Operating model for mobility

City of Espoo

Picture: Icons8 LLC

Aalto ITP 2022
Project report

Halén, Leevi
Khanal, Shradha
Niemi, Tytti
Peterson, Colin
Rueda, Mateo

EXECUTIVE SUMMARY

The client of the project is the City of Espoo. The specific task at hand is to develop a guideline for an operating data sharing model to enable co-creation of better services within Espoo. This report looks through the lens of mobility and identifying the municipality's possible role in the data sharing ecosystem.

Throughout our qualitative research we have consulted with industry professionals and stakeholders to develop a guideline for an operating model regarding data sharing at the City of Espoo. The operating model takes note of regulations, governance, roles, processes, and challenges.

The final deliverables of the operating model and example case uses were delivered in a final presentation event on August 30th in Otaniemi. The project was presented during the meeting with the operating model and example use cases. After the meeting the report was delivered to the client.

2 Picture: Icons8 LLC

TABLE OF CONTENTS

PROJECT BACKGROUND

CITY OF ESPOO

The city of Espoo is the second largest city in Finland with 300,000 inhabitants at the end of 2021. In addition, the population is growing. Creating services for a growing pool of citizens has its difficulties. (Espoo, 2022)

The core values of Espoo are being a resident- and customer-oriented city, being a responsible pioneer, and being fair. All of these values are encapsulated in the project. As a resident- and consumer-oriented city, Espoo wants to offer the inhabitants a smooth everyday life, with the best possible resources. It also wants to involve the residents in the creation of services. As a responsible pioneer, Espoo is striving towards creating new creative solutions for problems that they might face. As a fair actor, Espoo is open. (Espoo, 2022)

Picture: Icons8 LLC

THE BRIEF

This ITP project focuses on the sharing of data between stakeholders in the mobility sector. The aim is to find a way for Espoo to de-silo information from various databases and to share it securely with accepted stakeholders. In addition, the stakeholders can share their data to advance the mobility services of Espoo.

The project is a sub-project of the Secure Data Project created jointly by the City of Espoo and the City of Turku. The aim of the Secure Data Project is to develop municipalities' ability to implement utilization of information and knowledge management securely. The goal is to create tools and operating models to serve as support for all municipalities in their digitalization processes (Espoo, 2022)

As stated in European Union Directive 2010/40/EU (ITS), congestion costs the EU economy more than 1% of GDP per year (ITS proposal, 2019, 1-2). Time is lost by citizens and workers but also in unreliable and inefficient logistics feeding the economy. Deploying ITS and enabling a culture of smart data sharing has the potential to significantly improve road safety, traffic efficiency, reduce carbon emissions, and comfort by helping transport users to take the right decisions and adapt to the traffic situations.

In the following chapters, the project goal and approach are presented. In brief, human-centered design methods such as workshops and interviews were utilized alongside desktop research and benchmarking. The project outcomes, operating model and supporting material, were presented live in Otaniemi 30th of August 2022.

THE GOAL

The goal of this project is to create an operating model guideline for secure data sharing between mobility partners and the city to create a cohesive operating environment. The operating model should allow for routine data sharing with identified stakeholders securely, align with current and future legislation, and recognize the municipality's role in the data sharing ecosystem. The value of operating model is in enabling safer, smoother, sustainable and more accurate future mobility.

Picture: Icons8 LLC

THE APPROACH

The project approach was chosen to be the Human-Centered Design process (HCD) (IDEO, 2022). HCD makes sure that all our stakeholders are heard, and their input is taken in to achieve a more holistic end result. Human-centered design is divided into three distinct parts. The parts are Understanding, Designing, and Defining. Due to the iterative nature of the HCD, we were able to co-create value with our main stakeholder, the City of Espoo. The whole HCD approach is visualized in Picture 1.

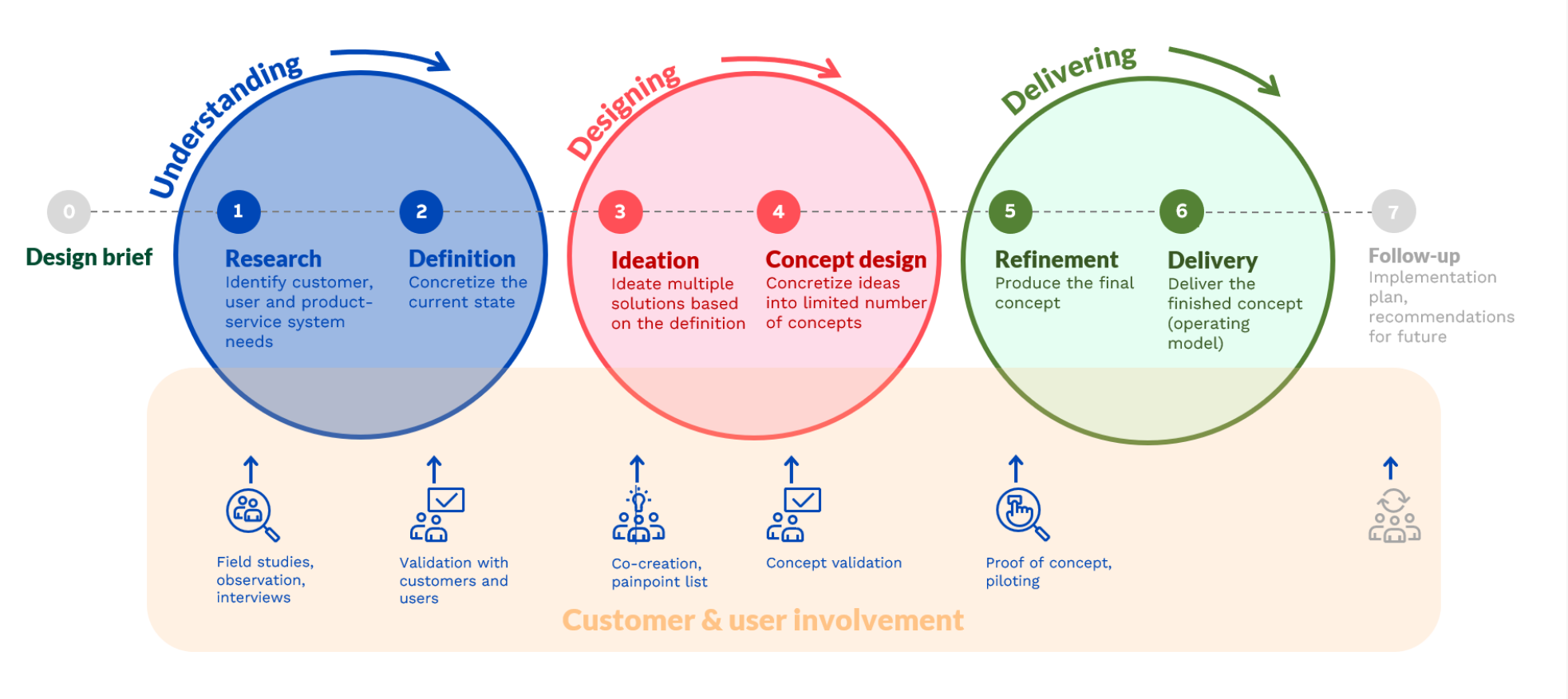
Picture: Icons8 LLC

In the Understanding phase, there are two parts, Research and Definition. In the research part, we identified the customers, the users, possible difficulties, and other parameters of the project based on desktop research. In the definition part, we concretized the current state in a workshop with City of Espoo. In the workshop we utilized the RACI matrix, gap analysis and a draft of an operating model.

The Designing phase has two parts, Ideation and Concept design. In the ideation part, we created multiple solutions based on the definition and the current state analysis from the Understanding phase. We interviewed stakeholders identified in the workshop and did pain point clustering and analysis. During concept design, we designed the concept and concretized the most valuable ideas into an operating model guideline.

The two parts of Delivering are Refinement, and Delivery. During refinement, we created the final concept and polished aspects of the report based on iterative feedback from the City of Espoo. We created supporting material for presenting the findings. While delivering, we delivered the final project; report and supporting material (presentation). The interviewees were also invited to the final presentation held in Otaniemi on August 30th, 2022.

Figure 1. Human centered design process.



As presented in Figure 1, customer & user involvement is taken into account on every part of the three-phase process.

Shradha Khanal
Primary point of contact
Bachelor's Programme
International Business,
Aalto University
Shradha.khanal@aalto.fi
Linkedin: shradhakhanal

Mateo Rueda
Research
Master's Programme
in Machine Learning,
Data Science and
Artificial Intelligence,
Aalto University
BSc. Biomedical Engineering,
Universidad de Los Andes
mateo.ruedamolano@aalto.fi
Linkedin: mateorueda

Tytti Niemi
Design
Bachelor's Programme in Design,
Aalto University
M.Sc in Electrical Engineering
& Energy Technology,
University of Vaasa
tytti.niemi@aalto.fi
Linkedin: tyttiniemi

Leevi Halén
Data analysis
Master's Programme
Information Service
Management,
Aalto University
leevi.halen@aalto.fi
Linkedin: leevihalén

Colin Peterson
Project management
Bachelor's Programme
in Management Information
Systems & Strategic Analysis,
Simon Fraser University
colin.peterson@aalto.fi
Linkedin: ColinPeterson

TEAM SCREAMING JETS

PROJECT PEOPLE

We are a multidisciplinary team studying in the fields of Arts, Business and Technology. Our team consists of students with diverse backgrounds background from Canada, Colombia, Nepal, and Finland. The guidance from ITP coordinators also immensely helped bring this team project to life.

INFORMATION TECHNOLOGY PROGRAM ITP,
AALTO UNIVERSITY

Otto Saarinen
ITP project coordinator, ISB track
otto.saarinen@aalto.fi

Mikael Blinnikka
ITP project coordinator, ISB track
mikael.blinnikka@aalto.fi

CITY OF ESPOO

Wilhelmiina Griep
Project Manager, Secure Data project,
Primary contact person from City of Espoo
wilhelmiina.griep@espoo.fi
tel. + 358 (0) 40 521 9704

Mervi Hämäläinen
Development Manager,
Sustainable smart city development
mervi.hamalainen@espoo.fi

Picture: Icons8 LLC

UNDERSTANDING

DESKTOP RESEARCH

We familiarized ourselves with the main themes of the project: data sharing in mobility and legislation regarding that.

Data sharing and mobility

The Support Centre for Data Sharing (SCDS) defines the term *data sharing* as the collection of practices, technologies, legal frameworks and cultural elements that are relevant to transactions in any kind of information digitally, between different kinds of corporations (SCDS 2022). Data sharing is becoming essential in transport system development as vast amounts of transportation data are generated every day around the world. This practice has proven benefits such as increasing the attractiveness and fluidity of public transportation, streamlining logistics chains, accelerating the domestic market, increasing export services and creating new business models and services (Fintraffic 2022).

In Finland, increasing transport sector development has a significant social component. Households and businesses spend an estimated 40 billion euros annually on mobility and transport, corresponding to about 13 percent of Finland's GDP. In addition, transport has a relevant role in carbon dioxide emissions with a share of 20 percent. Therefore, implementing rules for sharing mobility data that result in the development of the transportation system is relevant as it would directly benefit the savings of businesses and citizens, improve the competitiveness of Finland's transport, and reduce emissions (Fintraffic 2022).

However, there are no standard practices for sharing mobility data in the European Union. Therefore, it is necessary to develop new policy frameworks to guide the data sharing process between different stakeholders that respect the privacy of individual data according to established regulations such as GDPR.

The City of Espoo is currently developing innovative solutions through experiments and pilot projects that can improve the transportation system in the city. Considering this problem, the City of Espoo, through this project, seeks to be a pioneer in the world in developing models that regulate the data sharing process. These models would enable the use of information and knowledge management securely in conjunction with stakeholders.

Legislation

European Data Strategy

In February 2020, the European Commission published the European Data Strategy. It consists of a new data economy model that aims to improve and harmonize the current fragmented legal framework in the European Union (EU). The overall objective of this new framework is to promote the development and contribute to the growth of the EU data economy. The legislation also focuses on establishing a single market for data by providing rules for data sharing, regulating dominant companies, and giving people more control over their data (Bräutigam 2022).

The European Data Strategy comprises five Big Five proposals to regulate various aspects of data sharing, such as data rights, dominant companies, content, and artificial intelligence (AI). In Figure 2 the data strategy and the Big Five proposals are described.

Relevant proposals for our project

The Data Act (DA) and Data Governance Act (DGA) (in blue in Figure 2) are valid for developing the operational model as they have objectives compatible with our project. In the following, we will detail these two acts based on the work Data economy and EU regulations (Cunningham 2022).

Data Governance Act (DGA)

This proposal tries to establish an enabling governance framework for European data spaces as well as strengthen confidence and trust between those in the data market. In general, this act has three main objectives: **making public sector data available for reuse, facilitating data exchange in the EU and enabling data sharing for the common good**.

