Data-driven service innovation strategy for Scania

Data fuelling Scania's future business

Master thesis
Strategic product design
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Acknowledgements

Dear reader,

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Enjoy reading!

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Executive Summary

Scania is one of the world-leading manufacturers of trucks and buses for heavy transport, combined with an extensive product-related service offering. This thesis proposes a data-driven service innovation strategy to leverage the potential of data and data intelligence for Scania's future business in the truck segment.

The freight transport industry is significantly disrupted by trends such as digitalization, automation, connectivity and electrification. These trends will restructure the value network of the freight transport industry by creating new ways of doing business. Enabled by connectivity and data intelligence, vehicle data can be aggregated and processed to provide data insights that benefit the logistics chain. It unlocks new opportunities for Scania to deliver new digital services driven by data, extending beyond their traditional business model. Therefore, **to fully exploit the possibilities of the value pools created by data, the thesis aims to create an innovation strategy to define Scania's new market positions and customers and create a coordinated roadmap for Scania's future data-driven services.**

This strategy has been developed by analyzing the internal environment, the value network of the freight transport industry, the logistics chain, market trends and technologies. Insights from research have been synthesized to envision the future scenarios of the value network and define Scania's strategic direction. In the short term, Scania delivers digital logistics services to shippers and carriers, enabling them to achieve efficient and sustainable transport operations collaboratively by data sharing. In the long term, Scania aims to offer Logistics as a service with autonomous vehicles directly to shippers by partnering with a digital logistics broker. A future vision has been created for Scania's service development by 2030: **"Scania as a sustainable transport ecosystem enabler, providing customers collaborative and optimized logistics solutions powered by open innovation to drive their business forward."**

To reach the future vision, four main service systems were designed incrementally and related to other technologies:
1. Connecting & Sharing: Enable visible and controllable transport operation for both carriers and shippers through seamless data orchestration and sharing.
2. Optimizing transport operations: Delivering sustainable and efficient logistics and transport management services to customers via data-driven decision making and integration of digital logistics brokerage platforms.
3. EV transition Acceleration: Accelerating the transition to electrified vehicles by providing customers effortless transport experience with smart routing and power charging services.
4. Logistics as a Service with autonomous vehicles: Transforming towards the transport ecosystem enabler by providing Logistics as a Service with autonomous vehicles.

The strategy is presented in the format of a roadmap with all the elements such as trends, user values, service systems, technologies and business. By following this path and delivering these data-driven services to the market, Scania can create multi-dimensional business models and shift from a truck OEM (original equipment manufacturer) to a service provider with production.

Reading Guide

Abbreviations

OEM	Original equipment manufacturer
LSP	Logistics service provider
3PL	3rd party logistics provider
API	Application program interface
ICE	Intelligent control environment
TMS	Transport management system
FMS	Fleet management system
WMS	Warehouse management system
ERP	Enterprise resource planning
EV	Electric vehicle
IoT	Internet of Things
TCO	Total cost of ownership
FTL	Full truckload
LTL	Less than full truckload
DC	Distribution hubs
RFID	Radio-frequency identification
BOL	Bill of lading
ICT	Information and communications technology
EDI	Electronic data interchange
E-CMR	Electronic consignment note
ETA	Estimated time of arrival
INCOTERMS	International Commercial Terms

Text box

Discussion or chapter conclusion

Text in this red box represents a discussion or summary with the main conclusions from that chapter.

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Project Introduction

This chapter gives an introduction to the thesis context, defined problems with research questions, project assignment and design approach.

Chapter overview

01

1.1 PROJECT CONTEXT

Road freight transport is the backbone of Europe's economy, growth, and competitiveness. The freight transport industry in Europe is facing several fundamental challenges today. The industry needs to adapt to major changes in customers' behavior, global megatrends, technological changes, and new mobility concepts.

The worldwide freight volume is expected to grow by 4%, mainly driven by economic growth and global trade (Mckinsey, 2016). Customers have more buying power than ever before, and they increasingly want products and services on their own terms: delivered at the location and time they request (Deloitte, 2016). Companies expect their supply chain to be smart, customer-centric, transparent and efficient to reduce the operational costs and provide better purchasing experiences to their customers. Besides, governments, industries, and companies are under pressure to reduce carbon emissions and waste and to adopt more sustainable and green transport solutions.

To fulfill the increasing demand for freight transport capacity and respond to these trends, main actors in the freight transport industry like vehicle manufacturers (e.g., Scania, Volvo) and logistics providers are dedicated to developing new technologies such as automation, electrification, connectivity, and digitalization. These new technologies will restructure the value network of the freight transport industry by creating new ways of doing business in the future (Roland Berger, 2012). The interaction of these developments will open up space in the industry for new actors and new business models, but also create new opportunities for established actors to innovate their business.

The technology of the Internet of Things (IoT) enables vehicles to generate enormous real-time sensor data and create a direct data exchange with nearby devices, vehicles, infrastructures, and cloud through different networks (Coppola & Morisio, 2016). Enabled by big data analytics, a large amount of data can be aggregated and processed to provide data-driven insights and drive smart actions (Coppola & Morisio, 2016). With the integration of digitalization, these vehicle data and data insights are very likely to contribute to the logistics chain significantly. Therefore, it brings new opportunities to develop data-driven services by truck manufacturers who have access to the vehicle data, extending beyond their traditional business models.

This thesis is an assignment for Scania: one of the world-leading manufacturers of trucks and buses for heavy transport, combined with an extensive product-related service offerings. The thesis focuses on the truck segment. Leveraging data from vehicles, Scania has developed data-driven services that help customers to manage their fleets and increase the uptime of vehicles.

To fully exploit the possibilities of the value pools created by data and favorable market environment, Scania has to think how data as a key enabler can lead to future business opportunities with digital services and what the future value proposition will be in this disruptive transport ecosystem.

*"The world's most **valuable resource** is no longer oil, but **data.**"*
— The Economist, 2017

Service development & Connected intelligence

This thesis project was initiated by Connected Service department and Connected Intelligence department in Scania R&D. The Conneted Service team focuses on developing service strategy and delivering new data-driven services to customers. The Conneted Intelligence department aims at building technology infrastructure and connectivity solutions enabled for data analytics and helping other R&D departments and the service development team to make new services and products possible.

One of the primary purposes of this thesis is to bridge service development and data intelligence technology by creating tangible materials. It is because delivering scalable analytics requires inputs from the service development team, and they need to understand how customer demands will change in a more disruptive environment and what data insights based on vehicle data is valuable for customers. Without service and business innovation driven by user values and a clear definition of the relationship between data and user values, it would be difficult for the data scientists to deliver the data knowledge and to have an agreement on the direction of Scania's future data-driven services.

1.2 PROBLEM DEFINITION

Although the market environment and technological breakthroughs seem to open up space for Scania to unlock new business opportunities and data-driven services, it is still not clear for Scania in three aspects:

Firstly, there is no clear view on who will be their future customers in the freight transport industry. The traditional industry borders will likely blur by coorporations and digitalization. Market actors in this industry have the potential to approach potential users in the value network to deliver values via digital services (Riasanow, 2017). Should Scania still focus on their current customer segment or explore the new one in the transport ecosystem? What new data-driven services can Scania create? What is its business model that brings the revenues to Scania as well as values to its customers?

Secondly, Scania's new position in industry change is missing. How can Scania be competitive with their new services by leveraging their own data assets? Digital players have also recognized the potential for digitalization and connectivity technologies and are already active in this market today, offering a variety of digital solutions. Therefore, Scania sees a need for a coordinated roadmap enabling them to explore how data will fuel their future business. The roadmap needs to map out how they build their digital capabilities for new services, acquire external resources, and cooperate with partners in the value network.

Thirdly, how data as a key resource can support Scania's new digital services is also not clear. Valuable data insights and smart

decisions can be offered to customers enabled by data analytics. Therefore, a clear view on what data sources are available and what data analytics can be applied should be discovered in the thesis.

Therefore, the research questions were defined below:

- *Who are Scania's future customers in the freight transport industry?*
- *What favourable position could Scania take in the freight transport industry to create competitive advantage?*
- *What new data-driven services could Scania offer to create values for the customer?*
- *How data as a key resource can support Scania's new services?*

1.3 PROJECT DELIVERABLES

In this thesis, a data-driven service innovation strategy is created for Scania, where Scania delivers values to its future customers and obtains a competitive position in the road transport industry, with data-driven service offerings.

This thesis consists of the following:
1) A compelling and clear statement of future vision that Scania can capture, follow and reach. 2) Incremental data-driven service solutions that Scania offers to its customers to meet their needs in several horizons. 3) A value proposition and business model for new service solutions that Scania can get benefits as well as its customers. 4) Technology implementations with a focus on data collection and data analytics that are mapped out to support the new service solutions in several horizons. 5) Internal and external collaborations that are planned based on current and needed capabilities and resources.

In the end, the innovation strategy is summarized in a visualized strategic and tactical roadmap.

1.4 PROJECT APPROACH

The approach is based on a strategic design process. Strategic design refers to the use of design principles and practices to guide strategy development and implementation towards innovative outcomes that benefit people and organizations alike (Calabretta et al., 2016). A combination of the traditional Double Diamond design process (Design Council, 2015) and the Design Roadmapping process (Simonse, 2018) were used in this thesis. It is a designerly approach with user-centered and future-oriented research, co-creation with problem owners within the company, future visioning, diverging and converging process, and several rounds of iteration.

The project can roughly be divided into four phases: discover, define, develop, and deliver based on the Double Diamond design process (Figure 1).

Phase 1: Discover

In the diverging 'discover' phase, Scania's internal and external environment were researched. The insights of smart, connected product, data intelligence and value creation with data were discovered by literature research. Scania's business, vision, strategy, developments, and current service offerings were analyzed by internal interviews. Context research was conducted to analyze the road transport industry based on the value network analysis approach (Biem and Caswell, 2008), followed by logistics journey analysis and problem areas. After analyzing the current industry environment, expert interviews and desk research was done to discover trends influencing the future of the road transport industry and Scania.

Phase 2: Define

In the converging 'discover' phase, insights gathered were synthesized and analyzed. Two value mapping sessions were conducted with Scania employees to define the user values and future direction. Combining the insights from individual brainstorming, Scania's future direction, future customers, and a clear future vision were defined. The future vision was validated with employees.

Phase 3: Develop

In the diverging 'develop' phase, the user values were defined in more detail and ideas for new service solutions were generated. The chosen ideas were shaped into concepts and the business models were designed per horizon. The ideas were linked to each other and were plotted on four horizons of the roadmap with a timeline that is based on Scania's current developments and technology strategies. Ideas were also linked to the technologies of data intelligence and validated with Scania employees.

Phase 4: Deliver

In the final converging 'deliver' phase, all the service solutions were mapped out in the roadmap and all the elements. Two roadmaps were created: A strategic roadmap for the stakeholders with main user values, new services in visualization and future vision, and a tactical roadmap for internal usage with all the elements. The final roadmaps were validated with Scania employees in different departments.

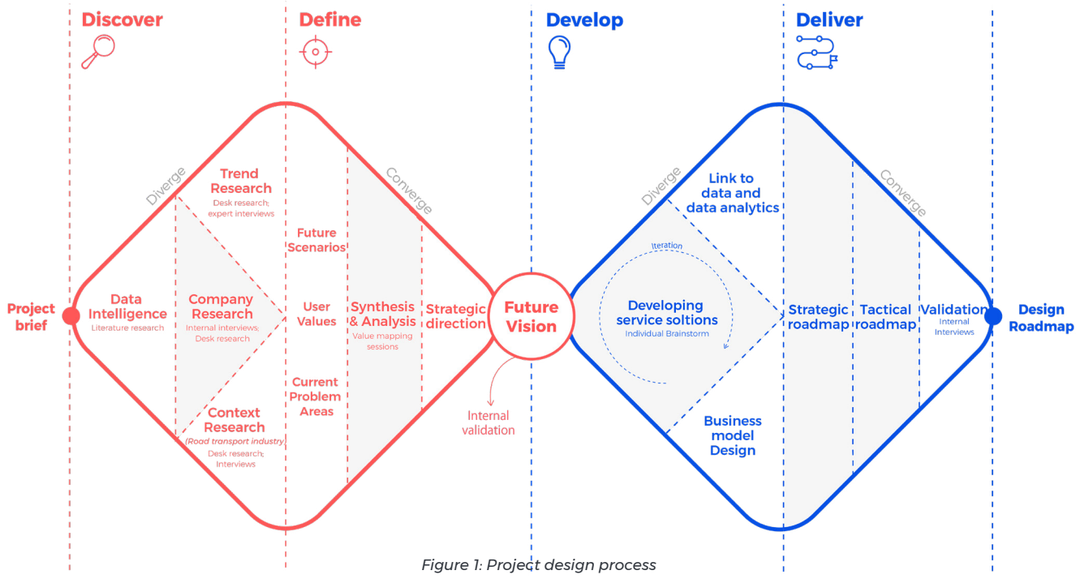


Figure 1: Project design process

Literature Research

This chapter draws a literature study starting from the understanding of smart, connected products and its main capabilities of generating added values by implementing data analytics. The study moves towards more specifically how data and data analytics can create values for business from an ecosystem perspective. This will provide insights on creating Scania' s future vision on its new data-driven service development.

Chapter overview

02

2.1 SMART, CONNECTED PRODUCT

The technology of the Internet of things (IoT) is revolutionizing products to become smart and connected. The physical products equipped with smart and connectivity components enable gather insights about the product use status, performance and environment and communicate with the Internet and other smart objects (Turber et al. 2014). This smart, connected products are transforming traditional industries, especially the manufacture industry, into a new era companies are forced to rethink what values of developing smart, connected products they can create and capture (Porter & Heppelmann, 2015).

To fully grasp how smart, connected products can positively influence the company's future business, its technology and capabilities should be understood. According to Porter and Heppelmann (2014), smart, connected products have three core components: physical components, smart components, and connectivity components.

Physical components consists of the product's mechanical and electrical parts.

Smart components consists of the sensors, microprocessors, data storage, acuators and software that can be an embedded operation system with user interface.

Connectivity components consists of the ports, antennae, and protocols and communication networks that allows information to be exchanged between the product and its user, systems and service cloud.

Based on these essential embedded components and a technology infrastructure that contains a platform for data storage and analytics, more capabilities of smart, connected products can be discovered.

2.2 DATA INTELLIGENCE

While reading sensor data from smart, connected products or aggregating other data sources in the data lake, the technology of data analytics can be applied to generate deep insights and even make intelligent decisions to serve customers' needs. It also brings great opportunities for companies to create new value offerings enabled by data analytics.

2.2.1 DIKW pyramid

DIKW pyramid (Rowley, 2007) is a simple way to explain the capabilities of data analytics in hierarchies. It consists of four building blocks – Data, information, knowledge and wisdom (Figure 4). Each building block up the pyramid builds upon the previous one, adding new values on it.

On the bottom of the pyramid is the layer of data: a collection of raw and unstructured data such as vehicle position data, sensor data that only explain the fact in each point. If the data is without any context, it can mean little.

Information is the next layer of the DIKW Pyramid. Useful information can be derived from data that has been given meaning by

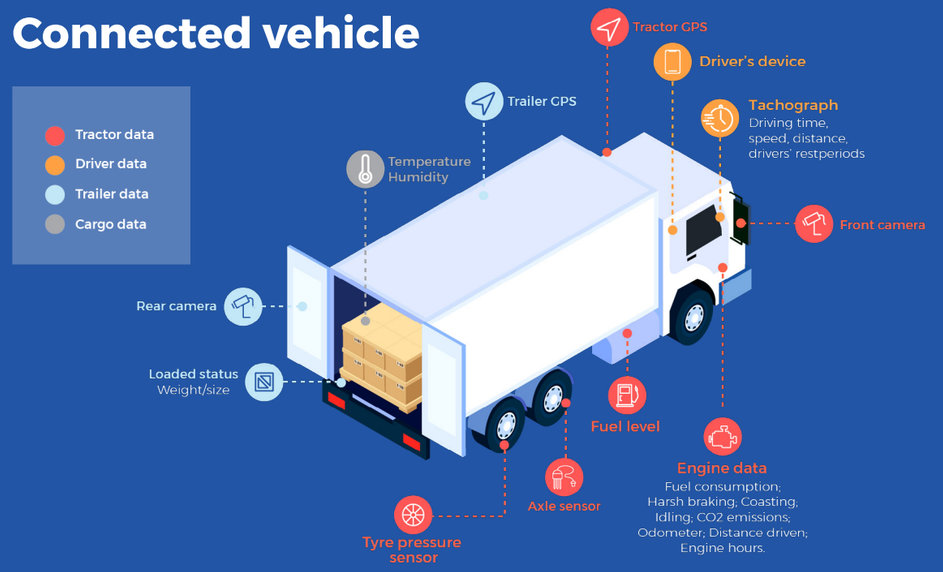


Figure 2: Connected vehicle operational data

Connected vehicle is one type of smart, connected product, which also comprises physical, smart and connectivity elements. The complete set of operational data consists of certain different operational variables belonging to different electronic control units in the vehicle. They are sorted to different buses throughout the vehicle. The information over the vehicle status can be collected by a small telematics device installed in the vehicle through plugging into the CAN bus port. This telematics device receives, stores and transmits different types of information relating to the vehicle's performance, condition, and usage. Apart from the tractor data, a connected truck as a unit also can collect data from trailers, drivers, and cargo through smart components embedded. Figure 2 gives an example of vehicle operational data assets.

A SIM card and modem in the device enable communication on the cellular network and frequent data transmission to a cloud server at a predefined interval **(V2N)**. The cloud server is a central data hub that combines and processes data for value-added services and applications (Figure 3).

In addtion, the smart and connectivity components enable other different types of vehicular communication systems (Coppola & Morisio, 2016).

Vehicle-to-infrastructure system **(V2I)** allows vehicles to collect information about traffic flow, cameras, charging stations, etc. Vehicle-to-vehicle system **(V2V)** enables vehicles to transmit information with nearby vehicles.

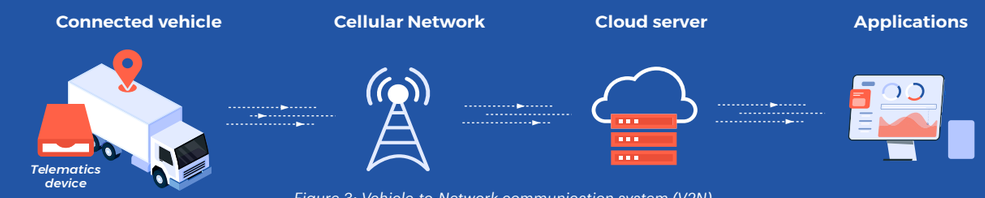


Figure 3: Vehicle-to-Network communication system (V2N)

defining relational connections. It is a set of data that has been cleaned, aggregated and processed in a way that makes it easier to measure, visualize and analyze for a specific purpose. The analysis is usually carried out to find the answer to Who, What, When and Where questions. For example, we can derive a vehicle's actual route on a day by analyzing the positions of it from point A to point B sent out by in-vehicle GPS.

Figure 4: DIKW Pyramid (Rowley, 2007)

The third layer is to move from information to knowledge to achieve the goal. Many pieces of the information connected to other data sources can have more meaning and value and help to understand how to leverage information to meet customers' needs. For example, more precise time of arrival could be delivered by integrating weather, real-time or historical traffic information with the best route selected. And the goal is to achieve accurate time of arrival.

The fourth layer is wisdom, which means to apply knowledge in action. In other words, the machine or the application can proactively give the suggestions of the next decision or automatically make decisions by itself.

Therefore, the more the data is enriched with meaning and context, the more knowledge and insights can be gotten out of it.

2.2.2 Stage model of data analytics

Figure 5 is another wide-used stage model for explaining data analytics use cases (Steentrup et al., 2014). It can be characterized by four types of data analytics: descriptive, diagnostic, predictive and prescriptive (Figure XX). Each stage presents how sophisticated the data analytics capability could be, which has the same characterization of the DIKW pyramid. It also implies the level of human input in decision and action activities. It means that the more machine input it has, the less human input it needs. To the final prescriptive stage, it aims at decision support or even automated decision making to derive actions based on the data without requiring any human input.

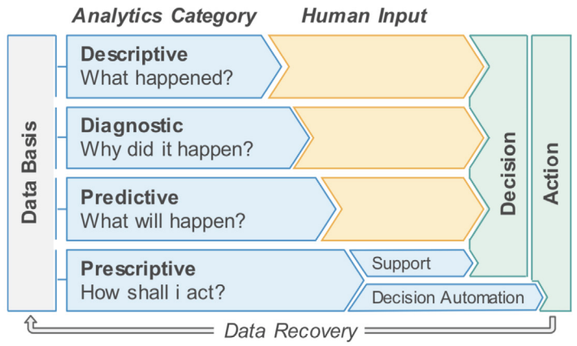


Figure 5: Stage model for characterizing data analytics use cases (Steentrup et al., 2014)

2.3 DATA, ANALYTICS AND VALUE CREATION

The previous discussion is more about the understanding of the requirements and capabilities of smart, connected products and data analytics from a technology perspective. More research is presented below to discover how data and data analytics can create values for business.

2.3.1 Servitization

Servitization is one of the main drivers to push the manufacturing industry to change the traditional way to deliver values and focus on innovative value-added service developments with their current product offerings to satisfy unmet customer's needs (Baines et al., 2009). The smart, connected products create massive new opportunities to open up service innovation as its generated data can foster smart, digital services. It is a way to shift the business goal of manufacturers from one-time product selling to gaining continuous profit from customers by value-added digital service solutions, which will enhance the company's core competencies in the future. In the end the boundary of the manufacturing industry and service industry will be burled.

Evolution of the market offerings of manufacturers

Figure 6 (Rabe et al., 2018) presents possible directions for the market offering of a manufacturing company, which is highly dependent on the levels of digitalization, servitization and technical realization. It also relates to how manufacturing companies reposition themselves on the market and what their business models can be.

The evolution **from product to solution provider** is to offer further products and services for the core manufactured product that customers need.

Value-added services driven by data insights are more closely linked to the usage and performance of the product. Meanwhile, these value-added services are likely to be linked to the connected, smart products from other companies, which pose a threat to a company with no such service.

The next stage is to deliver the core manufactured **product as a service**, enabling manufacturers to offer their products and services as a unified solution.

The final stage refers to **everything as a service (XaaS)**. Through the technical system, many product functions and value-

product provider	solution provider	value-added services	product as a service	XaaS on platforms
Focus on offering innovative products.	Focus on offering solutions based on an core product.	Focus on offering physical and smart services around the product.	Focus on operating the product with different services and offering its use.	Focus on offering products and services on own or external platforms.

Figure 6: Evolution of the market offerings of manufacturing companies (Rabe et al., 2018)

added services are digitized and transferred to service clouds and offered on their own or external digital platforms. Customers can purchase these services and use them whenever they want.

Therefore, the potential of such digital service offerings leads manufacturing companies to expand their service-oriented business along the servitization path (figure 7).

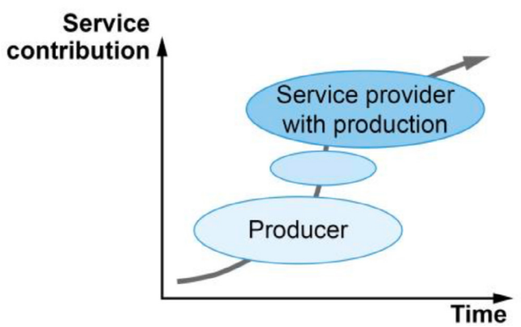


FIgure 7: Servitization path (Schuh et al., 2004)

For the manufacturing industry, many services are based on data analytics application in order to derive data-driven insights and integrate intelligence into the services. According to Engel and Ebel (2019), data-driven service innovation refers to using data as a key resource for value creation towards customers. In addition to selling data, companies can adopt the data exploitation strategy to become a data re-user through data analytics and deliver value-added services to their current and potential customers, while creating a multi-dimensional business model (Zhu & Madnick, 2009).

2.3.2 Creating values with data analytics on an ecosystem level

Traditionally, the main value creation of data analytics is focused on a direct relationship model between current customer and analytics service provider based on a closed system (Chen et al., 2011). This type of traditional analytics ecosystem usually operates in a siloed and inefficient model (Chen et al., 2011). End users or other relative partners need to work with multiple service providers to acquire and integrate data sources and apply analytics technologies to address their business needs, which is often costly and hard to implement. There is little sharing of related operation data, tools, and services for a broader customer base in the ecosystem.

