HITS Off Peak - KPI pilot

A test of measuring and reporting environmental KPIs, from real data in real time.

Participants

Scania, HAVI, ELAIN, Mc Donald's

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FFI Fordonsstrategisk Forskning och Innovation

What If we could report real time sustainability data?

A KPI – pilot that transport during off peak

Today there is little control of actual sustainability impact of your transport.
- What if you could track it in real-time?
- What should we measure?
- How can it be measured?
- Can it lead to better real-time decision making?

Content

How can sustainability data influence the transition to sustainable transport?

Background

Sustainable transportation is crucial for reducing environmental impact, strengthening economic development, and ensuring a well-functioning society. Many transport buyers are showing increased interest in contributing to sustainability, but several challenges remain. One of these is the uncertainty surrounding data, which is typically reported annually, making it difficult to accurately track progress toward sustainability goals. The ability to monitor certain KPIs in real time can therefore provide better insights and enable faster changes to improve sustainability in the transport sector.

A sustainable transport solution is off-peak deliveries. Despite off-peak deliveries being explored and tested in several projects over an extended period, the number of deliveries occurring at night remains limited. If we could increase the awareness with data of off-peak deliveries among those with decision-making power, we believe this could impact the number of nighttime deliveries.

What measures get managed!

DEFINITION OFF PEAK

Off peak refers to times when the traffic demand is lower. Off peak delivery can mean delivery early morning, late evening or night.

The day was grouped into different time slots. Defined by the actual start and end time of the route:

- Start time >= 00:00 and end time <= 06:00: Off-peak morning
- Start time >= 19:00 and end time <= 23:59: Off-peak evening
- Start time >= 06:00 and end time <= 19:00: On-peak

Sustainability challenges

You would think that heavy-duty vehicles being responsible for over a quarter of road transport emissions – despite making up just 2% of the vehicles – would make them a prime target for climate action. However, the CO2 emission from transport does not decrease.

The transport industry struggles with inefficiencies, like an average load factor of 30-50% in urban distribution.

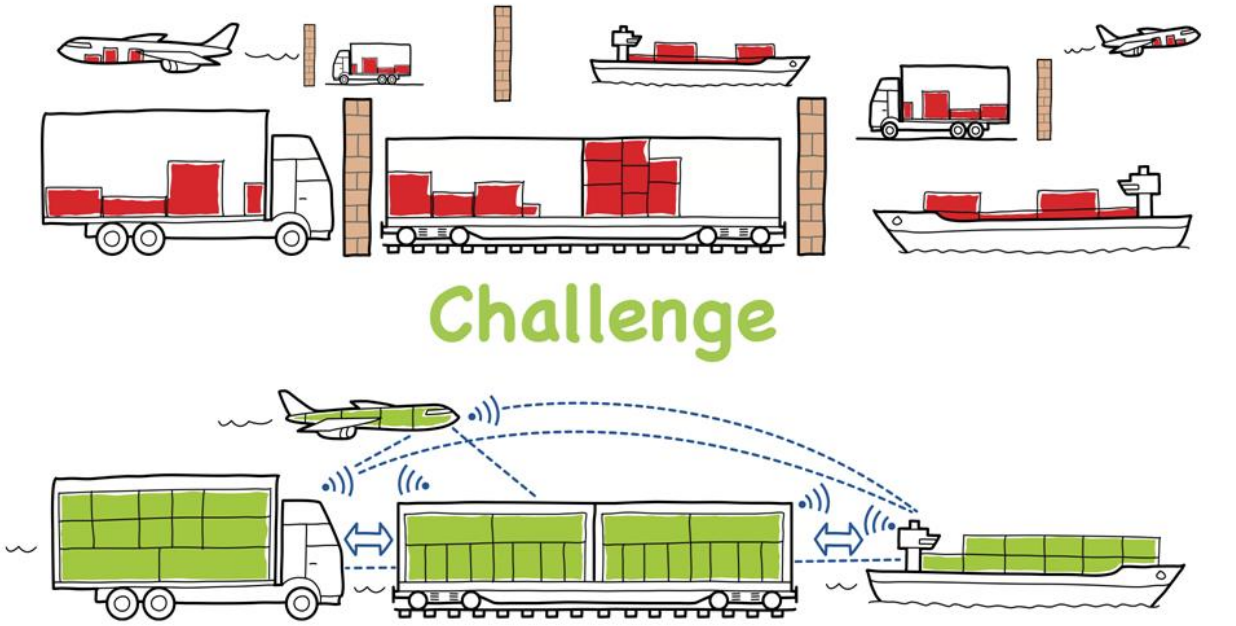
Most calculation of the environmental impact is also calculated based on assumption and no real data.