Scope

- Public sector
- Data sharing “trust” services (data intermediary services)
- Citizens

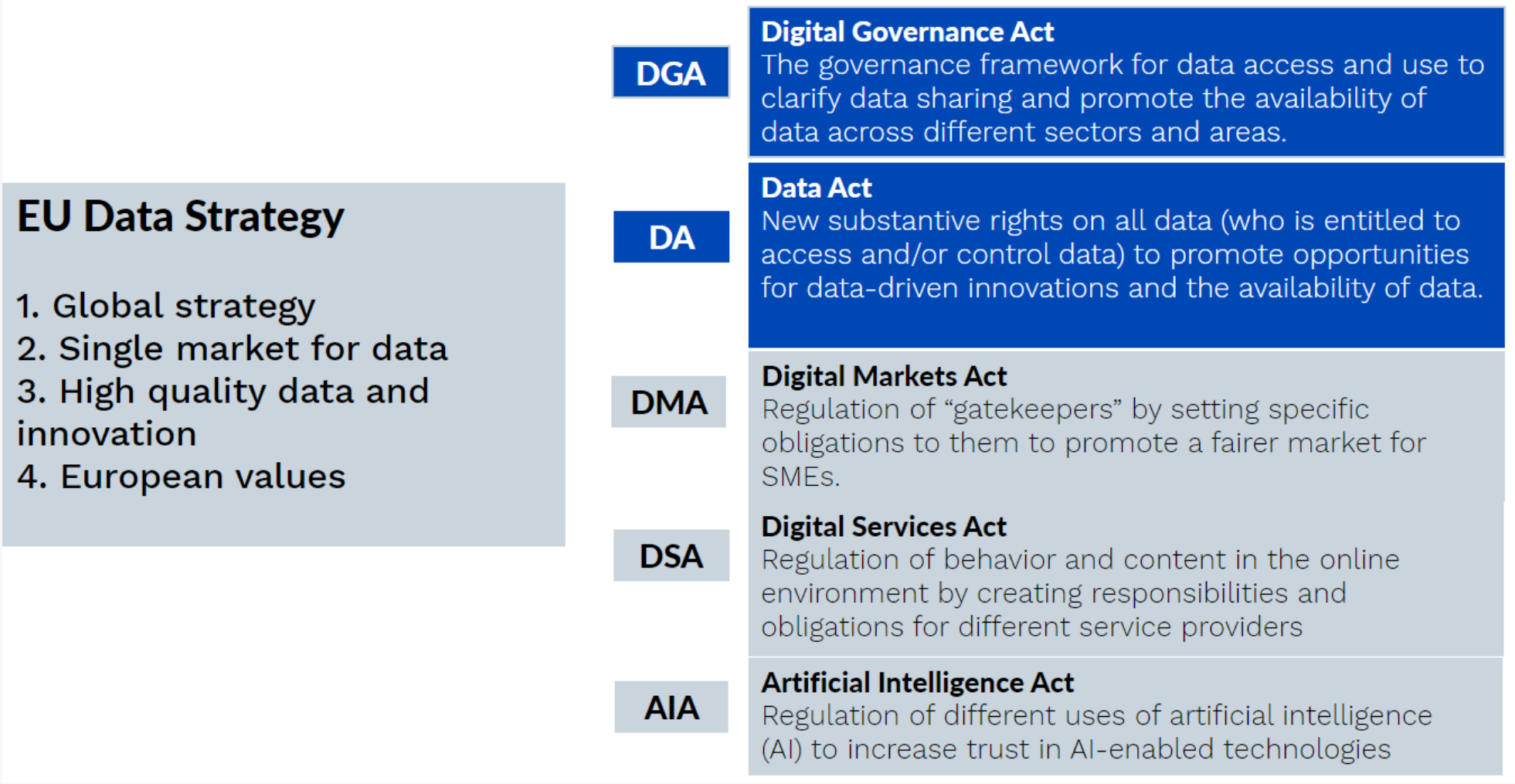
Key obligations

- Confidentiality
- GDPR one-stop-shop mechanism for data requests

Key definitions

- What is data?
- What is data altruism?
- What represents a data sharing service

Figure 2. The European Data Strategy and the “Big Five” proposals summarized.



Data Act (DA)

This act **facilitates the access and use of data in business-to-business (B2B) and business-to-government (B2G)** models in some cases. It also ensures the equal allocation of data value among actors in the data economy. It should be noted that this proposal is beneficial for SMEs as it obliges data holders to make their data available under fair, reasonable, and non-discriminatory (FRAND) terms. In addition, citizens will get new rights on their data, and old rights will be strengthened.

Scope

- Private-sector organizations with sets of industrial data.
- Public bodies and EU institutions.
- Data-processing and cloud computing services.
- Data generated by connected devices and related services.

Key obligations

- New rules for accessing and using non-personal data
- Data portability obligations and simplification for companies to switch between services
- Public use of data
- FRAND methodology in data sharing contracts

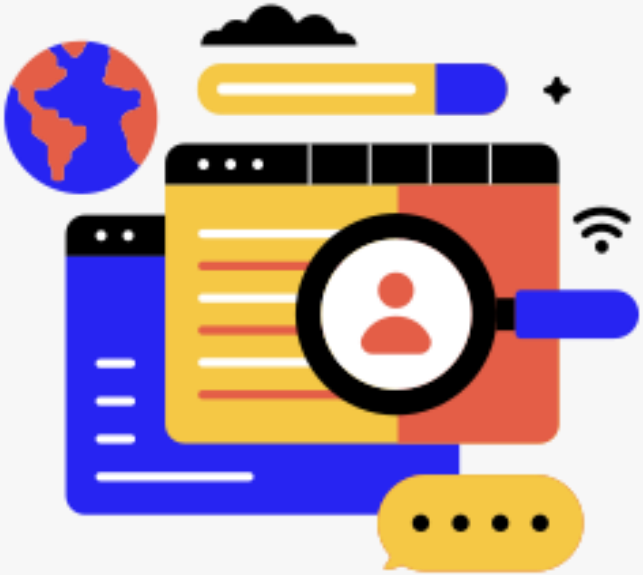
Key definitions

- What represents a fair contract in a business-to-business (B2B) environment?
- Public interest concerning business-to-government (B2G) data sharing

Picture: Icons8 LLC

Processes: The Rulebook for Fair Data Economy

Currently, there is a lack of guidelines or manuals designed for companies to enter the data sharing process in the specific environment of the mobility industry. However, some works guide the data-sharing process for any kind of industry. This section will present The Rulebook for Fair Data Economy, created by Sitra's IHAN program (2019), which contains a framework, agreement templates, and tools for creating and joining data networks.



Objective

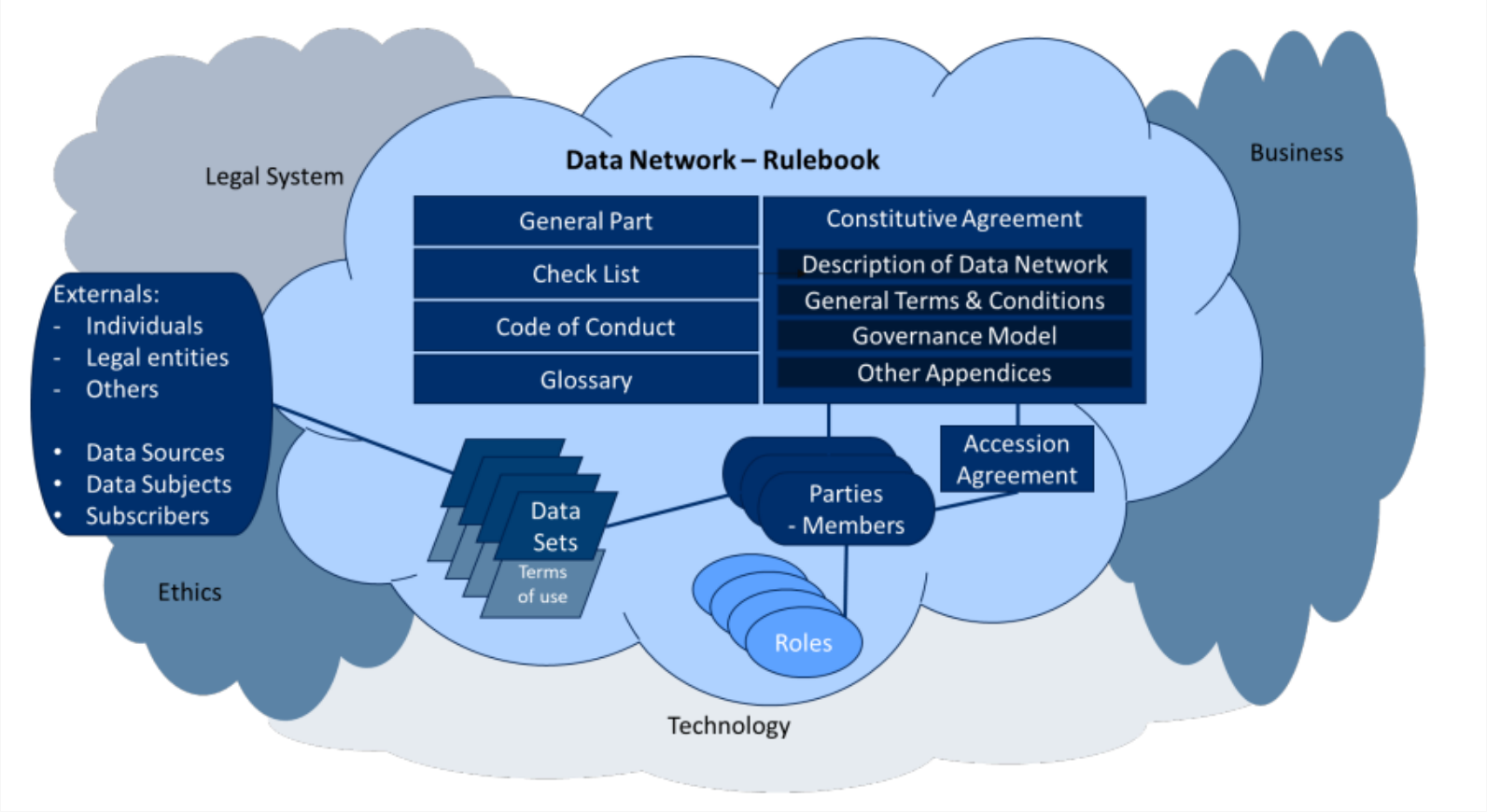
To provide an accessible manual that describes how to establish a data network and sets out the general terms and conditions of data-sharing agreements. The Rulebook for Fair Data Economy (Sitra, 2019) aims to help data providers and data users properly assess any requirements imposed by applicable legislation. It also serves as a guide for companies to adopt practices that promote data use and risk management.

Picture: Icons8 LLC

Content

Companies must still review the relevant legislation at national and sub-national levels and the laws regulating the data in question. The following figure (3) illustrates the content and the relationships between the different parts of the manual. In this document, we will describe in general terms the most important section: the contractual framework.

Figure 4. Content and relationships of The Rulebook for Fair Data Economy (Sitra 2019)



The contractual framework

The contractual framework consists of the following sections:

- Constitutive Agreement
- General Terms & Conditions
- Governance Model
- Accession Agreement
- Dataset Terms of Use

Constitutive Agreement

The constitutive agreement is the agreement between the different members that formalizes the data network among the signing members. It contains the companies or founding members and appendices such as a Description of the Data Network, General Terms & Conditions, List of Members and Contact Details, Governance Model, Code of Conduct, and any other that the companies may wish to add.

General Terms & Conditions

The objective of this section is to serve as a tool during the operational phase of a Data Network. The General Terms and conditions section is composed of applicability, scope and governance, some basic definitions for the agreement (e.g., data network, data provider, end-user), roles and their responsibilities (e.g., service provider activities), general responsibilities for all members (e.g., data security, protection, and management), subcontractors, fees and costs, confidentiality, intellectual property rights, termination and validity, applicable laws, among others.

Accession Agreement

This agreement lays the groundwork for a new member to join the Data Network. Members should describe the access criteria for new members in the Constitutive Agreement. Members should also define the criteria and procedures for accepting new members into the network in the Governance Model. This contract has as its main appendix the Constitutive Agreement, the Governance Model, Code of Conduct, General Terms & Conditions, and any relevant appendices to the Constitutive Agreement.

Governance Model

The Governance Model assumes that each member nominates a representative to serve on the Steering Committee. The latter is the ultimate decision-making body and aims to facilitate collaboration among members and appropriately organize the data network's management at a strategic level. The Governance Model appendix defines the functions of this committee, its composition,

organization and meetings, quorums, and decisions, among others.

Dataset Terms of Use

This section details the terms and conditions that apply to the dataset(s) that Data Providers make available on the data network. For example, it establishes the requirements for data redistribution to third parties.

Challenges: City Data Exchange

This section will describe some of the challenges and difficulties of implementing a data-sharing model in mobility from an organizational perspective in Finland based on the work *City Data Exchange – Lessons learned from a public/private data collaboration* (Municipality of Copenhagen 2018). We identified the following challenges: immature market, the limited number of use cases, lack of skills and competencies, insufficient infrastructure, fragmented data landscape, and reluctance to share data.

Immature market

Many companies in Finland obtain data from traditional institutions or specialized data companies. For example, the company Bank of Finland obtains data from Tilastokeskus to present its tables on topics like the international economy, Finnish economy, and financial stability, among others. Our project aims to establish an operational model that can be used by the City of Espoo and different stakeholders that are not necessarily specialized data market companies.
Often, a company's budget for buying and selling data is limited as this activity is not part of its business model. Although there are initiatives and interests in exploring data-sharing practices, some may not be ready to integrate this type of activity into their operating model.

The limited number of use cases

Currently, examples of data buying, and selling are limited in the area of mobility in Finland. Some efforts, such as the Smart Otaniemi project, a joint effort between VTT, City of Espoo, Aalto University and various companies, are in the development phase and are not well established in the industry. The lack of use cases can be a barrier for buyers and sellers of data. Buyers are looking for real examples of organizations that have benefitted from buying data. From the sellers' perspective, they want to use cases of companies that have been successful in selling data. Additionally, from the cities' perspective, there is limited information that guarantees investments in opening data to be available for free have resulted in new businesses and better services.

Lack of skills and competences

Organizations may lack the skills to process, store and transfer different data types from numerous sources. For example, sellers may not have the ability to collect and prepare data for sharing, and there is a possibility that they will transfer raw data. From the buyer's perspective, they may not know how to clean, process, and transform this raw data into helpful information for the company. Data sharing requires staff with data science expertise and can be costly for some organizations. Municipalities are no exception here. The City of Espoo is not focused on buying and selling data. However, they have some skill and competency gaps that are often a consequence of a limited budget and unclear roles and responsibilities.

Insufficient infrastructure

The data sharing process requires network infrastructure, databases, and servers to share, process, and store the data. It also requires software, specialized hardware (e.g., firewalls), and internal security measures to ensure data privacy and security. Many organizations may not be able to acquire the type of infrastructure necessary to enter this business model.

Fragmented data landscape

The data's value is subjective and depends on the stakeholder. The value of the data depends on the utility of it to the buying company rather than the raw data itself. Currently, there are no standardized market prices for the diverse amount of data in the mobility sector. Also, the lack of data market examples in mobility exacerbates the situation.

Reluctance to share data

Many organizations find it risky to share data with other organizations. One crucial reason is data security and privacy, as sharing data outside the company's systems increases the risk of data leaks. Also, sharing data on an open platform possibly entails that a competitor can access a competing organization’s business critical shared data. While limiting data access directly to competitors is easy, it is not easy to guarantee that other companies will buy the data and resell it to competitors.

Picture: Icons8 LLC

CURRENT STATE WORKSHOP

For analyzing the current state of Espoo and data sharing, we facilitated a workshop for Espoo representatives. The goal was to define the current state with three exercises: RACI matrix, GAP-analysis, and a draft operating model. The outcomes of the workshop are described in detail in the following chapters. Materials sent to introduce the exercises before the workshop are presented in Appendix 1.

RACI Matrix

RACI Matrix is a type of responsibility assignment matrix, that lists stakeholders and their level of involvement in each task (Howard, D. 2012, 22). R, A, C, and I stand for *responsible, accountable, consulted,* and *informed.*

R – Responsible is a person or a group of persons performing or completing the task. Every task should have at least one responsible person, but there could be several – they are usually project teams, developers, or other creators.

