DRIVE SWEDEN

DigiGoods phase 1

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1 Summary

Goods transport play a very important role in the society. Studies have shown that the current logistics chains are not only inefficient but also have a negative impact on environmental sustainability. Unutilized space in transport vehicles and low profit margins are two of many examples of the issues in the goods transport. Transport of goods from one place to another involves many actors. Each actor generates different kind of data which in some cases is shared with other actors. However by increasing and improving data sharing between actors can reduce the inefficiencies and contribute towards a sustainable system. The data can be shared within or across different logistics chain. This possibility is explored by the project by studying 3 different logistic chain from manufacturing, postal services and grocery.

The pre-study was carried out from the 3 different perspective as follows:

1. **Business models:** The activities included identification of actors, challenges faced by them appropriate solutions along with their value propositions to deal with the challenges.
2. **System architecture**: Developing architecture and semantics to share data between different actors.
3. Identification of **critical aspects or bottlenecks** which are causing hindrances in achieving the goal of shared data for a sustainable future.

The project has laid the foundation for a pilot project i.e. phase 2 and the results of the study are:

1. A detailed description of process from 3 different logistic chain, pains and gains of different actors. In addition several points with missing data were also identified.
2. A detailed data model from different viewpoints, sequence of operation etc. were also modeled. The model can later be utilized to develop a common digital service for three supply chains.
3. Research questions and the requirements for the system to be developed in phase 2.

2 Swedish Summary

Godstransport är en viktig del av samhället. Studier har visat att nuvarande logistikkedjor är ineffektiva och har ett negativ påverkan på miljö. Låg fyllnadsgrad, låga marginal osv. är exempel av dagens utmaningar. Transport av varor från ett ställe till ett annat krävs samarbete mellan flera aktörer. Varje aktör genererar och bibehåller olika typer av data som kan eller inte kan vara delad med andra aktörer. Ineffektivitet kan minska och hållbarheten kan ökas genom att förbättra befintlig datadelning och delning av ytterligare ny data. Data kan delas inom eller mellan olika leveranskedjor. Detta projekt undersöker denna aspekt genom för tre olika leveranskedjor från post, livsmedel och tillverkningsindustri.

Denna förstudie hade tre olika perspektiv/fokusområde:

1. **Affärsmodeller:** Aktiviteter i detta område ingick identifiering av aktörer, deras utmaningar, möjliga lösningar och deras värde erbjudande.
2. **Systemarkitektur**: Utveckling av arkitektur och semantik för att möjliggöra datadelning mellan olika aktörer.

3. Identifiering av kritiska aspekter som är hinder till att uppnå målet av gemensam data och en hållbar framtid.

Projektet hag lagt grunden till ett pilotprojekt som nästa fas. Resultat från förstudien är:

1. En detaljerad beskrivning av process från 3 olika leveranskedjor och s.k. “pains and gains” av olika aktörer. Dessutom har projektet identifierad flera ställe i leveranskedjor som saknar data.
2. En detaljerad arkitektur modell beskriven med olika vyer, sekvens av operationer osv. Modellen kan användas för att utveckla en gemensam digitalplattform för data delning och system optimering..
3. Forskningsfrågor och kraven för systemet i fas 2 är också ett resultat från förstudien.

3 Background

3.1 Why was the project initiated

Shipping goods even with just transport mode (the project has focused on road transport) requires the commitment of many parties, and each participant in the supply chain either possesses or creates data that can be used to increase the efficiency of the shipping process. Some data exchange is already taking place today, but there is a large untapped potential.

There is critical information related to deliveries that should be divided into different stages in the delivery and logistics chain, including items such as current position, contents of boxes and their deliveries, records and billing, filling speed, vehicle status and more. Sharing this information increases awareness of the situation, quality assurance of services, the predictability of the arrival of goods and simplifies the handling of shipping documents.

Addressing these issues represents a great potential for all companies to improve efficiency and accuracy and thereby increase profitability as well as contribute to meeting companies' sustainability and responsibility goals by reducing negative impacts on the environment.

We see an opportunity to migrate from an environment with information silos with old technologies to an extensive and interactive ecosystem. One example is the emerging "Internet of Logistics" (IoL) with definitions and standards from the Digital Cargo Forum (DCF) which is one starting point for overcoming the limitations of traditional communication systems for the supply chain, such as EDI, and the complexity related to the implementation of IT systems.

