you go. In this new forming ecosystem, other types of data can be produced, gathered and shared. Novel ways for fulfilling last-mile deliveries can be tested (drones, robots, etc).

Chapter 5:
The way forward

The call for projects

To open up for a more systemic way of innovating is to embark on a journey of exploration that involves both internal and external development, where at every new turn you need to understand and mature your own way of thinking, as well as what it means for projects.

The linear model of working and innovating is manifested in ourselves and our society. Therefore, the exploration work done in this project (and what it can mean for smart connectivity) is a brave start in understanding and addressing these linear, "business-as-usual" ways of acting and planning. While this new understanding is important, we also have to be mindful that not everything can be addressed systemically. We have to fine-tune our ability to understand and lead systems, while at the same time keeping what works in place; even

though transformation means more experimenting and testing in iterations than traditional innovation, linear innovation can work just as well in some cases. In other words, nothing of what we have learned about linear working is wasted. We just have to add on a systemic mindset and tool box and let ourselves and our surroundings evolve.

This project culminated in the launch of a call for proposals[1], reflecting the thinking and approach outlined in this report. Initially, the call might look traditional. However, it encourages a systemic approach to thinking and invites the innovation community to apply for funding aimed at establishing ecosystems[2], rigs, or platforms dedicated to challenge-based, adaptive innovation.

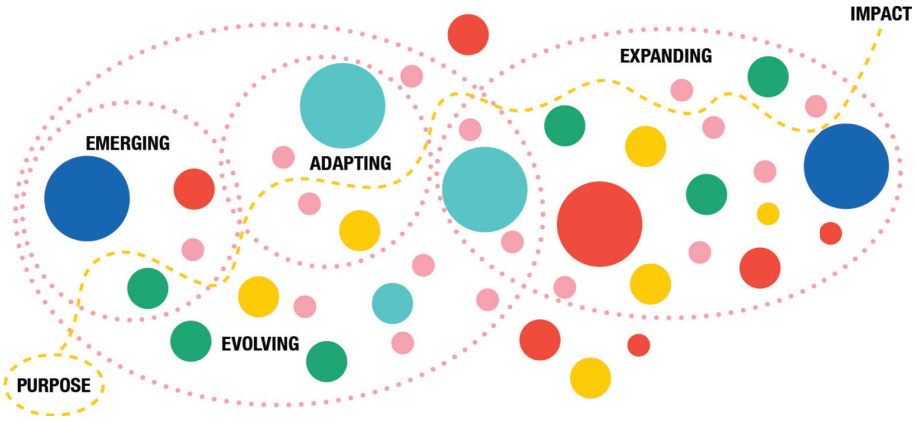


Figure 12: platforms or ecosystems for innovation have to find their way through emergence, adapt and expand towards impact.

Such an ecosystem should be designed to address challenges systemically and maintain flexibility regarding participants and financing. Ecosystems can orchestrate portfolios of interventions and activities. It should include all actors and stakeholders that are needed for change, spanning from industry, research institutions to public sector, government and civil society. These platforms need to be rigged for the long-term, as they will orchestrate collaboration across sectors, and collaborations that must continue even after a project ends. The long-term perspective of an ecosystem is beneficiary when it comes to scaling new innovations. One of the critical observations made during this project is the difficulty of scaling pilot projects, often due to the absence of essential actors within the project framework. In a well-integrated ecosystem, relevant stakeholders can be engaged as needed, and the composition of stakeholders can evolve in tandem with the project's progress.

It will take both knowledge and courage to manage these types of calls in the future. It will also require the implementation of learning processes and loops, so that the innovation community can grow and explore

1 https://nordicinnovation.org/news/we-are-looking-projects-within-smart-connectivity-and-data-sharing

2 https://ecosystemhandbook.com/unique-toolset/

these concepts together, understanding what it takes to work, lead and organise systemic and complex innovation through ecosystems.

Utilising this report as a tool for establishing future collaboration

Throughout this report, a process for engaging with stakeholders and discovering what the hotspots for innovation in mobility and logistics are in the Nordics was showcased. The importance of collaboration to transform opportunities into the impact we want to have in the future was also discussed. Hopefully, this report can be used to establish new collaborations between the industry innovators, governing and funding bodies. Two recommendations are of particular importance:

Developing persistent and iterative portfolios of innovation

As described earlier in this report, there are currently many streams of work attempting to address the important issues in mobility and logistics. Some are part of organisation-focused innovation projects, others are research projects; some of these are funded nationally, others at Nordic or European levels. Shortcomings and failures of completed projects (lack of scaling, conflicting approaches etc.) and how to avoid them in future innovation processes have been discussed.