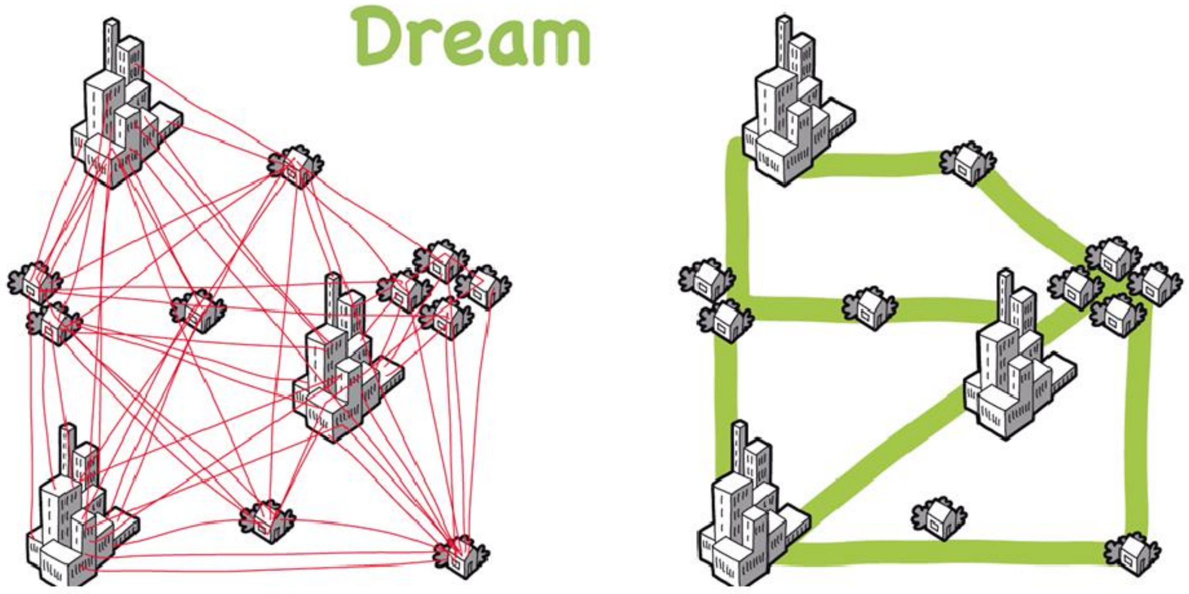
In HITS we wanted to test the value of measure the sustainability impact from transport with real data and understand if it can have an impact on decision for more sustainable transports - Like driving Off Peak!

A Possible FUTURE

Sustainable transportation is crucial for reducing environmental impact, In the future, there are hopes that logistics services will become digitized, enabling data to be easily shared between different parties. This vision is often referred to as the "physical internet." Once technology development reaches this point, sustainability data will be easily linked to individual shipments. This could lead to increased knowledge about the environmental impact of transportation. The hope is that when sustainability data can be shared in real-time, it will become easier to analyze and optimize for more sustainable transport solutions.

Future logistics, from global to urban, will be founded on a global open system of systems enabling assets and resources in logistics networks to be interconnected facilitating their use to the maximum capacity and productivity while increasing agility and resilience of supply chains. We call this vision the **Physical Internet (PI)** and it will support the affordable transition of assets towards **Zero emissions logistics.**