A – Accountable has sole accountability for the activity. They communicate the expectations and follow that the execution is on track. The accountable parties are typically managers or leaders of the project teams.

C – Consulted people may provide information or feedback needed to complete the task. The outcomes of a project might affect their current or future work, so they should be consulted to get their input on their needs and requirements. Not every task needs a consulted party, but all the possible stakeholders should be considered while creating the matrix. The consulted parties might be not part of the project team but teammates outside the project team or others whose work might be affected by the outcome.

I – Informed party needs to know the task or activity is occurring but does not need to be directly involved or overwhelmed with details or execution of the task. They are usually outside the project team, for examples directors or affected teams. (Howard, D. 2012, 22-23, Miranda et al, 2022)

We decided to use RACI as we wanted to maintain clear and open communication with the Espoo team as well as avoid unnecessary information shared because of unclarity of roles of the stakeholders. Also, working on a RACI matrix together helps the stakeholders to prepare for the operating model's future impact on their work. Alternative models to use could have been e.g., RASCI (*S for supportive*), CARS (*Communicate, approve, responsible, support*) or DACI *(Drivers, approvers, contributors, informed).*

Gap analysis

According to Maren Franklin (2006), gap analysis is the process used to determine where you are and where you want to be. For the workshop, we identified both *desired* and *current* operational results by asking the questions: **what, why, who** and **how**. The gap analysis could be followed by a root cause analysis. If the root cause is based on lack of skills or knowledge, the gap may be closed by training – otherwise a proposal for a solution to close the gap should be made. (Franklin, M. 2006)

In our analysis, we used the following questions as guidelines: what data is needed (now) and what data is valuable (in the future), why operating model is needed, who are the stakeholders currently and who will participate in the future, and how is this done: what the capabilities are right now and what could be the capabilities needed in the future. Overall, we wanted to solve how an operating model improves the current situation.

Draft of an operating model

As Colin Mynott (2012, 175) describes in *Lean product development: a manager's guide*, an operating model is needed to follow, plan and control the tasks and progress: it helps to create a culture of collaboration. According to Mynott's paper it can take up to 4-8 months to design a good operating model and up to four times to implement the culture needed for the model operation, mostly focusing on changing the values and habits of the management. To achieve this, the easiest route is to enhance an old system. In our case, there is not a reference system in place, but for future development, agile and continuous development on the model would be crucial for successful implementation. (Mynott, C. 2012, 175)

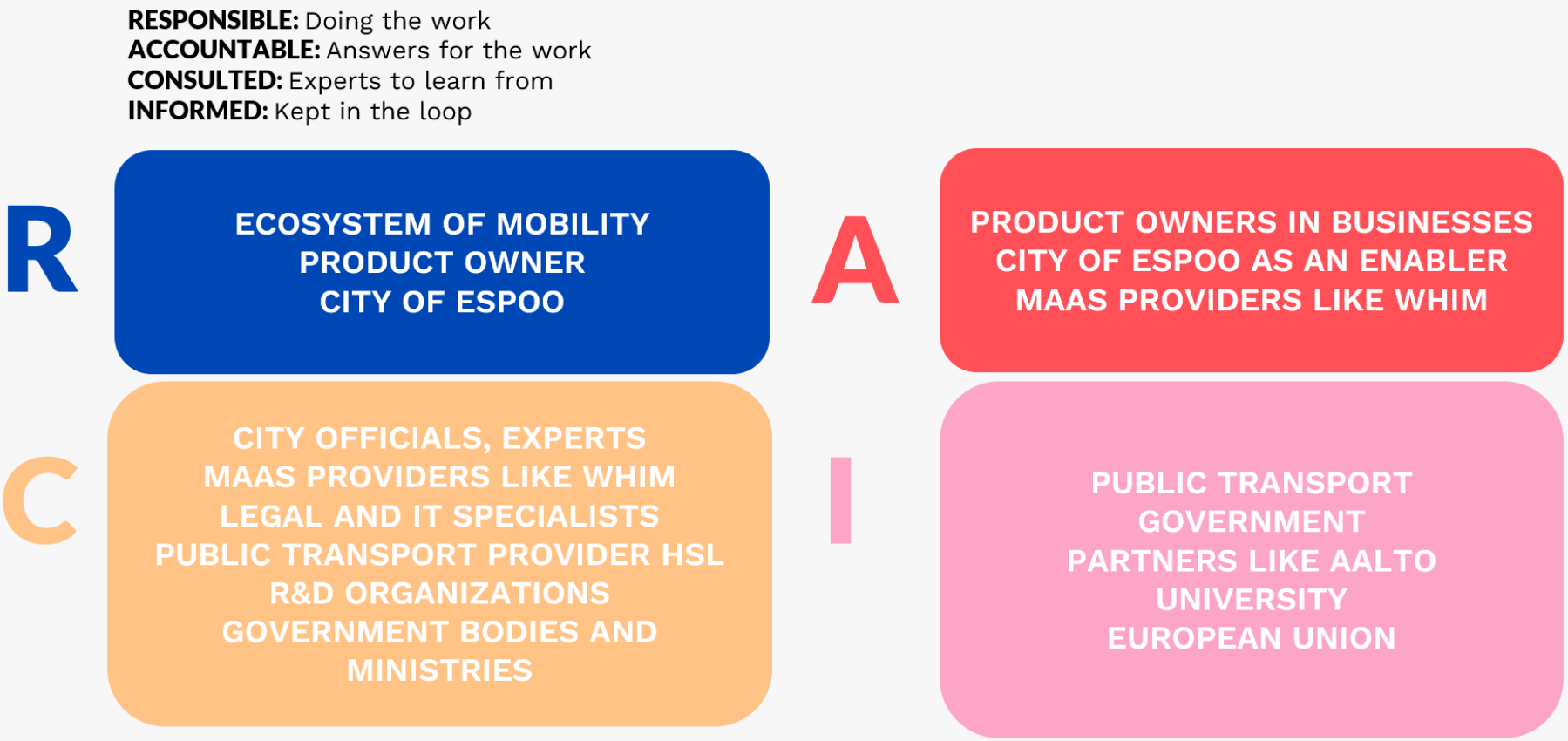
In the workshop, we drafted the operating model around six drivers that need to be considered: **management, capabilities, processes, data, people,** and **technology**. With the previous exercises we already had answers about who might be the people involved and what would be the capabilities needed.

In the next sections the analysis and key findings from the workshop are presented in more detail.

ANALYSIS

Analysis and results from the RACI exercise are presented in Figure 5. As a result, we managed to identify the key stakeholders in the context of data sharing in mobility. The responsible and accountable actors were the most difficult to identify, which leads us to the root cause analyzed in more detail within the proceeding exercises.

Figure 5. RACI matrix of data sharing in mobility.



The filled in Gap-analysis is presented in the following Table 1. While discussing the current and the future state of data sharing in mobility, multiple gaps but also action points were identified. This method helped us to gain understanding and more depth about the subject matter.

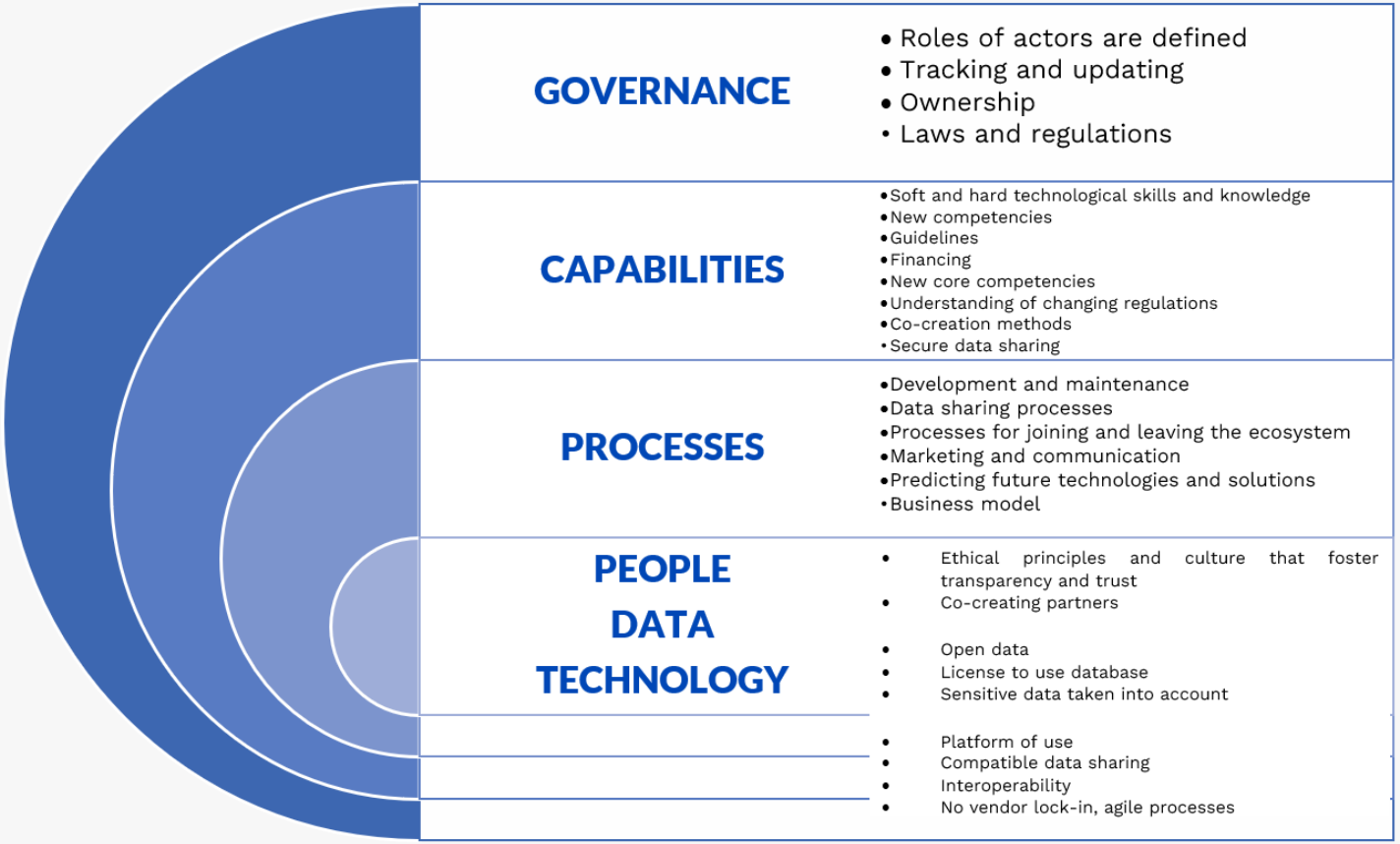
Table 1. The Gap analysis.

	Current state	Future State	Gap	Actions to close gap
WHAT	Context of the data is missing Customer voice is not heard	Customer values, feedback and needs are heard and served Data comes with context Services and mobility information is accessible	Information for predicting information to optimize business processes is missing There is no efficient tools to process the data	Combining data Data sharing associations to support the common way of operating Creation of standardized method for data sharing
WHY	Guidelines for contstant data sharing are missing Legislation and regulation is changing, and it will have unknown impacts	There would be clear goals and plan for develpment	Lack of common guidelines and understanding of the regulation	Operating model applied to various contexts would help to communicate and reach common goals Develop interpretation of laws and their upcoming impacts increases resilience of the organization
WHO	Actors in the mobility ecosystem, like municipalities and HSL – but as individual parties	Collaboration and co-creation of all the stakeholders: citizens, private companies, public transport organizations, city operations	Lack of ownership and unclarity of roles and responsibilities	Governance model defining the needed roles in the operating model would help to build the organization and define the needed capabilities. Co-operation and collaboration with associations and stakeholders leads to meaninful result.
HOW	There is momentum to collaborate: the actions shold be taken	E.g. the technical capabilities are out of scope Agreements, rules, contracts and common guidelines would be in place	The gaps will be identified once the operating model is ready	Transparency and trust help us to reach our goals

The concluding exercise done during the workshop was a draft of the operating model, and it is presented in Figure 6.

Figure 6. Draft of an operating model for mobility.

GOVERNANCE: Ensures efficiency and work within regulations
CAPABILITIES: Changes rarely
PROCESS: Changes often
DATA: Includes security & confidentiality
PEOPLE: Organisational structure, culture & partners
TECHNOLOGY: Includes applications & infrastructure?



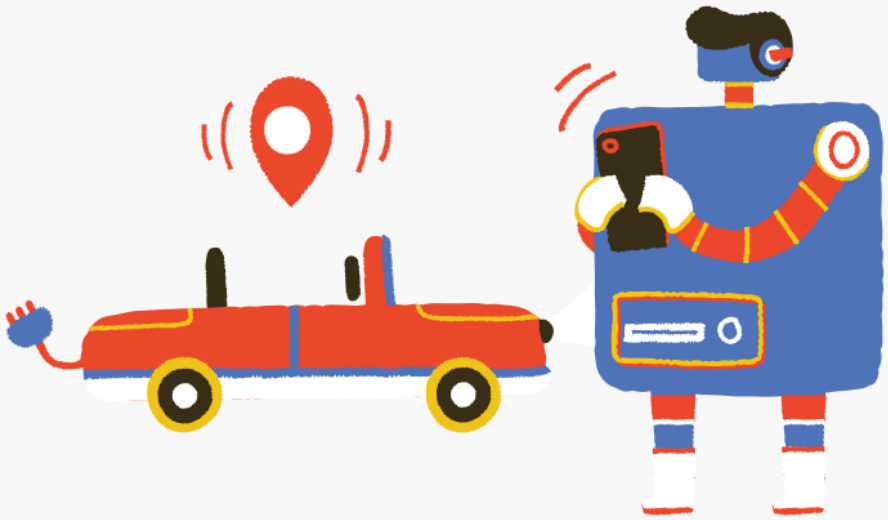
As presented in the figure above, with this exercise we identified the key tasks and categories that should be included in the operating model. For prioritization, all findings summarized emphasized the importance of common guidelines, clear roles and responsibilities, co-creation, collaboration, and trust among the actors.

KEY FINDINGS

From the RACI Matrix exercise the key findings were that the City of Espoo is responsible and accountable to be an enabler in the data sharing ecosystem. The whole ecosystem of mobility will also be responsible, accountable, and should be consulted on the subject matter.