Chen et al. (2011) proposed two concepts in a service ecosystem when applying data and analytics, namely Data-as-a-Service (DaaS) and Analytics-as-a-Service (AssS). DaaS regards a data service that aggregates and provides access to more data sources through cloud infrastructure. The benefit of processing and aggregating in the cloud is to offer low cost and scalable infrastructure for big data analytics (Chen et al., 2011). Open APIs can be one format to deliver DaaS. Beyond DaaS, AssS offers a rich set of analytics components on demand and infrastructure that are easy to integrate with other business applications or processes. These two new concepts enable an ecosystem transformation from a closed, proprietary, and business-directed model into a more open, collaborative, value co-

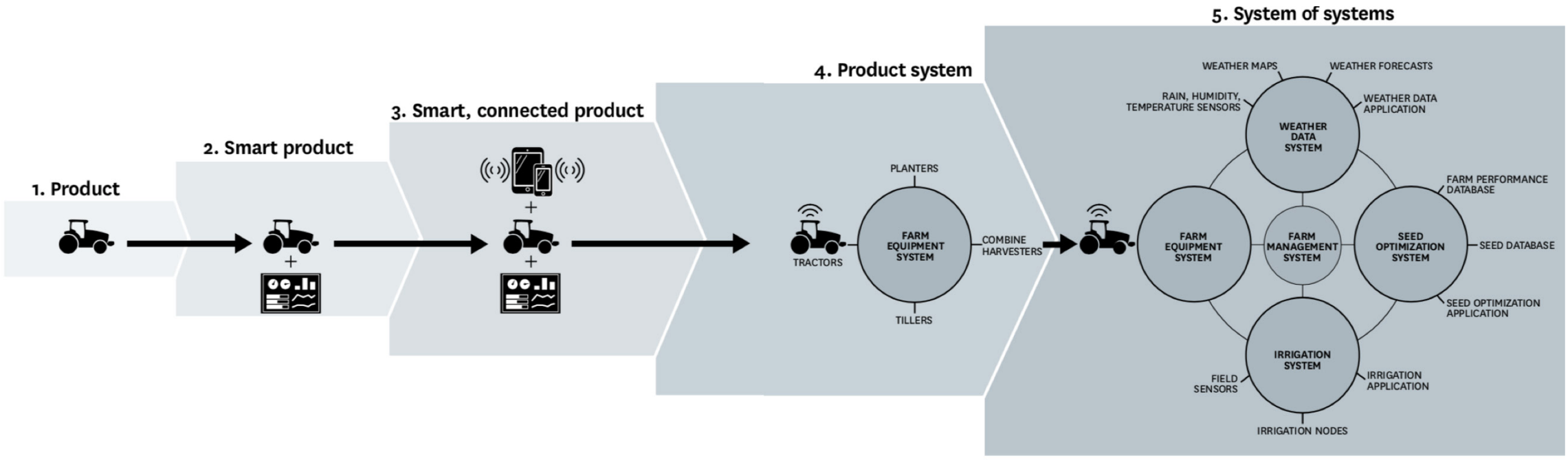


Figure 8: New Industry Boundaries and Systems of Systems

creation ecosystem that benefits multiple stakeholders: customers, industries, partners and end-users (Chen et al., 2011; Porter and Heppelmann, 2015). By entering into this open service ecosystem, companies are likely to unlock new business models by applying analytics as a value creator and key differentiator. For example, companies can aggregate data from one type of customers and create additional value for other business partners or end-users by deriving insights from the collected data and analytics.

Meanwhile, the applications of smart, connected products, physical and virtual value creation activities are often combined. Information, resources and smart objects are linked to each other, and customers and other business partners actively interact in the value network (Porter and Heppelmann, 2015). This will enable new forms of collaboration on a data and analytics level.

According to Porter and Heppelmann (2015), the industry boundary will be expanded by shifting from a single product system to systems of systems that connect an array of product and service systems and external information to improve the overall operation on an industry level. Within these dynamic ally networked systems, there will be multiple players participating in the systems of systems, and companies are intentionally seeking to broaden and reshape their business as well as their industry. Figure 8 presents an example of how a single product from a tractor company can evolve and expand its capabilities in a broader ecosystem.

Chapter conslusion

This chapter gives insights into smart, connected products, data intelligence, and how data intelligence creates values for the business. Main smart components (sensors) embedded in the connected vehicle and three types of communication technology (V2N, V2V, V2I) are studied to understand its capabilities. By aggregating and processing data from connected vehicles, data analytics can be applied to derive data insights.

Connected products and data intelligence bring business opportunities for companies to transform from a manufacturer to a service provider with production by delivering values and focus on innovative value-added service developments with their product offerings to satisfy unmet customer's needs. To discover more values from data intelligence, companies should consider themselves in a broader ecosystem where data insights can benefit more potential users and businesses.

Three main insights can be taken away from this chapter on developing new data-driven services for Scania:

1) Instead of focusing on selling data assets or providing customers with basic data insights on their product performance, Scania could deliver new digital services with aggregated data and data insights by data analytics to meet customers' unmet needs, while enhancing the company's core competencies.

2) The smart, connected product and capabilities of data intelligence can derive a multi-dimensional business model for Scania with different value offerings and enable a new position in the market.

3) Focusing on a single product system or a closed, proprietary system can hardly leverage the potential of data analytics. This is because only limited data sources (e.g., vehicle data) can be accessed and higher capabilities of data analytics are hard to achieve only by Scania itself. Scania needs to position itself into a broad, open, value co-creation ecosystem to unlock new business opportunities with data analytics.

Company Research

To create a successful service innovation strategy for Scania, Scania's vision and strategy, business, current data-driven services and on going developments should be researched and analyzed.

Chapter overview

03

2.3 INTRODUCTION TO SCANIA

Scania was founded in 1891 in Sweden and over a million Scania vehicles are in active use in more than 100 countries. Scania is a world-leading provider of transport solutions, including trucks and buses for heavy transport applications combined with an extensive product-related service offering. Scania is also a leading manufacturer of industrial and marine engines (Scania, 2018).

3.1.1 Scania's business

Offering heavy trucks and vehicle-related services to transport companies is Scania's core business and consists of 61% and 19% of Scania's global net sales (Figure 9). Scania offers tailor-made transport solutions for 36 different industries including construction, retail, mining, manufacturing, courier and postal, long-haulage, urban applications, etc. Scania has strong connections with over 1,000 global dealers in major markets, offering sales services including trucks, used trucks, Scania parts.

Scania's services in the truck segement

Utilizing the data from over 400,000 connected vehicles, Scania has developed value-added services that maximize vehicle uptime including flexible maintenance, fleet management system, finance and insurance, application-based driver training and coaching that can be adapted to specific industries. Figure 10 presents an overview of Scania's offerings in the truck segment. The flexible maintenance service enables vehicle servicing based on real-time operational data and actual usage, with maintenance only when needed. Scania's dealerships provide maintenance services that link to over 1,700 workshops around the world, presenting one of the primary profit sources for Scania apart from selling trucks. Scania will own more workshops globally to be close to the customers and drivers.

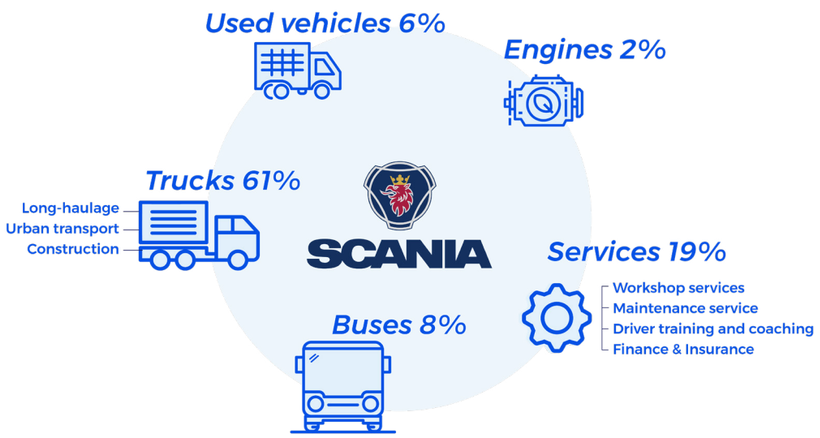


Figure 9: Scania product portfolio and global net sales (Illustration based on Scania, 2018)

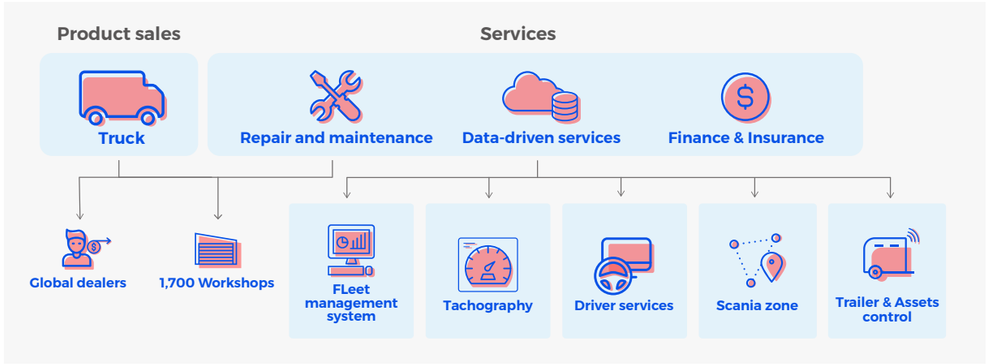


Figure 10: An overview of Scania's service offerings in the truck segment

Scania's value creation

Scania's value creation is based on providing customers with profitable and sustainable transport solutions that move their businesses ahead. This means that Scania's business model is about understanding and improving the revenue and cost aspects of transport companies' industries by offering tailor solutions including vehicles and services supported by vehicle data. The service offerings such as financing, insurance and maintenance contracts enable Scania to be closed to the customers and their business operation, creating a long-term relationship and bringing Scania continuous profits. Figure 11 presents Scania's and customers' business model components.

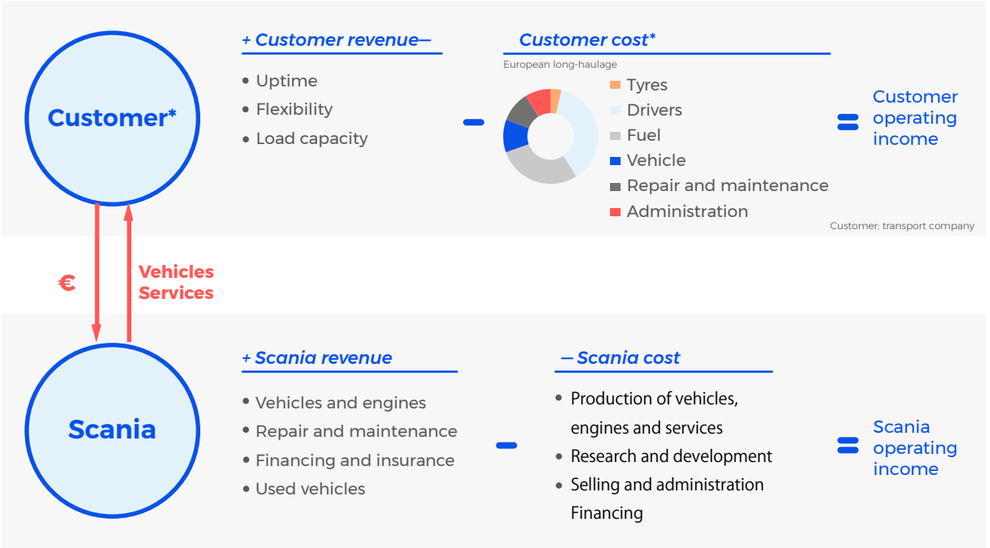


Figure 11: Scania and customers' business model components (Illustration based on Scania annual report, 2018)

3.1.2 Scania's Parnership

Scania is also part of TRATON GROUP. Under this umbrella the brands Scania, MAN and Volkswagen, RIO work closely together with the aim to turn TRATON GROUP and its brands into a Global Champion of the truck and transport services industry by utilizing the strong network of strategic partners to access all major profit pools (Scania, 2018).

The main collaborations focus on synergies in the components of hardware and infrastructure of back-end systems, which also applies to the development of new technologies such as electric and autonomous vehicles. The competition between Scania and other brands within TRATON GROUP should be fair on the market, whether it is truck sales or digital service business.

3.1.3 Scania's vision

Scania's vision is to drive the shift towards a sustainable transport system, creating a world of mobility that is better for business, society and the environment.

Company vision explanation

One of the reasons why Scania set up this company vision is that transport is an industry where the digital revolution is moving fast. Connectivity, digitalization, electrification and automation, new business models and new market entrants will disrupt the traditional freight transport industry in the next few years.

In the future, the adoption of electrification requires the electrified powertrain, and it will abandon the traditional engine that has been the core capabilities of truck OEMs for decades. Besides, there would be no cabin needed for autonomous vehicles, and vehicles will become a mainly software-defined sensor platform. All development will be based on simulations and data from the connected product.

Therefore, these market trends and technology developments are pushing Scania to selectively abandon some past offerings and transform the company strategy towards a bigger picture to find a competitive position in the transport and logistics ecosystem instead of only being an OEM.

> " We used to belong to the heavy commercial vehicles industry. Now we belong to ***the ecosystem of transport.***"
>
> *— Scania CEO*

3.2 SCANIA'S STRATEGY AND DEVELOPMENTS

To achieve the company vision of being a transport system solution provider, Scania has invested heavily in developing new technologies such as automation, electrification and connectivity to provide customers with sustainable and efficient fleets and also try to integrate these new technologies into new business models. The insights gathered below is based on internal interviews. See Table 1 for the intervew list.

The **automation** will be first deployed in the confined area for specific industries such as mining and forestry, followed by hub-to-hub autonomous driving on public roads with supporting infrastructure. Scania has been developing the Intelligent control environment (ICE), which means that the customer's transport can be followed and monitored in real-time from the back-end office.

Scania has set the objective to be fossil-free in 2050 and focuses efforts on **electrification** technologies for both battery and infrastructure to reduce environmental impact. It will enable digital integrations with external partners and stakeholders such as charging service platforms, charging infrastructure providers, etc.

The technologies of **connectivity** and IoT can enable data-driven insights to optimize vehicle performance and minimize customer total cost of ownership (TCO) and also to increase the efficiency of the transport system and optimize the logistics flow. This means that Scania may not only be an OEM focusing on its traditional business model, but shift towards a transport system provider with multiple business models in parallel enabled by technology push and market pull.

There are some Scania's subsidiary companies and invested companies going on to drive this shift.

LOTS GROUP

Scania's wholly-owned subsidiary LOTS group, Lean Optimised Transport Systems, focuses on mining, agriculture, and forestry transport across the world (Scania, 2018). It is a strategic investment and an example of how Scania is moving forward to optimize transport flows. LOTS leverages data from connected trucks, information from fuel partners, and other key data to optimize the daily flows of the fleet based on the principles of Lean (Scania, 2018).

Sennder

Scania also invested in a startup, Sennder, a digital, contract-based road freight matching platform for small carriers and big shippers. Sennder mainly focuses on Full Truck Loads (FTL) shipments, which means that one truck drives exclusively for one shipper. See figure 13 for Sennder's business focus. According to the internal interview, one of the reasons Sennder focuses on FTL is that FTL is relatively easy to set up and gain higher profits compared to Less Full Truck Loads (LTL). Meanwhile, the EU road freight market is vast, with an overall size of 350bn euros with significant structural inefficiencies and top 5 logistics service providers (LSPs) only hold less than 5% market share. The platform, such as Sennder, would be a new industry entrant to gain a certain market share. Through close cooperation, Sennder now offers its customers key tools based on Scania's connected service portfolios, such as fleet management software, Fleet App for drivers.

Internal Interview – Transport System Lead

An internal interview was set up with the Lead of transport system in Scania R&D department. The goal is to see his vision on Scania's future position in the transport and logistics industry and Scania's strengths and weaknesses of developing digital and connected services.

Insights on future services:

The development of new digital and connected services by leveraging existing data that Scania has collected can be two directions:

One is still developing the services around the vehicle performance and usage that Scania is making profits now. Future services might also work around vehicles with electrification or automation.

Another way is to integrate or develop new logistics services enabled by vehicle data and find the roles of Scania and carriers in the logistics system.

Strengths

- Market leader of vehicle manufacture
- A considerable amount of vehicles running on roads globally
- Strong competence in developing new technologies (ACE)
- Strong connection with customers
- Possibility to collect considerable vehicle data
- Knowledge of modular thinking (possible to adapt to the logistics system)
- Lean thinking (possible to develop efficient logistics transport system)

Weaknesses

- A relatively narrow business model
- Limited transport buyer relation
- Limited knowledge about logistics business and its operation
- Limited software development competence (e.g., artificial intelligence)

Discussion

All of the strategies and developments pave the way for Scania to achieve the company vision. However, transforming towards a transport system provider seems to be a big challenge. This is because Scania only knows the sales market well, but has limited knowledge about the transport and logistics business and customers' operating systems, which is hard for Scania to monetize data and develop digital services that are more logistics-related. Although Scania has the logistics competence of its vehicle supply chain, it is not business-related. Meanwhile, historically, Scania have had a more focus on hardware development. Limited software development skills such as artificial intelligence and big data analytics might be a reason to slow down this transformation.

Interviewed Scnania employees

This table presents an overview of interviews conducted with internal employees (including informal interviews) during the 'discover' phase of the graduation project. The primary purpose of the interviews was to understand Scania's strategy, partnerships, products and services, developments, technologies, and data usage. See more interview insights in Appendix 1.

1. Head of Strategy and product planning, Conneted Service
Goal: 1) Understand Scania's partnership in TRATON and its purpose. 2) Get Insights into collaborations between Scania and RIO.

2. Lead of transport system, Scania R&D
Goal: 1) Get insights into Scania's future service direction and its limitations both from Scania itself and industry environment (data sharing). 2) Scania's strengths and weaknesses of developing new digital services.

3. Business model designer, Conneted Service
Goal: 1) Get insights into Scania's connected service strategy 2) Get insights into Scania's current data-driven projects.

4. Strategic business developer, Conneted Service & Sennder
Goal: 1) Understand Sennder's business, business model and service roadmap to the future 2) Get Insights into Sennder's current data-driven services for carriers and shippers.

5. Development engineer, Scania R&D
Goal: 1) Get insights into Scania's strategy, organization culture, current research projects at the data intelligence department and the relations between Scania's technology roadmap and service roadmap.

6. Product owner, Conneted Service
Goal: 1) Get insights into what data assets in Scania's FMS and rFMS standard APIs.

7. Head of central operations & digitalization, LOTS
Goal: 1) Get insights into LOTS business, the strategy of digitalization, tools and the applications of data analytics to drive transport performance in operations. 2) Future strategy on automation

Table 1: Interviewed Scania employees

3.3 SCANIA DATA-DRIVEN SERVICES

Since the goal of this paper is to develop a roadmap for Scania's future data-driven services, Scania's current data-driven services should be introduced and analyzed as the new data-driven services should be linked to existing service offerings and capabilities.

In 2019, Scania reached over 400,000 connected vehicles across the world, and the strategy for 2025 is to reach 95% connected fleets. By leveraging the vehicle data, Scania has developed a series of data-driven services for carriers to increase their uptime and efficiency of operation. Currently, Scania offers three primary connected services: 1) Fleet Management Services, 2) TachographServices and 3) Driver Services. Scania Zone and Trailer Control are new services that are subjected to Fleet Management Services (Figure 12).

Figure 12: Scania's main connected services

1. Fleet Management system

The fleet management system is one of the core services offered by Scania. It provides customers benefits in increased uptime, improved safety, and reduced operating costs by collecting and analyzing the vehicle data. Main functions are explained below:

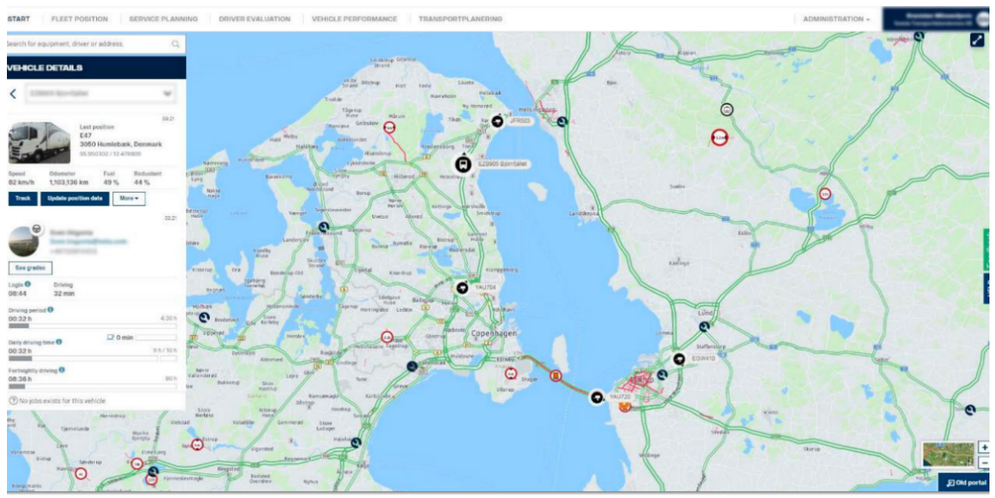


Figure 13: Fleet management system — Fleet positioning

1) Fleet Positioning gives the customer an interactive map where they can see their vehicles and equipment in real-time (Figure 13). It helps carriers to track and take control of their fleets. The transport operator can see who is driving, how long they have been driving, when they started driving, where they stopped, how long they stopped driving and when the driver has to take their rest based on the standard EU law. They can also see the speed at which the vehicle is traveling, how much fuel is left.

2) Service planning is the service where fleet managers gain control over the maintenance and repair requirements of the fleet. If the customer has a Scania Maintenance plan, the planned service events are shown in Service Planning. Through positioning and vehicle operational data, Scania actively diagnoses how vehicles perform and plans ahead which vehicles will need maintenance service, when and for how long they will need to be in the workshop to avoid unexpected breakdown. This offering helps carriers to keep all activities related to service planning well organized and increase the uptime.

3) Vehicle performance helps customers to evaluate how their vehicles are being used (Figure 14). Customers can find over 90 parameters of data that display vehicle performance. Customers can receive the environmental report that shows calculated emission values for their vehicles. The emission values are based on a vehicle's calculated fuel consumption.

4) Driver Evaluation is a service that gives customers an overview of drivers' driving behavior. It also identifies the parameters within which there is the greatest potential for improvement. If a driver starts with grade E and improves their grade to A, they have the potential to reduce their fuel consumption with around 15% due to improved driver behavior.

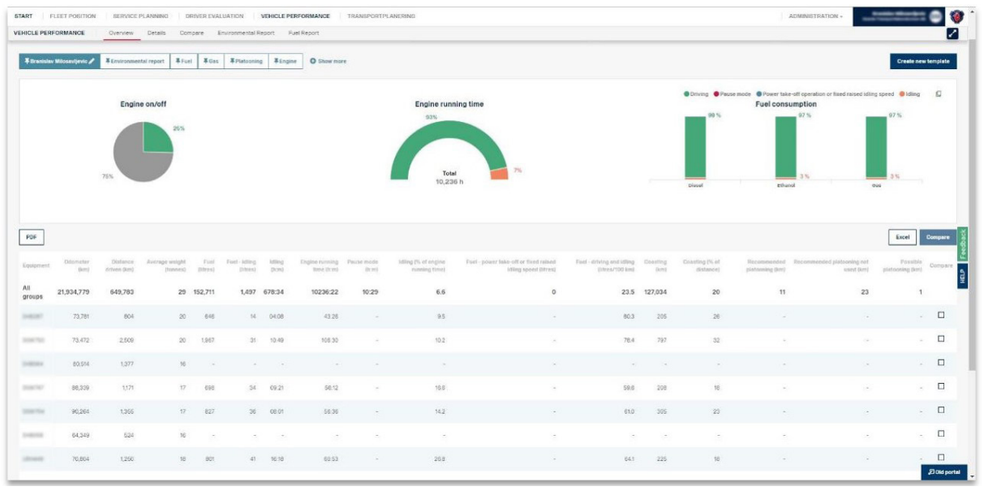


Figure 14: Fleet management system — vehicle performance

4) Scania Zone allows drivers to receive notifications when the vehicle enters geo-fencing areas with traffic restrictions such as speed limits, emissions and noise regulations, which prevents drivers from overriding the set rules (Figure 15).

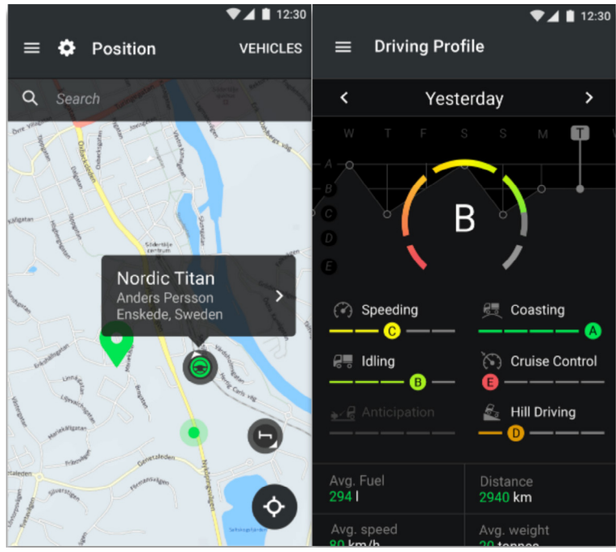
5) Trailer control & assets control allows customers to connect equipment such as trailers, commercial vehicles or mini-vans by providing the data of location, performance & goods control. The offerings of performance and goods control are still under development. It helps carriers track and find the trailers easily and monitor the condition of the goods, which is also one of the requests from shippers.

6) Fleet APP helps to link driver and fleet manager closer in the daily operation. The app gives them access to their positioning, grades and vehicle information (Figure 16).

7) API integration

Scania also offers API data services for its customers when they have another own-built or the third party systems. The API data can be integrated into the third-party digital platform with standardized vehicle data formats (rFMS[1]). Since customers may have fleets with multiple brands, they can integrate all vehicle data from several systems into one third party FMS.

Figure 15: Scania zone



Position **Driving profile**

Figure 16: Fleet APP

2. Tachograph services

Scania's tachograph services provide customers insights into driver activity and vehicle usage, which helps them to analyze potential legal responsibility issues regarding infringements, delays, required calibrations, etc. The tachograph records the speed, distance, driving time and drivers' rest periods.

3. Driver services

Scania leverages a variety of vehicle operation data to monitor drivers' driving behavior and performance periodically, and offers the driver coaching sessions if they find negative trends in terms of driving efficiency.