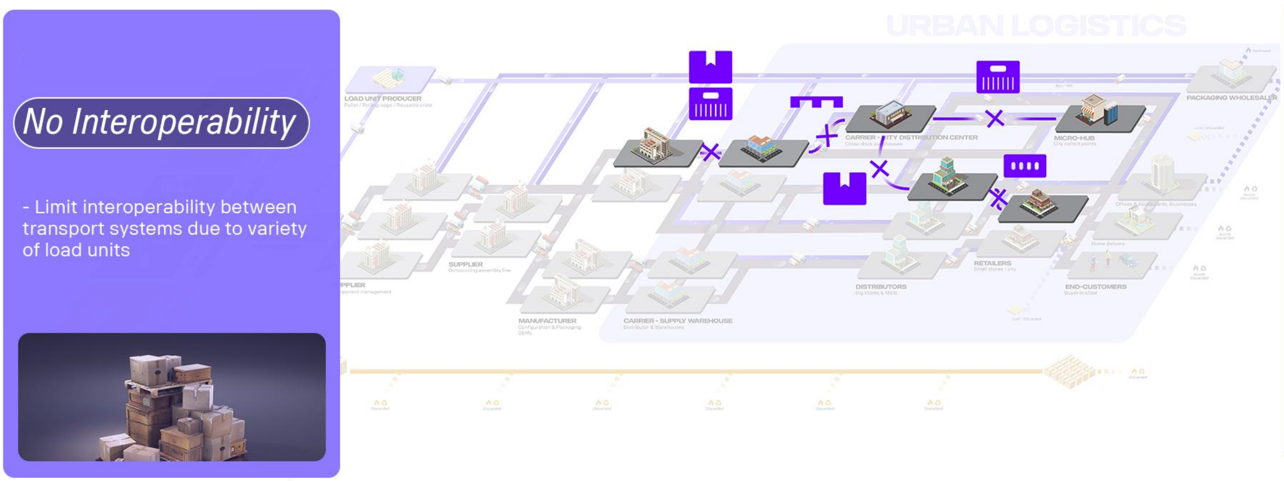


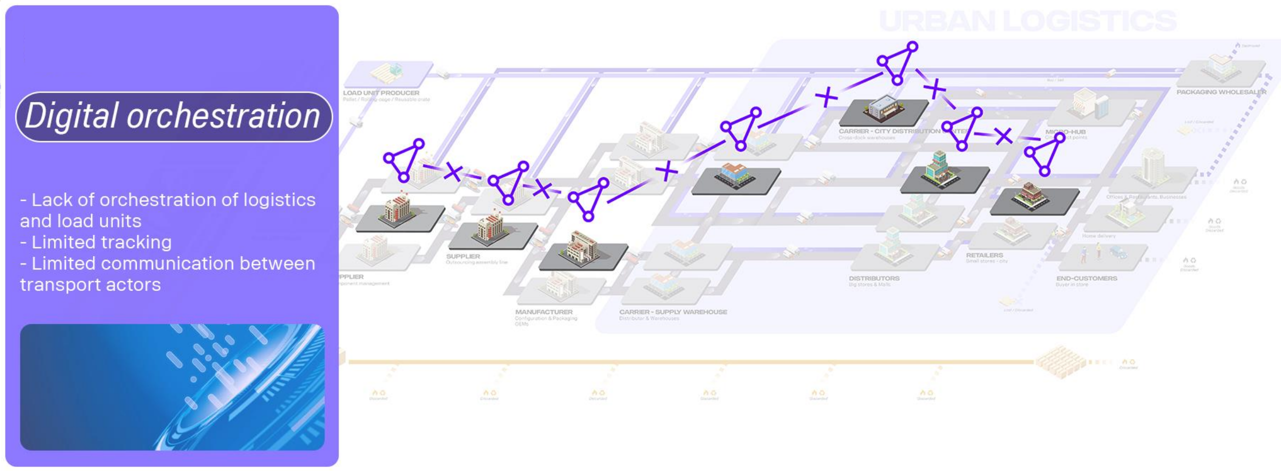
Obstacles to overcome for Full System Interoperability

Today, there are not many data sources that generate qualitative data and transmit it in real-time. Neither are they integrated into a network or IoT platform that can share and access this data. In HITS, understanding this topic better has been a priority. Fortunately, there is data available that can help assess the environmental impact of transportation. All vehicles are equipped with telematics systems that, in best scenarios can send data in real time. Data such as:

- Timestamp
- GPS position
- Odometer
- Fuel level (%)
- Amount of fuel used in lifetime

In this pilot, the service ELAIN is the platform for tracking and assessing data. Read more about ELAIN



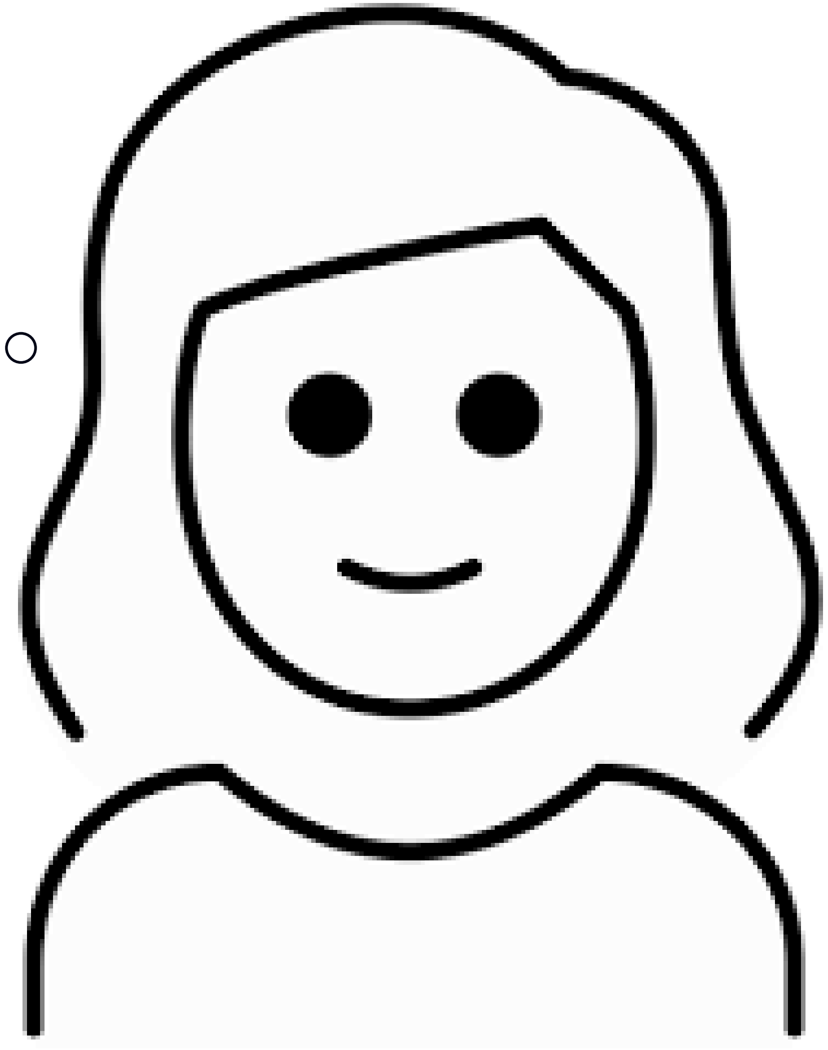


What measures gets managed!

How do I measure them? How do I communicate them?

How big are my CO2 emissions? Is 50 tonnes CO2 good or bad?

How do I understand what has an impaced on the emissions?



" How important is it to lower your CO2 footprint for your sustainability targets?"

To better understand the interest outside of HITS partners in reducing the environmental impact of transportation, several interviews were conducted with sustainability managers. On the question: “How important is it to reduce your company’s carbon footprint for your sustainability goals?” All respondents answered that it was important or very important. A total of 55% answered very important.

They were also asked whether they believed that Off-Peak traffic could help their company achieve its sustainability goals and whether they could consider implementing off-peak deliveries for their operations.

Several of the respondents we spoke to do not associate Off-Peak with sustainability benefits or business advantages. They have a vague understanding of the potential benefits in general and for their own organization. Demonstrating the benefits of Off-Peak, as well as showing that emissions decrease when deliveries are made off-peak, became important aspects of the HITS project.