3.2 Challenges and needs

Every actor in the supply chain generate and have handle data which can be utilized to increase the overall efficiency and sustainability of the supply chain. Currently there is a lot of unutilized potential. Sharing of critical data such as position, contents of a package etc. can lead to situation awareness, forecasting of goods, ease of documentation etc. The challenge of letting the right actor have access to the right information lies both in the difficulty in legacy systems, digitalizing data, integrating information systems, finding win-win business models and in building trust between actors. In addition the sector has oftentimes small margin that does not allow for large investments.

3.3 Contribution to Drive Sweden's mission

Drive Sweden has the stated mission "to drive the development towards sustainable mobility solutions by creating and demonstrating efficient, connected and automated transport systems". This is broken down in a number of for the long term and the short term. The project helps advancing mainly towards the goals in the area of Business Models and Digital Infrastructure. In the short term (2021) the goals that have been addressed are:

Business models

- Barriers related to business models within the scope of Drive Sweden (including e.g. data sharing, AV control towers, Innovation Cloud, operation of automated vehicles, Mobility as a Service) identified.
- Multi-stakeholder demonstration of cooperative, connected and automated mobility solutions for goods and people, including description of business models.

In addition the project gave insights into Digital infrastructure and the goal:

- Defined requirements on the digital infrastructure to support a first set of commercial services in a digitalized, cooperative, shared and automated mobility system

4 Project set up

4.1 Purpose

The idea of the project is that if the right person / actor in a road transport goods chain has the right information at the right time, better decisions can be made, and more profitable and sustainable transport is achieved. For example, if you as a consumer or decision-maker know how much CO2 a transport really causes, you can actively choose a more sustainable transport.

By using data from goods, pallets, trailers, vehicles and drivers, the transport system can be made more efficient. Areas include, for example:

- Improved handling of goods (eg extended shelf life if the transport cold chain can be guaranteed)
- Improved coordination of transports from different goods owners, which provides an increased fill-rate in the trucks
- Improved planning and synchronization of transports (eg packages) at arrival to a terminal

4.2 Objectives

The project objectives were with one exception kept unchanged and fulfilled during the project.

The objective of the project was to take a step towards realizing "informed decisions" by tackling the challenges from two sides:

The first question was who needs what information when? Where possible actors can be the end consumer (both e-commerce and in store), decision-makers at different levels at the product owner / transport buyer, decision-makers at different levels at the carrier.

The second question was how to guarantee the right data to the right person, especially when data comes from different actors and in different formats with sub-questions such as:

- What does the architecture and semantics look like?
- What are the requirements for connection?
- How is data shared securely?

The project also had the objective to study how business models can be created so that all necessary actors in the chain have sufficient incentives to continue their activities without financial support in the form of project money. To realize this, it is important to 1) create sufficient added value through efficiencies and improvements in the process 2) ensure that this value is distributed in an appropriate manner between the parties in the value chain. The sub-problem of creating sufficient incentives and trust to share data was also an objective with to be given special consideration.

The project studied different user cases, for example those related to the project members' activities such as food delivery (Lidl), parcel deliveries (Postnord) and material supply for industrial production (Scania).

Initially the project also had the objective to investigate the possibility of including the sustainability of transport in the business model, for example through CSR policies and collaborations such as Fair Transport (https://www.akeri.se/sv/fair-transport). The emphasis on CSR was removed during the project and focus was instead on the market demand for better sustainability KPIs.

The project was the first phase and build the basis for a pilot project to increase the efficiency in the transport system and to create information for actors based on data from goods, vehicles and other sources to be able to improve the answers on when the goods will arrive at its destination and if the goods was affected by the transport (for example for groceries).

4.3 Project period

The project officially started in October 2019. The official end date i.e. May 2020 was extended to December 2020 due to the global pandemic of Covid-19 and the related delays and furlough of personnel by in the participating partner organizations.

4.4 Partners

The project was led by KTH (research) and also involved several players who represent different parts of the logistics chain: Lidl (product owner), Postnord (carrier), Scania (vehicle and service provider) and Ericsson (provider of infrastructure for communication).

4.4.1 Kungliga Tekniska högskolan (KTH)

KTH is consistently ranked as one of Europe's leading technical universities and is a world leader in many areas of automation and transport. KTH is represented in the project through ITRL - Integrated Transport Research Lab. ITRL is an interdisciplinary research center with a focus on sustainable transport solutions at system level and with a strong focus on demonstration-based research.