1. The rFMS API is used to remotely access vehicle FMS data in a standardized way without installing any additional hardware to the vehicle by using the existing OEM hardware.

Discussion on Scania current data-driven services

Scania's current connected services mainly focus on fleet management to increase vehicle uptime, having limited interaction with the operation of logistics and transport. Most control and monitor packages offered by Scania are to deliver the information of assets' positioning, performance.

According to the DIKW pyramid studied in the previous chapter, these offerings are only at the information level. The levels of knowledge and wisdom are rarely achieved by current offerings. For example, the fleet management system gives customers an overview of all the vehicles' real-time locations. However, it cannot provide insights into when the truck potentially arrives at the terminal or which route is faster. Geo-fencing services, as another example, are valuable for drivers to efficiently follow the environmental rules, but it also has more potential to be integrated into route planning. The Fleet APP focuses mainly on vehicle performance and linkage between fleet managers and drivers, which contains only part of drivers' daily operation activities.

Meanwhile, some parameters presented on the FMS portal are just vehicle-related information stacks that customers might not even check or leverage for their operation. The value of providing these parameters to customers is relatively low.

The strategy of offering API for customers to integrate data from Scania's connected vehicles into their own system will benefit third-party telematics providers to leverage data for more new offerings. To some extent, it limits Scania to develop services that focus on improving transport and logistics operations.

Most of Scania's service offering focuses highly on the current customer segment - carriers, without thinking from the perspective of customers' customers which refer to shippers.

To deliver new data-driven services, Scania needs to consider how the data collected from vehicles and current service offerings will benefit the logistics system and how Scania can expand its narrow business model.

Chapter conclusion

Scania is a world-leading provider of transport solutions, including trucks and buses for heavy transport applications. Scania is a part of TRATON GROUP with MAN, Volkswagen and RIO, a telematics service platform. The focus of this partnership is on synergies in the hardware, back-end infrastructure and new technologies.

In the truck segment, Scania has developed value-added services including flexible maintenance, FMS, finance and insurance, driver training and coaching. Scania's company vision is to drive the shift towards a sustainable transport system, which is mainly driven by changes in the external environment.

To reach this future vision, Scania has invested heavily in developing new technologies such as automation, electrification and connectivity and also trying to integrate these new technologies into new business models. Scania's subsidiary companies, LOTS GROUP and wholly invested company, Sennder also expand Scania's transport solutions to different applications.

Scania's main data-driven services have been introduced and analyzed. Most data-driven services offered mainly focusing on fleet management, having limited interaction with transport operations and logistics activities. The value of data and data intelligence from current offerings has not been fully discovered yet.

Context Research

This chapter provides insights into the context of the freight transport industry. The freight transport industry and its main actors are studied, followed by logistics chain analysis, which identifies the major problem areas and relative actors' needs that are data-related.

Chapter overview

04

4.1 VALUE NETWORK ANALYSIS & MAIN ACTORS

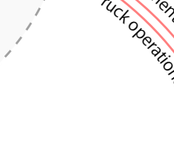
Due to the freight transport industry becoming more complex and connected, a framework of the value network is proposed to analyze the main market actors and their interactions in the current freight transport industry (Figure 17).

Value network is a method to visualize inter-organizational value exchanges and dependencies (Biem and Caswell, 2008). The value network displays cooperation alliances and relationships, which helps the strategist to analyze the company's current position in the industry and identify strategic moves. The value network analysis is different from traditional strategic modeling approaches that only focus on fulfilling the needs of the immediate customer. The value creation and exchange of offerings should be targeted towards identifying the value drivers to the end-users (Biem and Caswell, 2008). This means that the interactions with current customers will be analyzed and downstream market actors will also be considered.

Truck OEMs

Truck OEMs refer to original truck manufacturers such as Scania, Mercedes-Benz, Volvo, DAF and MAN, that manufacture and offer engines and heavy trucks for different applications. OEMs usually sell vehicles to truck dealers across the world to transport companies. Besides it, OEMs have expanded their business into more vehicle-related services including contracted workshop services, FMS services, driver training, finance, insurance, etc. The current value offerings of truck OEMs are still based on product sales and after-sales services to their existing customers, transport companies, having little interaction with other actors in the freight transport industry.

The current offerings of telematics services from most OEMs are similar, focusing on improving the uptime of the vehicles and improving the cost of ownership. Most OEMs put much emphasis on high-quality hardware production and advanced technologies such as electrification and automation. When it comes to digitalization transformation, OEMs are experiencing a hard time developing new value-added digital services with multiple business models within the logistics sector (Deloitte, 2017).



Workshops

Most OEMs incorporate Workshops worldwide as aftersales are the primary profit driver and bring continuing revenues to OEMs. It also helps OEMs to keep a tight relationship with their customers. Scania incorporates more than 1,400 workshops, performing maintenance on complete vehicles, including trailers.

Figure 17: Value network of the freight transport industry

The telematics services offered by OEMs enable more efficient workshop services to transport companies based on every connected vehicle's usage status.

Dealers

Dealers take care of the procurement of the trucks from truck OEMs, and the distribution towards the transport companies. Dealers play an important role in explaining the truck features and connected services to the customers and getting feedback on truck usages and services from them. Some local dealers also link the third party workshops to customers for maintenance.

Carriers

Carriers are also called 2nd party logistics providers (2PL). It refers to the asset-based transport companies that obtain orders for transport demand from logistics service providers or some shippers, offering transport-as-a-service (TaaS) and carrying out road transportation activities within the logistics chain. The TaaS incorporates cost for the driver, representing a large part of transport cost (Figure 18). They also provide services to lease the fleets to 1PLs[1] and logistics service providers.

Transport companies take the risks of owning fleets and asset depreciation. Therefore when it comes to customer expectations, uptime is one of the most relevant criteria for transport companies to reduce their total cost of ownership (TCO) that includes drivers, vehicles and fuel consumption. In Europe, transport companies with a 2-20 fleet size take over 35% of the market share, working as subcontractors and/or cover market niche (Roland Berger, 2018). Individual truck owners take around 15% of the market share. Both segments are profoundly affected by market consolidation due to low professionalization (Roland Berger, 2018).

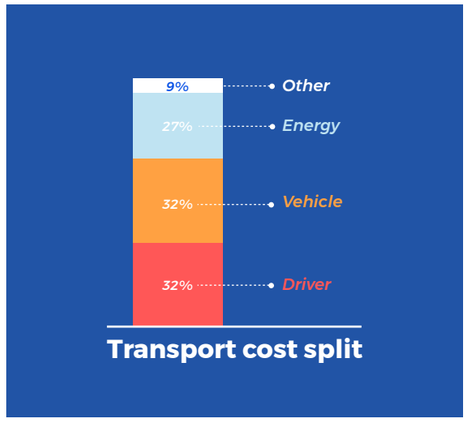


Figure 20: Transport cost split (Roland Berger, 2018)

Fleet manager

Within a transport company, the fleet manager is the person responsible for selecting the right fleets and maintaining them in a good operating condition so that the company can meet its transportation objectives efficiently and cost-effectively. Fleet managers use fleet management software provided by OEMs or third-party telematics service providers to track and monitor the various aspects of fleet and driver operations, such as vehicle performance, fuel consumption, driver time. Fleet managers also give the driver advice on driving behavior based on vehicle usage data.

1. The 1st party logistics provider refers to a firm that operates their own truck fleets (at least for base load) and transports goods from one point to another point without any middlemen in the process.

Transport planner

The transport planner is responsible for the daily planning coordination to ensure efficient transportation operations. The transport planner links the client's order to a truck driver and a specific truck. He/she also needs to manage orders and plan the fleet schedules via an order management tool or transport management system with detailed input of delivery time, destination, route planning, load volume, and weight that gives information on the vehicle's fill rate. Some transport planners have no dedicated system for transport planning, but Microsoft Excel and an in-house developed program solely for billing. One difference between transport companies is if they plan and execute the transportation themselves or their customers like logistics service providers plan their activities and they only execute the planning.

Truck driver

Once the transportation takes place, the truck driver is the person who executes transport and delivers the goods to the recipients. The driver uses the navigation system via smartphone or onboard interface to make sure he/she arrives on time and takes the best route possible. According to recent EU rules, drivers have to follow many specific tachograph rules with regard to maximum driving hours, breaks and minimum rest each day.

Sub-contractors

Sub-contractors are hired to complete only a portion of the transportation when a transport company or logistics company cannot fulfill the transport tasks with the capacity peak. In this case, information about actual transport operations is rarely updated or exchanged with the transport buyer.

Logistics service providers (LSP)

Logistics service providers (LSP) refer to 3rd party logistics providers (3PLs). Some companies, such as manufacturers, retailers and wholesalers, outsource all or part of the supply chain management to 3PL that provides services such as fulfillment, storage and distribution, etc. Logistics service providers usually assign 2PL players for actual transport operations. Asset ownership is focused on warehouses, often owning only a small or no truck fleet. Figure 19 presents a holistic framework of freight transport-relevant logistics decisions from different sources. Most logistics service providers are responsible for these three main areas of logistics decision making: transportation, inventory/warehousing and planning/administration. In the context of LSP, the technological adoption of information and communication technology (ICT) is crucial as they play an essential role in consolidating and managing both physical and information flows over different sources (Evangelista, 2013).

Logistics planner

Logistics planning focuses on the physical movement of material through the supply chain and that predominantly translates as transport and warehousing. In transportation, a logistics planner needs to process the order from suppliers, select delivery location and carriers, assign orders to the carriers, schedule the delivery and routes, etc.

Warehouse/ Distribution hub provider

The warehouses have always been a critical touchpoint in the flow of goods within a supply chain and servers as a key source of competitive advantage of logistics service providers. They receive freight and perform all handling operations needed for transporting goods: unloading, storage, preparation, wrapping, packaging, etc.

Shippers

Shippers refer to retailers, manufacturers, wholesalers and in general cargo owners who require logistics services such as warehousing, packaging, and transport that are fulfilled by LSP and transport companies. Some big shippers such as Walmart operate their own fleets to ensure full control and visibility.

Logistics management system

Transportation	Inventory & warehousing	Logistics system planning & administration
Location selection	Sourcing	Demand forecasting
Network design	Packaging	Sales forecasting
Reverse logistics	Material handling	Order processing
Mode selection	Warehousing and storage	Production planning
Vehicle type selection	Inventory management	Customer service
Carrier selection		Sustainability
Rout n & schedulin		Import and export

Figure 19: Framework of function area of logistics
Illustration based on Tavasszy et al., (2019)

Discussion on the value network analysis

Scania, as one of the truck OEMs, only contains part of value exchange towards transport companies by offering fleets, maintenance services and data-driven services that focus on fleet management. In the value network of the freight transport industry, Scania has little interaction with the upstream market actors. Digitalization enables the increasing complexity of firm relationships and companies are likely to approach potential users in the value network via digital services. Therefore, Scania should consider its market position and find potential customers in the value network by delivering more digital services enabled by vehicle data instead of only focusing on current customers.

4.2 LOGISTICS CHAIN ANALYSIS

4.2.1 Logistics process

Figure 20, as an example, describes an overview of a manufacturer's logistics process mainly performed by third-party logistics and multiple transport companies. The consignee is, for instance, a retailer/ wholesaler (B2B) or customers (B2C).

The logistics process consists of several main steps: inbound, manufacturing, supply and distribution logistics. 3PL takes over the logistics management for the manufacturer, which includes order processing from suppliers and customers, demand forecasting, production planning for the factory, warehouse and inventory management. Distribution management and order confirmation and customer services for recipients. Within every step of the logistics process, transportation is needed and executed by several carriers contracted by the LSP. Carriers with different specialization carry out long-haulage or distribution transportation but with similar transport operation process shown at the bottom of figure XX.

Within the logistics process, transportation with Scania trucks is only part of the process and value delivered by Scania is mainly fleet itself. The opportunity arises from starting to think about how Scania can provide added value to the bigger chain, how Scania can utilize vehicle data and insights on fleet operation on the road and how this information can improve transport operators' experience.

In the transport operations, there are many stages where the trucking process connects to all kinds of other activities, like loading, unloading, storage, etc. These touchpoints provide the linkage to the logistics chain where information can be valuable that comes from the truck. Stakeholders such as drivers and warehouse loading/unloading crew in the logistics chain also link to these touchpoints and their activities are highly related to vehicle information such as vehicle location. to the logistics chain where information can be valuable that comes from the truck. Stakeholders such as drivers and warehouse loading/unloading crew in the logistics chain also link to these touchpoints and their activities are highly related to vehicle information.

4.2.2 Isolation of systems

One challenge to achieving efficient and cost-effective logistics is that within the supply chain logistics activities are performed by different parties that include shippers, logistics service providers, several carriers and end users.

The information such as goods, warehouse, distribution hubs, trucks/trailers is hardly exchanged to the party who needs it as information is stored and processed in isolated software systems held by multiple parties. They all build their own solutions based on their little centric role in the logistics ecosystem without communicating with each other.

These well-known operational software systems are highly used by most organizations to manage their operations, such as Enterprise resource planning (ERP), Warehouse Management systems (WMS), Transportation Management systems (TMS), Fleet management system (FMS), etc. Figure 21 presents the isolation of systems among different parties: shippers, LSP, carriers and end-users. To be sure that different

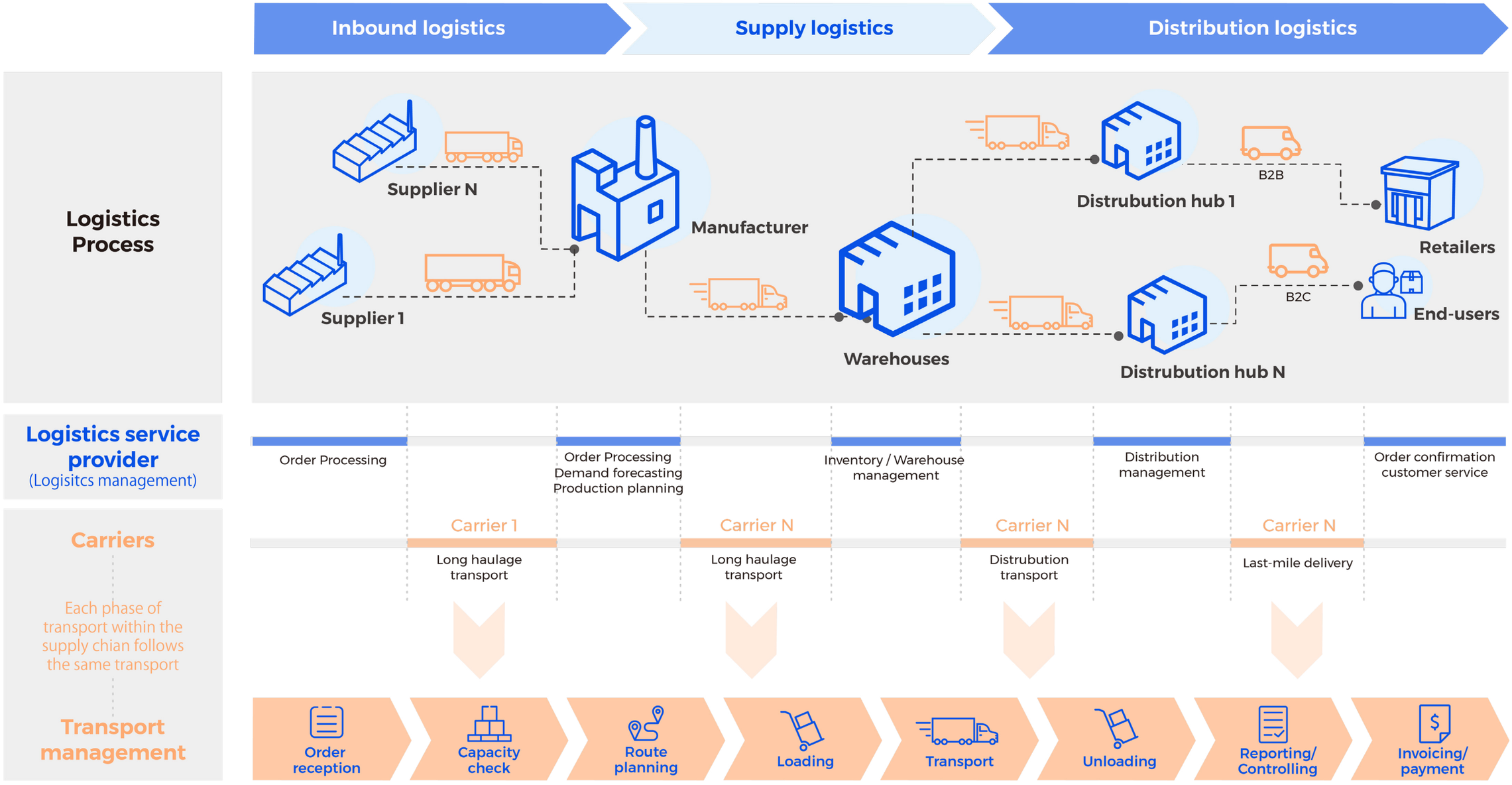


Figure 20: Logistics journey

parties might also use the same type of systems. It depends on the company's size and business. As an example, Some big carriers also use their own TMS to manage the operation of transport and fleets. The business boundary between carriers and LSP is blurred in many cases.

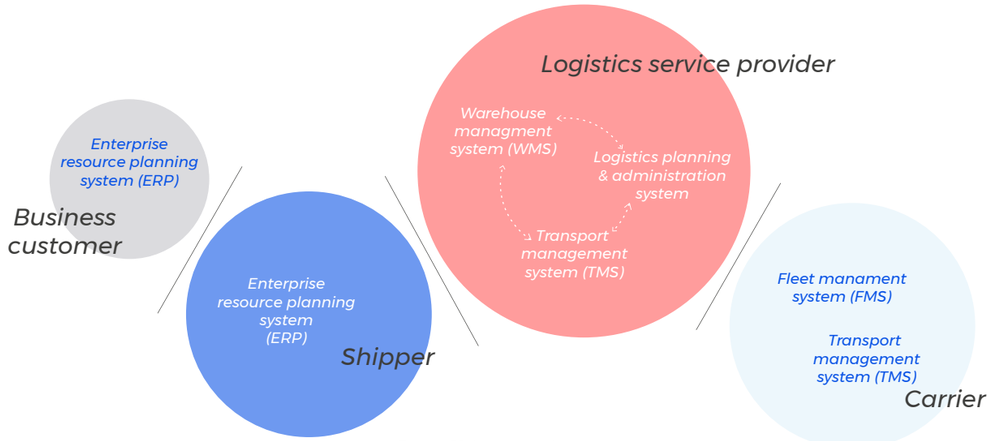


Figure 21: Isolation of systems

4.2.3 Information gaps

The passive nature of the operation systems and the distribution of data across the actors and systems leads to blocked and fragmented information flow that causes the information gaps. Each supply chain starts at the manufacturing level, at specific production sites, from where shipments to markets are defined and picked up and distributed by LSPs and their carriers by trucks, which fosters information gaps, not mentioned to the global logistics when it comes to the intermodal transportation. In other words, The right person or the party can hardly get the correct information at the right time. Currently, Information exchange across logistics players is often conducted by manual processing, by email, individuals pulling data via multiple interfaces and portals. Only a few LSPs and carriers have innovated their workflows by sharing information with their customers in a real-time manner.

These information gaps lead to **operational inefficiency** and **negative environmental impact**. Empty runs are often caused by trucks traveling from one place to the next pickup point without any payload due to inefficiencies in the dispatching process.

It also leads to a lack of transparency in the end results in a **suboptimal experience** for transport service buyers.

It also **increases the operational costs** as the freight transport industry is still labor-oriented and asset-based. For example, delivery status information (e.g., the time window of loading, time of arrivals) is currently only available in scattered operation systems. This information needs, therefore, to be handled, distributed and retrieved manually. Thus, transport operators and dispatchers have to perform time-consuming, repetitive tasks (check multiple times delivery status) to manage the workflow. Figure 22 shows an example of an inefficient logistics journey caused by information gaps.

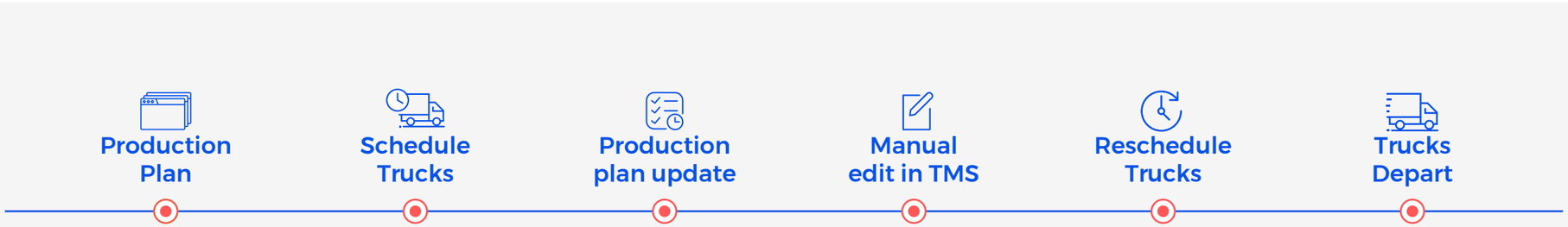


Figure 22: An example of an inefficient logistics journey caused by information gaps

4.3 ACTORS' NEEDS

Figure 23 on the next page presents some key needs of the main actors in the logistics chain. Based on interviews with different actors in the industry, experts and insights from Scania past projects, their needs were defined. Table 2 provides the insight sources See more insights in Appendix 1. These key needs imply what information actors want to obtain or provide, thereby creating interactions between different parties or actors and potentially reducing the information gaps.

One limitation is that DHL was the only interviewed logistics service company that owns around 17,000 fleets and leases fleets from subcontractors. Therefore, the needs of LSP defined here only come from DHL. Big LSPs usually create their own ecosystems and digital services to support their logistics business, and their needs from OEMs are minimal except for the hardware.

Three main information flows are of great importance between the stakeholders:

- *Shipper — Carrier;*
- *Carrier (transport planner) — Driver;*
- *Drivers — Warehouse/hub crew.*

Shipper – Carrier

Shippers value the visibility, efficiency and sustainability of the transport services. They expect that carriers could provide cargo and transport information so that they can track their shipments, especially when the shipments have high values or need temperature control. They also expect to receive efficient and flexible transport services from carriers by delivery accuracy as it reduces their operation costs of logistics such as labor cost and storage spaces. Sustainability is one of the essential compliances for shippers. They need to provide sustainable logistics and transport services to their customers. However, it is hard for them to measure or deliver it without getting transport information from carriers such as actual routes, types of trucks used and CO2 emission for their delivery services.

Carrier (transport planner) – Driver

Another defined information flow is within the carrier company, which refers to the transport planner and the driver. As mentioned previously in the value network analysis, transport planners are responsible for coordinating daily transport operations and drivers' jobs.

During the transport planning phase, drivers hope to get the transport schedule for the next few days, However transport planners cannot arrange it in advance as they have a hard time to match the order with remaining driving hours.

During the transport execution phase, the communication between transport planner and driver is usually carried out via call or email. Transport planners couldn't proactively react to some unexpected transport events such as vehicle breakdown and traffic jams. Moreover, drivers need to pick up trailers, which are not always easy for them to find the location of in the vehicle depot or terminals. The transportation route is also usually decided by drivers themselves and it may not be planned well without the information about weather, traffic and road condition. They also have a hard time finding parking places for trucks on the way before they reach the maximum of driving time. They have to handle the paperwork during and after the transport execution.

These all require some information exchanges between the transport planner and the driver so that transport tasks can be fulfilled better.

Drivers – Warehouse/hub crew

The last main information flow is between the warehouse/hub crew and the driver. As the warehouse/hub crews are responsible for planning and fulfilling the tasks of freight loading/unloading when trucks arrive. They want to get notified when the trucks will arrive soon. This information depends on the position of the truck and can be sent out by drivers.

Insight sources

Interview:

1. Digital strategist/business developer for Scania logistics center.
2. Professor of transport and planning department at TU Delft.
3. Professor of Logistics and Academic Director at the Kuehne Logistics University in Hamburg Germany.
4. SAP Transport Management consuntant
5. Program Manager GoGreen Europe at DHL Express.