If you’d asked me 3 years ago, I’d say we were cost-driven. Now we are reducing footprints and sweating the assets.

To stay interesting to our customers we got to work with these issues. Also due to regulations.

I wouldn’t say we do it to a 100%, because that’s hard to reach.

Lower CO2 is important but not the only parameter. We think about accessibility, costs…

What is a KPI?

A key performance indicator [KPI] is a metric that can be measured continuously over time and for a specific purpose. It's a way to follow up on strategic goals, track their progress, and generate insights for better decision-making.

There is two kinds of KPI, Strategic and Operational. For transport the strategic KPI for CO_2 is more dependent on the ambition set by the company. If you are a transport company, possible objectives could be:

- By 2035, all vehicles should be driven on fossil-free fuel

A KPI to measure the strategic goal could be total CO_2/km.

The operational Day-to-day metrics focus on short-term goals, as on the transport operation. Examples of more day to day matters that can be measured are: When in time the transport is carried out, delivery on time, fill rate, how the driver drive (fuel consumption), percentage of fossil-free fuel etc.

This pilot will only focus on the operational KPIs.

What KPI could be tested in a pilot?

To identify the most valuable KPIs that could be tracked in real time, an investigation of commonly used KPIs was conducted. A summary of this investigation is shown in the accompanying image, with the complete list provided at the end of this appendix. Following this, a workshop was held where participants rated the KPIs they were most interested in measuring in real-time or on a day-to-day basis. Categories marked with a heart symbol in the picture to the left, were the most preferred.

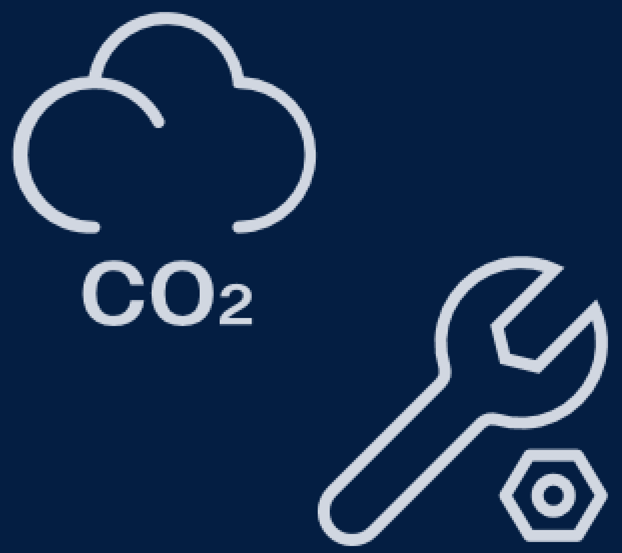
When exploring what was feasible to measure in real time and the perceived value of doing so, both groups expressed a desire for pilots focusing on real-time CO_2 measurement and potentially tracking a few additional emissions. Notably, there was significant interest in improving the evaluation of subcontracted carriers, as many participants expressed concerns about the lack of control in this area.

1. follow an entire supply chain, preferably where the goods are driven to the end customer off peak
2. CO2 tracking as basis for decision making during route planning and dialogue with customers.
3. Positional data linked to CO2 emissions and noise

Out if theses, number 2 and 3 was achievable within the scope of HITS 2. These initiatives will continue into HITS, were noise and safety KPIs will be further investigated and hopefully also tested in a new pilot.

	Dwell time
	Average speed
	Infrastructure expenditure
Operational indicators	Fill rate
	Fleet efficiency
	Time per stop
	Vehicle speed
	Fuel-related transport cost
	Cost of facilities
	Vehicle-related transport cost
	Employee-related transport cost
	Working man hours
	Annual use of vehicle
	Fuel consumption per vehicle
	Replacement battery price
	Expected battery lifetime
MAINTENANCE COST PER VEHICLE	Estimated annual repair and maintenance costs
	Charging management system
	First-line support for the charging system
TAXE OTHER COSTS PER VEHICLE	Vehicle tax
	Insurance costs
	Infrastructure - one-off investment costs
	Congestion tax
Sub-carrier management.	How many of your driver are employed directly by you?
	How many of sub contractor
	KPI for ensuring compliers of sub-contractors
ENERAL CONDITIONS	Contract length/period of vehicle ownership
	Discount rate
	Number of vehicles
	Purchase price
	Driver's Cost
END OF LIFE	Remnant value
DRIVER	Road safety
	Training hours in trafic safety
	Training hours in eco-driving/efficient- driving
	Vehicles with alco-lock
EMISSIONS	Noise
	CO2e
	NOx
	PM
	Other
Vehicles typ	Euro 3 (1,2)
	Euro 4
	Euro 5
	Euro 6
Fuel	Diesel
	Gasoline
	HVO 100
	Ethaol

Pilot and method



Purpose and Execution of the Pilot

Previous, it was mentioned that there was a wish to test the operational values of measuring environmental KPIs continuously. The pilot aimed to evaluate whether this measurement of environmental KPIs could contribute to better operational decisions and demonstrate whether driving off-peak is more beneficial.