The GAP Analysis demonstrates that there are gaps between the current and future state of an operating model. Customer feedback and data is needed, however, to obtain valuable data there is a lack of tools to process and analyze the data. A recommendation that can help enable easy data prediction to provide information on customer needs and availability of services will be critical to the success of this project. Currently there is a lack of guidelines on data sharing, and it is difficult to understand changing regulations and how they may change in the future. When developing the operating model framework, it needs to be applicable to different contexts, and needs to be flexible to adapt to future changes in regulation. Stakeholders in the operating model will need to have clearly defined roles to where then ownership can be given. To tackle this, developing a management model and collaborating with actors in the system will be necessary. The core pillars of the operating model will be built on transparency, trust, and co-creation.

The Draft Operating Model echoes key findings from the RACI Matrix and GAP Analysis. In addition, processes for entering and leaving the ecosystem need to be addressed. Discussed was a license system that can be used to give companies access to the City of Espoo's database. Doing so can ensure that whoever should have access to the system will have access while anyone who should not have access will not have access. However, gatekeeping access to the ecosystem could inhibit innovation.



Picture: Icons8 LLC

DESIGNING

INTERVIEWS

Leavy (2014, 119-120) quotes Lord Kelvin (Sir William Thompson) that nonquantitative studies are “at best” a preliminary to true knowledge. Still, the ground theory method (GTM) suggests that the researchers should gather data as a basis for developing the research project in its initial stages (Leavy, 2014, 126). In his paper, he proposes following GTM questions: *what is happening here, what is this data,* and as a reflection *from whose viewpoint is a given process fundamental, how do participants’ actions construct, who exerts control over these processes* and *what meanings do different participants attribute to the process* (Leavy, 2014, 126).

We decided to use semi-structured interviews, as it can make better use of the knowledge-producing potential of dialogues by allowing flexibility on follow-up questions and angles that might seem important during the interview. On the other hand, it is harder for the interviewer to stay neutral and not participate in the conversation (Leavy, 2014, 286). Individual and small groups were preferred, as it might be easier to lead the conversation in a direction that is useful in relation to the research interests (Leavy, 2014, 289). The platform medium chosen was Teams, considering a tight schedule due to summer holidays but to have a chance for somewhat bodily interaction and analysis of the atmosphere as well. The Fintraffic interview was the only one conducted on campus.

The people to interview were decided based on findings from the workshop: as the stakeholders were defined, some of the key organizations and roles were identified as valuable sources of requirements, needs, and wishes for the operating model. The interviewees are presented in Table 2.

Picture: Icons8 LLC

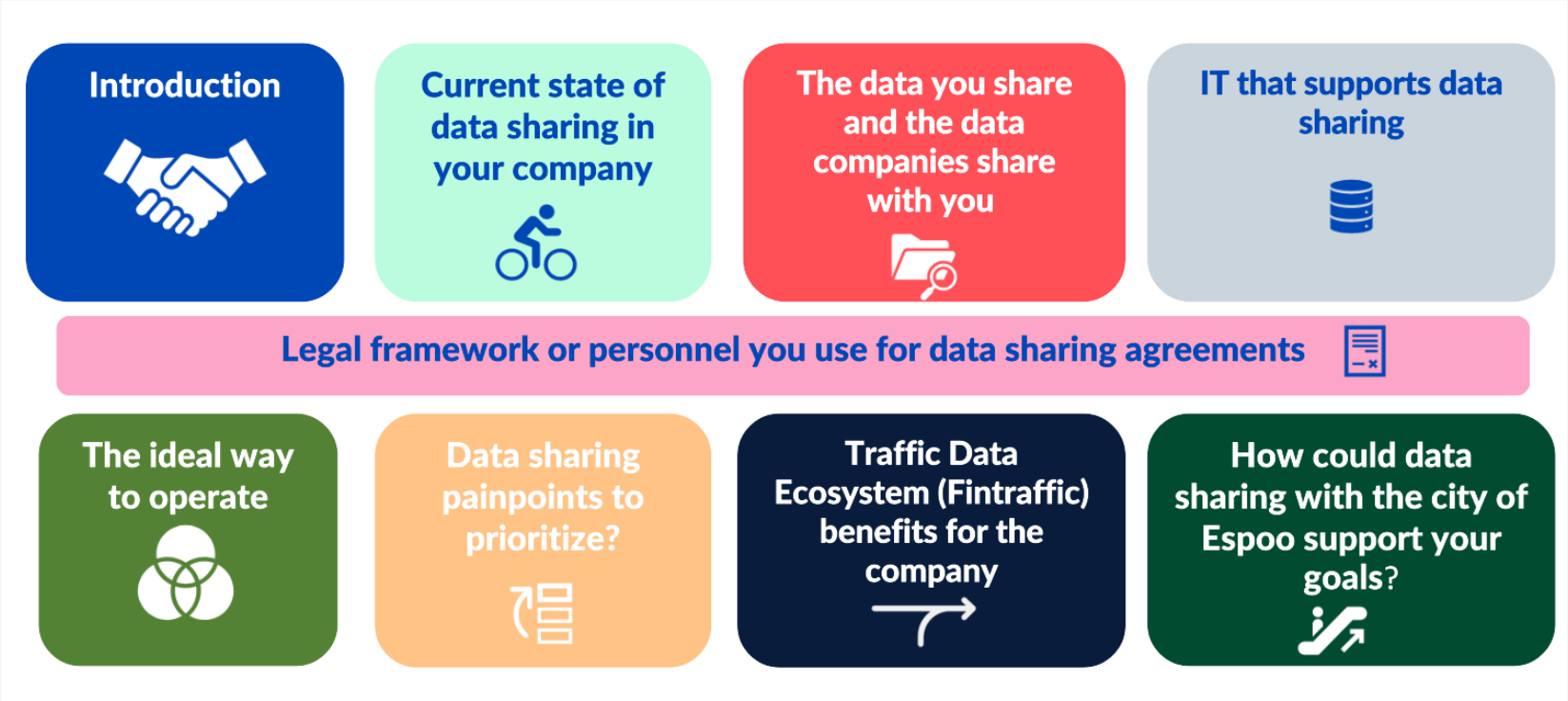
Table 2. The interviewees, their organization, roles and relevance.

	Stakeholder	Interviewee	Role	Relevance
1	Espoo	Suvi Kajamaa	Project manager, MaaS & Public Transport	Internal insights
2	HSL	Johanna Wallin	Director Traffic	Expert insights
3	HSL	Lauri Räty	Head of Southern Market	Expert insights
4	HSL	Jan-Erik Antipin	Head of Data and Analytics	Expert insights
5	HSL	Ossi Berg	Data platforms and IT	Peer insights
6	Fintraffic	Janne Lautanala	Chief Ecosystem and Technology Officer	Expert insights
7	MAAS Global	Sampo Hietanen	Chief Executive Officer	Expert insights
8	City of Turku + TEK + Turku City Data	Matti Vähä-Heikkilä	Council member + TEK Data Project Manager + Chairperson of a board Turku City Data	Expert insights

Interview questions

The questions prepared for the interviews are shown in Figure 7. The interviews started with an introduction to the project and then an introduction from the person interviewed and their role. We asked them for their insights on the current state of data sharing and the stakeholders they interact with. We asked them to describe the processes and the supporting IT, as well as describing the ideal way to operate. Whenever challenges occurred, we asked for prioritization: which problems should be tackled first. We also went through the legal side of data sharing and asked specifically about their involvement in the national data point Traffic Data Ecosystem, as many (but not all) of the interviewees were obligated by EU directive to share data with it. Lastly, we asked them what kind of impact it would have on their goals if Espoo would be the enabler of data sharing in this ecosystem.

Figure 7. Interview structure & questions.



DATA ANALYSIS

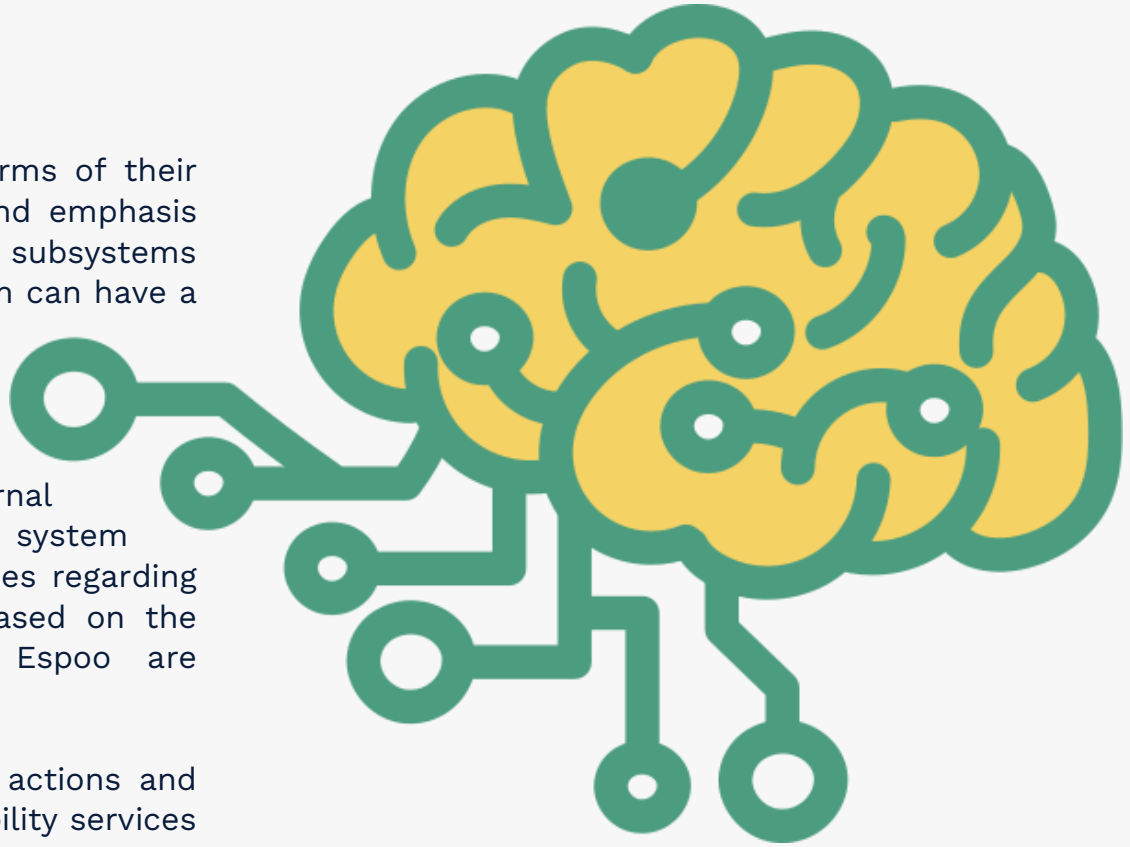
To have a 360-degree view on the data gathered by the interviews, we utilized a system map to concretize the current state and future possibilities on a technological side, and pain point analysis to gather the requirements and needs from the stakeholders.

System map

All complex systems can be described in terms of their architecture, with hierarchical subsystems and emphasis (Baldwin et al 2014). Major changes in the core subsystems and their linkages to other parts of the system can have a significant impact on performance and industry structure (Baldwin et al, 2014, 1381).

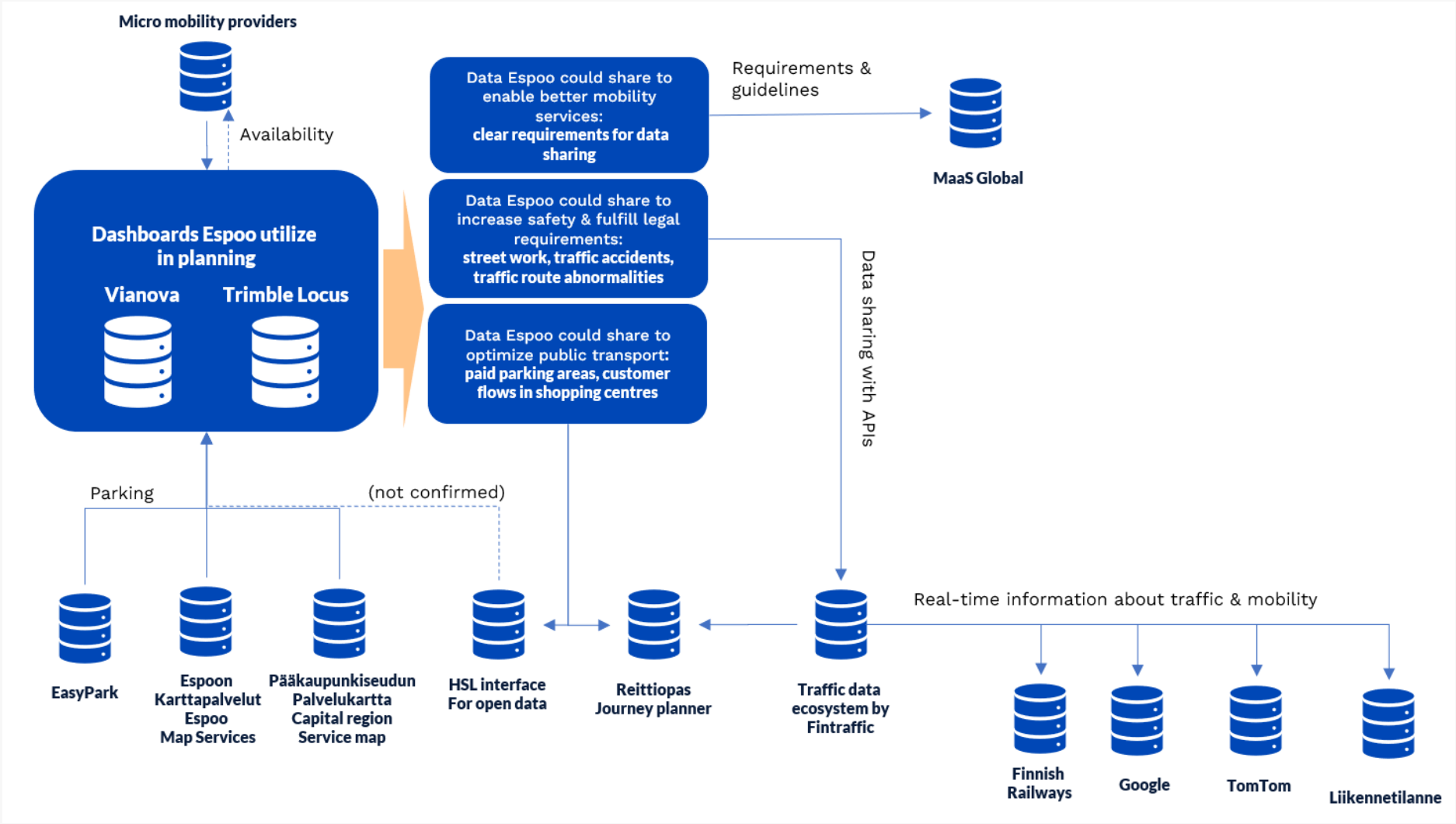
In this project we focused on mapping the system via interviewed internal and external stakeholders, to have a cohesive view on the system landscape and map the gaps and opportunities regarding Espoo. The current state of the systems based on the interviews and future opportunities for Espoo are presented in Figure 8.