Table 2: Insight sources

Insights from Interview	Needs	Actors	Information flow	Actors	Needs	Insights from interview
*We wants to know **where** our cargo is on the road and if it's in a good condition and **when** the truck arrive at the destination.* *The **estimated time of arrival (ETA)** provided by our transport companies are not accurate enough. We hope it can **take all the situation into account.***	**Tracability & Accuracy**				**Reliable data sharing**	*We don't want to **open up all our operation data** to the third losgistics party.*
					Having contol of all vehicle data in one interface	*Transport planners **want to have an overview of the vehicle status** in one place instead of using several telematcs service providers' interfaces.*
*We want to connect all the fleets, now it's **a mix of transport companies** and it's **a mix of fleets with different brands** and this is the challenge.* *We want to connect the transportation information into our **material planning** side of the logistic. In the planning systems we see now the collection has occurred, but then **we did nothing happens until arrival.***	**One view of transport information**				**Less empty runs**	*Transport planners expect to **increase the fill rates** of their trucks.*
					Flexible replanning	*Transport planners want to **quickly react to the unexpected transport events** during the execution, such as replan the routes.*
					Proactive updates to drivers	*Transport planners want to **update the information to the drivers quickly before drivers take their own decisions.***
*We want to know **exactly how the trucks been running**. Then from a **CO2 perspective**, it's actually interesting to see **diverting routes.*** *We have the goal of **being a sustainable manufacturer.** We need to proof this by making sure the transport companies that are driving for us have **got everything set up in a good way**. We have lists of things that we check. If we only get checkpoint marking or just track a trailer then there is no possibility for me not to see anything.* *We want to know **what type of trucks** the transport companies are using.*	**Need to have sustainable transport services**				**Less paperwork**	*Drivers have the needs to hold the **digital version of bill of lading** document that goes with the truck so that they can drive accross the customs or handle the goods to the warehouse more efficiencly.* *A copy of the driving report must be sent to the manager and one to the customer to whom the goods were delivered. Drivers would have liked to **have filled it in digitally** and be able to submit it that way.*
*Let's say in a future where we have predictions for everything. Maybe we **don't have stock places.** We can have **flexible slot time.** We have slot areas where you need to deliver, then we do it **flexibly and we communicate**. We can even ask them to slow down a bit and the you can save the fuel by arriving later.*	**Having flexible transport services**				**Easily find facilities/assets**	***Parking places** are very hard to find. Drivers have to follow very **strict regulations of driving time** so they have to park the truck before reaching to the maximum of it.* *It would be nice to find the stops where drivers can fit their trailers in.* *It would have been very interesting to **see where a trailer is located** to avoid having to go several laps around the terminal before finding the right trailer.*
We hope to integrate all our subcontrators' telematics data into our own system to improve our services, yet ***not all of them are willing to share it.***	**Integrate subcontractors' vehicle data into systems**				**Actively react to the requirements and unexpected events**	*Drivers sometimes do not know where the destination is, so they **have to call** to see where you are going.* *Some requirements from clients that drivers **need to notify before they arrive** and then they must call.*
The ***arrivals of trucks are very irregular.*** Warehouse/hub crew want to know when trucks will arrive at the warehouse/hub. Deploying robots to load/upload the goods requires the information from the truck is very ***real-time and regular.***	**Achieve efficient loading/ unloading workflow**				**Stressless driving experience**	*Drivers think it would be helpful to get information about **road works and alternative routes** for a truck a with a trailer.* *Drivers don't want to have too many surprises on the road like **low viaducts, traffic accidents or other road and vehicle restrictions.***
Warehouse/hub crew want to ***get the notification bebore the truck arrives*** so that they have time to prepare for the workflows of loading/unloading.	**Get notified when the truck is going to arrive**					

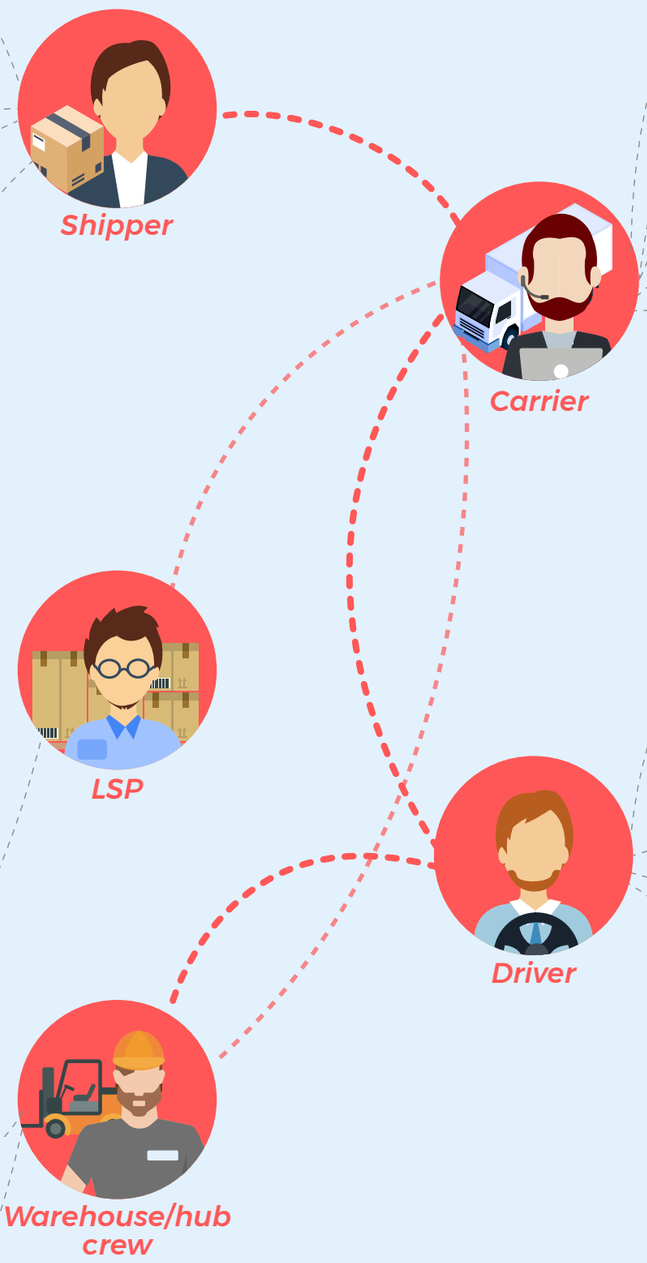


Figure 23: Actors' needs

4.4 DATA SHARING IMPLEMENTATION

Enabling data sharing across the logistics chain and the interoperability of systems is the way to enhance the supply chain visibility, create the interactions, and reduce the information gaps across different logistics parties. The interoperability of systems means that applications need a standard way of communicating about their activities in the logistics chain. As shown in the figure of stakeholders' needs, the critical information related to shipments that should be shared at different stages across the logistics chain, including information like real-time position, bill of lading (BOL*), fill rate, vehicle status, etc. Sharing data such as real-time position increases the predictability of the arrival of goods and enhances shipment handling efficiency. Such open data source innovation could also reduce the amount of empty transport since connectivity could make it easier to connect transport buyers with drivers. The more market actors participate in data sharing, the more the system benefits as a whole (Sidbrant & Börjesson, 2018).

There are several prerequisites to enable such open source innovation:

1. Building trust of data sharing

The first prerequisite regards building trust across the logistics actors. According to the interview with Scania transport system lead in R&D, companies are afraid of sharing data because they want to protect their data for their future business or security and are skeptical of how other companies will use it. Meanwhile, no clear view of which party should initiate to share data in the logistics transport industry. The interviewee also mentioned that if there is no solution for data sharing from the downstream, from truck manufacturers to carriers and LSP, the threats will come from the upstream, big shippers, like Amazon or Alibaba, who hold the customer data. They will also start using their data to build logistics competences. Similar insights were mentioned in the interview with DHL that most subcontractors (carriers) are not willing to share all of their telematics data to the LSP. One interviewed researcher also suggests that:

> **"The premise of open data sharing is to secure the data for sharing, so that involved organizations see the confidence with the data they share. Still, it will not open up too much, both for business data and operation data."**
> *— Director of Integrated Transport Research Lab (ITRL) at KTH Royal Institute of Technology.*

2. Adoption of digitization

Another prerequisite is the greater adoption of digitization. Most OEMs or telematics service providers have provided the services to connect the trucks, yet it is not enough for reaching the potential of logistics. Connecting the goods by Radio Frequency Identification (RFID) tags[1] is also necessary as transport buyers need to see where their cargo is. Other elements such as infrastructure, loading forklifts, trailers, etc. are also required to be digitized to exchange information.

3. Data standardization

Enabling the standardization of data format is one of the most important prerequisites to achieve interoperability of the systems and data sharing. Initiating the interoperability of systems and harmonizing data transfer requires the involvement of multiple organizations (ERTRAC, 2019). As mentioned in the chapter of Isolated systems, organizations handle their own systems where a common language to share data is missing. It is a time-consuming process wherein the shared information is not always on time, correct or complete. The data standardization should be implemented in the whole spectrum of this logistics industry i.e., packaging, labeling, process standardization, and ICT standardization.

1. RFID means Radio Frequency Identification and is the use of wireless signals to transfer data between a microchip and a reading device, which makes it possible to identify and trace objects.

Chapter conclusion

In this chapter, the value network of the freight transport industry and its main actors are studied. Scania, as a truck OEM, only has value exchanges with several downstream actors in the value network, such as dealers, workshops and carriers. However, based on logistics chain analysis, vehicles connect to a variety of other logistics and transport activities where information from the truck can be valuable and other actors could benefit from vehicle data insights. It brings the opportunity areas for Scania to develop new data-driven services that could help customers to share transport-related information with involved actors in the logistics process.

The research moves further into the information exchange between different parties. The main problem area discovered is that the isolation of the operation systems and the distribution of data across the actors leads to blocked and fragmented information exchange that causes the information gaps. It causes various negative impacts such as operational inefficiency, increased operational costs, suboptimal customer experience. Meanwhile, the main actors' needs in terms of data and information sharing among actors are defined based on interviews. In the end, three implementation barriers of data sharing are researched, which refers to the lack of trust in data sharing, the lack of digitization and the difficulty of data standardization.

Therefore, Scania's future data-driven service strategy should consider how to help customers' businesses by sharing valuable data insights with the right actors, what data insights Scania could provide to the potential customers in the value network and how to overcome the implementation barriers of data sharing.

Trend Research

To be able to create a future foresight, creative trend research was executed and trends were scanned based on expert interviews and desk research. Within this trend research, the focus is put on uncovering the main user drivers of change in the freight transport industry and sketch future scenarios of Scania's future business. In total, four overarching trend groups were summarised.

Chapter overview

05

5.1 MARKET TRENDS

Sharing economy logistics

The sharing economy has been a hot topic mainly on a consumer level such as Deliveroo and Uber, yet there are many opportunities in the logistics industry. The concept of sharing logistics capacity enables the allocation of idle operational capacity to its best use, either by vehicle capacity sharing, warehouse, or infrastructure sharing (Melo, et al., 2019). Shared transport capabilities also allow carriers to increase fill rates and reduce overall operating expenses and achieve sustainability for business and society.

As an example of warehousing sharing FLEXE is a cloud-based online marketplace to seamlessly access underutilized warehousing space.

Digital logistics broker

Where large asset-heavy organizations have difficulty with changing along with markets, new digital asset-light companies step into the gaps, reforming the transport ecosystem.

The growing need for flexible, transparent and easily adjustable logistics services has fostered the open logistics marketplaces where goods can be matched directly between shippers and carriers (DHL trend radar, 2018). Through the online freight matching, Shippers can profit from better comparability and transparency of proposals and carrier rating systems (DHL trend radar, 2018). Carriers can benefit from the optimization of capacity utilization, reduction of empty rides and flexibility. These digital logistics services will be highly likely to replace the role of traditional brokers, and eliminate their profit margins (Roland Berger, 2018). Therefore, these new digital logistics brokers would be a threat to LSP's business and influence the value network of the current freight transport industry.

Examples can be some startups Convey, Uber freight (Figure 24), Sennder, Uturn. Some were established by carriers or LSPs, like J.B. Hunt 360 platform, XPO Connect, Saloodo from DHL (Figure 25). Some platforms focus on one specific freight shipping such as container, FTL, etc.

Logistics data sharing through cloud

The logistics industry's complexity leads to fragmentation and blocking of information nodes in different systems and software. Cloud-based platforms enable the convergence of the essential logistics data streams in central platforms using open APIs. Companies can digitally collaborate with their business partners and connect each other's planning, transport and fleet management systems, and exchange digital assets through cloud, which reduces the in transparency of logistics. The logistics cloud provides the foundation to create new services by having access to various data sources. This type of cloud-based collaboration platform should further evolve using existing standards such as EDI and managing the data interfaces by integrating all the stakeholders, vehicles, LSPs, hub operators, and public authorities (ERTRAC, 2019).

However, Data migration and security issues (GDPR and data export control) still need to be verified. Meanwhile, integrating these modular cloud services into supply chain management systems remains a challenge. It also requires high capabilities of data processing with increased data volumes.

One example is Frightly — Real-time, cloud-based system covering all logistics processes for transportation that makes logistics services affordable, especially for small and medium-sized companies. Another example is a Dutch company, SIMACAN, providing cloud-based transport control tower to make geospatial, traffic, and logistic data better available, usable, accessible, and shareable.

"Major change is coming to the logistics and transport industry – a transformation that promises to be even more dramatic than the move to third-party logistics a generation ago. With increasing digitization, new business models will connect new players, wash away inefficient old ones, and harness the new technologies."

(Harvard business review, 2019).

Figure24: Uber freight

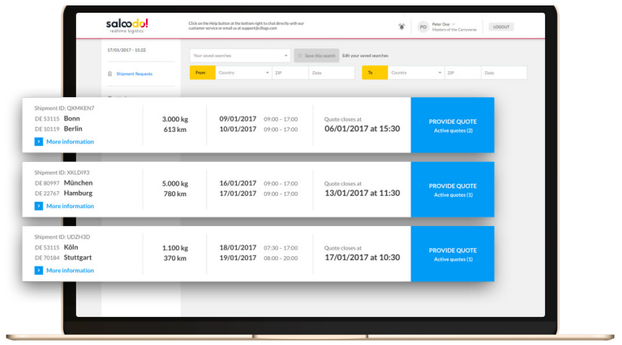


Figure25: Freight matching platform —Saloodo

Continuing driver shortage

The Driver shortage is a pain point in both the United States and Europe. This affects mainly the long-haul transportation, where it is both challenging to retain current drivers and to attract new ones as the work experience of long-haulage drivers is not ideal even though they get paid reasonably (Roland Berger, 2018). Yet, this trend has the potential to accelerate the development of autonomous vehicles in the future.

OEMs expanding logistics services

IoT technology and digitalization enables OEMs to develop more and more connected services for their customers. Sensor-generated data from connected trucks can be used to track, monitor, analyze and maintain an entire fleet and in real-time. OEMs like Mercedes-Benz trucks (figure XX) and MAN have been expanding their fleet management system into new logistics services such as track and trace, transport route planning, control of transport orders, planning of transport workflow. RIO, a cloud-based freight transport platform owned by MAN, provides essential FMS services and transport management services from partners on its marketplace.

Increasing new 3rd party telematics service providers

The number of service providers offering telematics services to the transport industry is vast. There is an ongoing consolidation happening in the industry

as the founders want to capitalize and move onto new business fields and larger companies wanting to build the customer base, which also fierces the competition between OEMs and 3rd parties. At the same time, many new players are entering the industry, starting from the cloud and global connectivity. Some of them have been expanding their service portfolio to transport planning.

Digital supply chain

Industry 4.0, known as "smart manufacturing," or "industrial internet," creates a disruption and has the potential to affect entire industries by transforming the way companies' supply chains are designed. More expectations from consumers and business partners, drive companies to develop the supply chain ecosystem with more flexibility, and transparency, and integrated collaboration with value chain partners (PwC, 2018).

Data and connectivity will drive digitization in all aspects of the supply chain, such as manufacturing, warehousing, procurement, logistics, transportation, etc (PwC, 2018). This means all sensors, devices, machines from the physical world will be connected and automated and enable seamless interaction with the business systems such as ERP in real-time and with full logistics visibility (Hofmann & Rüsch, 2017).

As for the transport process, it may not be planned individually anymore, but in an integrated manner. The just-in-time delivery can be achieved by a reliable transport network, transport demand prediction, and seamless connection with all the elements in the logistics chain (Hofmann & Rüsch, 2017).

Discussion on market trends

Looking ahead into the future of the logistics and transport industry, Digitalization and connectivity represents the biggest opportunities for creating new business models by established market actors as well as new entrants. Various new platforms and cloud-based digital solutions are emerging in the market to digitize and share assets, connect systems and stakeholders, exchange logistics data between business partners, reduce the complexity of logistics management, and enable the supply chain to become more transparent, efficient and sustainable. Traditional LSPs is either trying to innovate their services or being washed away. Some OEMs are trying new business models by expanding digital logistics services.

5.2 TECHNOLOGY TRENDS

Paving the road for autonomous trucks

Autonomous is coming and therefore industries are preparing. The fastest adoption rates are seen in industries that have less human interaction and that work more with enclosed zones for mining, agriculture and construction transport. The next step will be highly automated hub-to-hub transport from factories to ports or terminals in a relatively simple environment, likely to be implemented in a few years (ERTRAC, 2019). The highlMoreover, implementing an efficient autonomous transport system still needs to be fully linked to the interconnected logistics chain (ERTRAC, 2019).

Electric trucks

Road transport currently accounts for 74% of total transport CO2 emissions (ERTRAC, 2019). As environmental regulations will only become more strict over the next decade, many transport companies recognize that moving towards sustainable transport solutions is the key to fuel their future business. Electrification has been a fundamental element of this transition. Integrating electric or hybrid electric vehicles into the fleet portfolio could reduce the total carbon footprint of transport. Deloitte estimates that EVs will represent 10% of the total automotive market share by 2024. As electric trucks rely heavily on charging infrastructure either at vehicle depots or public roads, any progress on a public charging network could help relieve some of the 'range anxiety' that drivers may feel about potentially running out of power on the road. The implementation of electric trucks has to enable collaboration among all of the stakeholders, such as truck OEMs, battery and charger suppliers, transport companies, governments, etc.

5G network technologies

Wireless network technologies and the rise of entirely new networks such as 5G technology are accelerating IoT applications in both the consumer and enterprise environments. In the logistics and transport industry, these intelligent networks can reduce energy consumption, enable cost-effective and seamless connectivity and fast localization of trucks, shipments and assets (DHL trend radar, 2018).

Big data analytics

The logistics chain is being optimized more and more based on data analytics and artificial intelligence. High adoption of digital and connected solutions enable vast amounts of data to be captured from various sources. The operation of transport and logistics can be optimized and even automated through machine learning algorithms and intelligent analytics. The real value is unlocked when this data is cleaned, funneled, and targeted back with the purpose of coaching/informing the customer on how they make better decisions.

Connectivity is everywhere

The Internet of Things (IoT) has the potential to connect virtually anything to the internet and accelerate data-driven logistics. Everyday objects for instance facilities, goods, pallets, tractors and trailers can now send, receive process, and store information, and thus generate actionable insights that drive change and new solutions. Besides connecting physical objects, the rise of digitalization enables more mobile

interfaces tailored for various logistics tasks to evolve the connection between physical objects and employees and also communication between stakeholders such as drivers, dispatchers, loading/unloading crew, etc.

Blockchain

Blockchian is a nascent back-end technology that enables collaboration in the logistics chain and facilitates greater trust, transparency, and data security between supply chain stakeholders. It enables public record-keeping and automatic coordination where digital and physical logistics events can trigger one another (Harvard business review, 2019). Data generated by sensors equipped into trucks and goods, ERP systems, inventory palettes, trade document information and transportation events can automatically add records to the blockchain, creating a single source of truth that all can see (Harvard business review, 2019). Figure 26 presents the benefits of blockchain in supply chain management.

Example: The Fr8 Network is a digital startup aiming to modernize logistics, leveraging Blockchain technology at its core and offering the new set of standards, suite of software tools, and accurately targeted incentivization structure that benefit all stakeholders across the supply chain.

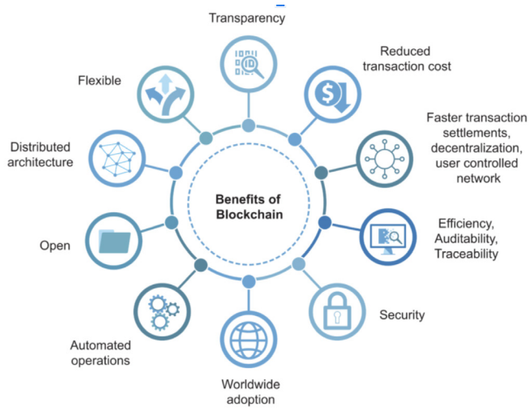


Figure 26: the benefits of blockchain (ITpreneurs)

Big Blue has simply stuck to its blockchain architectural principles of open source collaboration, emphasizing that everyone owns their own data and has the authorization to permit who gets to see that and what the privacy implications are.
— Marie Wieck, the general manager for IBM Blockchain[1]

1. The quatation derived from: https://www.coindesk.com/ibm-maersk-finally-sign-up-2-big-carriers-for-shipping-blockchain

Discussion on technology trends

Automation and electrification are two main technology trends that are highly related to OEMs's future business. The electric trucks will first be implemented in the transport industry to reduce the total carbon footprint. The highly automated trucks will be deployed later to transport goods from hub to hub in a relatively simple environment. One of the premises to go electrification and automation is to optimize the truckload first. 5G network technology could be used to speed up the adoption of autonomous vehicles, enabling V2X (vehicle-to-everything) communication and speeding up edge computing. Data analytics relates to automated transportation. Various data sources from sensors and ICT systems could be aggregated and processed to gain data insights and automated decision making by machines. Blockchain can facilitate greater trust, transparency and data security between supply chain stakeholders. All of these technology trends imply some new business, new customer values, new digital services, or possible solutions to support the back-end systems.

5.3 CONSUMER BEHAVIOUR

Environmental awareness

Customers and companies display increasing environmental awareness and demand for sustainability. For certain e-commerce stores, it becomes evident that sustainability is an important value for their consumers, and this is where ecologistics begin to make sense in their investments. B2B e-commerce also becomes eco-conscious: shippers often also have to report on their emissions and other environmental impacts on logistics and transport to their customers. Meanwhile, more and more customers need to have a choice of the green logistics for their delivery services. This means that choosing the right carriers or LSP is crucial for shippers who expect to compare the carriers' reliability and their sustainable level.

Frictionless expectations of delivery services

Consumers are getting used more and more to instant access to the things they order on any medium and also expect deliveries to be delivered just-in-time that are fitted to their personal schedules and conveniences. Just like these end consumers, industrial customers, like manufacturers and wholesalers, now want to have the transport services with higher flexibility and transparency at a lower price (Tipping & Kauschke, 2016). This means that LSP and carriers have to speed up their logistics operation, adopt new digital solutions and cater to customers needs.

Growing importance of creating digital trust

With increasing reliance on technology to gain competitive advantage, information security has been one of the most critical and challenging requirements for conducting a successful business (Barreto et al., 2017). There is a strong focus on how data is treated and shared to 3rd parties. Meanwhile, GDPR legislation has been updated and is now even stricter than its first version that came in 2018.

Increasing collaboration between parties in the logistics chain through cloud solutions needs to work with large amounts of information, including both business-related data such as shipment documents and personal data such as drivers. And the most interesting data sets are often the ones that are exchanged across connected logistics ecosystems that include customers, OEMs, and service providers. People and businesses have been aware of the risks of sharing data.

One study suggests that consumers are not fully comfortable with any one type of company managing their connected data (Deloitte, 2018). Yet, there is also one tendency that consumers and companies are willing to take the risk to share their data if the service they get in return is sufficiently good (Barreto et al., 2017). The thing is that companies have to inform interested parties about the procedures regarding how and what the data is used and get consent.

5.4 POLICY TRENDS

Emission policies drive low-emission transport

The growing movement towards sustainability is driven largely by regulations requiring companies to reduce carbon emissions and other emissions. Not only are national standards set and becoming more and more strict, but also cities have started to set their own standards and often much tougher. An increasing number of cities will have low or even zero-emission regulations for specific zones, which will require appropriate vehicle concepts (e.g. hybrids, fully electric vehicles) and an efficient transport system. Meanwhile, there is increasing pressure for freight transport due to rising tolls. In 2019, legislators in many European regions will continue to push up toll fees especially for fossil fuel trucks. As for gas-fuelled and electric vehicles, Germany has decided that it will be exempt from all highway road toll charges during 2019 and 2020 (Scania, 2018).

The rise of B2B E-commerce

The growth of the e-commerce industry is changing the way businesses operate. This growth is most often discussed in terms of B2C e-commerce segments, but there is the same potential for B2B e-commerce to grow at a dynamic pace (DHL, 2018). With big players such as Amazon Supply and Google Shopping disrupting the e-commerce business, this market has been becoming more competitive than before. Many manufacturers and wholesalers have been trying to adopt digitized logistics services to improve their logistics process, for instance, by using digital forwarding platforms.