Setup for Calculation and Data Sharing

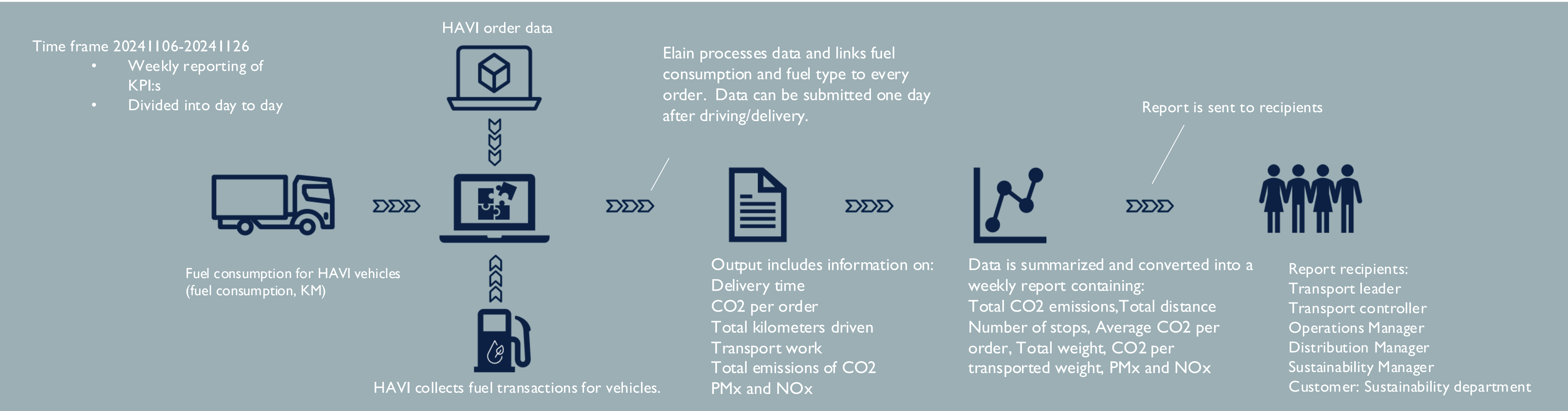
HAVI integrated its order system with Elain. Information about HAVI's orders is sent daily. The data sent for each specific order includes order number, registration number, customer, start address, date and time, delivery address, and order weight.
HAVI then uploads fuel transaction files to the Elain portal, some weekly and some monthly. The fuel transaction file contains information about the fueling location, type of fuel, amount/volume of fuel, and the vehicle refueled. In the Elain portal, the fuel is allocated to the respective vehicle.
All this data is processed in the portal, which allows us to calculate CO2 emissions per order. The portal provides data such as CO2 per order, distance, PMx & NOx, and the number of stops.
To compile a complete report, additional information is gathered. Elain sends a file with complementary weight data.

Distribution of the Report

The report was sent out on three occasions. It was distributed to transport managers, transport controllers, operations managers, DC managers, sustainability managers, and the customer and their sustainability department.
Data was collected weekly over three weeks and compiled three times during this period. The week was counted from Wednesday to Tuesday. The material was received by HAVI on Wednesday morning, processed, and sent out to recipients on Wednesday afternoon.

Performance indicators that was measured:

- Total CO2 emissions
- Total distance
- Number of stops
- Avg. CO2 per order
- Total weight
- CO2/transported weight
- Total NOx & PMx
- On- and Off-Peak comparison



To calculate CO2 emissions, NOx, SOx, and particles, the tool Elain was used. Elain is a Scania Venture dedicated to providing robust sustainability reporting and insights to help companies decarbonize their logistics.

The tool follows the GLEC Framework for emissions calculations*. In this project, which compares deliveries during and outside peak hours, the decision was made to focus solely on fuel consumption and CO2 emissions between the pickup and delivery points, thereby excluding empty mileage.

The calculations in Elain are based on data from vehicle telematics for actual fuel consumption and data from transport management systems to allocate CO2 emissions to specific orders. When an order is registered in the system, it is matched with vehicle data by comparing the GPS position and timestamps of the order and the vehicle. Once a match is found, information on actual fuel consumption and distance is added to the order data.

For the HITS project, the entire route is used as the basis for emissions calculations. The order data contains information about individual deliveries and stops. To define a route, deliveries and stops with the same start time, location, and vehicle are grouped together. The first and last telematics events linked to the route are used to calculate the total fuel consumption, which is then combined with assigned emission factors to calculate the CO2 emissions for the route.

To calculate CO2 emissions from fuel consumption, emission factors are applied. Elain uses a well-to-wheel (WTW) approach for emissions calculations and obtains emission factors either from the fuel supplier, a governing body responsible for tracking emission factors at the vendor level, or from GLEC's default values if neither of the previous options is available.