4.4.2 Lidl

Lidl operates more than 1,000 grocery stores (170 in Sweden). Lidl transports food from suppliers to central warehouses and then out to the stores. Sustainability and efficient

logistics are the highest priority for Lidl. Lidl conducts, for example, high-profile trials with the operation of fully automated trucks in Jönköping.

4.4.3 Ericsson

Ericsson is a leader in the delivery of 4G and 5G technologies for the automotive and transportation sectors. In addition to research within ITRL, Ericsson is active in standardizing and regulating the future communications that serve connected vehicles, including the 3G Partnership Project (3GPP), the Automotive Edge Computing Consortium (AECC) and the 5G Automotive Association (5GAA). Ericsson is also a member of the Digital Cargo Forum (DCF) which develops ontologies and specifications for the Internet of Logistics.

4.4.4 Postnord

PostNord is the leading provider of communication and logistics solutions to, from and within the Nordic region. We also ensure the postal service to private individuals and companies in Sweden and Denmark.

4.4.5 Scania

Scania is a world-leading manufacturer of trucks and buses and provides transport solutions. Scania is driving the shift to a sustainable transport system. Scania is a global company with sales in more than 100 countries and R&D centralized in Södertälje, Sweden. Scania is determined to lead the transition to a sustainable transport system. Scania focuses a lot of research resources on automation, connectivity, C-ITS, control systems and electrification and has conducted many field tests and demonstrations.

5 Method and activities

Apart from general analysis and structuring three main types of methods have been utilized:

1. Study visits
2. Workshops
3. Literature studies

5.1 Study visits

Each of the three logistics chains, that is food delivery (Lidl), parcel deliveries (Postnord) and material supply for industrial production (Scania), were studied through on site visits at the actor in question. This allowed for a deeper understanding of the realities and boundary conditions for each operation. The study visit at PostNord gave the opportunity to look at the sorting process of the packages. All three study visits (PostNord, Scania and Lidl) gave the opportunity to talk to company experts in their own environment to collect data about the different steps in the logistics chain, as well as current problems and areas for improvement.

5.2 Workshops

A workshop format was used to structure the data collected in the study visits as well as complement it to fill out any gaps in the description. The workshops were mainly focused on three activities:

i. Analyzing the actors to define an actor model that presents a simplified method to represent how different stakeholders interact with a system
ii. Define information, material and data flow

iii. Identify value proposition using Osterwalder's value proposition canvas. The value proposition are vital inputs required for defining business models.

5.3 Literature studies

In addition to above a literature study was also carried out to understand three different standards namely iShare, Internet of Logistics and ONE RECORD.

6 Results and Deliverables

6.1 Findings

The main findings are as follows:

1. There are several parts of supply chain with missing data. In cases with heavy equipment the generation of the missing data requires sensors with high level of robustness to sustain different kind of physical shocks. In cases with high volume new innovations are required to enable fast and low cost sensing.
2. IT system integration is one of the main challenges in sharing data between different kind of supply chain.
3. All actors do have willingness and motivation to move towards the common sustainability goals. However, more efforts are required to address the challenges.

6.2 Results

The following results have been produced:

1. A detailed description of process from 3 different logistic chain, pains and gains of different actors. In addition several points with missing data were also identified.
2. A detailed data model from different viewpoints, sequence of operation etc. were also modeled. The model can later be utilized to develop a common digital service for three supply chains.