5.5 SUMMARY OF TREND RESEARCH

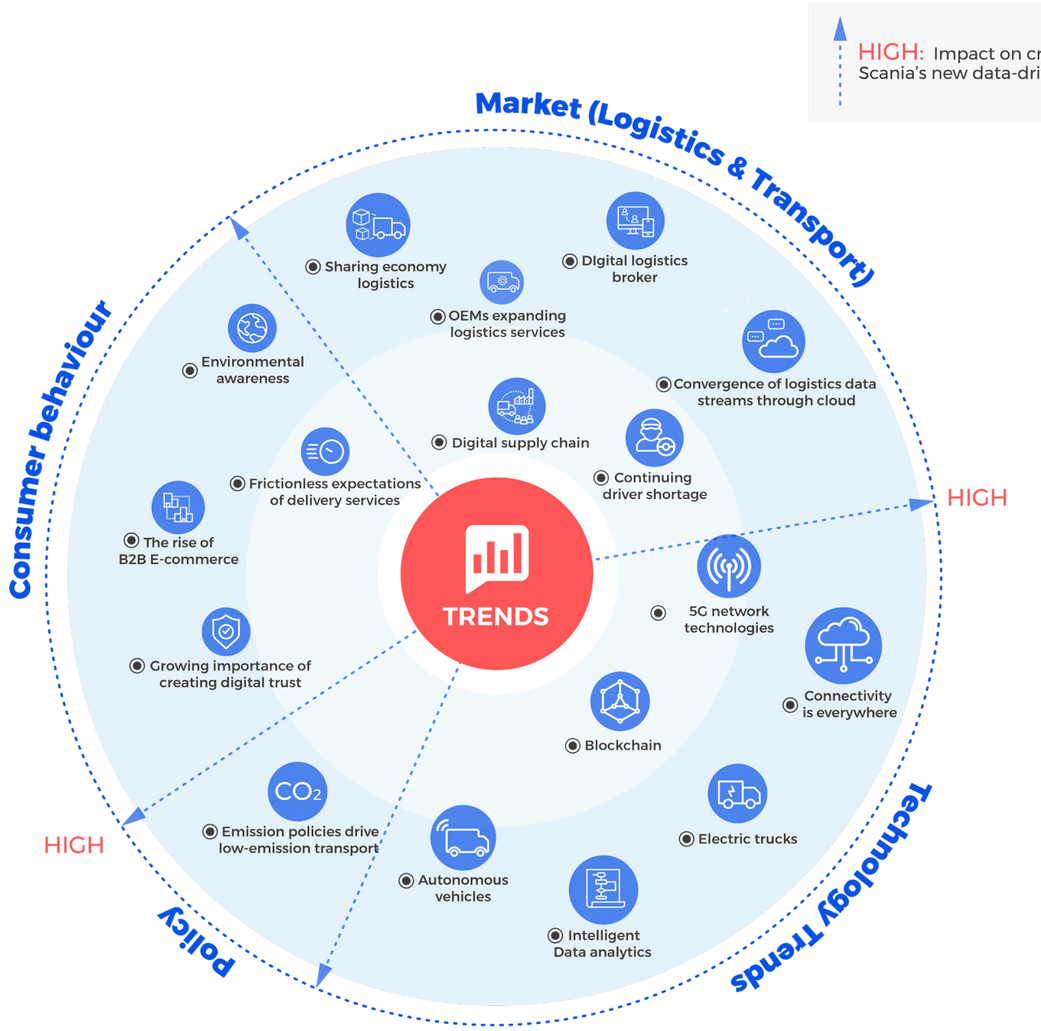


Figure 27: Trend map

As mentioned in the beginning of this chapter, major change is coming to the logistics and transport industry. With increasing digitalization, new technologies, new business models, the industry is being disrupted. The trends clustered in these four blocks (Figure 27) will influence the current structures of the value network in the freight transport industry, foerster new user values for each stakeholder and also bring tremendous opportunities for truck OEMs to develop new digital services.

The advent of the digital truck will transform how freight is transported on the road, starting from hub-to-hub and open road transport. The combination of new technologies of IoT, data analytics, cloud computing, wireless network technology, and new advanced vehicle concepts will make the tracking of goods, assets, trucks, etc and connection of involved stakeholders always available to boost transparency and enable transport planning and execution more dynamic, efficient and sustainable.

As these digitally enabled, cloud-based logistics solutions come on line, it will rearrange how the logistics business operates. Customers can just efficiently and easily manage their logistics and transport requests through logistics platforms, covering end-to-end logistics services. Information from different systems can be exchanged, communicated and analyzed in real-time through the cloud to improve visibility, drive smart actions and increase the customer experience. These disruptive trends will change the roles of different parties in this industry. Especially for LSPs, increasingly open transport marketplaces pose potential threat to their market power. To survive in the business, partnerships are fundamental both for larger industry players who can exchange data within the collaboration and for smaller companies who need to be allied with the main actors to get access to the platforms and the services provided on them. One premise for enabling this open innovation is to build the digital trust that is highly regulated by privacy laws and that increases tensions with customers if data is not managed properly.

The value network of the freight transport industry will likely blur due to collaborations, mergers, and vertical integration. One interviewed expert, suggests that:

“We can see many non traditional logistics service providers. It is going to alter who has the power. This is a transition in just every single element of the freight industry. So we are going to know for sure how things sorted out for a number of years. I think in the long run truck manufacturers will no longer sell trucks. They will sell a service package.”

More and more truck OEMs are looking at what role they will take in the logistics and transport industry and how they leverage their vehicle data to create new digital services for their current customers and even shippers in the future. The promise of connected trucks combined with digital logistics services is huge as a variety of data sources can be reachable. Some OEMs are being active in the market by collaborating or acquiring digital logistics players. Same for Scania, Leveraging new vehicle concepts and connectivity data could create many future business scenarios based on these trends.

Future Visioning

This chapter defines what future position Scania should take in the freight transport industry and who could be Scania's future customer segments and its value drivers. A future vision is defined to lead Scania's future data-driven service innovation.

Chapter overview

06

6.1 FUTURE SCENARIOS OF THE VALUE NEWORK

As mentioned in the value network analysis, the value network will be restructured, and companies can approach potential users in the value network enabled by market and technology trends. Given these changes in the freight transport industry, four possible future scenarios of the value network are proposed, depending on how far the players, mainly OEMs in the logistics chain, pursue the coming opportunities.

Current value network

As seen in figure 30, the current value network is dependent on several main market actors, from the truck OEMs that provides the vehicles, to the carriers that operate the transport and deploy the trucks, to the LSPs that dispatch the goods, to the shippers that buy the transport and logistics services and sell the goods to the end consumers. One thing mentioned here is that some large LSPs also purchase the fleets from OEMs and operate part of the transport tasks by themselves. Therefore there is some overlap of value offerings between carriers and LSPs.

Future Scenario 1:
Transport-as-a-service

In the future, OEMs will have the capability to manufacture autonomous vehicles and develop the autonomous transport system. Given the detailed knowledge of vehicle functions and maintenance, they could be in a position offering transport-as-a-service to LSP by operating the transportation by themselves.

However, this scenario will be highly based on the maturity of autonomous vehicles and require scalable autonomous operation sites locally and globally. It will only soon be possible in the applications of mining, construction, agriculture in the confined area. Meanwhile, It also highly depends on access to transport buyers, which is currently unavailable to todays' truck OEMs.

Furthermore, following this direction, OEMs cannot deploy this strategy in the short-term with traditional trucks as it will compete against their own customers, not to mention that the transport margin is relatively low compared to selling trucks and holding the assets is a substantial financial risk for OEMs.

Future Scenario 2:
Embracing digital transport and logistics services

Pointed out previously in the trend research, there are increasing new disruptive digital players entering into the freight transport industry to provide freight-matching digital services that directly match shippers and transport operators. This has posed a threat to the traditional LSP and took a certain market share of the logistics business.

OEMs could have a chance to partner with these digital logistics brokers and offer digital transport and logistics services both to carriers and shippers. In this way, OEMs could expand their digital capabilities and enter into more open, logistics and transport-related data sources with the creation of integrated information flow through the entire logistics chain. It also helps OEMs to optimize the transport operation by delivering data-driven insights and have access to the new customer segment - shippers. This strategy will not compete against their current customers' business. By contrast, it brings more added values for carriers to move their business forwards. As OEMs move from downstream into this business with data-driven solutions and new targeted customers, they will put increasing pressure on current traditional LSPs.

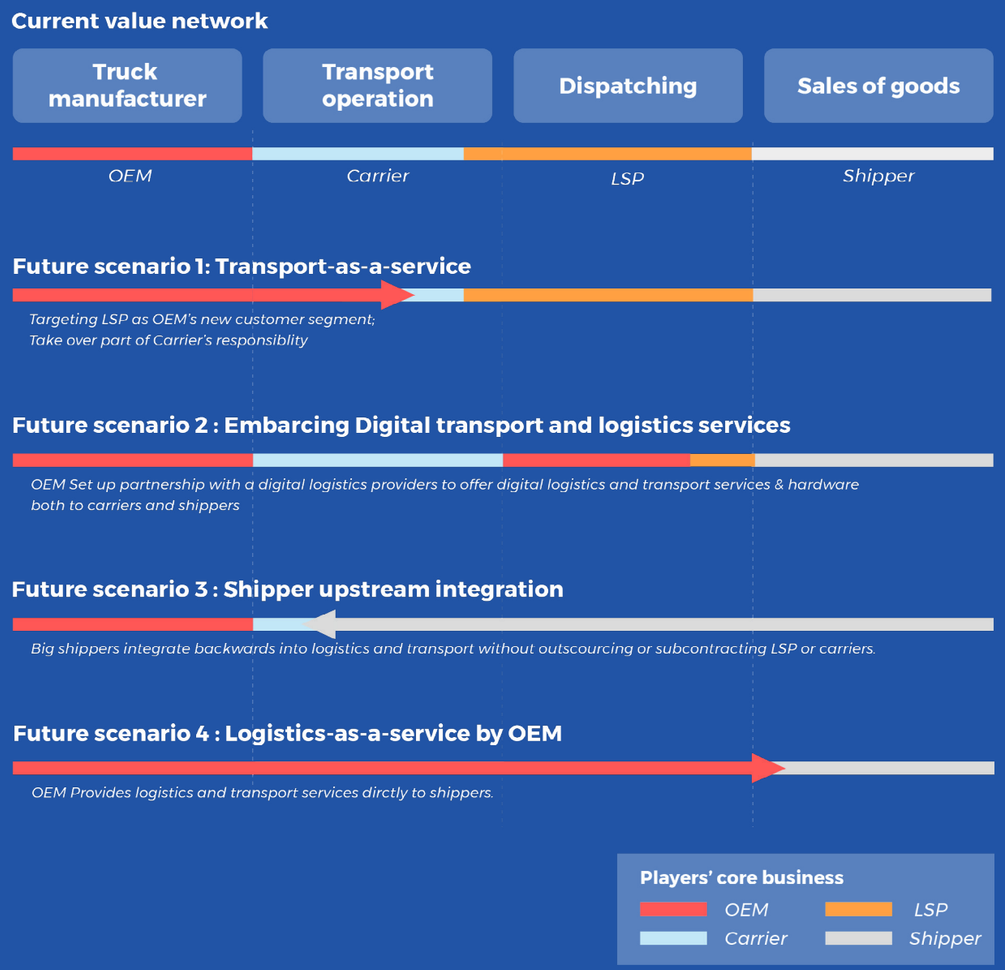


Figure 30: Future scenarios of the value network

Future scenario 3:
Shipper upstream integration

There would be a possible scenario that big shippers, such as Amazon, use its market power to move upstream to become a logistics and transport provider without outsourcing and subcontracting LSP or carriers as they hold big volumes of goods orders and customer data. The new digital services offered by OEMs or other parties might not be necessary since all supply

chain activity will take place within the shippers' own business. The only possibility for OEMs would be offering autonomous vehicles to these big shippers. The part of the value that LSPs will also disappear.

Future Scenario 4:
Logistics as a Service by OEM

Offering Logistics as a Service by OEM would be an aggressive strategy based on OEMs' current capabilities. However, it would be possible to realize if they delopy the strategy of future scenario 2 in the short term. Future scenario 2 would bring OEMs having access to the shippers and build a relationship with them through digital logistics brokers. In the future, they are likely to offer Logistics as a service to shippers directly once autonomous vehicles are fully developed.

6.2 VALUE MAPPING

6.2.1 Value mapping session

To define Scania's future strategy and value drivers for target groups, two value mapping sessions were conducted with 4 Scania's employees with different backgrounds (service development and data intelligence). The process of value mapping sessions is based on the design roadmapping methodology (Simonse, 2018). A presentation about the context research on the freight transport industry was given, and main trends were put on the trend cards (Appendix 2) that were clustered before the session.

Figure 31: Value mapping session scenario.

Through the presentation, the participants needed to consider these questions:

- *What (unique) future position should Scania take in the value network?*
- *Who could be Scania's future customers? Shall Scania still only focus on the current customers?*
- *What value could Scania bring to the future customers to fulfill their unmet needs?*

The definition of value drivers was explained as the following:

"Value drivers capture the key compelling benefits of value wishes: wherein the specific value fulfills an unmet need or solves a dilemma of a user target group in the future (Simonse, 2018)."

Due to the time limitation and other constraints, it was hard to align all the participants' opinions in two short sessions. Based on the insights from sessions and additional qualitative research on the target groups, Scania's future business strategy and target groups are defined, followed by the main value drivers of the target groups. See figure 31 for the value mapping session scenario.

6.2.2 Choice strategic direction

Future scenario 2 and 4 in the previous sub-chapter were chosen to develop Scania's future strategy. See Figure 32 for a rough indication of the horizons.

Horizon1 – Horizon 3
Offering digital logistics service both to shippers and carriers with partners

Digitalization and connectivity bring huge opportunities for Scania to shift from a hardware provider to a more digital logistics service provider with the creation of integrated information flow through the entire logistics chain.

In the short term, Scania will start offering digital logistics services to carriers and new customers, which refers to shippers, with "real-time" vehicle data playing an important role. The partnership will be set up with digital logistics brokers, such as Sennder, to have access to shippers. The reason why Scania should choose to partner with digital logistics brokers rather than traditional LSPs is based on the trend research. Digital logistics brokers are gradually taking the place of traditional ones and offering intelligent, asset free, and transparent logistics services. Therefore, this trend cannot be ignored.

The short-term strategy will position

> *"So far Scania is in talks with us on electrified and autonomous vehicles, which is important. But we are so happy you finally brings this area up and want to talk about **OUR business**. Data driven insights and to **assist in improving our supply chain** is of highest interest for us indeed."*
>
> — A international transport buyer[1]

1. confidential company information

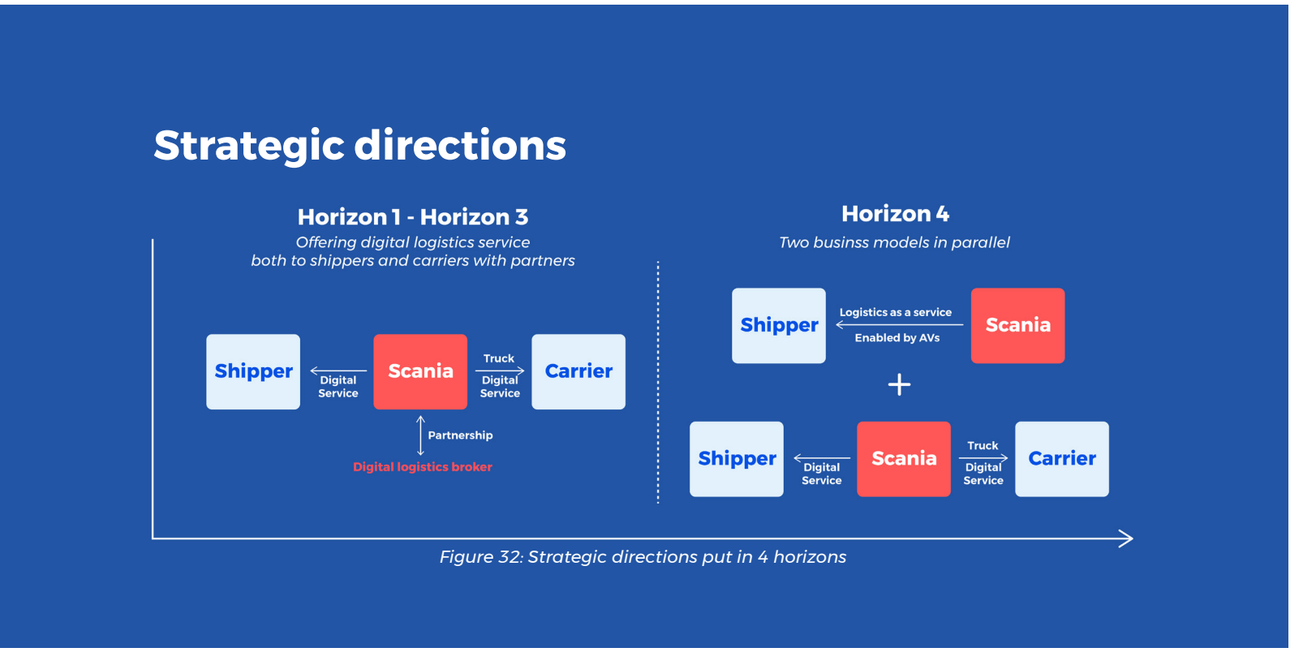


Figure 32: Strategic directions put in 4 horizons

Scania as a logistics service provider to link shippers and carriers with value-added services enabled by data-driven insights. In this way, Scania will also boost the current business of selling trucks to carriers as more digital transport and logistics services are followed to optimize the carrier's transport operation process and meet their real needs. The main target carriers would be these small-to-medium sized companies that have relatively lower innovation capabilities to choose to build up their own ecosystem. As for shippers, Scania will be the middleman ensuring optimized and sustainable transport services and enabling shippers and carriers to share transport-related data and reduce the information gaps. This short-term strategy also aligns with Scania's company vision being a leader in sustainable transport solutions.

Horizon 4

Two main business model in parallel

In the long term, two main types of business models go in parallel. When Scania has the capabilities of manufacturing Autonomous vehicles and building autonomous back-end control system, Scania can offer Logistics as a Service directly to the shippers, which will tremendously transform how Scania does the business in the future. This is because Scania will have the capabilities to provide logistics services with partners and build relationships with shippers enabled by the short-term strategy. Scania will continue to expand the hub-to-hub autonomous operation sites globally and run the operation itself mainly to big shippers through the digital freight-matching platform.

The long-term strategy does not mean that Scania will give up the business of selling trucks as the freight transport market is huge, and transportation operated by autonomous vehicles will only take a small part of it in ten years. Many transport companies will still buy electric trucks from Scania. Therefore, Scania will be able to offer transport systems with the end-to-end logistics process covered in the future.

6.2.3 Defining value drivers

To further imagining the future vision and the ideas of digital logistics services enabled by data-driven insights, the main value drivers of the newly chosen target groups were well defined based on insights from trend research and context analysis. Some rough value drivers were also came up with by the participants in the value mapping session and organized by the author. All the ideas or services developed in the later stage should be based on these main value drivers.

Value drivers for shippers:

1. Transparent transport insight sharing

True transparency starts with data and visibility. Based on the analysis of actors' needs, It becomes clear that shippers desire to increase the transparency of their received transport services by data sharing. They expect to reduce the information gaps and easily get informed about the positioning of trucks, goods condition, actual routes, type of truck used, unexpected transport events. Therefore, they can proactively react to it, choose the right transport partners, and provide better customer experience for the end consumers.

2. Sustainable transport partner

Increasing environmental awareness of the whole society and tighter environmental regulations enable shippers to expect more sustainable transportation services. This does not only mean they will only choose the transport partners owning eco-friendly trucks but also shippers value the exact transport operation efficiency, which is one of the most critical criteria to reduce the CO2 emission. Getting data-driven insights from carriers on their transport operation efficiency could help shippers to evaluate their transport partners.

3. Information reliability & accuracy to boost logistics

Once the transparency of transport operations is achieved and available for shippers, they expect to receive accurate and reliable transportation information from transport providers to boost the efficiency and automation of their logistics activities such as warehousing and enable their supply chain lean, flexible and cost-efficient.

> *" At the heart of roadmapping are the **user values** that drive the future timing of innovation. Only when users embrace a new innovation, when there is **a close connection between their value wishes, desires and needs,** and only when the time has come that a critical mass agrees on the value of the innovation, it can become successful."*
> — Lianne Simonse (2018)

Value drivers for carriers:

1. Controllable transport flows

Carriers value controllable transport operations from connected assets to drivers in one view. It enables transport planners to increase the utilization of assets, and they can then efficiently plan and execute transportation.

2. Effortless transport experience
To a large extent, transport planning is a manual process, and with plenty of paperwork transferred around systems, partners, and drivers. Carriers expect to have a streamlined transport management solution covering all main parts of their workflow. Seamless connection, reliable data sharing, and the digitized process will help carriers to reduce the operational costs and save time. Meanwhile, once the electric trucks are ready, transport planners and drivers also highly value effortless transport experience that takes everything considered.

3. Enabling operational efficiency
To fully utilize the data collected from assets and drivers, carriers further expect to optimize the transport and fleet management and achieve operational efficiency through having predictive and reliable data insights and automated decision-making. Enabling operational efficiency helps carriers to have less empty runs and reduce the operational costs and manual work, and deliver efficient and sustainable transport services to shippers.

6.3 FUTURE VISION

Based on these defined value drivers, some rough ideas were come up with (see Appendix 3) and discussed in the second value mapping session. The future vision was defined in the end by the author and validated with Scania's employees.

Who are our future customers?
Scania's future customers will not only be **carriers** but also expand to **shippers** such as LSPs, manufacturers, wholesalers who require transport services. The main business will still focus on regional and cross-regional transport instead of city transport.

Aligning with Scania's company vision
The future vision will be under Scania's company vision shifting towards a sustainable transport ecosystem provider instead of only being OEM.

Scania as a sustainable transport ecosystem enabler, providing customers *collaborative and optimized* logistics solutions powered by open innovation to drive their business forward.

What logistics solutions?
In the short term, Scania provides digital logistics solutions, focusing on **transport information sharing** between shippers and carriers and **transport operation optimization** by using data analytics and partnership with digital logistics brokers.
In the long term, **Logistics as a Service** will be provided to shippers through brokers and Scania's back-end autonomous control system.

Based on core user values
- Enabling shippers and carriers to **collaboratively achieve efficient transport services** and **value co-creation** by digitizing transport workflows, sharing transport insights, and proactively making decisions.
- To achieve sustainable and efficient transport, **the transport operation needs to be optimized** by delivering dynamic, predictive, and accurate transport information.

All the specific user values presented before can be concluded into these two words.

Why open innovation?
Customer level:
Customers need to capture data across various stages of the logistics chain and share digital data across systems with business partners to achieve value co-creation. They need to be willing to open up their data access and have the capability to decide what to share.
Service level:
Scania's new data-driven offerings should be based on open innovation by integrating external analytics capabilities. The service offerings should be easily integrated into customers' systems, allowing them to expand their business.

6.3.2 Requirements

To realize this future vision, Three main requirements should be considered.

1. Collaboration is the key

Internal

As this strategy involves multiple elements, including service development, connectivity, automation and electrification, Scania's internal R&D department and service development team need to agree on how Scania's future will be and then co-create the solutions.

External

Scania have had a more focus on hardware development. Limited software development skills such as artificial intelligence and big data analytics could be one of the reasons to slow down the data-driven service innovation. To enable fast and agile service development and compete in this disruptive market environment, Scania needs to quickly identify and implement services through collaborating with some analytics service providers. Some analytics service providers offer logistics and transport-related software packages with APIs that can be easily integrated into Scania's new services. Some recommended initiatives are provided in the tactical roadmap.

Since the future is to offer Logistics as a Service to shippers directly, the partnership with digital logistics brokers is of great importance. Meanwhile, digital logistics brokers will be the primary medium to match carriers and shippers in the short term. As Scania fully invested in Sennder, a digital freight matching platform, the collaboration should be sped up to develop new data-driven services and run pilot tests.

2. Data security assured

Since the new service offerings work with large amounts of data, including both business-related data of customers and personal information such as drivers, Scania has to strictly follow GDPR to get the customer consent and always be transparent with data use. To ensure better data security, partnering with data security vendors such as blockchain initiatives would be a promising solution for transparent and reliable data transactions.

3. Legal compliance

Export control

Export control regulations between nations apply to not only physical objects, but also data. Scania is moving into the new business around digital services driven by data. Therefore, this requirement also needs to be considered while developing data-driven services that enable data transfer between different organizations. Export-controlled data is any information that cannot be released to foreign nationals or representatives of a foreign entity without first obtaining approval or license. Meanwhile, If data is covered by Export Control Regulations, there will typically be a license that defines who can see that data. Thus additional controls have to be put in place for that data. Only those entitled to see the data will be granted access.

Competition law

It is a consistent theme that existing competition law should be sufficient to ensure the development of a fair and undistorted market (TRL, 2017). The implementation of retrieving vehicle data from the vehicle manufacturer's back end server and developing digital services to customers may have significant liability implications among OEMs. Other OEMs may be unwilling to allow access to other OEMs as the risks of allowing access will outweigh the benefits and create a competitive advantage for their competitors (TRL, 2017).

Roadmapping

This chapter presents the designed service product systems and final deliverables. Product service systems have been generated within the scope of strategy direction. In each horizon, service proposition, user values, detailed design solutions, busienss model and collaborations are presented. A time pacing strategy is proposed to define the timeline for each horizon. The strategic and tactical roadmaps are presented in the end with all main design elements, followed by the concept evaluation.

Chapter overview

07

7.1 ROAPMAP HORIZONS

7.1.1 Overview of design solutions

This thesis proposes four main design solutions that have a significant role in realizing the vision and leverage the potential of data and analytics. The solutions are all linked together, and each new design solution are built on the previous one. Meanwhile, Scania's current service offerings and planned service and technology development are considered and linked to these design solutions. Moreover, the design solution in every horizon involves different parties and stakeholders. Figure 33 presents an overview of design solutions that are roughly divided into time frames, including current status. The actual time frames are further detailed in the next sub-chapter.

The **current status** of Scania's service offerings mainly focuses on increasing the uptime of vehicles. The main customer segment is carriers, and Scania provides them connected services to manage their fleets such as flexible maintenance contracts and Fleet Management System.

The design solutions in **horizon 1** focus on connecting shippers and carriers in the cloud where they can seamlessly communicate and share the transport information about their transport schedules, updates, real-time position of goods and trucks, etc.

In **horizon 2**, once the data has been collected and shared, the focus shifts towards the optimization of the transport operation process driven by data analytics that enables accurate, predictive, and dynamic data insights for shippers and carriers. Digital logistics brokers are involved to match carriers and shippers to increase capacity utilization. The goal of this horizon is to achieve sustainable and efficient logistics and transport management.

Entering into **horizon 3**, when the electric vehicles are ready, the smart routing and power charging service will provide carriers effortless transport experience with EV and deliver more sustainable transport services to shippers.

In **horizon 4**, Scania will transform towards a transport ecosystem enabler, providing Logistics as a Service directly to shippers with autonomous vehicles through Scania owned digital logistics network and the experience of transport and logistics management accumulated in previous horizons. It enables an entirely new business model in the end.