As illustrated in Figure 8, with data sharing actions and improvements Espoo could enable better mobility services and ensure safer and better optimized (public) transport. Based on the interviews, the focus on these actions should be on creation of clear requirements and easy, standardized plug-ins by APIs.



Picture: Icons8 LLC

Figure 8. System map for future data sharing, based on the interviews.



Pain point analysis

The qualitative nature of the research highlighted the subjective pain points of the stakeholders. This type of approach was crucial, as the underlying causes of similar problems might differ from one stakeholder to another. Conducting interviews helped us to gather various pain points, that we listed and clustered into themes.

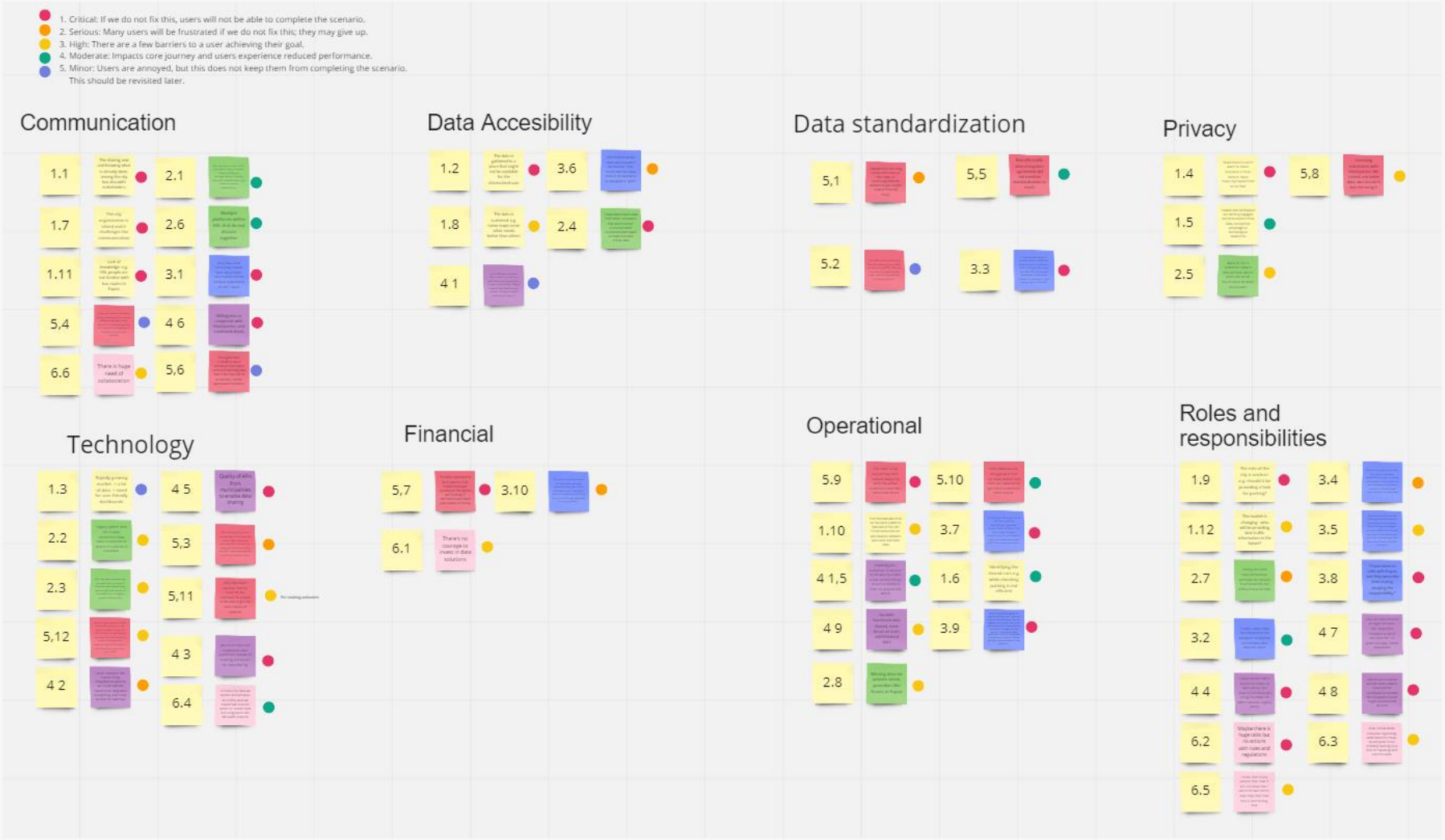
Unsupervised classification, or cluster analysis, seeks to discover groups from data (Govaert, 2009, 216). Cluster analysis includes pattern recognition, information retrieval, micro-arrays and possible data mining, and as a set of exploratory data analysis methods helps to discover structures in data (Govaert, 2009, 215). In our analysis, we placed pain points with shared characteristics in the same class (Figure 9). As the figure shows, the eight characteristics were *communication, data accessibility, data standardization, privacy, technology, financial, operational,* and *roles and responsibilities.*

The clustered pain points were further analyzed with creation of metrics. The pain point clusters were identified by the impact they would have on the operating process. The key metrics were defined as:

- **Critical:** If we do not fix this, users will not be able to complete the scenario.
- **Serious:** Many users will be frustrated if we do not fix this; they may give up.
- **High**: There are a few barriers to a user achieving their goal.
- **Moderate**: Impacts core journey and users experience reduced performance.
- **Minor:** Users are annoyed, but this does not keep them from completing the scenario. This should be revisited later.

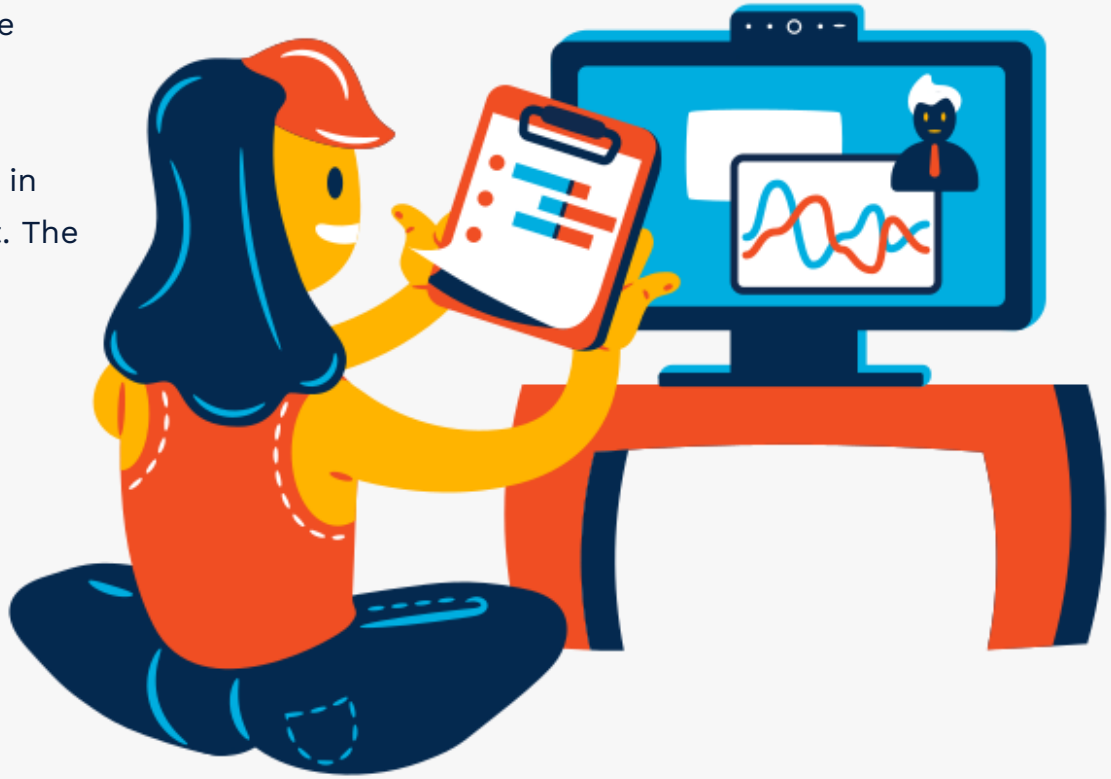
(King, 2021)

Figure 9. Pain point **clusters**: communication, data accessibility, data standardization, privacy, technology, financial, operational, and roles and responsibilities. Individual pain points are summarized in Table 3.



In Figure 9, the risk metrics are illustrated with a colored dot beside the pain point. When sorted by criticality, we have the prioritized list for the pain points. Half of the critical status pain points were considering communication and roles and responsibilities. In the following Table 3, pain points are grouped by severity in order that emphasis the importance of the pain point. The summary is gathered from overall 58 pain points.

For the next chapters, we extend the analysis to benchmarking and then conclude the discovered requirements for the operating model.



Picture: Icons8 LLC

Table 3. Summary of pain point analysis & metrics.

SEVERITY	CATEGORY	SUMMARY OF PAIN POINTS	SOLUTIONS FOR RELIEVING THE PAIN POINTS
	Communication	Lack of knowledge: what data is already accessible and how, how to communicate with stakeholders to have efficient interaction	Operating model to communicate the ways of working
1 - Critical	Roles & responsibilities	Lack of use of enabler power: the role of city is unclear	Emphasis on enabler: create and communicate clear guidelines
	Operational	Connecting the data & analytics to the customer needs: lack of focus	Evaluate the opportunities what data to openly share
	Privacy	Balance between open and business critical data	Validate open data by emphasis on benefits, but admit the business-critical data that will be out of scope
	Technology & Data Standardization	Lack of API standardization: focus on platforms is hindering	Create guidelines and standardization for APIs instead of creating own platform
	Data Accessibility	All data is not open, municipalities are not sharing the data they are obligated to share by EU-legislation	Analyzing the gaps between current legislation & data sharing operations and closing the gaps accordingly
	Financial	IT investment might be costly	Utilize existing ecosystems, platforms & services
2- Serious	Roles & responsibilities	Lack of new capabilities: need for prioritization and training	Create a roadmap for new capabilities: identification, gap analysis, implementation
	Technology	Lack of automatization: manual work, quality issues	Automatization
	Data Standardization	Combining different forms of data sets is tricky	Create guidelines and standardization
	Data Accessibility	E.g. municipality level street works etc. Are lacking from the national ecosystem	Open the data of street constructions for Fintraffic ecosystem
	Financial	Municipalities are not focusing on using their limited resources on improving the regulations and guidelines	Focus on legislation and regulations to create effective guidelines that will support the growth of the industry
3 – High	Operational	Lack of functional data – data shared being historical or somehow restricted	Increase real-time data access
	Technology	Legacy systems	Risk-assessment
	Roles & responsibilities	The changing market needs organizational changes	Create capability roadmap
	Privacy	Licensing, anonymous data lacking value	Act according to legislation
	Data Accessibility	Data is scattered	Streamline data gathering and easiness of use by operating model
4 - Moderate	Operational	Identifying the customer needs and matching the data possibilities	Out of scope
	Communication	Complex organizational & system structures	
	Roles & responsibilities	Private roads do not have anyone responsible for data sharing	
	Privacy	Business critical data	
	Data Standardization	Joining existing communities	
5 - Minor	Communication	Agreements would need additional actions regarding open data sharing to be effective	
	Data Standardization	Costly data analysis tools	
	Data Accessibility	Integrations differ internationally	
	Technology	Growing market increases the data volume and need for user-friendly solutions	

BENCHMARKING

This section benchmarks successful practices that have been implemented internationally. The Netherlands has been chosen as a benchmark city to be compared to Espoo to see whether Espoo is able to utilize similar practices as well. Secondly, the City of Turku has founded an external company called Turku City Data Oy. Benchmarking what the Turku City Data Oy has been able to achieve can be of use for the City of Espoo. Lastly, a revised ITS directive proposal has been sent to parliament and will likely be implemented or revised in the future. Considering this proposal should be important in the development of the operating model.

Netherlands – Data Top 15

This Data Top 15 is the starting point for digitization in the Netherlands. It is an extensive list of 15 data types in mobility, which have been identified as the most crucial and is published by the road authorities. Five parts of the country are working together to become 'digitally capable of mobility' in the Netherlands through the digitalization of governments program. The aim of this is for all road users to be digitally capable. The information in this section is found from Datapedia, in a section entitled *Data Top 15*.

A summary Data Top 15 published by the road authorities is highlighted below:

1. **Planned road works:** Road managers can more easily and efficiently control accessibility by digitizing planned roadworks and disruptions as soon as they are known and keeping them up to date. This digitalization also helps in preparing for self-driving transport, which needs to be aware of the current situation on the road.

2. **Current road works**: Current Road works are activities that affect the flow of traffic. As up to date reporting can be cumbersome to road authorities and implementing parties, it was decided on a national level to automate the current reporting of road works.

3. **Incidents:** Whenever disruptions or incidents occur, immediate action must be taken. Making agreements with all parties involved to limit the handling time of accidents will limit the social costs (traffic jams) caused by incidents.

4. **Remaining duration of incidents:** Road users should also be informed about how long a road has been closed and what traffic disruption can be expected. This information allows road users to postpone a journey or choose a different route well-informed. Those already stuck in traffic jams are made aware of the

nature of the incident and the expected duration of the jam.

5. **Speed limits:** It must be made available online where maximum speed limits apply on the road. Service providers and the automobile industry benefit from accurate data supplied by road users. The road becomes safer and more efficient as a result.

6. **Signs (and prohibition):** These traffic decisions must be published digitally by governments. Additionally, as road authorities responsible for road safety and traffic flow, they must ensure that all signs and directions are widely and accurately communicated to road users.

7. **Control Scenarios from traffic centers:** Control scenarios, measures deployed in the event on an incident, event or road work, are used to influence the traffic flow by the traffic authorities.

8. **State highways:** The national Public Works and Water Management provides data and images of all national roads with signaling such as arrows, intersections, speeds.

9. **Bridge openings:** Real-time data about opened bridges and available berths help time savings and smooth passage through better communication between water way managers, shipping and road traffic.

10. **Dynamic Parking:** Dynamic parking data concerns data on the current availability of parking spaces. Searching for parking in urban or busy areas can be tedious and time consuming. This might lead to loss of time, frustration, traffic unsafety, unnecessary use of road capacity, environmental impact and nuisance for the surrounding areas. It becomes even easier when up-to-date information is available on the availability of the parking facilities.