The hotspots for innovation presented earlier, identified as needed and possible by industry stakeholders, may serve as a starting point for developing innovation portfolios that can be adopted across different projects. Ideally, these portfolios could be hosted by neutral organisations (e.g.: government bodies, ITS organisations) that can make them available for the industry innovators, as well as facilitate engagement so that the content in these portfolios can be updated and iterated upon as more and more stakeholders engage with them (e.g: setting goals, adding more detail to each hotspot with their own knowledge, defining different initiatives and projects to demonstrate impact, etc). Individual projects can refer to these portfolios, and the orchestrating organisation(s) facilitate cross-learning between projects.

In practice, this means that different types of projects with different kinds of funding structures can attempt to demonstrate progress towards impact on the same innovation hotspots. Orchestrators make sure that progress is tracked and cross-learning between projects can happen. As projects deliver, we learn and move forward. Our understanding of each hotspot matures. With this new understanding,

we can iterate the portfolios by reviewing what we know about each hotspot, redefining goals, etc. This opens opportunities for new innovators to contribute. This cycle repeats itself and the portfolio persists, cycle after cycle.

Finding the right rig for collaboration to emerge

Systemic innovation should be adaptive, and the most adaptive way to organise innovation processes is in an innovation ecosystem. Such a system can embrace all the actors needed for handling the complexity (industry, research institutions, public agencies, civil society, and media, among others). It can also embrace new initiatives or change directions as the context changes, making it more resilient.