Figure 33: Overview of the fianl design solutions

7.1.2 Horizon 1: Connecting & Sharing

This subchapter presents the design solutions for horizon 1, that expands Scania's current service offerings and solves customer's existing unmet needs.

Service proposition

*Enable **visible** and **controllable** transport operation for both carriers and shippers through **seamless data orchestration and sharing**.*

The design solutions in this horizon aim to create a cloud platform where shippers and carriers can work digitally in a controlled, reliable, and transparent manner through data orchestration and sharing. Since information gaps mentioned in the context analysis are the main problem causing the inefficiency, and in transparency of transport operations, a logistics cloud is proposed where carriers can take control over their assets and drivers and share the transport events to shippers. Customers can connect their existing transport management system, fleet management system to the logistics cloud to easily share transport information such as transport order and schedule, truck positioning, etc.

What is in for customers?

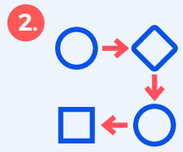
Carrier

1.

Single unified interface controlling all available assets.

Carriers can control and track all their vehicles and trailers in one unified interface without any hassles. No matter what FMS services they have been subscribed from third-party telematics providers, they are able to connect them to the cloud and have an overview of their assets.

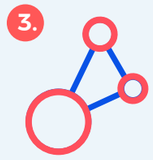
2.



Digitized and efficient workflows for transport planner and drivers.

All the transport workflows are digitized and paperwork is eliminated. Drivers and transport planners can communicate and update transport events to achieve the efficiency of transport operations.

3.



Reliable data sharing to business partners

Carriers can collaborate with shippers and directly securely share the transport information. Carriers decide what information is visible for who and who is allowed to edit. They can stay in control of what and how information is used.

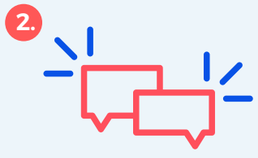
Shipper

1.

Transparency of delivery operations

Shippers are able to monitor their delivery operation, view where their cargo and chartered trucks are, when the driver is about to arrive at the warehouse or distribution hubs. It helps them increase the transparency of the delivery operation and wisely plan other logistics work.

2.



Seamless connection with carriers

Shippers can get a grip on their communication flow. When there is a delay or other unexpected transport events on the road, everyone involved in the transport operation can get notified and react to it.

Design solutions in visual

HORIZON 1

Figure 34 presents an overview of design solutions for horizon 1 with involved stakeholders, platforms, information flow, and back-end infrastructure.

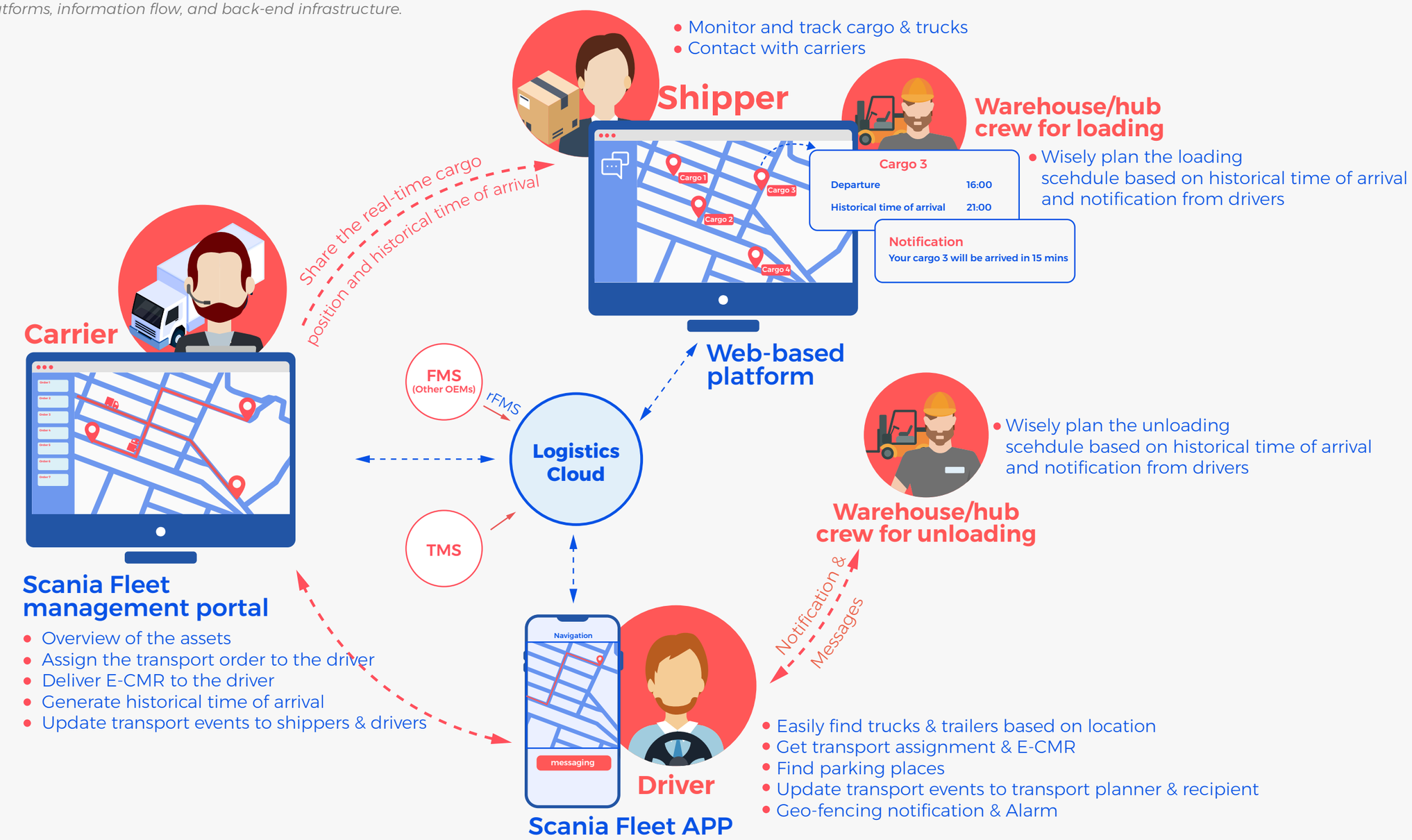


Figure 33: Visual of design solutions in horzion 1

Design solutions in detail

1. Logistics cloud

A logistics cloud where shippers and carriers can integrate and connect their management system and share information in real time. Carriers can integrate all their API vehicle data from third parties into the cloud with standardized vehicle data format (rFMS). Shippers can also connect their order management system or warehouse management system to the cloud. The cloud infrastructure is able to provide high quality data and data analytics services across a large client base, which builds the foundation for design solutions in horizon 2.

2. Platforms

Scania fleet management portal

The solution for carriers is based on Scania's current fleet management portal and extended to transport management. Through the portal, transport planners are able to have an overview of their assets such as tractors and trailers in real time.

Fleet APP

Fleet APP is Scania's current offering for drivers where they can view the vehicle performance and truck locations and communicate with fleet managers about the truck usage. In horizon 1, It will deliver drivers more values for their daily transport operation. Drivers can receive notifications via Fleet APP once the vehicle enters geo-fencing areas with traffic restrictions. Drivers are able to find the location of the assigned trailer at the vehicle depot or terminal as it has been connected to the system. Meanwhile, drivers can easily find the parking places on the way, which is one of the main requests from drivers as they have very strict driving time.

Shipper's web-based platform

Shippers can monitor the positions of their chartered trucks and cargo in real time through a web-based platform once their subcontracted carriers are willing to share transport information to them. They are also able to view the temperature and humidity inside the trailer to make sure the goods are in a good condition. With the real-time monitoring of transportation, they can wisely optimize the loading/unloading schedule.

3. Information flows

As one goal of the new service offerings is to enable collaborative transport operation through data sharing, three main information flows between stakeholders are defined. Apeendix 4 shows what detailed information is shared to each involved stakeholder.

1) Shipper – Carrier (transport operator)

Through the logistics cloud, carriers can share the real-time cargo and truck position, cargo condition and historical time of arrival to shippers. The historical time of arrival means that if the carrier offers transport services to one shipper on a regular basis, the time slot of delivery is normally the same and shippers can view the deviation of arrival time and deliver patterns based on historical arrival time. Therefore, warehouse crew can proactive prepare the loading activities. Figure XX illustrates how it works for shippers.

In addition, carriers can update the transport status through the platform where shippers will also get the notification about delay or any unexpected transport events.

2) Carrier (transport operator) – Driver

The connection between drivers and transport operators will be enhanced through digitalization. Transport operators can digitally assign the transport order and e-CMR to drivers via Fleet APP so that drivers can view the schedule and well prepare for the next delivery. Once drivers get the order, the location of the designated trailer is also shared. Drivers can easily update unexpected transport events such as traffic jams, truck breakdowns, enabling transport operators to actively make decisions and report to shippers. Once the delivery is done, drivers can finish the proof of delivery via Fleet APP and send it to the transport operator.

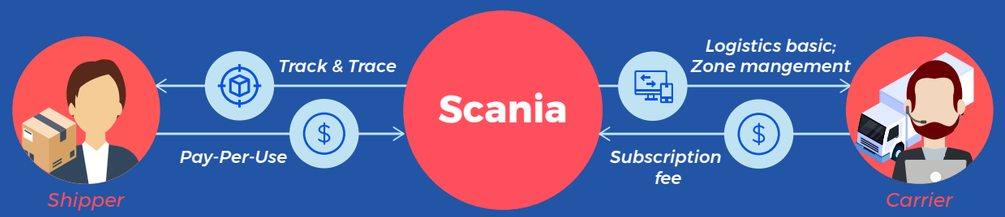
3) Driver - Loading/Unloading warehouse crew

Before drivers arrive at the warehouses or distribution hubs, drivers can send the notification to warehouse crew that the truck is about to arrive. This helps warehouse crew prepare the loading/unloading work in advance and get the forklift ready.

4. Data resources

As the design solutions in horizon 1 is to enable data sharing between carriers and shipper, which requires data standardization. A data model, OpenTripModel, is proposed. It l is a simple, free, lightweight and easy-to-use data model, used to exchange real-time logistic trip data on the web.

Business model



Value capturing is one of the core components of business models, describing how the value proposition is turned into revenue for the company. In horizon 1, Scania, as a digital logistics solution provider offering logistics cloud with value-added services to carriers and carriers can pay the subscription fee in turn for the service called Logistics basic and Geo-zone management.

Scania offers the logistics cloud, mainly track and trace services for shippers and shippers pay per track in turn. Currently, some shippers now are willing to pay per transport service for tracking the trucks. Meanwhile, customers are usually skeptical about subscriptions if they don't use it regularly. The revenue model of Pay-Per-Use is a way to get revenue for every transport tracking and give the customers the flexibility to use the services when they need it. Therefore, the revenue model towards shippers will not be subscription-based but Pay-Per-Use.

7.1.3 Horizon 2: Optimizing transport operations

This subchapter presents the design solutions for horizon 2, that leverages data analytics to optimize the transport operation and create data-driven services.

Service proposition

*Delivering **sustainable and efficient** logistics and transport management services to customers via **data-driven decision making** and **integration of digital logistics brokerage platforms**.*

The design solutions in this horizon aim to deliver sustainable and efficient logistics and transport management services mainly to carriers and link shippers to carriers through logistics brokerage platforms. The smart transport system, one of the main offerings in horizon 2, enables carriers' daily transport operation being more dynamic, predictive and reliable by aggregating various external and internal data sources and applying big data analytics to make decisions automatically. In turn, shippers can strategically choose the right transport partners through digital logistics broker platforms and receive on-demand, sustainable and efficient transport services.

What is in for customers?

Carrier

1.

Optimized capacity utilization by freight sharing

Sharing transport capacity enables the allocation of idle operational capacity to its best use and decreases TCO. Carriers can optimize their capacity utilization by getting on-demand transport orders through the integrated digital logistics platform or consolidating multiple orders based on delivery schedules, locations, etc.

2.

End-to-end digitized transport management process

Through integrating digital logistics broker platforms into transport management, carriers can have end-to-end digitized and streamlined transport management processes including ordering, transport planning, execution, reporting, payment, insurance, etc through one platform.

3.

Enhanced operational efficiency by data-driven insights

Transport operation can be improved by delivering data-driven transport insights to carriers. Carriers can benefit from dynamic transport planning, predictive and accurate transport information, transport exception updates, etc. Meanwhile, achieving excellent transport operations are likely to build solid relationships with shippers.

Shipper

1.

Flexible and on-demand transport services

With the integration of the digital logistics broker platform, shippers can flexibly manage their transport demands and benefit from on-demand and reliable transport services, thus having less storage spaces and making the supply chain more lean.

2.

Accurate and reliable transport information sharing

Shippers are able to get accurate and reliable transport information from carriers. It benefits shippers to improve the efficiency and automation of their logistics activities such as warehousing and goods handling.

Design solutions in visual

HORIZON 2

Figure 34 outlines an overview of design solutions for horizon 2 with involved main actors, platforms and partners, main information flows, explaining their relationships.

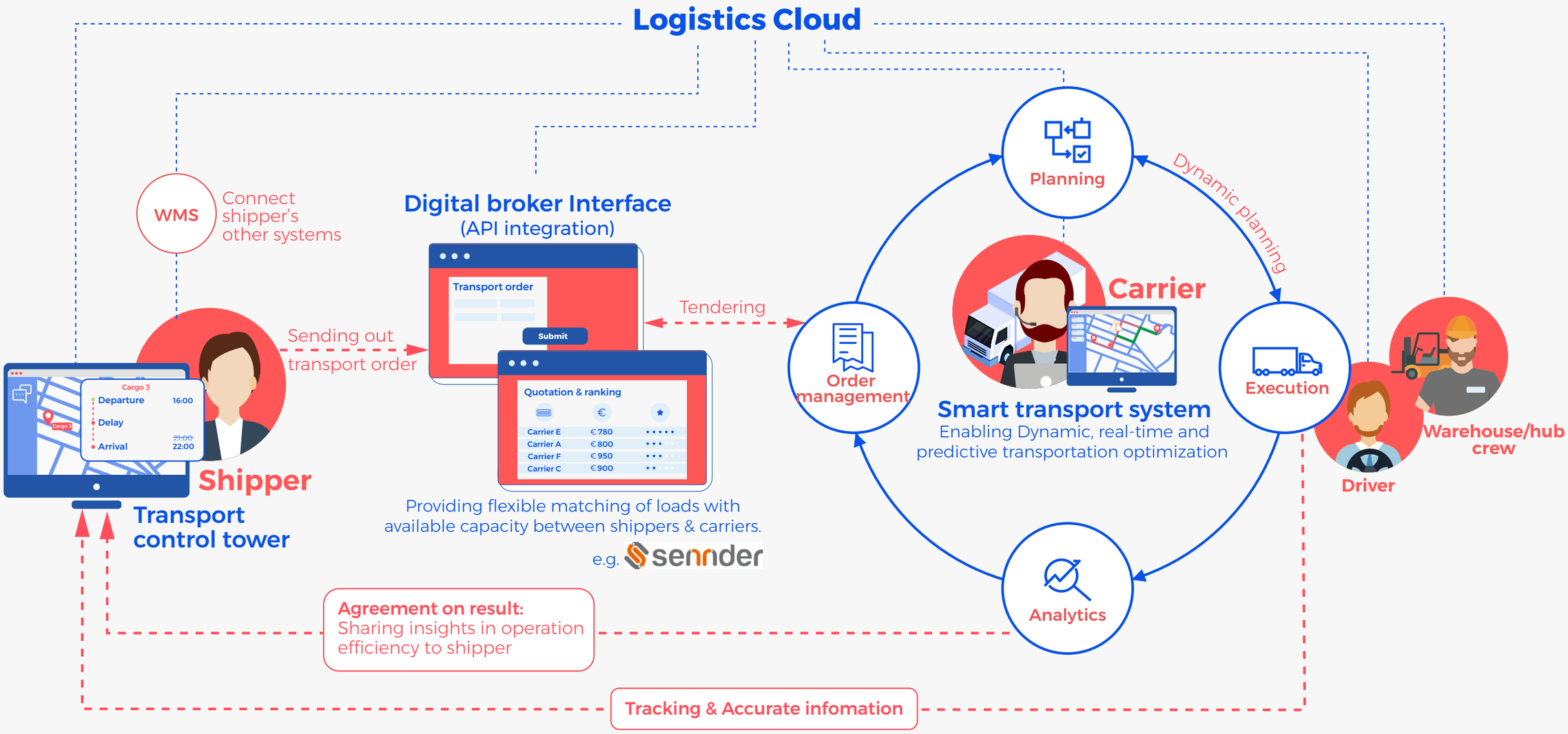


Figure 34: Visual of design solutions in horzion 2

Design solutions in detail

Platforms

Smart transport system

A real-time, cloud-based, optimized transport management system that enables carriers to utilize assets efficiently, orchestrate, plan, and execute transport tasks via data-driven insights and offers streamlined connectivity to business partners and external systems.

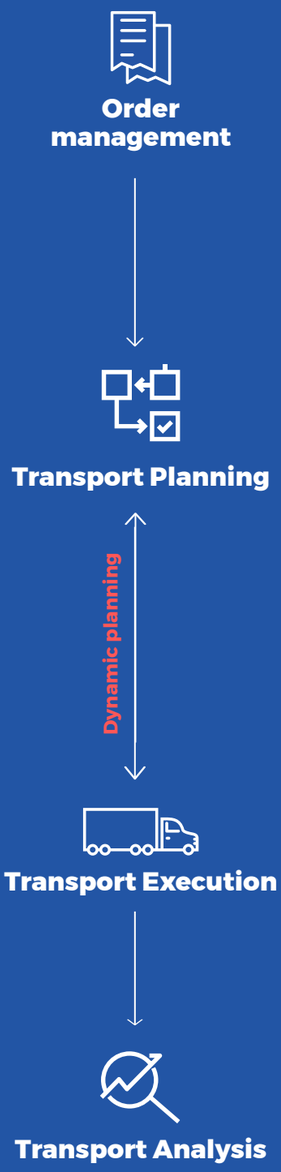
The smart transport system is updated from horizon one design solutions that focus on controlling assets and sharing actual transport information. The smart transport system consists of four main stages:

- *Order management*
- *Transport planning*
- *Transport execution*
- *Transport Analysis*

The main goal of it is to aggregate various data sources from Scania's other connected service offerings such as tachograph, geo-fencing management, vehicle performance as well as external data sources. It also leverages data analytics to optimize the transport operation, enabling better transport experience.

Developing the Smart transport system is based on the concept of building an API economy as it has the potential to integrate and leverage external capabilities rather than build all features by Scania itself.

Smart transport system – Main features



With the integration of digital logistics broker platforms, transport planners can automatically consolidate orders from the platform and regular transport orders from frequent transport buyers. Based on routes, capacity, delivery schedules, two or more transport orders can be combined to increase the capacity utilization and reduce the operation costs. Notifications can be sent out to transport planners if there are proper transport orders for freight sharing. The tender sent out will also be competitive due to less empty runs.

During the transport planning, transport planners can wisely plan the transport schedules, transfer the orders to drivers with all information included and also share the schedule and ETA to shippers.

1. Automatically matching orders to the driver and truck:
Based on the truck availability, maintenance service plan, driver schedules and remaining driving time and current locations, the transport planner can get suggestions on what order should be assigned to which driver and truck.

2. Optimal route planning:
The Smart transport system can generate the optimal routes by aggregating and processing the data of geo zones, historical traffic and weather conditions and stops.

3. Precise ETA:
ETA can be automatically generated including driving time and resting time, speed limits in geo zones, historical and real-time traffic and weather conditions (Figure 35)

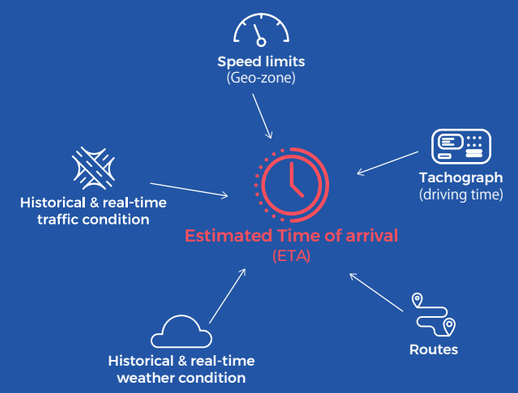


Figure 35: Estimated time of arrival data source

During the transport execution, more stakeholders are involved and transport exceptions might happen frequently. The smart transport system allows dynamic planning during the transport execution, which means that routes and ETA can be automatically renewed based on real-time information. It enables transport planners to make new decisions proactively. Meanwhile, drivers can know what they should do next and all involved stakeholders from client sides can be informed of the delay in time. Since warehouse/DC are connected, the information about the loading/unloading time slots is available. The low punctuality of delivery can affect the existing delivery schedule. When there is congestion in the dock due to delays, transport planners and drivers can choose to automatically get updated to arrive later at another time slot. It helps to reduce the idle time of vehicles and the pressure of the dock traffic.

1. Dynamic route planning and ETA
2. Drivers and clients (autonomatically) getting updates
3. Automatically sending notification to the warehouse / DC before arriving

Once the transport is done, transport planners can get insights in operation efficiency and share it with shippers as well. Insights include idle time, loading/unloading time, actual routing, CO2 emission, fuel consumption, driving behavior, etc. It helps shippers and carriers to improve the transport operations collaboratively.

Digital logistics broker interface

The role of digital logistics brokers is to provide flexible matching of loads with the available capacity between shippers and carriers. The platform can be integrated into the smart transport system via API, enabling the seamless connection and data sharing among the shipper's platform, digital logistics broker platform and the smart transport system for carriers.

One of the disadvantages of utilizing digital logistics brokers is the difficulties in guaranteeing the quality of carriers. The smart transport system can share the transport analytics insights to the platform once carriers agree with it. Through this way, platforms can evaluate carriers' quality and level of sustainability based on the types of owned trucks (alternative fuels, diesel, electric), enabling shippers to find the reliable carriers and shifting their transport demands to the platform instead of contracting with LSPs.

Sennder, Scania's fully invested digital logistics broker, can initiate to provide its customers with the freight matching platform with an integration of the smart transport system, to gain more customer base.

Transport control tower

A transport control tower (platform) is offered to shippers to increase the visibility and efficiency of their supply chain. Shippers can connect to the digital logistics broker's platform, monitor and track all their cargo, chartered trucks, and get informed of all the transport operation information. Shippers can also connect to their other management systems or warehouse management system. It allows the warehouse/DC to manage the yard efficiently, define the workflows of loading/unloading crew wisely, and get the

Uncertainties of the design solutions

The phase of transport analysis included in the Smart transport system intends to deliver the report of transport operation performance for shippers, where the CO2 transport emissions per good are calculated.

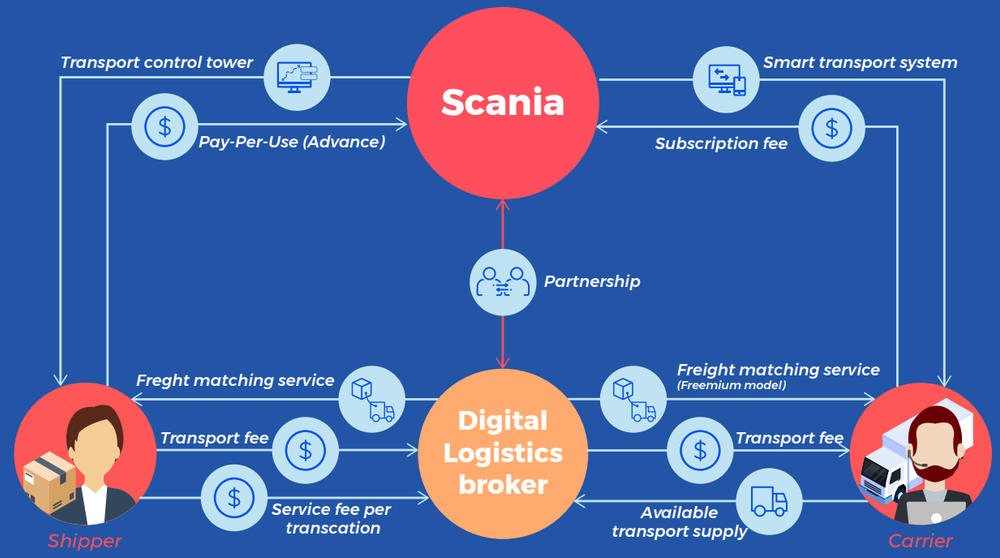
However, there is no agreed way to define the responsibility for the environmental impact of the goods. For example, a shipment from a shipper fills up 50% of a truck during transport. The question arises whether the CO2 emission generated should be attributed to the shippers based on the weight and volume of the goods or the remaining 50% of the empty truck should also be attributed to the shippers. It depends on how to define the ownership of the environmental impact.

One way is to follow the legal transfer of goods ownership stated in International Commercial Terms (INCOTERMS[1]). It states that the seller pays for the carriage of the goods up to the named place of destination. However, the goods are considered to be delivered when the goods have been handed over to the first or main carrier, so that the risk transfers to buyer upon handing goods over to that carrier at the place of shipment in the country of Export.

Another issue is the need to integrate with fuel suppliers to differentiate between the types of fuel used in vehicles since there is no way for the truck to identify the type of fuel.

1. An incoterm represents a universal term that defines a transaction between importer and exporter, so that both parties understand the tasks, costs, risks and responsibilities, as well as the logistics and transportation management.