11. **Static Parking:** The reason for this data is similar to dynamic parking but static parking data concerns the data for parking spaces with more than 25 vehicles.

12. **Events:** Data that shows planned events and the expected impact on public space and the traffic flows are utilized in this case. Information is digitally available about traffic events that cause road closures and diversions.

13. **IVri (Interactive Voice Response):** These provide messages, through which intelligent traffic lights can better communicate with the road user over a greater distance. Some insights that these messages provide

are about intersections and road users at the intersection

14. **Logistics:** With logistics data, parties are aware of restrictions, preferred routes, and locations for parking, loading, and unloading before and during their journey. Properly parked trucks and freight traffic prevent infrastructure damage and prevents inconvenience near city centers. This includes data on, for example environmental zones, dangerous goods, preferred routes etc.

15. **Bicycle:** Cycling is one of the most common methods of transportation in the Netherlands, As cycling also contributes to health, sustainability, there are plans to work with cycling data in the coming years. Some of the most common data needs regarding bicycles are bicycle parking, offer and available shared bikes, use of bicycle network.

This list does not have to be limited to only 15 data points but is rather a suggestion to start making these data items available. The Netherlands promotes digitalization, an essential tool to make mobility smarter, a way or governments to perform tasks more efficiently, promote innovation and inform its citizens more effectively. Most of these data points are in line with the upcoming regulations of the ITS directive which is set to take place by the end of 2025. More information regarding this can be found in the EU Intelligent Transport Systems (ITS) Directive section. Additionally, these data points are illustrated in Figure 9, under requirement definition at the end of this designing chapter.

Limitations

Information regarding Data Top 15 program was only found in Dutch. Therefore, the website was translated to English using Google translate. The translation might have errors and one website was used to gather information as there were no other websites that could be translated.

Picture: Unsplash

Turku City Data Oy

In 2019 the City of Turku founded an external company, Turku City Data Oy, to help the city to reach their strategic goals *(Smart & Wise Turku)*. The company is fully owned by the city, and its mission is to bridge the gap between fragmented data and the needs for better and more sustainable services for citizens, helping the cities around the world. They have automated the value chain from data ingestion to publishing ready-to-use functionality through easily accessible APIs (Turku City Data 2019).

Based on the interview, the externalization of open data sharing activities might help with the constraints municipalities face due to legislation etc. This is an option that could be studied further within Espoo. Turku City Data is one option for a vendor of urban data sharing solutions.

Picture: Pixabay

EU Intelligent Transportation Systems (ITS) Directive

Directive 2010/40/EU is from 2010 and talks upon the framework for the deployment of Intelligent Transport Systems (ITS) in the field of road transport and for interfaces with other modes of transport (EUR-Lex, 2010). On December 14, 2021, an ITS directive proposal was sent to the European Parliament and of the Council amending Directive 2010/40/EU (EUR-Lex 2021). The proposal addresses three problems with intent of contributing to decarbonization, digitalization, and increasing resilience in transportation networks. The three problems are as follows:

1. The lack of interoperability and lack of continuity of applications, systems and services.
2. The lack of concertation and effective cooperation among stakeholders.
3. Unresolved issues related to the availability and sharing of data supporting ITS services.

A comprehensive stakeholder analysis took place and policies were developed to tackle these issues. A notion outlined is the idea of having national access points (NAP) for each country within the EU. A byproduct of this notion and policies of which the City of Espoo can take notice of is Annex III which is an updated version of types of data on regulations from Commission Delegated Regulation (EU) 2015/9626 (EUR-Lex, 2014). This revised version provides for a new article requiring Member States to ensure the availability of data for the data types listed below and their accessibility on NAPs. The full table can be found in the ITS directive proposal, however key data types that the City of Espoo can act on creating capabilities (if not already able to measure) and their sought-after dates of implementation are presented in Table 4.

Picture: Icons8 LLC

Table 4. Types of data on regulations from Commission Delegated Regulation (EU) 2015/9626 (EUR-Lex, 2014).

Data type	Date
Static and dynamic traffic regulations, where applicable, including –access conditions for tunnels -access conditions for bridges -speed limits Freight delivery regulations -overtaking bans on heavy goods vehicles -direction of travel on reversible lanes -traffic circulations plans -permanent access restrictions	31 December 2025
Types of data on the state of the network -road closures -lane closures -roadworks -temporary traffic management measures	31 December 2025
Types of data on safe and secure parking places for trucks and commercial vehicles -static data related to the parking areas -information on safety and equipment of the parking area -dynamic data on availability of parking places including whether a parking is: full, closed or number of free places available.	31 December 2025
Data on detected road safety-related events or conditions -temporary slippery road -animal, people, obstacles, debris on the road -unprotected accident area -short-term road works -reduced visibility -wrong-way driver -unmanaged blockage of a road -exceptional weather conditions	31 December 2026
Location of identified access nodes for all scheduled modes, including information on accessibility of access nodes and paths within an interchange (such as existence of lifts, escalators)	31 December 2026

To be in line with the European Union legislation, the City of Espoo should share its mobility data with the national access point (NAP). As the EU's ITS directive states, "NAPs organize the access to and reuse of mobility related data to help support [...] EU-wide interoperable travel." In addition, the NAPs are used as a part of EU's strategy for data, and the access to the mobility data can help in many avenues, e.g., fighting climate change, reducing accident-related injuries and deaths, and increasing the overall mobility security.

Benchmarking Conclusions

Taking both the Netherlands and ITS Directive into account there are common types of data being sought after to co-create safer, more efficient, intelligent transport systems to better serve the population. Static and dynamic information are of value when creating a smoother ecosystem of mobility. Developing communication channels to communicate available parking and current roadworks can decrease congestion and smoothen bottlenecks on the road. Making speed limits and accurate weather conditions aware to service providers and drivers will enable them to drive safer. A challenge in Finland is that roads are maintained by multiple parties. Some roads are maintained by municipalities, some by the government (Finnish Transport Infrastructure Agency), and the rest are owned and maintained privately.

One option is to externalize the open data sharing solutions to a company like Turku City Data. For example, the City of Oulu has a Smart City project, where they are also piloting city data framework with Turku City Data. (Smart City Oulu, 2022) During the pilot, the goal is to collect user experience and benefits from data modelling using knowledge graph, Artificial Intelligence (AI) and Machine Learning (ML). Together with Turku City Data, collected data will be combined with for example address database and traffic streams. Combined data is then visualized according to the users need. If decided, a similar type of pilot could be conducted on one of the pilot cases recommended in this report (paid parking or road construction information).

REQUIREMENTS FOR AN OPERATING MODEL

Based on our benchmarking and interviews; critical, serious, and high severity pain points we have identified requirements for an operating model. Using the categories from the draft operating model workshop these requirements will be categorized under management, capabilities, processes, people, data, and technology.

Management

The management of the operating model should focus on three core principles: enabling, facilitating, and enforcing data sharing. As the municipality Espoo has the power to create guidelines that can drive innovation. One of the critical points was the lack of guidelines and standardization of APIs. Deciding on a standard format of how data and APIs should be formatted can streamline the data sharing process. However, such regulations would have to come from a national level before actions can be taken. Another possible notion to explore is creating a regulation that enforces businesses to be connected to a certain number of different preexisting data sharing platforms to operate in the City of Espoo. This is what Antwerp has done successfully. Antwerp uses their power as an owner of infrastructure to make sure that everybody within the industry also follows the same open API rulings.

If a company wants to do mobility over there, then there are guidelines you must follow. In the case of scooters or bikes (MaaS) the companies must show the city that they are integrated to at least two different aggregators of data. However, with such recommendations it will be key to further explore what APIs and data formats are already being used within the ecosystem of mobility. An important subject to mention is that there is no such body in the City of Espoo that would be able to open data sets or develop APIs internally. However, Sampo Hietanen, CEO MaaS Global cautions the notions on regulations warning to not strong-arm companies into restrictive guidelines:

“No one will ever make a service that will only work in Espoo. The best way of doing policies for a city like Espoo is to go with the flow and be the easiest plug-in there is.”

- Sampo Hietanen

Picture: Icons8 LLC

Capabilities

New regulations are coming into EU data sharing such as the Data Act (DA) and Data Governance Act (DGA). Training and familiarization and understanding of future and current legislation amongst employees will be critical. As identified through the success of establishing regulations. To prepare for the changing environment, the organization should create a capability roadmap. With this tool, knowledge gaps could be identified and needed capabilities could either be developed internally or procured externally.

Processes

Through our interviews we discovered that Janne Lautanala, Chief Ecosystem and Technology Officer at Fintraffic, Sampo Hietanen, CEO MaaS Global and Jan-Erik Antipin, Head of Data and Analysis at HSL shared similar outlooks on APIs and platforms:

"If everybody were to publish data in different data formats, in different APIs, through ***their own portals*** *- for the actual developer it becomes totally horrendous to get connected to 300 APIs."*

- Janne Lautanala

"We still live in a world of server rooms and everybody wanting to be the platform themselves. The ideal world is that you just have ***easy plug in APIs****."*

- Sampo Hietanen

"Currently I believe we have multiple platforms that ***do not discuss*** *together and hence there might be some technical difficulties and major efforts should be [made]."*

- Jan-Erik Antipin

For a definition, a portal or platform is a point of access where you can access information from various APIs. APIs are the backbone of the system aggregating data and sending it out. A platform is a point of access while an API provides the key valuable information.

The City of Espoo creating their own data sharing platform is unnecessary as there are preexisting data platforms identified in the Figure 8 system map such as Fintaffic's national data access point. Creating a platform for access to APIs would cost money to make and make the process of accessing the information more congested. Within HSL having multiple platforms proves internally problematic as information is siloed behind different platforms. Developing an easy to plug in API would be the best means of enabling

co-creation of better services within Espoo therefore the operating model should pursue this notion.

An existing process that could provide important information is accurate information on roadworks within Espoo. The as-is system has companies ask permission to do roadworks during a certain time frame. However, information on when roadworks is occurring during that time period are not recorded or input by companies. Developing a simple requirement form for companies to explicitly state when roadwork is happening can better improve transportation routing within Espoo.

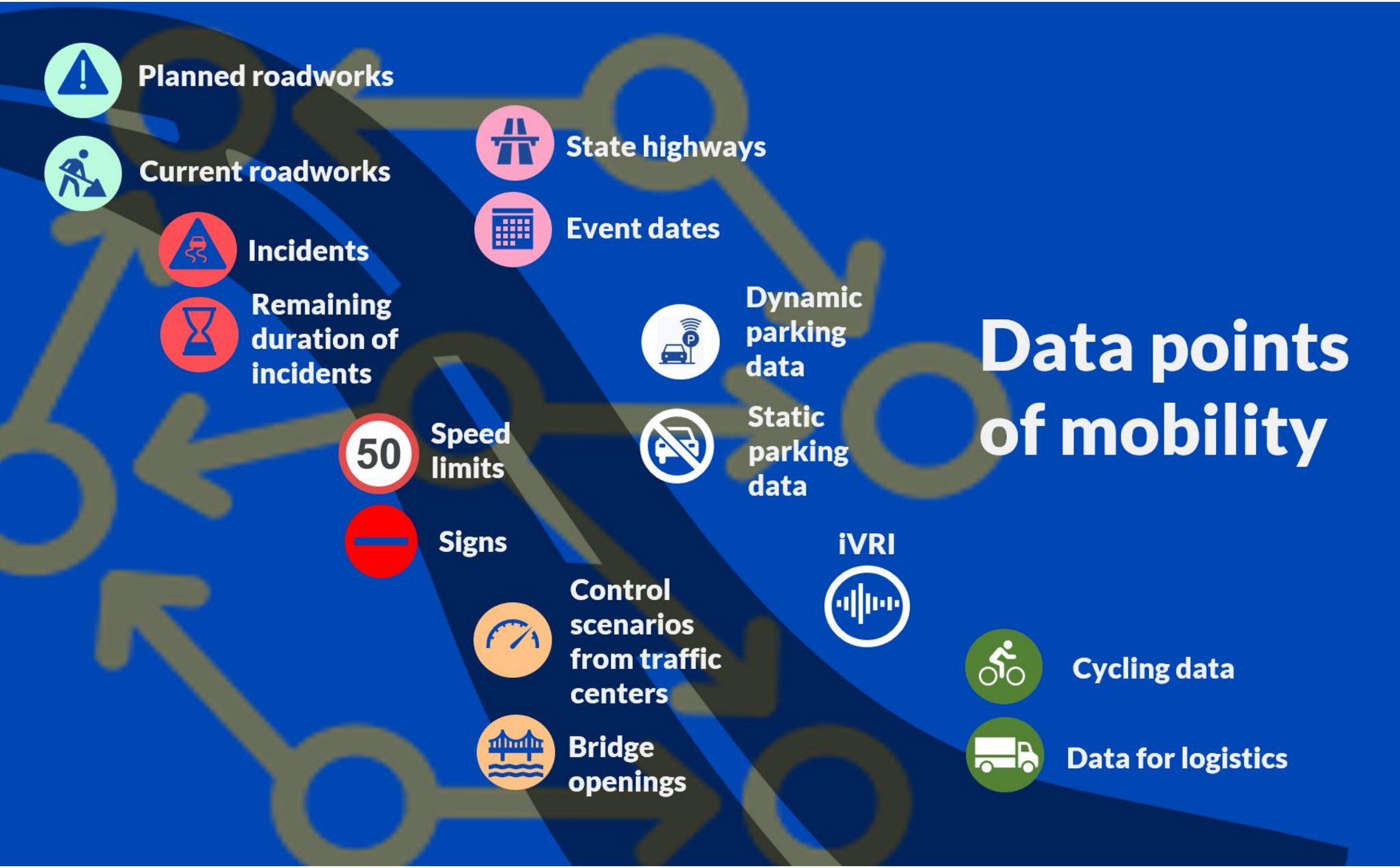
People, Data, & Technology

Collaborating and communicating with businesses to identify what information is being gathered and where to access the data will be critical in the operating model. Data duplication and inefficient use of resource distribution will make development and investments not impactful. Developing a medium for channels of communication between the members of the ecosystem of transportation within the City of Espoo should be developed if already not. In an interview Suvi Kajamaa, Project Manager, MaaS and Public Transport, City of Espoo illustrates this point best:

*"So, I think the sharing and **knowing what is already done**, what is already gathered and where I can get access and how can I know what kind of data there already is [is challenging]."* - Suvi Kajamaa

For the data points, we recommend following the data points described in the Netherlands example as these are valuable data points to collect and provide to mobility service providers. As presented in Figure 10, the data points are: planned & current roadworks, incidents and their remaining duration, highways, event dates, static & dynamic parking data, signs, speed limits, control scenarios from traffic centers, bridge openings, interactive voice response and data for cycling & logistics.