* Emissions factors go to page 26

RESULTS

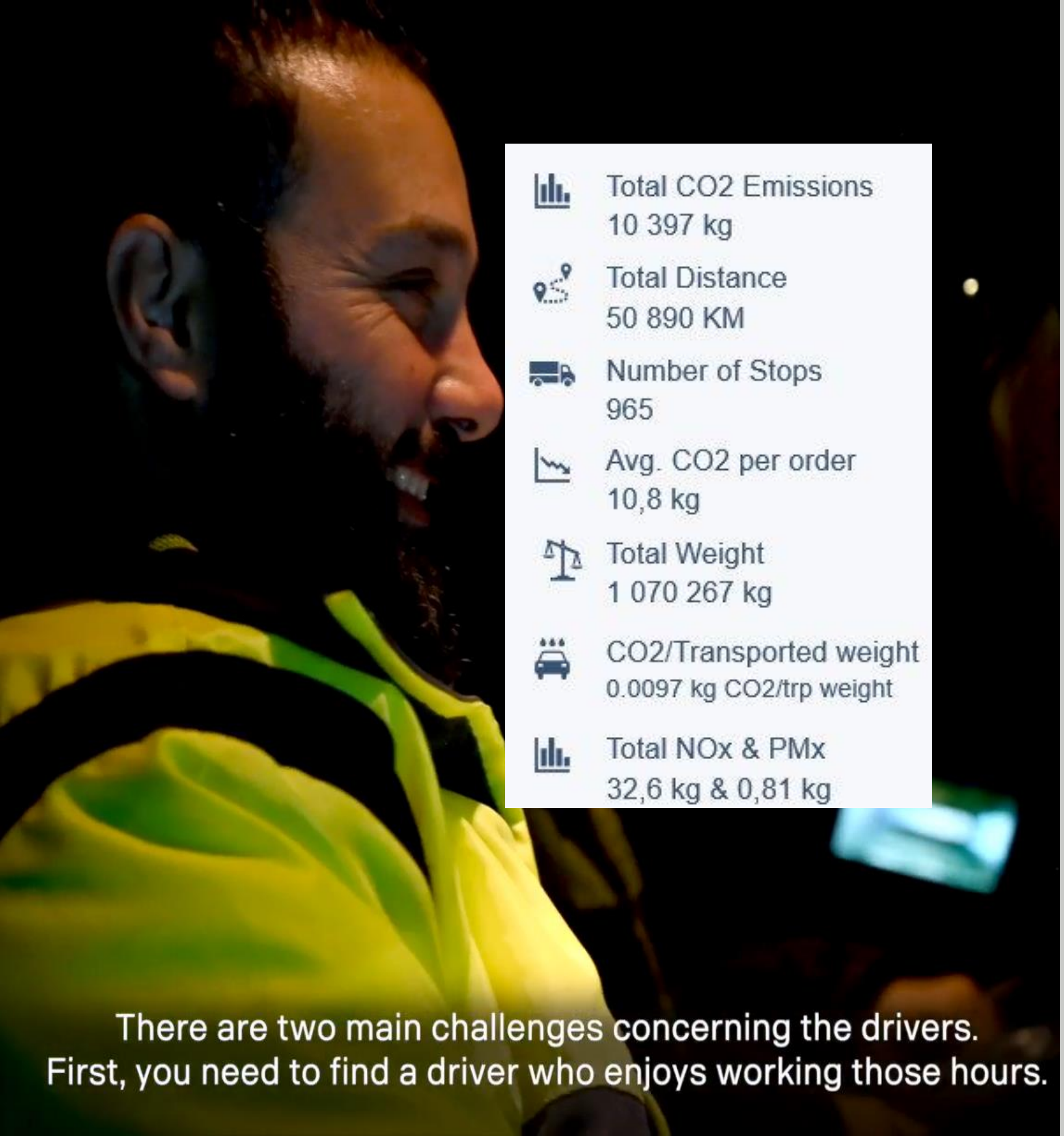
Insights and opportunities

Potential in Sustainability Data Reported Regularly

- There are interesting opportunities to analyze changes, e.g., before and after a route adjustment, during the introduction of new fuels such as electrified transport, etc.
- Increased collaboration and transparency with customers, for instance, by demonstrating how their choices regarding fuels, delivery frequency, and delivery timing affect their emissions per order/ton/km (or other metrics). It allows scenarios such as analyzing the impact of removing a delivery.
- Provides factual data as a decision-making basis for analyzing operations.
- Enables comparisons, identifies trends, and analyzes them. For example, it allows comparisons between different deliveries such as on/off-peak or different areas such as urban/suburban environments.

Challenges with Selected KPIs for Decision-Making

- CO_2 per order is not the best as an operational KPI, it is difficult to act on or directly influence by simply monitoring this metric.
- More actionable and directive KPIs, such as the percentage of renewable fuels (%), would be more effective in enabling operational improvements.

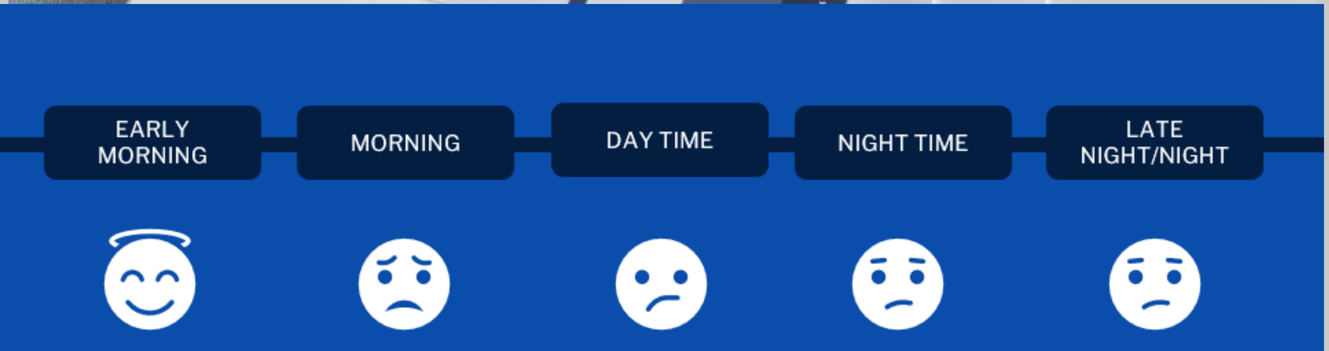


Forward-Looking Actions

- To support operational work, KPIs should focus more on metrics that create value at the operational level. For example, safety and working environment are interesting KPIs.
- More actionable and directive KPIs, such as the percentage of renewable fuels (%), would be more effective in enabling operational improvements.
- Driving behavior significantly impacts fuel consumption and should be an area of focus. Measuring and analyzing driving behavior in relation to CO_2 emissions creates opportunities for action.
- Sustainability data should be presented in a way that facilitates action for various stakeholders. The presentation should allow more flexible filtering over, for instance, time spans. It should be more visually appealing and easier to analyze using graphs, and it should include historical data to track trends.