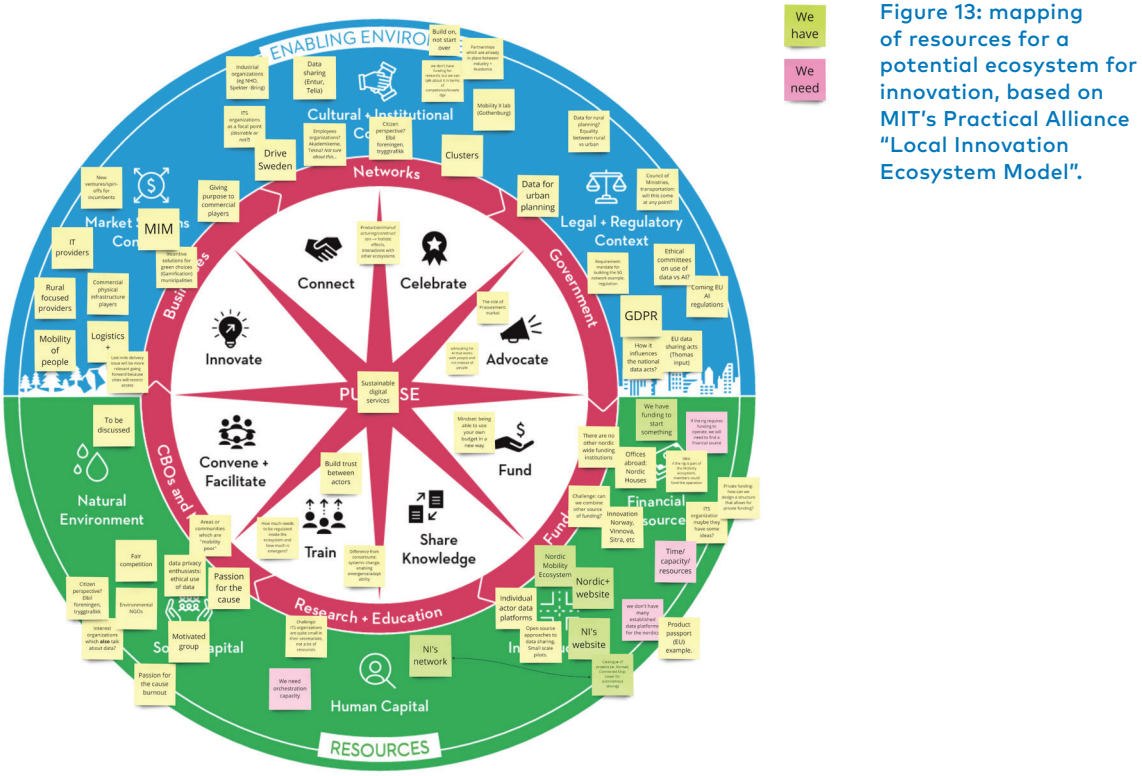
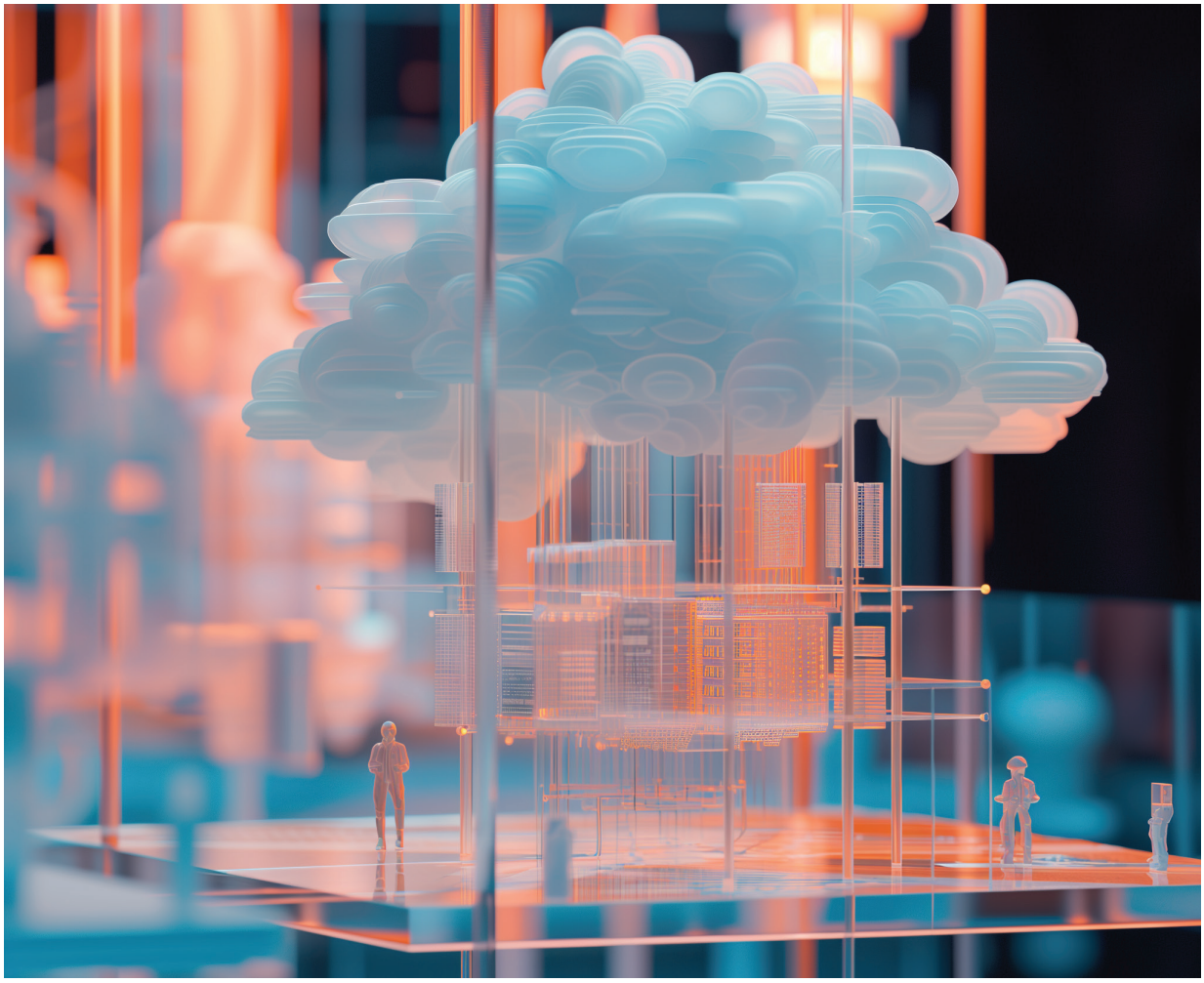


Figure 13: mapping of resources for a potential ecosystem for innovation, based on MIT's Practical Alliance "Local Innovation Ecosystem Model".

Missions are another way of organising innovation processes. Interestingly, the EU's mission approach is not organised systemically in an ecosystem. Missions are organised as programmes, with a programme-mission board. In the programme's midterm evaluation[3], this is mentioned as a weakness, as the missions have not met expectations and failed to attract investments from businesses, philanthropic organisations and engagement from the civil society.