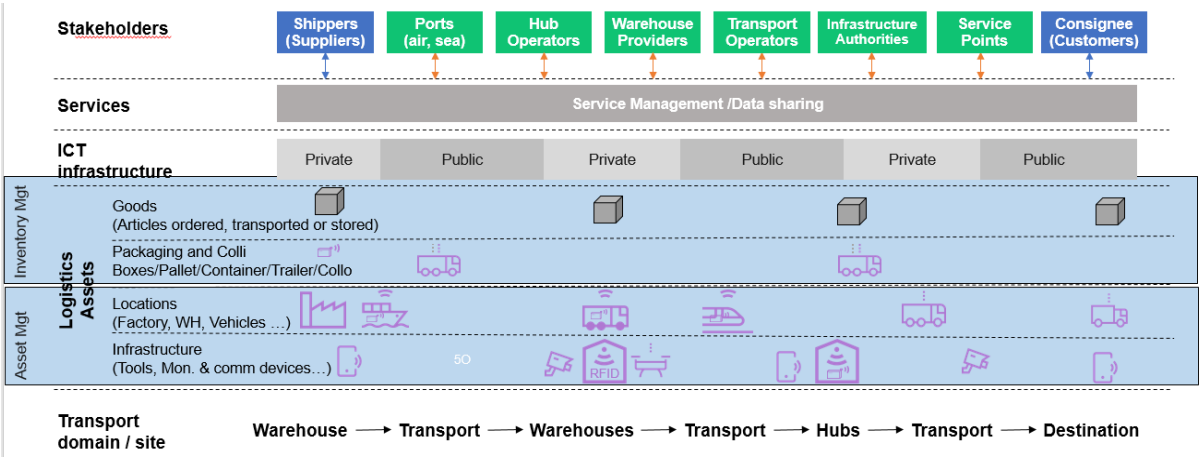

Fig 1: Generic model for systems of systems in supply chain

(Picture source and credit: Ericsson AB)

3. Fig. 1 shows a generic model of supply chain. From the study it was found that the depending on the type of supply information was missing at different locations. For example, while the postal service require better sensing at the shipper side, the

information from the warehouse is a challenge for the grocery industry. Linking of different kind of data was found to be one of most pressing challenges for all the chains. (see also section 7).

4. At a higher level all supply chain have similar dynamics and exchange of data can not only expedite the processes but also bring improvements at a regional level.
5. The project has identified 3 areas as next steps as discussed in Section 6.

6.3 Connection to Drive Swedens vision and goals

The main focus areas addressed by the DigiGoods project was “Business models” and primarily two of the goals. The first one is:

“Barriers related to business models within the scope of Drive Sweden (including e.g. data sharing, AV control towers, Innovation Cloud, operation of automated vehicles, Mobility as a Service) identified.”

The study highlights poor traceability of goods as one of the common pain points in the logistics chain. At the same time thresholds in the form of limited profit margins leading to small possibilities to invest in combination with the need for integration with a heterogenous population of other IT-systems.

The second goal is:

“Multi-stakeholder demonstration of cooperative, connected and automated mobility solutions for goods and people, including description of business models.”

Here the main contribution of “DigiGoods phase 1” is to study real logistics chains and document the structure and the pain points, as well as making a value proposition canvas for each logistics chain.

In addition the project has given insight into the area of “Digital Infrastructure” and the goal *“Defined requirements on the digital infrastructure to support a first set of commercial services in a digitalised, cooperative, shared and automated mobility system”* by highlighting the thresholds in harvesting and sharing data.

7 Conclusions, Lessons Learnt and Next Steps

The visibility of supply chain is a very complex problem requiring more actors onboard. This includes but not limited to logistics providers, academic, IT system suppliers etc. We have identified several areas for continuation.

One area is to make a proof of concept solution to radically lower the thresholds in the form of cost and complexity for introducing a digital freight transport chain by the vehicle manufacturer (OEM) by integrating a basic functionality in the vehicle that can report back from a goods sensor in the trailer. This would enable the haulier to digitally and online make the goods' position available over time to the consignor. Because the position of the goods is reported or can be searched for in real time, better decisions can be made. This can lead to more efficient transports, a higher degree of filling and the possibility of following up key figures to identify potential for improvement (for example the key figures proposed in the Vinnova project MMID project) both in transport flow, administration and environmental effects.

A second area is to find suitable ways of sharing the information with a special focus on who “owns” the information and which stakeholder is considered a reliable partner where both

traditional centralized, federated and distributed (blockchain-based) solution hypotheses can be explored.

A third area is to continue to build of the learnings of the value proposition canvases that were created in the project and to study how business models can be created so that all necessary players in the chain have incentives for their activities. To achieve this, it is important to 1) create sufficient added value through efficiencies and improvements in the process 2) ensure that this value is distributed in an appropriate manner between the parties in the value chain (especially the second point).

8 Dissemination and Publications

Due to secrecy issues, no results will be published. However, the general finding described earlier will be presented on different forums whenever possible.

Drive Sweden is one of the Swedish government's seventeen Strategic Innovation Programs (SIPs)- Drive Sweden consists of partners from academia, industry and society and together we address the challenges connected to the next generation mobility system for people and goods. The SIPs are funded by the Swedish Innovation Agency Vinnova, the Swedish Research Council Formas and the Swedish Energy Agency. Drive Sweden is hosted by Lindholmen Science Park AB.

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