Figure 10. Data points of mobility, bench marked from the Netherlands example introduced earlier.



DELIVERING

ESPOO & LEGISLATION

Some of the gaps present in the City of Espoo with respect to existing EU mobility legislation will be presented below. These gaps will be classified in different legislative documents currently in force in the region.

ITS Directive

- Section 6 of this document mentions the persistent deficiencies that have led to a fragmented and uncoordinated deployment of road transport systems and services. Currently, Espoo lacks communication channels with other cities such as Turku or Tampere to improve road transport services in Finland.

- According to this legislation, national access points are very important to organize the access and re-use of transport-related data to facilitate the provision of interoperable EU-wide traffic and travel ITS services to end-users. The legislation recommends building on them, especially regarding data accessibility. However, currently the City of Espoo does not share some data referred to in Annex 3 with the national access point in Finland (Fintraffic).

- With respect to Annexes III and IV, the mandatory provision of these essential ITS services and critical data is recommended in order to ensure both the continued availability of such data and the continued provision of the mobility services across the Union. However, according to the interview with Fintraffic's CTO, certain data is not shared with the national access point. Moreover, there is a lack of awareness within the company of the data to be shared in accordance with this directive.

- Finally, the list of services in Annex IV and data in Annex III are regularly updated. Therefore, the City of Espoo must be alert to these changes in order to modify its services and shared data so that those are in accordance with the current legislation.

Data Governance Act

- This act encourages public sector bodies to adopt measures to encourage the reuse of data for non-commercial purposes (altruistic data sharing) in order to improve public services. However, there are still some barriers in the City of Espoo to openly sharing its mobility data (e.g., parking data) to stakeholders.

- The directive recommends public sector bodies to designate one or more third party bodies with the legal and technical expertise to assist in different tasks such as access for data reuse, provision of a secure data processing environment (technical infrastructure) and technical support in anonymization.

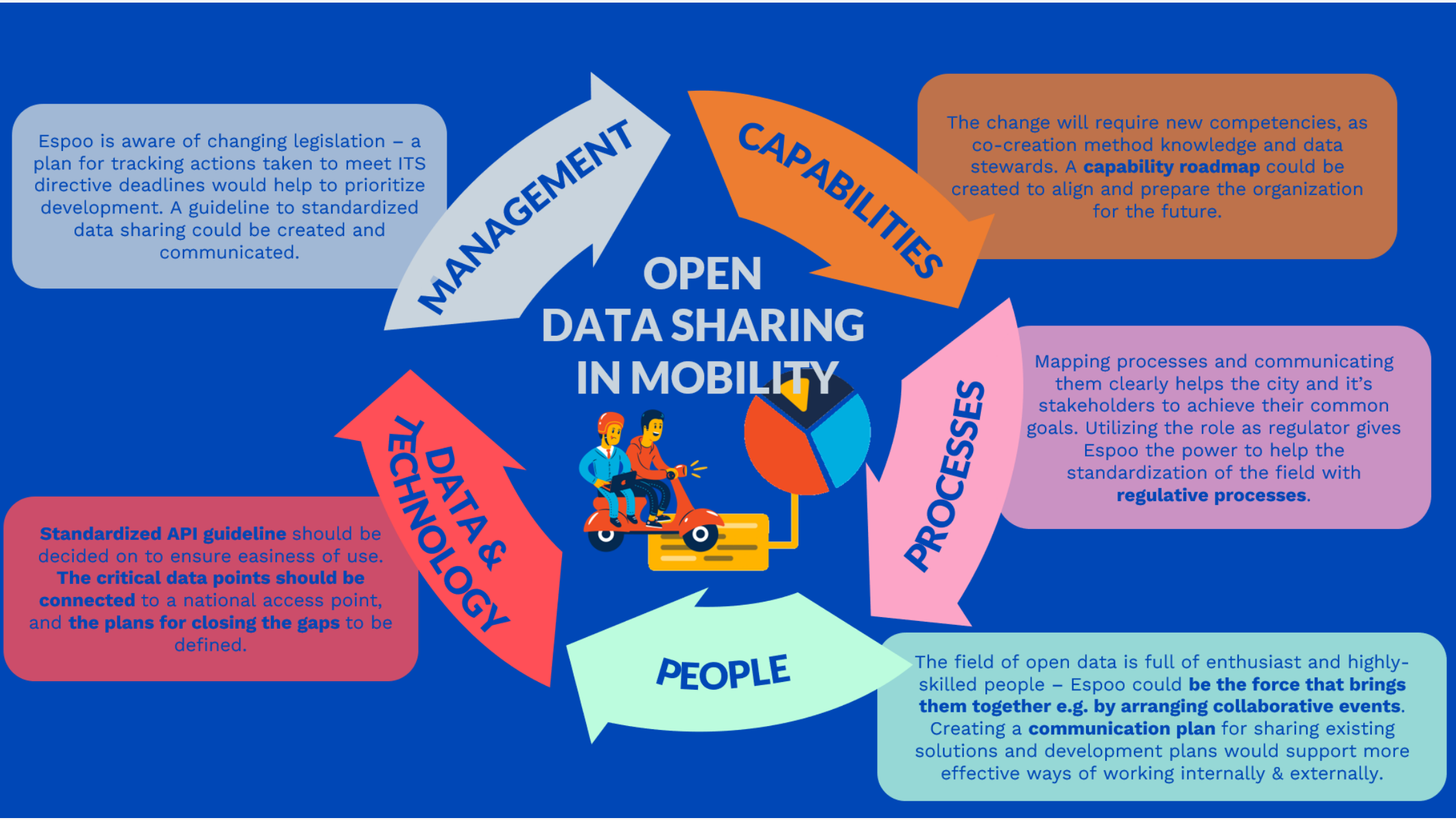
THE OPERATING MODEL FOR MOBILITY

The City of Espoo has some skills, and know-how, to be leaders in the mobility space. However, it requires staff and modern IT and IS infrastructure to create functional APIs to create the optimal way of operating. Additionally, Espoo is lacking the knowledge on what the most optimal way of operation is.

After several interviews with key stakeholders, ranging from Espoo employees to the CEO of MaaS Global, contrary to initial belief, Espoo should not focus on building its own platform. Instead, Espoo would be best suited to create APIs to share with interested stakeholders and to use their power as a municipality within the HSL system to influence HSL guidelines. In addition, as a municipality Espoo can be an enabler and a facilitator.

The visualization of basic guidelines of the operating model are presented in Figure 11. It concludes the requirements concluded in previous chapter: capabilities, processes, people, data & technology and management and their key takeaways. The supporting material for presenting the operation model guidelines are shared with the customer in an individual PowerPoint presentation.

Figure 11. The guidelines for an operating model for open data sharing in mobility.



Pilot case recommendations

In the following chapter, two cases for piloting are described: updating road work reporting & sharing paid parking data. Both are collected from the stakeholders during interviews.

Updating road work reporting

Espoo could digitally map planned road works and disruptions in a timely manner and keep them up to date. Most city and municipality owned roads in Finland do not have full situational awareness. This means that the information on road conditions, volume of traffic, current and upcoming road works are not updated. This information can however be useful in many ways; For example, it can help coordination of road works and regional agreements with emergency services and public transport and help reduce unnecessary nuisance for road users.

Currently it is very difficult for cities to manage this data. Companies that are approved for road work do not have to provide specific dates for when they will work. They only have to provide time frames, for example between May and August. It might be that they only start working the last week in August and thus the city authorities have no clue when the road is actually open and what the impact of it. When benchmarking against Netherlands' *Data Top 15* found from Datapedia, the following data types are found, which could also be made available by Espoo.

- What exactly is being done.
- Where the work takes place.
- What the impact is: for example, traffic delays and restrictions.
- In what period will the work take place
- Who will be impacted by the work

This communication of disruption will help keep navigation apps and service providers digitalization up to date. This also helps in preparing for self-driving transport, which needs to be aware of the current situation on the road.

Sharing paid Parking data

Currently Espoo does not share paid parking data with HSL. However, this data could be deemed useful to HSL as they can plan current traffic flow better. For citizens, searching for parking in busy areas can be time consuming and irritating. Not only that it also has environmental impacts but also unnecessarily impacts road capacity.

Netherlands' *Data Top 15 suggested* some information that cities like Espoo can gather regarding parking spaces. They are mentioned below:

- Location data (GPS coordinates entrances and exits and entrances and exits)
- Rates and Times (If applicable: rates and times when rates apply)
- Opening hours (If applicable: opening hours and last exit time)
- Capacity (Number of parking spaces)
- Restrictions (If applicable: headroom in meters)
- Contact details

Regarding both parking places and state of road networks, there are regulations that require that member states such as Espoo to ensure the availability of data and their accessibility on NAPs. More information on specific data types can be found in the EU Intelligent Transportation Systems (ITS) Directive section of this report. EU member states are expected to have these by the end of 2025, and the Netherlands has been actively taking part in this

Regulative Management Processes

As a municipal body the City of Espoo can serve as the enabler of co-creation of better services through data sharing within Espoo. At a municipal level deeming how service providers should standardize their data is out of scope and needs to be figured out on the national level first. However, the City of Espoo can create standardized guidelines within the organization itself. Doing so the city will be able to more efficiently communicate dynamic and static data to stakeholders within the ecosystem of mobility. Espoo can also adopt a NGSI framework for receiving data. An NGSI framework means that any data delivered to Espoo can be sent in any format if it is an OSLO defined standard (Open Standards for Local Administrations in Flanders) or a commonly used format such as MDS (cf. Infra) or GBFS (General Bikeshare Feed Specification). This framework has been adopted by the City of Antwerp in Belgium for their open data strategy (EIB, 2021).

As the City of Espoo issues operating licenses for businesses, it can use its regulatory authority to enable data sharing. The City of Antwerp has successfully gone using their regulatory authority to enable data sharing. Antwerp chose not to unilaterally impose data sharing frameworks. They used bilateral consultation to create two agreements, the first being about which data must be

supplied and for which applications and for what reason the city can use such data. Secondly the minimum availability, support, and duration of access to the data. In exchange the City of Antwerp shares data with service providers so they can estimate compatibility and profitability of operating in Antwerp.

In the case of Mobility-as-a-Service platforms (MaaS), which do not own physical vehicles, they do not need a license to operate in Antwerp. How Antwerp navigates this problem is by obligating mobility operators (deploying physical vehicles or devices) to integrate with at least two MaaS platforms in the city. What this could look like in the context of Espoo could be having MaaS's connect to WHIM and a scooter provider.

Communicating with stakeholders to develop data sharing agreements is what the City of Espoo should look forward to enable co-creation of more efficient services in Espoo. If agreements were not to be made bilaterally and regulations were strict and rigid, then service providers would simply not operate in Espoo.

API as the technological future tool for data sharing in the City of Espoo

As mentioned above, the ITS directive recommends public entities to share their mobility data at a single point of access. Consequently, efforts to build applications or dashboards to share data have less impact than using a single point of access. This is due to the reduced number of users who will use the application compared to those who use the access point. Additionally, building applications/platforms in a specific city or location limits collaboration between different cities, which causes a fragmented mobility data infrastructure in Finland.

According to the interviews we had with private sector companies, there was constant mention of the benefit it would bring to private mobility services to have Espoo data shared directly through APIs. It is difficult and time-consuming for private companies to access city-created portals for mobility data and many companies see these portals as more of an obstacle to accessing the data. Therefore, we recommend the City of Espoo to share its data through standardized APIs with interested private sector platforms. This would benefit the mobility services in the city (which in many cases are offered by private companies) as the companies would provide a better service to citizens using the data that the city has in its possession.

Investing in APIs also brings other benefits to the City of Espoo by not having to invest in technology infrastructure to support a platform. The costs required for a platform are high in terms of design, infrastructure, maintenance, and security. Investing in API development is more affordable as it has only one development component, which is vastly cheaper than that required resources for a platform.

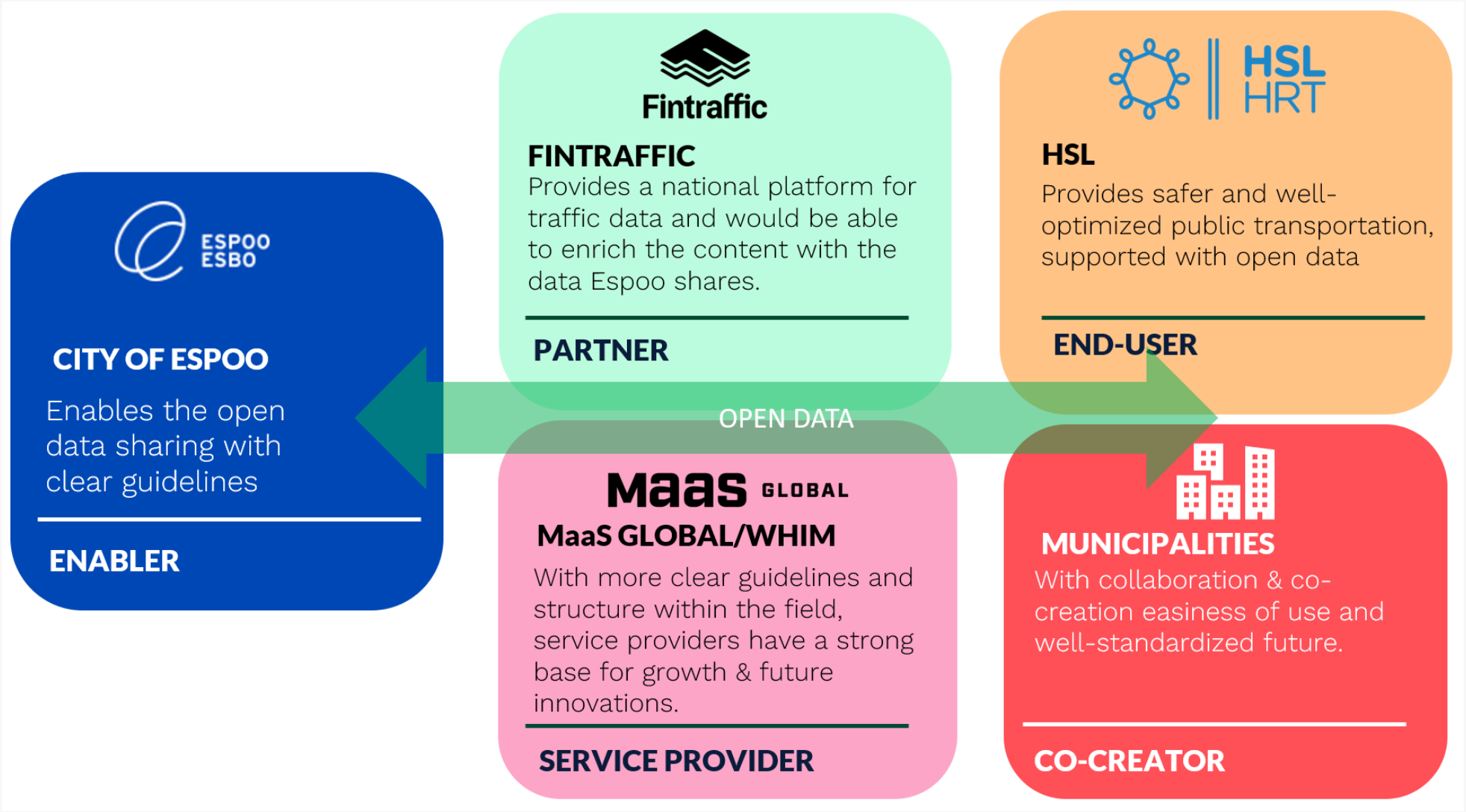
Picture: Icons8 LLC

Stakeholder management

Success lies heavily in management, especially in data, change and stakeholder management. The stakeholders identified during this ITP project are illustrated in Figure 12. Based on the interviews, we identified Fintraffic as a partner, HSL as an end-user, MaaS Global as a service provider and municipalities as co-creators. The City of Espoo has a double role as an enabler and as a municipality, a member of the community of co-creators.