Business model



In horizon 2, The platform of digital logistics brokers is involved as a partner in the ecosystem. The role of the digital logistics broker is primarily to provide freight matching services to bridge shippers and carriers. According to the business model of most digital brokers, shippers pay the service fee for each transaction, while the freight matching service for carriers is based on a freemium model. Digital logistics brokers as a middleman to transfer the transport fee to carriers.

Scania in the ecosystem is to provide value added services in transport management to shippers and carriers. The smart transport system is offered to carriers to optimize their end-to-end transport operations and carriers in turn pay the subscription fee to Scania. The service offering is an advanced version of Logistics basic offered in the first horizon. On the shippers' side, Scania provides them a transport control tower that includes more value added features such as precise ETA and transport analysis report to help shippers improve the efficiency of their supply chain management. In turn, Shippers still pay for on a by-usage basis and the charging fee is higher than that in horizon 1.

7.1.4 Horizon 3: EV transition acceleration

This subchapter presents the design solutions for horizon 3, that respond to the megatrends in electric vehicles and mainly focus on improving the transport experience of EV.

Service proposition

*Accelerating the **transition to EV** by providing customers **effortless transport experience** with smart routing and power charging services.*

Context

With the increasing air pollution, environmental awareness and regulations, moving towards sustainable transport solutions seems to be the key to drive the future business of transport companies. Electrification has been a fundamental element of this transition. Besides the sustainability concern, the total cost of operation for an electric vehicle will be lower than for a combustion engine in the future. Within five years, electrified vehicles will do most of the transport work, especially in urban areas. For long haulage, super-charging infrastructure might be solutions.

In the early adoption, carriers and drivers might be afraid to adopt electric, especially fully electric vehicles due to little knowledge about its performance and usage and the lack of public power charging services. Except getting fully power charged in the vehicle depots, the services around the routing and power charging availability is of great importance to reduce the “range anxiety” and de-risk the use of them. Therefore, the design solutions in horizon 3 aim to accelerate the transition to EV by providing customers, mainly carriers, effortless transport experience with smart routing and power charging services.

Smart power charging system

A smart power charging system is proposed in this horizon, which can be easily integrated into the smart transport system delivered in horizon 2. The smart power charging system will cover all the elements related to transport experiences from supporting transport planning such as route planning to supporting drivers to fulfill transport tasks better with EV. This is mainly because the actual transport planning and execution for EV is different from traditional trucks due to the location, availability, charging time, etc of power charging infrastructure.

What is in for customers?

Shipper

1.

Getting sustainable transport services

Shippers are able to work with more sustainable and emission-free transport providers having EVs through the platform and the quality of transport services will still remain the same as the transport operation for EV is also optimized by Smart power charging system.

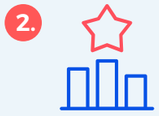
Carrier

1.

Effortless transport experience with EV

Driving with EV could be a hassle for drivers. With Smart power charging system, drivers are always able to view the battery capacity in real-time and have access to the power charging network on the road, which helps to relieve the range-anxiety. Same for transport planners who need to coordinate a fix of fleets, they are able to quickly customize the routings and generate ETA specific for EVs without any effort.

2.



Improved company ranking with EV

Investing EV can be costly and it has to be worthy. Carriers can improve their company rankings shown in the digital logistics broker platform, enabling stronger competitive position and gaining more customer base.

Design solutions in visual

HORIZON 3

Figure 36 outlines an overview of design solutions for horizon 3 with the structure of smart power charging system and involved stakeholders, platforms, infrastructure, etc.

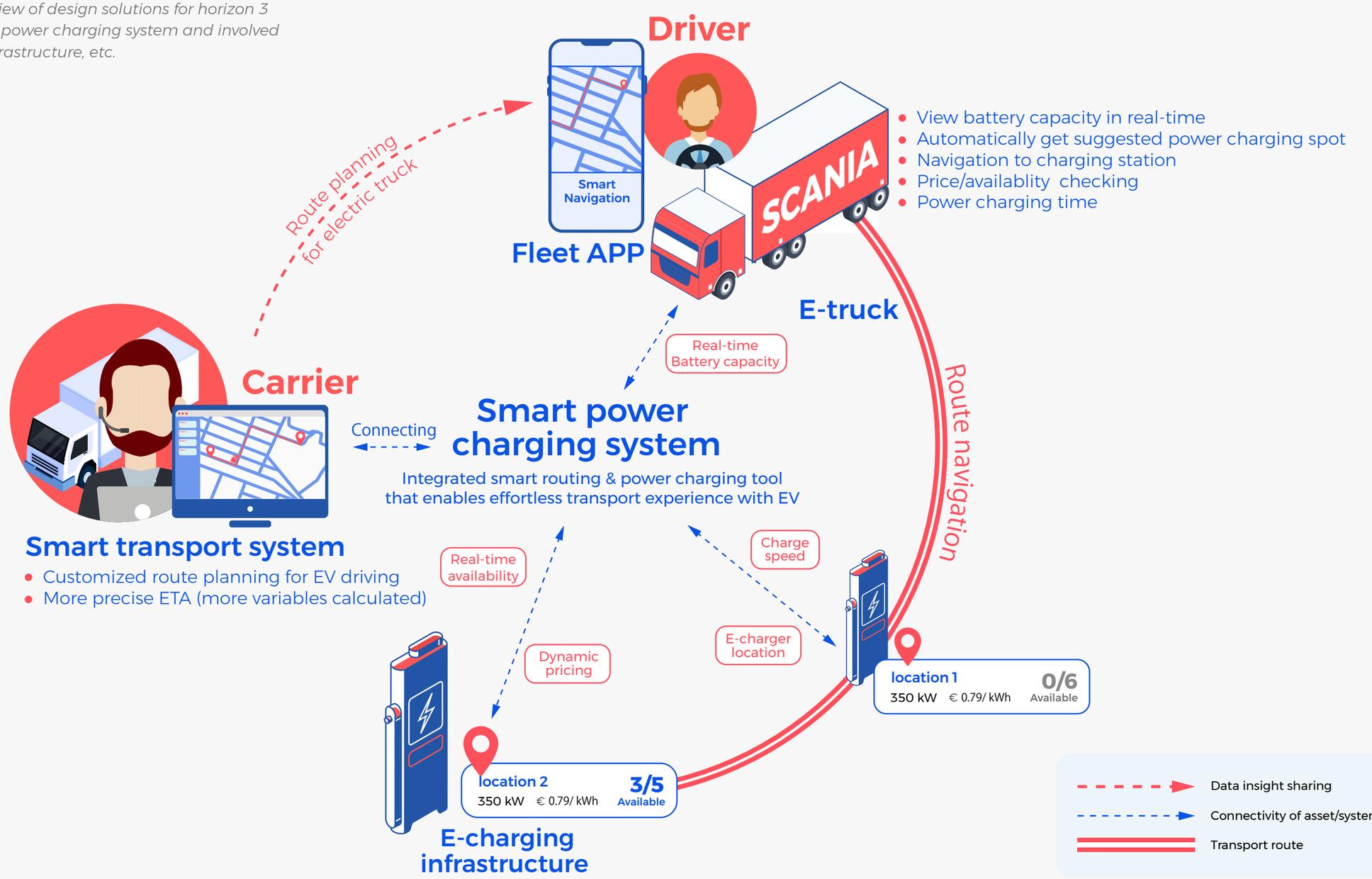


Figure 36: Visual of design solutions in horzion 3

Design solutions in detail

Integration of systems

Smart power charging system can be easily integrated into Smart transport system launched in horizon 2, by having access to API. It gives transport planners data-driven insights for planning the EV routes and more precise ETA that aggregates more data sources. Same with previous design solutions, it also allows dynamic planning during the transport execution based on real-time environmental variables, usage status of charging stations and real-time battery capacity. In the transport analysis, the CO2 report is specified for EV transportation that gives transport operational insights both to carriers and shippers.

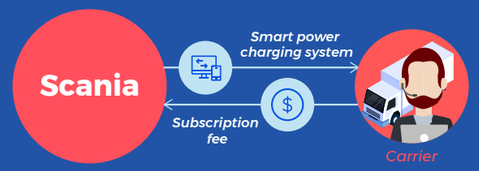
Optimized Driving experience

During the transport execution, drivers are able to use Fleet App to check the real-time battery capacity and automatically get suggested power charging spots if the battery capacity is low. They are able to view multiple locations, availability and prices and estimated charging time of the charging services. Once they choose the optimal one, the system will generate the best routes and navigation to the spot. This gives drivers the confidence to go electric.

Data intelligence

The smart power charging system uses various different variables to calculate the real-time range of electric vehicles. Variables such as charge speed, real-time battery data, congestion at charge stations, charging pricing are taken into account to calculate the best route to the delivery destination, with the optimal charge stations in between. The variables such as weather, traffic conditions, driving time that are included to calculate ETA for Smart transport system, are still included in Smart power charging system.

Business model



The Smart power charging system is offered to carriers with a monthly subscription. It can also be offered as a package with Smart transport system integration or offered solely.

Collaborations

Building such a smart power charging system is impossible for Scania to do individually. In order to gain the market niche, the development of this data-driven service should be fast identified. It will enable digital integrations with external partners and stakeholders such as charging service platforms, digital initiatives offering data intelligence tools for related power charging services, etc.

7.1.5 Horizon 4: Logistics as a Service with autonomous vehicles

This subchapter presents the design solutions for horizon 4, that focuses on transforming towards a transport ecosystem enabler.

Service proposition

*Transforming towards the **transport ecosystem enabler** by providing **Logistics as a Service** with **autonomous vehicles***

Context

Within 10 years, fully autonomous vehicles are expected for mass-market deployment. It will remove the manual task both from the driver and other actors in the transport systems.

Scania's efforts are geared towards developing an ATS control tower, also named intelligent control environment (ICE). This means that customer's transport can be followed and monitored real-time. TCO will also be heavily affected by autonomous driving with a huge cost reduction compared to a traditional truck. Scania could potentially provide Transport as a Service to large LSPs enabled by autonomous vehicles and ICE or could sell the autonomous vehicles to LSPs with the ICE services.

Logistics as a Service

A concept of Logistics as a Service is proposed in this thesis that leverages the transport network from Sennder, Scania fully invested digital logistics broker platform. Based on the design solutions from previous horizons, Scania has the capabilities to enable data sharing to shippers about transport operational information and the experience of operational optimization. Most importantly, Through Sennder's network, Scania are able to have access to big transport buyers that are Sennder's current customer based and the transportation is frequently run from a hub to another hub. Therefore, In horizon 4, A new business model is set up by offering Logistics as a Service directly to big shippers.

Scana still offers services such as smart transport system and smart power charging system to traditional transport companies as autonomous transport will only contain a small amount of transport market share within 10 years.

What is in for customers?

1.

Fully controlled and reliable transportation

Transport operations are fully controlled by Scania's back-end autonomous control tower and automated vehicles transporting goods on delicate highways with the reliable and efficient time of arrival and fewer human errors.

Shipper

2.

Integrated and automated logistics performance

Enabling efficient and smart supply chain management requires trucks to be integrated into real-time logistics data across the entire supply chain, from parts and materials suppliers to manufacturers to warehouses and distributors and finally to the end customer. Infrastructures such as warehouses, distribution hubs, automated forklifts are fully connected to the system. Logistics as a service offers shippers seamless connections with their supply chain management systems as well as automated transportation ordering and settlement via blockchain-based smart contracts, enabling an integrated, automated and transparent logistics performance. This increased transparency and efficiency will help shippers reduce the amount of time goods are stored in the warehouse and distribution hubs based on just-in-time delivery planning along the entire supply chain.

Design solutions in detail

Future scenario of automated logistics:

The freight matching platform, Sennder, will be seamlessly integrated and connected into the shipper's system (ERP), enabling **automated transport ordering and administration** based on shipper's transport demand. A blockchain-based smart logistics contract will be created to track shipments from the beginning to the end of the transport journey.

Scania's autonomous control system can receive transport orders from Sennder in a real-time manner. It initiates **automated transport planning** for autonomous vehicles based on delivery schedules, vehicle availability and real-time position, cargo volume and weight, routes and other related information.

Autonomous vehicles can receive transport tasks through the cloud and initiate **automated transport execution.** Autonomous vehicles on the road can proactively communicate with other vehicles (V2V), infrastructure (V2I) such as charging stations where autonomous vehicles can have **automated power recharging**. As autonomous vehicles are fully integrated into the supply chain, the vehicle can **automatically update transport status** such as ETA, cargo condition, breakdown through on-board computing system to involved parties across the logistics chain. The shipper's warehouse system can automatically assign each truck to a loading dock, where several autonomous forklifts stand ready to unload it **(Smart loading).**

Once the delivery is done, the blockchain-based system will automatically verify the delivery, check whether the goods were delivered in good condition (e.g., temperature, humidity) and the right place with the right time and based on IoT data. It enables the **automated transport settlement** by smart contracts and releases correct payments, increasing the efficiency and integrity of logistics performance.

Automated load optimization

Enabled by Sennder's logistics network that connects to many shippers, a large amount of transport demand is available to be automatically consolidated based on sensors its available space and weight, as well as scheduled route, ETA, etc. Likely, the autonomous vehicle can pick up shipments from the location of the ports, terminals to similar destinations where many factories are located.

Other related technologies

In horizon 4, more technologies are required than the design solutions in previous horizons. The hub-to-hub autonomous vehicles (level 4*) require the edge computing technology to transmit data with nearby vehicles and infrastructure and also to aggregate and process data in the on-board system. 5G network technology is also required to enable cost-effective and seamless connectivity. Blockchain technology should be adopted to increase efficiency along with the entire logistics and settlement process. As digitized shipment documents and real-time logistics data become embedded in Blockchain-based systems, this information can be used to enable smart contracts. These contracts can automate payment for autonomous transportation.

Business model

In horizon 4, the business model will be profoundly different from previous horizons. Scania will offer Logistics as a service directly to shippers and, in turn, shippers pay the logistics management fee and transport operation fee per order to Scania.

Collaboration

The further collaborations should be set up tightly with Sennder as it provides a significant amount of transportation demand from big shippers. A blockchain vendor should be involved to provide the back-end system.

Design solutions in visual

HORIZON 4

Figure 37 outlines an overview of design solutions for horizon 4 with the future scenario of automated logistics.

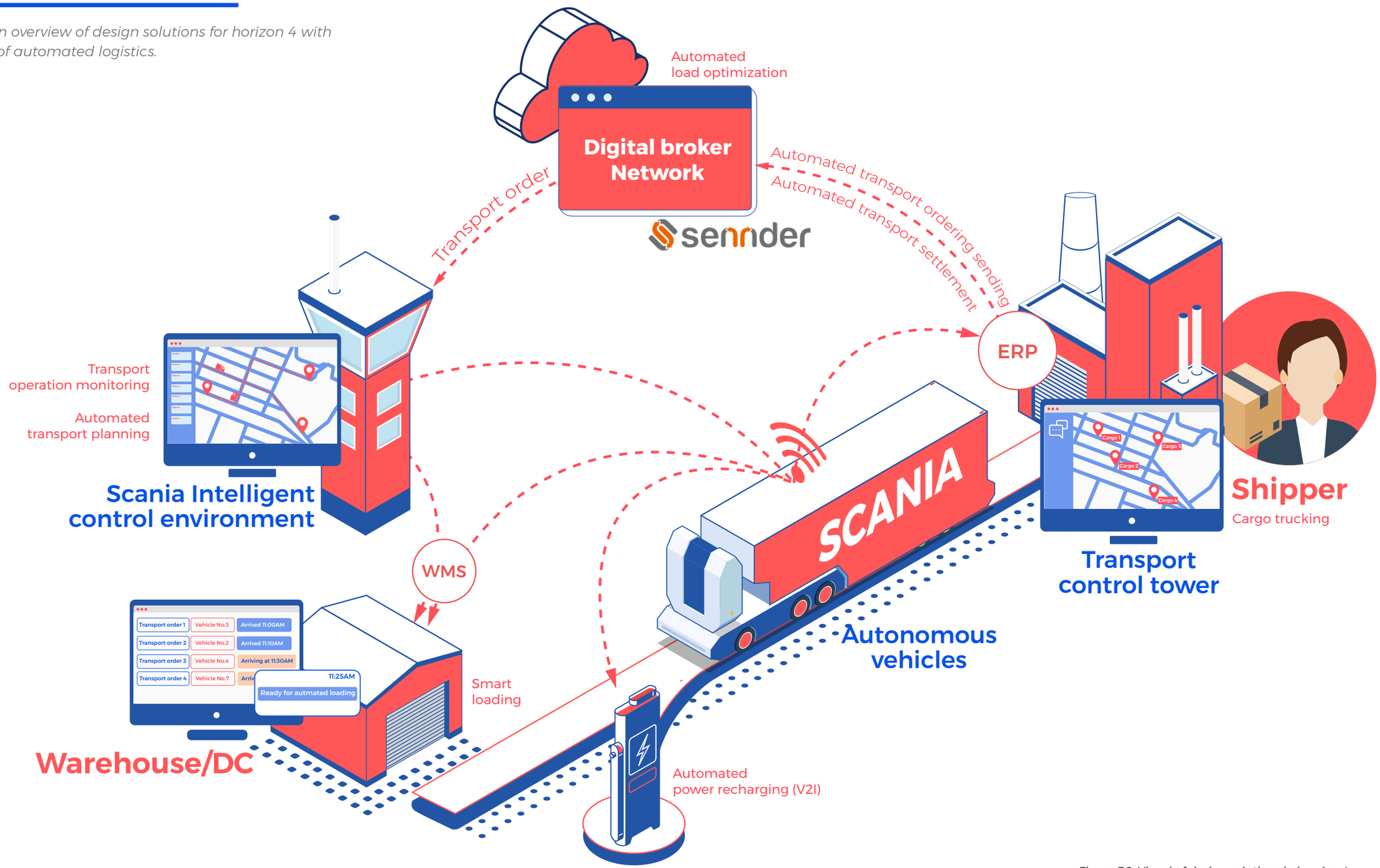


Figure 36: Visual of design solutions in horzion 4

7.1.6 Shifting towards systems of systems

Figure 38 presents the evolution of Scania's product service systems. In the current stage, Scania offers the product system (mainly fleet management system) that connects connected trucks, trailers, fleet managers and drivers to optimize the vehicle performance. By the end of the horizon 4, Scania expands beyond product systems to systems of system — that is, a set of disparate product systems offered by Scania as well as related external information can be coordinated and integrated.

Scania's fleet management system can integrate the FMS APIs from other OEMs and third-party telematics providers. The Smart transport system offered in horizon 2 integrates multiple customers' transport and logistics-related data sources as well as external data sources and analytics capabilities from business partners.

The external digital broker networks are involved and connected. The smart power charging system and autonomous transport system are developed by Scania to deliver customized services for customers in terms of electrification and automation. It is worth noting that the product service system proposed only covers part of Scania's current and future service offerings that focuses on logistics management and transport operation as Scania has a wide range of product and service portfolios for different applications.

These systems are value-added, interdependent, and unified into a cloud-based logistics system. Following this path, Scania is likely to redefine and broaden its industry and become a service provider with production in the freight transport industry.

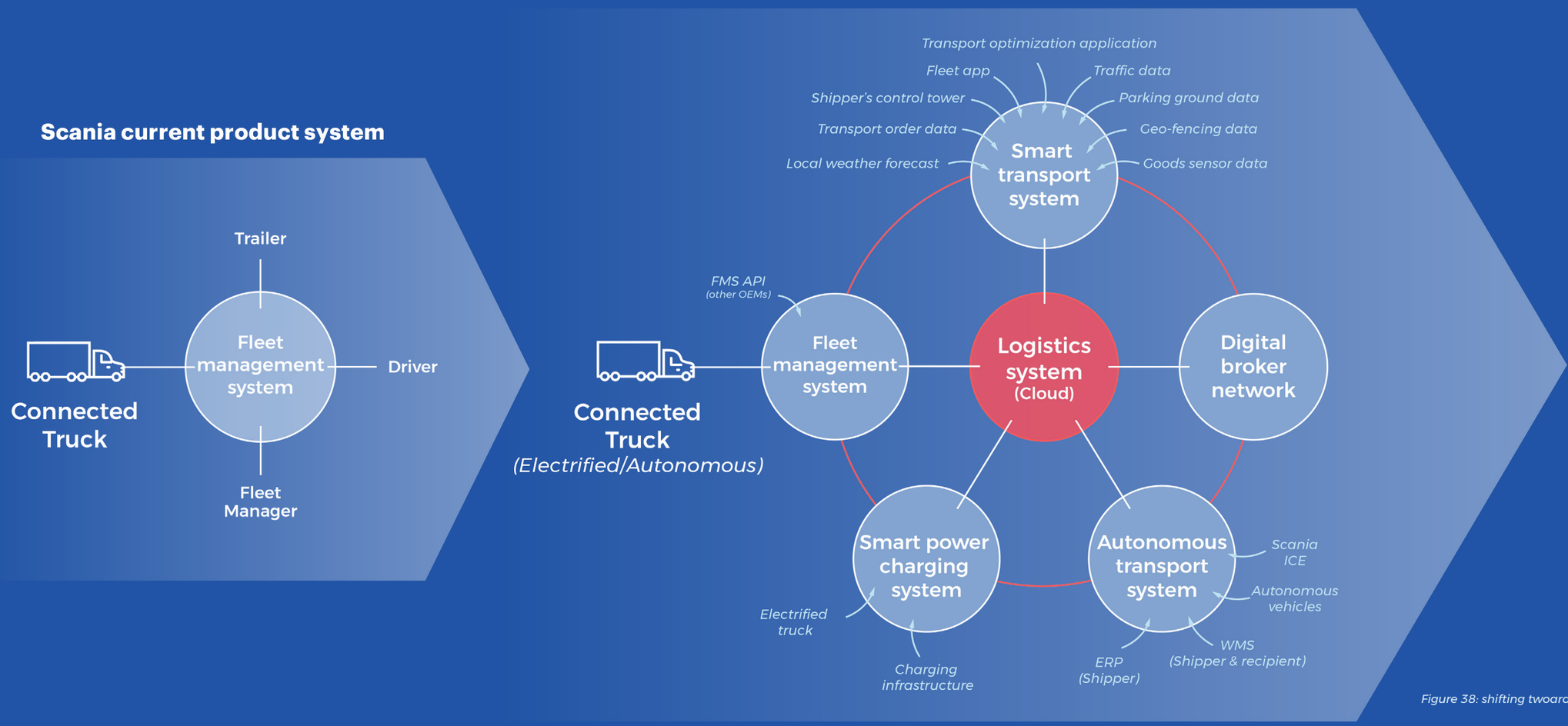


Figure 38: shifting twoards systems of systems

7.2 TIME PACING STRATEGY

The time pacing strategy for Scania is adapted from the strategic life cycles model of three horizons (Simonse & Hultink, 2017). The future timeline focuses on the future chronologically and pacing of opportunities of innovation, and built upon the change of customer needs and the technology developments (Simonse, 2018). The time pacing strategy for Scania is also based on Scania's 20-year connected service development timeline, resources, digital innovation capabilities and Scania R&D technology roadmap. See figure 39 for the time pacing strategy of this thesis.

Design value enhancement

The first phase concentrates on enhancing design value to current product or service portfolios. It brings value enhancement within the current target market situation, and therefore a short implementation and market launch would be desirable. It starts connecting shippers and carriers to share transport-related information within the logistics cloud. Carriers' assets such as Scania's trucks, trucks from other OEMs, and trailers can be connected and managed in the updated Scania fleet management portal. The services for drivers is also offered through Fleet APP that Scania offers to drivers currently. The required data analytics is linked to current projects in Scania R&D. Therefore no other data analytics capability is needed for horizon 1.

Thus, the first horizon is set to two years from 2020 to 2022. The first horizon aims to bring new versions to the market by a certain updated rhythm. Scania will still lose a certain strategic fit over time with its environment in this horizon because it involves a new customer segment and the concept of open source innovation is relatively new to Scania.

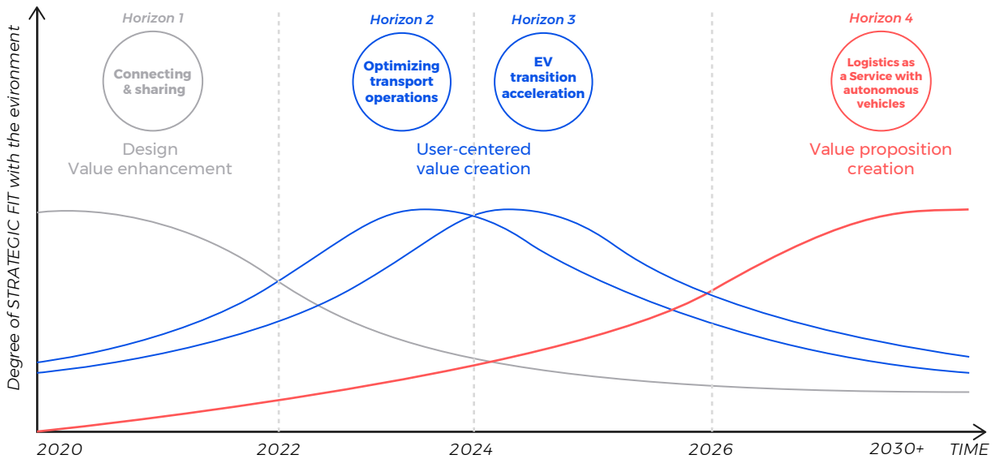


Figure 39: Time pacing strategy

User-centered value creation

The phase of user-centered value creation aims at creating new markets with new products and services that differentiate from the existing offerings. It also concentrates on compelling new user values that solve the dilemmas of users and tests new technologies.