Summary

The sustainability report has the potential to create value at both strategic and operational levels. The sustainability KPIs currently in use have been challenging to apply operationally, and there is a desire to adopt alternative KPIs. For example, CO_2 per order has proven more suitable for strategic decisions, such as vehicle selection or procurement, rather than for direct operational management. Additional adjustments are required to maximize the report's usefulness. By clarifying the connections between data and decisions and incorporating visualizations and other functionalities, the report can become a powerful tool for supporting sustainability goals and operational efficiency.



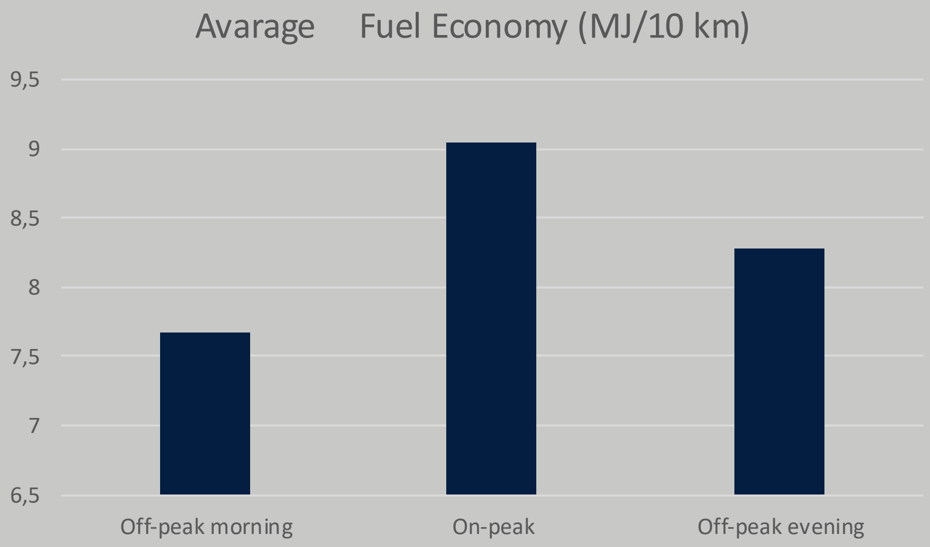
* Appendix XY

Off-peak provides the most value during the morning shift!

In the interviews with sustainability manager and goods receivers, it became clear that it was important for the recipients to see concrete evidence that driving off-peak is better before they start changing their routines. This pilot demonstrates that the morning shift has the least environmental impact. The highest environmental impact is observed during the "on-peak" time interval.

In interviews conducted with drivers*, they also mentioned that they feel the safest time to deliver goods is early in the morning.

Therefore, the conclusions and recommendations are that anyone looking to start driving off-peak should begin changes to a morning shift, to achieve the greatest possible sustainability benefits from the change.



THE SMART CONNECTED WORLD

In work package 4 we explored a possible future, and different scenarios was built, to better understand desirability, feasibility and ?? some of hypothesis was tested. This KPI pilot was one of the test, where we could see both value here and now but also wanted to understand shift needed and challenges on the journey ahead.

On thing spotted for the future is AI agents and full interoperability, that is an exciting vision where advanced technologies create a seamless, interconnected world.

Forward-Looking Possibilities with AI agents
AI agents can play a central role in automating and optimizing the logistics and transportation ecosystem:

- Dynamic decision-making: AI agents could handle real-time routing, fleet management, and warehouse operations, adapting instantly to changing conditions like traffic, weather, or supply chain disruptions.
- Predictive analytics: Agents would use historical and live data to forecast demand, identify risks, and streamline operations.
- Proactive communication: AI agents representing different stakeholders (carriers, shippers, customers) could negotiate contracts, schedule deliveries, and resolve disputes autonomously.

For example, an AI agent managing a trucking fleet might reroute vehicles to avoid traffic delays while ensuring optimal fuel efficiency and on-time delivery.