3 https://errin.eu/news/eu-missions-european-commission-publishes-its-first-mid-term-review

It is therefore utterly important to rig systemic innovation in a way that it can adapt to new needs, open up for new opportunities and new partnerships as well as different types of financing. If we start moving towards persistent iterative portfolios of innovation, the way we organise collaboration structures needs to reflect this. Ecosystems for innovation allow for more emergence. This makes them more resilient towards changes in the external environment, and they can accommodate for multiple types of innovations.



Conversely, data spaces are ways to organise collaboration in the digital sphere. Like innovation ecosystems, they rely on a loose association of stakeholders pursuing a target. Mobility and logistics data spaces should strive to create a wide range of solutions for the establishment of a well-functioning market for data, based on common principles. However, without identifying clear benefits for participants, these initiatives tend to be technology-driven, losing sight of societal benefits.

Throughout the development of this report, we see that successful initiatives identify clear, context-aware business cases and are able to

gather resources because of that. They demonstrate impact and grow as they display the ability to respond to real-life situations. Common to these initiatives is the presence of stakeholders from academia, industry and the public sector, working together on different pieces of the puzzle, taking into account technical, cultural, economic and regulatory aspects. They also have strong orchestration capabilities, sharing knowledge, inviting new stakeholders in, and connecting initiatives to maximise synergistic effects. Multiple specialised ecosystems or data spaces for mobility and logistics can exist at the same time. Each of them with their own portfolio of innovations to pursue, as long as they adhere to ground-level EU interoperability standards.

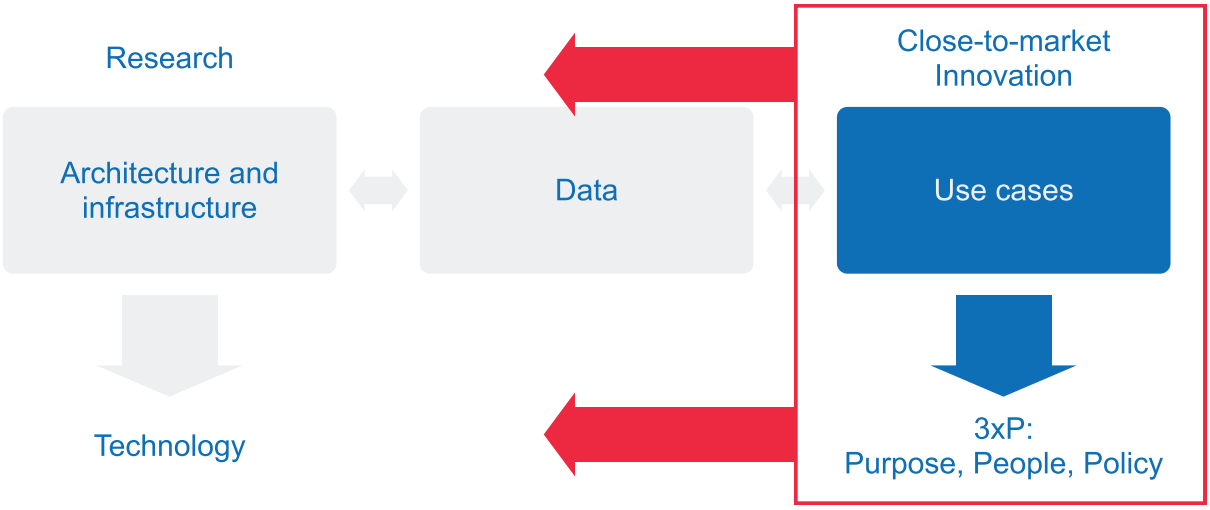


Figure 14: as we move towards the future of mobility and logistics we desire, we will need close-to-market innovation grounded in real-life use cases, with purpose, people and policy in focus. This will trigger innovation in data and architecture that is grounded in Nordic values and principles.

Ultimately, it is as important to support the work of establishing such platforms for collaboration as the work of innovators. As described above, the work of orchestrators is complex and demands attention. Orchestrators also need legitimacy: they need to be respected by industry stakeholders, and be trusted to provide a level playing field for different profiles to benefit from ecosystems. Once again, starting with the ones who are already doing good work is the way to go.

All in all, the Nordic region is well-positioned to make relevant contributions to advancing connectivity for mobility and logistics. Previous innovation work has displayed that the region has built the necessary capabilities to solve the most important challenges for making the region more connected and integrated. The time for a new wave of innovation for connectivity is here. As Europe gears up to build the European Mobility Data Space, Nordic innovators can play an important role in addressing the most pressing governance issues in practice, showcasing a Nordic approach that simply works. We have the data, now it is time to coordinate and scale.

Nordic Innovation