The product service system offered in horizon 2 is to optimize transport operations through data-driven insights that key values in operational efficiency and sustainability for both carriers and shippers. The partnership is set up with digital logistics brokers to improve customer's capacity utilization and help Scania gain more customer base. As data analytics is highly required in this phase, Scania also needs to partner with more experienced analytics service providers, adapting their analytics capabilities into new service offerings. The second horizon is set to two years, from 2022 to 2024.

The transition to electrified vehicles can be accelerated once the transportation has been optimized. In horizon 3, Scania focuses on customer's transport experience with electrified vehicles. More partnerships are initiated, such as charging infrastructure providers, charging service platforms, digital initiatives offering data analytics tools for related power charging services. The third horizon is set to two years, from 2024 to 2026.

Value proposition creation

The third phase encompasses the creation of a new value proposition, with the integration of new technologies, new markets and new businesses. In horizon 4, The design solution of Logistics as a Service is proposed to deliver integrated and automated logistics solutions directly to shippers by leveraging autonomous vehicles and incremental innovations from previous horizons. It will disrupt Scania's business in the future.

However, fully adopting autonomous transportation requires inputs from shippers, charging infrastructure providers, road authorities, and the maturity of 5G and blockchain technology. The time pacing of horizon 4 is expected to be more long term. Therefore it is set beyond 2030, and Logistics as a service can likely become the leading business for Scania in 2035.

7.3 STRATEGIC ROADMAP

The strategic roadmap is used for external communication with stakeholders, business partners and involved parties. It presents the innovation strategy in an inspired and generic way without going into detail. The main idea of the strategic roadmap is to have an agreement on the company's future path.

The strategic roadmap is visualized in Figure 40. It presents the future vision, four horizons' service solutions with its value proposition. The value drivers for shippers and carriers are also linked to every horizon.

7.4 TACTICAL ROADMAP

The tactical roadmap is used for internal communication, aligning with the service development team, business management and R&D department in the organization. It is a detailed representation of all elements in the tactical plan.

The tactical roadmap is visualized in figure 41. It consists of four main elements: market, product service systems, technology and business.

Market

1) Service value proposition: the service value proposition is presented as a marketing statement that implies the service and main values that Scania can deliver to customers on every horizon.

2) Trends: Trends that are obtained from trend research are mapped out throughout horizons. It indicates the market foresight that Scania should follow in every horizon.

3) Values: The value section is divided into value drivers for carriers and shippers. As the service offering of horizon 4 is to deliver Logistics as a Service directly to shippers, the values mapped out in horizon 4 only imply shippers' values. Every value is linked to the trends and service elements.

Product service system

The product service systems mapped out in the tactical roadmap consists of its structure with visualization and service elements that describe the features. The service elements are linked to values and technologies.

Technology

The technology section is divided into three parts: data analytics, data streams and other related technologies. As one of the research questions of this thesis focuses on how data as a key resource can enable Scania's future services, the required data analytics and data streams are mapped out in detail and linked to main service elements.

1) Data analytics: Based on literature research, DIKW pyramid is used to describe the level of data analytics from data to wisdom, which is also applied to the tactical roadmap and helps Scania connected intelligence department to define technical requirements quickly. The bottom of the DIKW pyramid is the data layer, which is mainly about the available data sources. Therefore the data layer is not shown in this section.

2) Data sources: The section of internal input means that data could be obtained from Scania's current and future service offerings. The section of external input means that data sources are required from customers or other parties.

3) Other related technologies: It shows the other required technical capabilities to develop the services.

Business

The business section mainly describes the required external business resources and partnerships and business models.
The definition of visual elements is shown below to help readers better understand the format of the tactical roadmap (Table 3).

Definition of visual elements

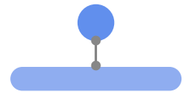
	*A trend that implies multiple values for customers in different hoirzons.*
	*A trend that implies a value for customers*
	A selected service component that links to the data analytics and data streams.
	*A service component that also requires data analytics and data streams, but is not shown in the roadmap.*
	A link between a value and a service component. (If it has more dots, multiple values or service components are linked)
	*The bigger the dot, the higher data analytics capability required.*
	The data streams required for data analtyics.

Table 3: Definition of visual elements

SCANIA

as a sustainable transport ecosystem enabler, providing customers ***collaborative*** and ***optimized logistics solutions*** powered by ***open innovation*** to drive their business forward.

Horizon 4

Transforming towards the transport ecosystem enabler by providing **Logistics as a Service** with **autonomous vehicles**

Horizon 3

Accelerating the **transition to EV** by providing customers **effortless transport experience** with smart routing and power charging service.

Horizon 2

Delivering **sustainable and efficient** logistics and transport management to customers via **data-driven insights** and the integration of digital logistics brokers.

Horizon 1

Enable **visible and controllable** transport operation both for carriers and shippers through seamless **data orchestration and sharing**.

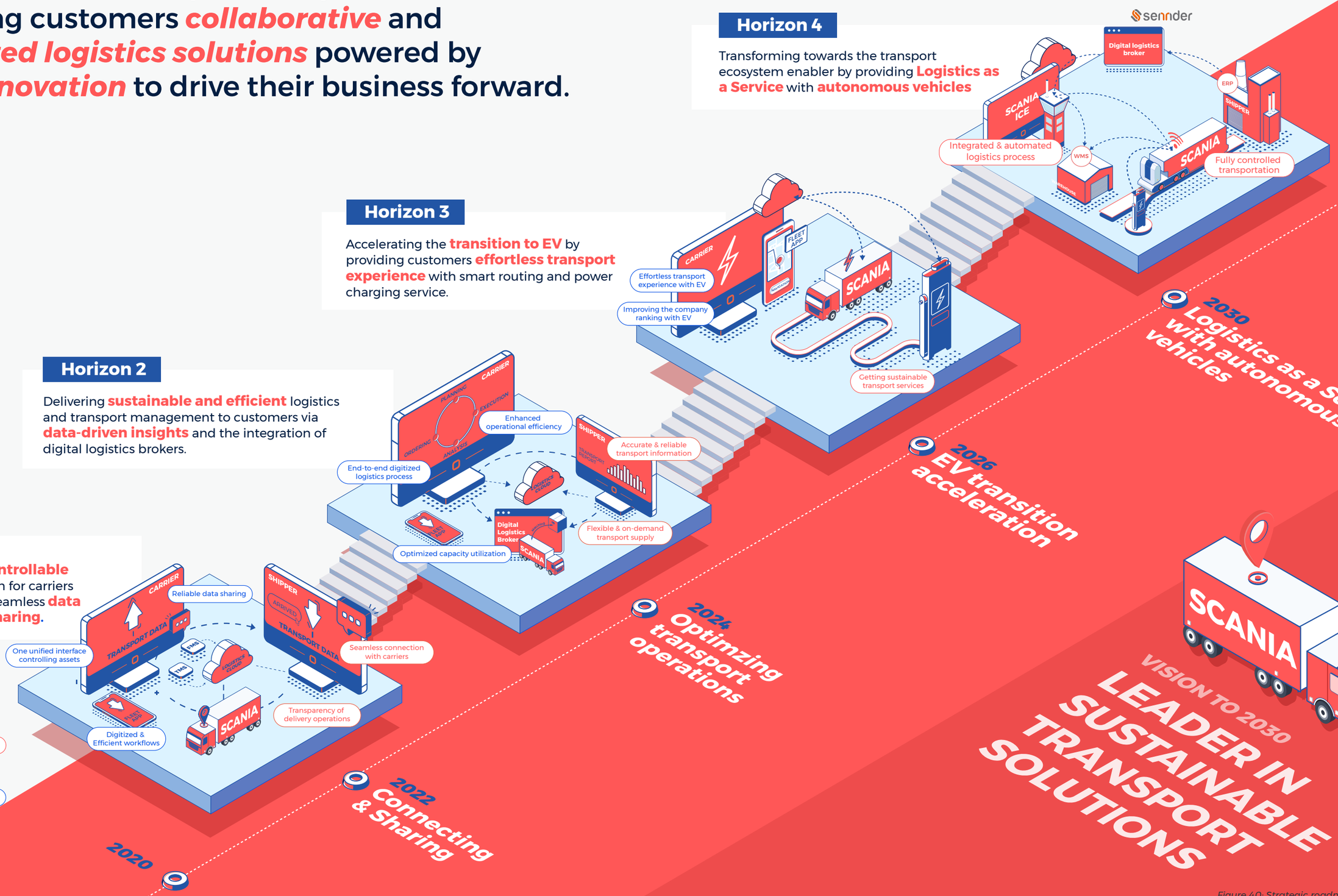
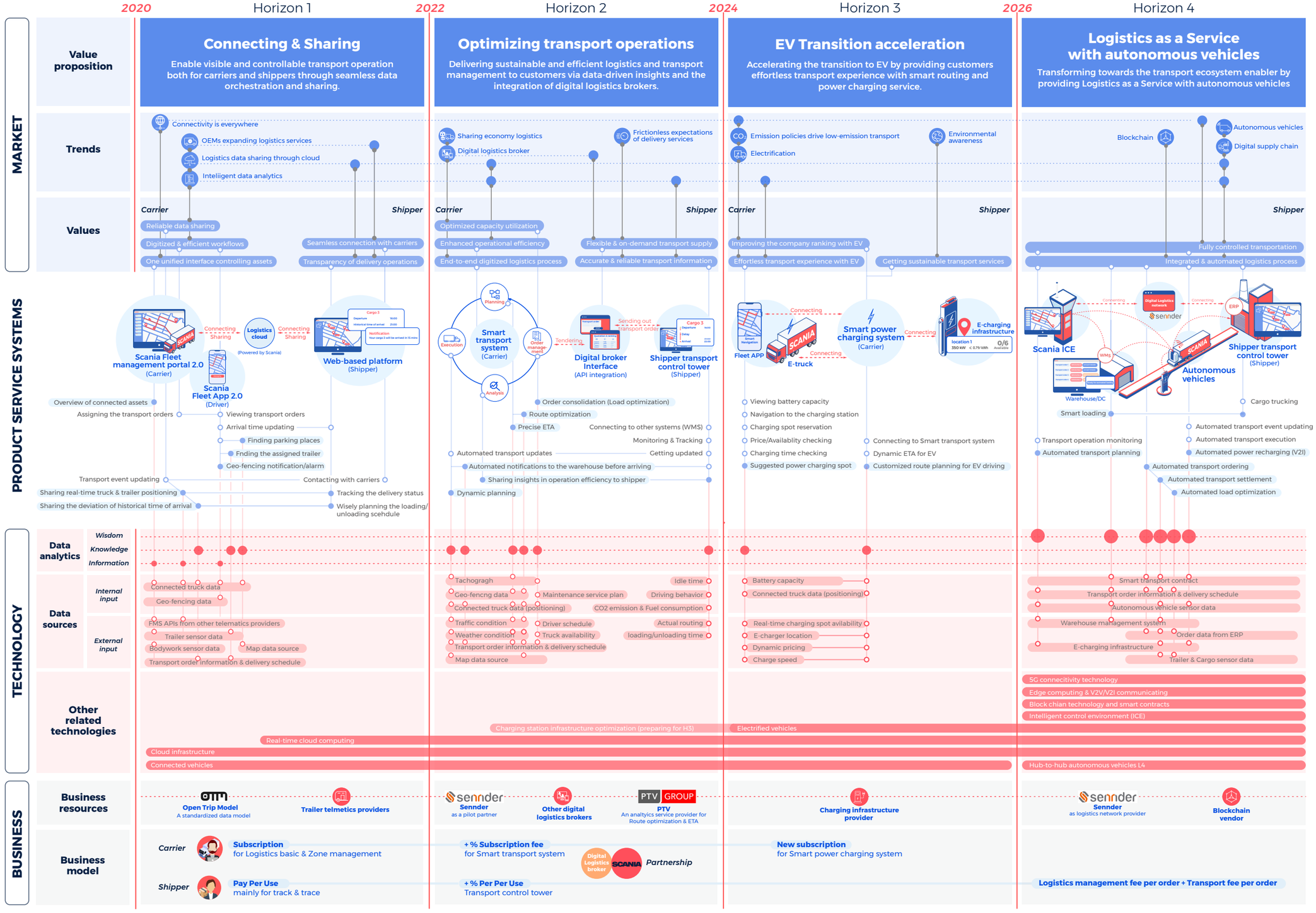


Figure 40: Strategic roadmap



Vision to 2030

SCANIA

as a sustainable transport ecosystem enabler, providing customers *collaborative* and *optimized logistics solutions* powered by *open innovation* to drive their business forward.

Requirements

- Collaboration is the key
- Data security assured
- Legal compliance

Figure 41: Tactical roadmap

7.5 EVALUATION

This graduation project was evaluated internally through two interviews with Scania employees from Connected Service department. During the evaluation session, a presentation was given with main insights from research, strategic direction, future vision and design solutions in 4 horizons. The evaluation questions were formulated based on three lenses of innovation by IDEO: desirability, viability and feasibility (figure 42). Overall, two interviewees all agree with the quality of this thesis and believe it will contribute to Scania's future service development.

Desirability

One interviewee agrees that the solutions mapped out in 4 horizons serve certain needs of customers. For example, the idea to offer a single unified interface for carriers to manage their assets and workflow definitely meet their needs as currently all the carriers use multiple fleet management portals to manage their fleet. Meanwhile the idea of enabling data sharing for shippers and carriers is agreed by one interview as shippers have the need to track the transport operations. One interviewee mentioned that the solutions proposed for 3nd horizon should also consider end-to-end transport experience with electrified vehicles. For example, how vehicles are charged, serviced and ready to go in the morning.

Feasibility

Interviewees agree that Scania is able to initiate these innovations and have the capabilities to build that as Scania has a very large customer base, considerable data assets and history. They all think the service systems proposed in 4 horizons are built in an incremental way and linked to each other. Meanwhile, the concept of open innovation that enables Scania to obtain external analytics capabilities could accelerate the innovation. One uncertainty arises about the logistics cloud because logistics data standardization is still an obstacle for Scania as well as other parties to tackle. Especially when it comes to the long-haulage transport that crosses nations.

In terms of the concept of Logistics as a Service, an interviewee mentioned that Scania should conduct small-scale pilot projects at an early stage to determine whether it is feasible. Meanwhile, the time pacing for 4th horizon should go beyond 2030, ideally 2035. This is because even though in 2030, Scania will have some autonomous operation sites globally, but it will still contain a small amount of the market.

Viability

The interviewees agree that Scania should definitely enter into the value network of the freight transport industry and find a new position in the market that does not exist today. Scania should provide data-driven services through API that provide values to multiple customers, in which case the shipper is one of the potential customers Scania can reach. As for carriers, the idea to upgrade the Scania fleet management system with more transport management services could be adopted for the future service development. One interview also mentioned that the concept of Logistics as a Service proposed in horizon 4 is one of the new business models that Scania could go in the future.

One interview agrees that the revenue model of pay-per-use for shippers could bring continuous service revenue to Scania based on how large the customer base is and how they use the services frequently. Moreover, one interview accepted the idea that the business model of geo-fencing management should be integrated into the smart transport system as a value-added service instead of as a sole offer. Another interview mentioned that the business model needs to be further explored and validated as the current business model is still focusing on the revenue model at a very high level.

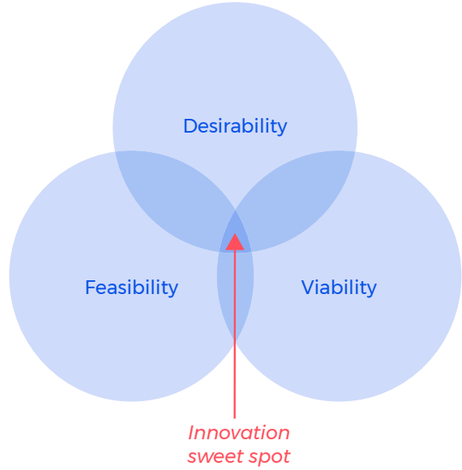


Figure 42: Trifecta of innovation (IDEO)

Discussion

In this chapter the thesis's study is concluded by stating answering the research questions, followed by final recommendations to Scania and to designers on designing data-driven services. In the end, it presents this master thesis contribution and personal thesis reflection by its author.

Chapter overview

08

8.1 CONCLUSION

This thesis aims to design a data-driven service innovation strategy for Scania and discover how data could create values for Scania and its customers.

The thesis starts with a broad scope to discover Scania's new market position, future customers in the freight transport industry, and potential opportunity areas with data and data intelligence. This is because the truck manufacturing industry is being profoundly disrupted by market trends such as digitalization and servitization, and technology developments. Manufacturers' market position is likely to shift from a purely OEM towards a service provider with production to create competitive advantages.

Based on the insights from trend research, company research, context analysis on the freight transport industry, four potential future scenarios of the value network were sketched. Scania's future strategic direction, new customer segment and future vision were defined, followed by new service systems driven by data and data intelligence that were mapped out in a design roadmap.

Answers to research questions

The research questions have already been answered throughout the several design phase of discover, define, develop and deliver. In this paragraph, the most important conclusions are drawn to answer the research questions explicitly.

1. Who are Scania's future customers in the freight transport industry?
In the future, Scania will not be limited to the current customer base, which mainly refers to carriers, but will expand to shippers by delivering data-driven services that meet their specific needs. Scania will focus on bridging the gaps between shippers and carriers by enabling data sharing and providing data-driven insights so that they can improve the transport operation collaboratively. The targeted carriers are these small-to-medium sized transport companies as they have lower capabilities to build their own IT systems to optimize their transport operation and have less access to shippers than big carriers.

In the long term, Scania will focus on delivering Logistics as a Service directly towards shippers, mainly big shippers, enabled by autonomous vehicles, autonomous transport systems and digital logistics networks.

2. What favourable position could Scania take in the freight transport industry to create competitive advantage?
The logistics and transport industry is going through a time of rapid and unprecedented transformation. It is a transition in just every single element of the freight industry. Under this external environment, Scania will not be relegated to the role of a purely OEM that produces hardware only. By offering data-driven services and Logistics as a Service for the end of the innovation stage, Scania will position itself as a service provider with production in the end and become a transport ecosystem enabler with multi-dimensional product service offerings and business models.

It will post a threat to the hardware-oriented manufacturers that digitize and servitize their trucks late. It will also create competitive advantages for telematics service providers as Scania can combine its product with value-added services and provide the product service systems as a package directly towards customers.

3. What new data-driven services could Scania offer to create values for the customer?
The four main data-driven services are designed in this thesis: Cloud-based platform for transport data sharing between shippers and carriers, Smart transport system that optimizes the transport operations, Smart power charging system that improves transport experience with electrified vehicles and Logistics as a service with autonomous vehicles. These four data-driven services are interdependent and interconnected, are built incrementally. They are designed to solve customers' (shippers, drivers, transport planners, warehouse owners) current unmet needs and future needs with new technologies. Meanwhile, Scania's current data-driven services such as Geo-fencing zone management, vehicle performance, vehicle positioning are linked and contributed to new ones.

4. How data as a key resource can support Scania's new services?
One of the spotlights in this thesis is the concept of open source innovation, which is relatively new to Scania. This means that Scania's future data-driven services will not only leverage the resources of the connected vehicle data that is currently available for Scania to collect. Instead, the new data-driven services focus on connecting customers' operational data with vehicle data through the cloud. Once these operational data sources are available, different levels of data analytics are applied to derive data-driven insights that benefit customers and their customers (shippers).

8.2 RECOMMENDATIONS

After the design solutions and roadmap have been designed and validated with Scania internal employees, recommendations have been formulated that should be taken into consideration for the further development of the proposed service solutions.

Intermodal freight transport

This thesis only focuses on the road freight industry. However, the transport and logistics industry is complex and dynamic, including multi-modal transportation such as air transport, rail transport, ocean transport, etc. To boost logistics and transport performance, shippers need to choose the appropriate mode of transport to carry goods. From the perspective of an even bigger transport ecosystem, the service solutions provided in the future should also consider the seamless connectivity with other transport modes. In other words, activities of road transport should be linked to that at ports, terminals, etc. Data such as truck positions, estimated time of arrivals, discharging/loading windows, locations of loading docks, the traffic situation at ports and terminals, and transport schedules should be exchanged with involved organizations to increase the efficiency of transport and logistics.

More services to accelerate the transition to EV

Accelerating the transition to electrified vehicles requires more service elements provided for carriers in the smart power charging system that should include electric energy storage and electric road systems for long-haulage transport, etc. Only when more use cases are considered in the service system, Carriers and drivers can have the confidence to go for electrified vehicles and have effortless transport experience with it.

Adapting services into Urban transport solutions

This thesis mainly focuses on the context of long-haulage transport. However, urban transport is within an even more complex environment with various constraints, and customers expect to get frictionless delivery experience with precise delivery updates. It also requires collaborations and reliable data sharing between LSPs, truck operators, end-users and distribution hubs. The design solutions delivered in this thesis, such as the cloud-based data-sharing platform, Smart transport system and Smart power charging system, can also be adapted into the urban transport solutions. The big difference lies in the business strategy in the far future. For urban transport, LSP is usually required to manage the complex logistics tasks and distribution hubs. The collaboration could be set up with local LSPs to enable data exchange and autonomous transport operations.

Further applications of blockchain

In this thesis, the technology of blockchain is applied in horizon 4 to enable transparent and traceable data sharing and automated transport settlement by smart contracts. Scania could consider earlier adoption of a blockchain-based system into service systems as it is one of the most promising ways to enable reliable data sharing. Further studies should discover more values from blockchain into logistics and transport solutions.

Further design of automated logistics solutions

The concept of logistics as a service in horizon 4 is presented by the future scenario of automated logistics without details due to the complexity. In the roadmap, the data and data intelligence is also mapped out on a high level. Scania should further design the automated logistics solutions where automated vehicles are just one element and should be fully integrated into supply chain management. The required internal data sources and external data sources should also be further studied and elaborated.

Accelerating collaborations and having a shared vision

The thesis proposes several collaborations with different parties and Sennder is one of the essential partners in supporting the service solutions and reaching the future vision. Scania should further focus on how Sennder's business will benefit Scania's future business and service and build a shared vision for the future. Besides, Scania should consider how the Smart transport system proposed in horizon 2 could reach to other digital logistics brokers with other shippers and carriers instead of only serving Sennder's customers.

Data standardization

As mentioned in the context research, one of the barriers to implementing data sharing is the lack of data standardization that enables the interoperable systems to exchange information. One data model, named OpenTripModel, is proposed in horizon 1. OpenTripModel is a simple, free, lightweight and easy-to-use data model, used to exchange real-time logistic trip data on the web. The service development team and connected intelligence team should further assess this data model to ensure its feasibility.

Business model detailing

The business models designed in 4 horizons are more on an abstract level and with a focus on the revenue models. It should be further elaborated and validated with stakeholders and partners to ensure viability.

Gaining more user insights for developing data-driven services

The research insights gained from this thesis are limited with a few customer samples. Most insights are gathered from desk research and expert interviews. To deliver more user-centric services, Scania should dive into customers' needs and validate the needs from this thesis. More interviews with different type of carriers and shippers should be set up to understand their real needs and what values Scania could deliver by leveraging data and data intelligence.

Value creation for potential customers in the value network

This thesis starts with a study of the value network of the freight transport industry, rather than focusing on Scania's current customers. This is because the transport and logistics industry is undergoing fundamental changes and new market roles will emerge. Meanwhile, creating values with data and data intelligence should think from an ecosystem perspective

where data generated from one customer type, once aggregated and processed, may benefit other customers. Therefore, Scania should also change the way of thinking to find more potential customers and bring values to them along with data.

Discovering the value of strategic design

Based on my work experience in Scania, I think the field of strategic design could benefit Scania's service development team. Strategic design is the application of future-oriented design principles to increase innovative and marketable qualities of any business. Strategic designers are more like a system thinker that bridges gaps between business, customers' needs and technologies. Scania is a manufacturing-oriented company and is under the development of digital transformation. Strategic designers could contribute to this transformation with various designer tools.

8.3 PERSONAL REFLECTION

When looking back at my thesis, I truly believe that I have learned a lot and grown in both a personal and professional way.

Everything started in my interest in data and mobility. I still remember the first moment when I found this project brief online and immediately realized that this was going to be my master thesis project. The whole path of the thesis was not smooth all the time. I have experienced the difficulties of finding stakeholders for interviews, running the creative sessions, working from home after the lockdown, planning my thesis schedule wisely and writing the academic report. Meanwhile, doing a five-month project individually was a big challenge for me as I am always a team worker and like to build up ideas through discussions. But from these difficulties, I have also learned what I should do once I encounter these problems again. The biggest gains from this project in a personal way are that I feel more confident to speak out and acknowledge my contributions and capabilities without doubting myself all the time.

When I reflect on my process, I am proud that I could handle such a complex project with limited knowledge in the field of transport and logistics as well as the data world. It took me quite a long time to interpret the purpose of the project and to understand the company and industry context. I am also pleased that I could use the design roadmapping method to design the innovation strategy for Scania in my thesis. It further developed my strategic and systematic way of thinking to tackle problems.

In relation to project management, I always know that I am not always a good planner and a plan follower. During the project, I had a hard time handling the complexity of the project and delivering materials on time, which struggles me a lot. Especially during the lockdown due to Covid-19, I had lower productivity working from home and more difficulties to push myself to finish my daily work on time.

During the project, I facilitated two creative sessions with internal employees. I experienced the difficulties of getting people aligned with a direction, which depressed me a lot. After that, I still decided to follow a provoke path that I thought would create values for Scania, and I am pleased that I followed this way.

Last but not least, I hope that this project gives Scania valuable insights into one possible strategic direction that Scania could follow in the future and how design roadmapping methods could be applied to design Scania's future vision and service

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