For managing the increasing network, establishing a communication plan is critical. This may be created in collaboration with the stakeholders to engage the community. For Espoo, this means that the roles and responsibilities within the city itself should be clarified first, and a strategy to fill the gaps of future capabilities defined. With a clear organization, also the stakeholder expectations are easier to manage.

Figure 12. Stakeholder map based on the ITP project research & interviews.



CONCLUSIONS

This is the project report for the 3-month summer long project that was created by the students in Aalto's Information Technology Program (ITP) in collaboration with the City of Espoo. We utilized the Human Centered Design (HCD) approach where we conducted the project in three phases: Understanding, Defining, and Delivery. We conducted a workshop with the City of Espoo and interviewed a variety of stakeholders. We synthesized a qualitative pain point list from the interviews and formulated recommendations based on the findings.

Based on the desktop research and interviews with various stakeholders, there are three main areas that Espoo could focus on in their future regarding data sharing in mobility.

1. **Keeping up to date current and upcoming legislation in the field of mobility**

The legislation regarding data sharing in mobility is rapidly changing. The ITS directive recommends that public entities share their mobility data at a single point of access, such as national access points. Espoo should divest from creating its own dashboards and open data for current and upcoming road works, incidents, road works, parking spaces by the end of 2025. Making this information available to interested stakeholders such as HSL can ensure effective services that make the lives of the citizens of Espoo smoother. In addition, this supports the green transition.

Additionally, the data should be anonymized whenever possible. To comply with the ITS directive, the data should also be machine readable and standardized. Thus, a guideline to standardized data sharing could be created and communicated by Espoo.

It has also been highlighted that these guidelines and standardization of APIs should come from a national level. However, at the municipality level Espoo can create guidelines that enforce mobility providers to connect to certain different preexisting data sharing platforms if they want to operate within Espoo. Antwerp, Belgium is a city that has implemented such guidelines.

2. **Collaboration and communication**

The field of open data is full of enthusiasts and highly skilled people. As one of Espoo's core values is being a responsible pioneer, Espoo could be a force that brings

these people together for example by arranging collaborative events. Creating a collaboration plan for stakeholders such as HSL, Fintraffic, MaaS Global and other municipalities by highlighting the sharing of existing solutions and development plans could be beneficial. The interviewees saw Espoo as an important piece to open data and acted as a highly valued partner in the ecosystem. Events such as open data festivals run by Espoo were also welcomed.

3. Managing change and capability roadmap

Being data centric in the mobility space requires new competencies thus it is recommended to create a capability roadmap.

The interviews with the City of Espoo highlighted that there is information overload and finding relevant information is also difficult within the organization. Thus, it might be crucial to train people and co-create solutions on how to keep up with the data available and where to find it. A well put newsletter or dashboard could help people to find the newest information available or to know when to expect them.

Additionally, the pain point analysis of interviews has highlighted that the lack of responsibility and leadership is a common practice within municipalities. The field of open data also needs a regulative entity to establish rules and guidelines for data sharing. For example, regarding API standardization, technical capabilities would need to be studied to define the best possible solution for the required API format. The technical aspects of data management may be done by a specific role such as a data custodian.

The field of open data sharing is on constant movement, and the legislation is expected to be approved, implemented, and revised during the next few years. Also, the commercial side of open data sharing is developing. All in all, there are changing requirements for capabilities internally and externally. For example, the changing legislation might require change management on the operational level. Open data sharing being a collaborative field, expectations of different stakeholders should be listened to and managed.

For future research, roles and responsibilities within Espoo now and in the future could be studied, as well as the option for using an external partner, such as Turku City Data Oy. Also, the recommendations for managing master data and technological solutions were left out from this research and should be studied further when creating an implementation plan.

REFERENCES

Bräutigam et al. (2022). EU regulation builds a fairer data economy (Working paper). Sitra. Available online: https://www.sitra.fi/app/uploads/2022/06/sitra-eu-regulation-builds-a-fairer-data-economy.pdf [cited 31.6.2022]

Cunningham F. et al. (2022). Data economy and EU regulation. Bird & Bird LLP. Available online: https://www.sitra.fi/app/uploads/2022/04/data_economy-and-eu-regulation_francine-cunningham.pdf [cited 31.6.2022]

Datapedia Data Top 15. (n.d.) Available from: https://www.datapedia.nl/datatop15/nodes/datatop15 [cited on 03.08. 2022].

Espoo (2022) The City of Espoo. Homepage. Available online: https://www.espoo.fi/fi/espoon-kaupunki [cited 30.6.2022]

Espoo (2022) Espoo and Turku to launch cooperation to develop municipalities' ability to use information securely. Available online: https://www.espoo.fi/en/news/2022/01/espoo-and-turku-55 launch-cooperation-develop-municipalities-ability-use-information-securely [cited 30.6.2022]

EUR-Lex (2010). Directive 2010/40/EU of the European Parliament and of the Council of 7 July 2010 on the framework for the deployment of Intelligent Transport Systems in the field of road transport and for interfaces with other modes of transport Text with EEA relevance. Available online: https://eur-lex.europa.eu/eli/dir/2010/40/oj [cited 21.8.2022]

EUR-Lex (2014). Commission Delegated Regulation (EU) 2015/962 of 18 December 2014 supplementing Directive 2010/40/EU of the European Parliament and of the Council with regard to the provision of EU-wide real-time traffic information services (Text with EEA relevance). Available online: https://eur-lex.europa.eu/eli/reg_del/2015/962/oj [cited 21.8.2022]

EUR-Lex (2021). Proposal for a DIRECTIVE OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL amending Directive 2010/40/EU on the framework for the deployment of Intelligent Transport Systems in the field of road transport and for the interfaces with other modes of transport. Available online: https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=COM%3A2021%3A813%3AFIN [cited 21.8.2022]

European Investment Bank (2021). EIB Technical Note on Data Sharing in Transport, Pages 41-45. EIB. Available online: https://www.eib.org/en/publications/eib-technical-note-on-data-sharing-in-transport [cited 21.8.2022]

Miranda, Dana, Watts, Rob. (2022) What is a RACI chart? How this project management tool can boost your productivity. A blog post. Forbes Advisor. Available online: https://www.forbes.com/advisor/business/raci-chart/ [cited 28.6.2022]

Fintraffic (2022). Service development in the transport sector gains new momentum at a critical juncture - operators agree on common rules for the game. A news article. Available online: https://www.fintraffic.fi/fi/uutiset/liikennealan-palvelukehitys-saa-uutta-vauhtia-kriittisella-hetkella-toimijat-sopivat-datan [cited 31.6.2022]

Icons8 LLC (2022). An illustration of a bike. Available online: https://icons8.com/illustrations/illustration/clip-riding-a-bicycle [cited 27.6.2022]

Franklin, M. (2006) Performance Gap Analysis: Tips, Tools, and Intelligence for Trainers. 1st edition. Place of publication not identified: American Society for Training & Development.

Howard, D. (2012) IT release management : a hands-on guide. 1st edition. [Online]. Boca Raton, Fla: CRC Press.

Municipality of Copenhagen (2018). City Data Exchange – Lessons learned from a public/private data collaboration. Available online: https://cphsolutionslab.dk/media/site/1837671186-1601734920/city-data-exchange-cde-lessons-learned-from-a-public-private-data-collaboration.pdf [cited 31.6.2022]

Mynott, C. (2012) Lean product development : a manager's guide. London: Institution of Engineering and Technology,

Leavy, P. (2014) The Oxford handbook of qualitative research. New York, New York: Oxford University Press.

Kristovič et al. (2022) Smart Otaniemi Project Report.

Support Centre for Data Sharing- SGDS (2022). What is data sharing? A news article. Available online: https://eudatasharing.eu/what-data-sharing [cited 31.6.2022]

Sitra (2022). Rulebook for a fair data economy. Available online: https://www.sitra.fi/app/uploads/2021/07/rulebook-for-a-fair-data-economy.pdf [cited 31.6.2022]

IDEO (2022). Human centered design. Available online: https://www.usertesting.com/blog/how-ideo-uses-customer-insights-to-design-innovative-products-users-love [cited 30.6.2022]

Baldwin, Carliss, MacCormack, Alan, Rusnak, John. (2014) Hidden structure: Using network methods to map system architecture. Research Policy, Volume 43, Issue 8, 2014, Pages 1381-1397, ISSN 0048-7333, https://doi.org/10.1016/j.respol.2014.05.004

King, Rachel. (2021) Measuring pain point severity to prioritise business actions. Findologic. Mar 1, 2021. Available online: https://www.findologic.com/en/2021/03/01/measuring-pain-point-severity-to-prioritise-business-actions/ [cited 4.8.2022]

Govaert, G (ed.) 2009, Data Analysis, John Wiley & Sons, Incorporated, Hoboken. Available from: ProQuest Ebook Central. [4 August 2022].

Unsplash (2022) Picture from Netherlands. Available from https://unsplash.com/photos/eDvG3IO8-Io [cited 5.8.2022]

Turku City Data (2019). Homepage. Available from: https://turkucitydata.fi/ [cited 28.8.2022]

Smart City Oulu (2022). Piloting city data framework with Turku City Data. An article. Available from: https://smartcityoulu.com/en/solutions/piloting-city-data-framework-with-turku-city-data/ [cited 28.8.2022]

Pixabay (2022) Picture from Turku. Available from https://pixabay.com/photos/transport-night-city-turku-bridge-1931035/ [cited 29.8.2022]

APPENDIX

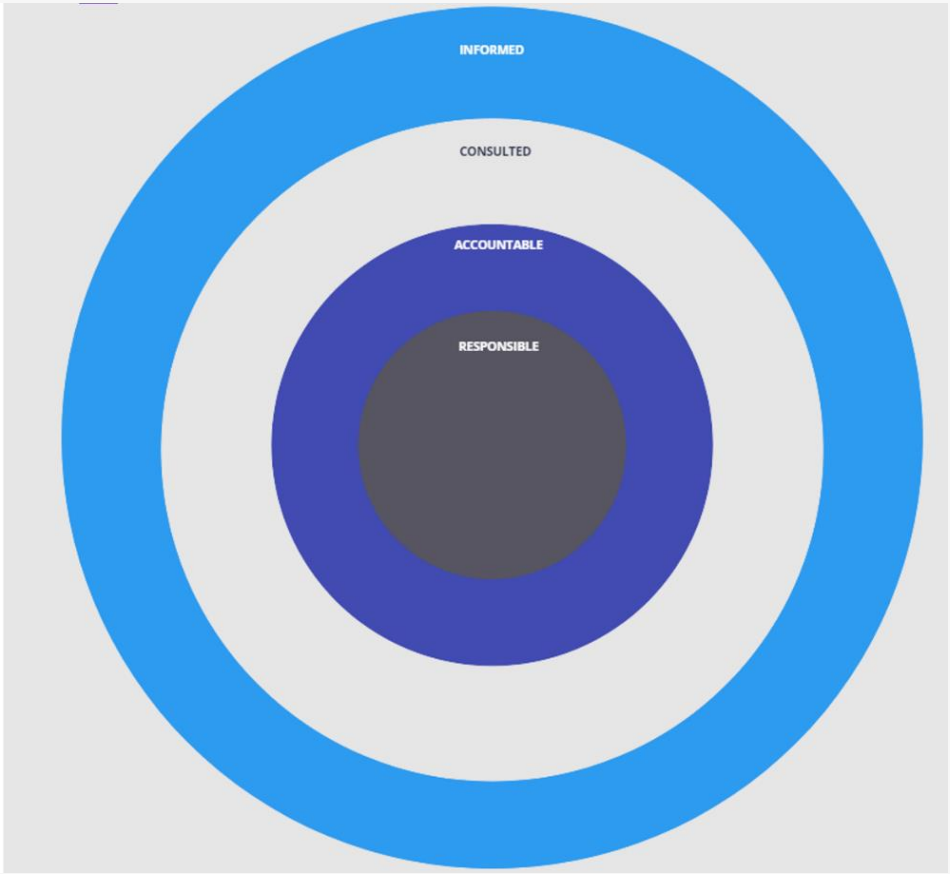
APPENDIX 1: Workshop pre-materials

RACI matrix

DONE DURING THE WORKSHOP:
Identifying the current actors involved in operating model

RESPONSIBLE: Doing the work
ACCOUNTABLE: Answers for the work
CONSULTED: Experts to learn from
INFORMED: Kept in the loop

28.6.2022 Team Espoo | Slide12 of 16



GAP analysis

DONE DURING THE WORKSHOP:
Identifying the current state and the gaps to be closed with an operating model
Questions to think about:

	Current state	Future State	Gap	Actions to close gap
WHAT	What data is needed?	What data is valuable?		
WHY	Why operating model?	Benefits?		
WHO	Who are the stakeholders (identified in RACI-exercise)	Who will participate in the future?		
HOW	What are the capabilities right now? What is lacking?	What are the capabilities needed (technology, governance)? How is an operating model improving current situation?		

Draft of Operating Model

DONE DURING THE WORKSHOP:
Review the draft and next steps

GOVERNANCE: Ensures efficiency and work within regulations
CAPABILITIES: Changes rarely
PROCESS: Changes often
DATA: Includes security & confidentiality
PEOPLE: Organisational structure, culture & partners
TECHNOLOGY: Includes applications & infrastructure?