THE AI AGENT

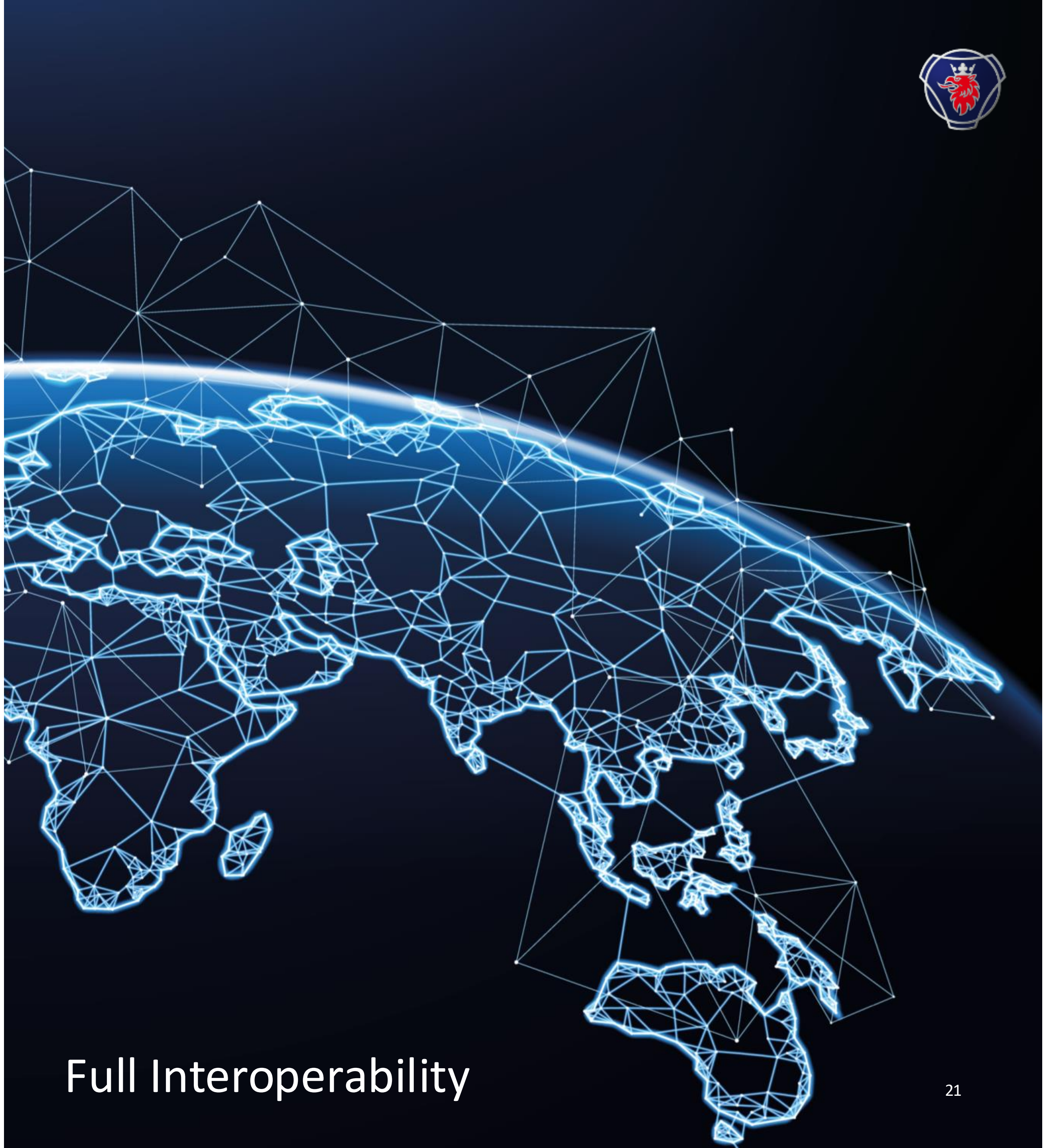
A highly sophisticated digital assistants—would act as personal and professional enablers.
For example, your AI agent could negotiate a contract, coordinate your daily schedule, very much the same job as a transport planner does today.

THE SMART CONNECTED WORLD

Full Interoperability in Logistics
Interoperability ensures seamless integration and communication across the entire logistics network, including manufacturers, distributors, carriers, and customers.

Forward-Looking Possibilities with interoperability

- End-to-end visibility: Unified platforms would allow all stakeholders to track shipments, inventory levels, and transportation routes in real time.
- Collaborative logistics: Companies could share resources (e.g., warehouse space, delivery vehicles) to optimize costs and reduce environmental impact.
- Integrated technologies: AI agents would connect IoT devices, autonomous vehicles, and blockchain systems to create a fully transparent, tamper-proof supply chain.
- For instance, a shipment could be tracked from factory to doorstep, with real-time updates accessible to all involved parties.



THE SMART CONNECTED WORLD

Conclusions
There is great potential for more efficient transport as these new technologies come into play. However, there are still many issues that need to be addressed.

Typically, we tend to automate processes as they function today. What we learned from this pilot is that it is crucial to understand what data is needed to optimize transport and enable better decision-making. It's not just about having the right data—it's also about ensuring that the data is of sufficient quality for the "agents" to utilize effectively.
The integration of different systems that hold data is another challenge. In this pilot, we managed to integrate only two systems, while the rest had to be handled manually. During follow-up interviews, it became clear that receiving a standalone report does not add much value. Environmental KPIs need to be visualized alongside other operational KPIs to play a significant role in decision-making.

Given this, one of the most important insights from this pilot is the need for further research into which KPIs truly matter in the transformation toward more automated decision-making for sustainable transport. Additionally, it is essential to address the gaps and ensure the ability to measure real-time data that can have a meaningful impact.

Källor

- rapport_2014_8_godstransportrer_i_staeder_-_scenarier_foer_framtiden.pdf
- Roadmap-to-Physical-Intenet-Executive-Version_Final-web.pdf
- Peter Drucker's 1954 book The Practice of Management.
- Appendix XY (Intervjuer som Maria gjort)

EMISSION FACTORS

To calculate CO2-emissions from fuel consumption, emission factors are needed. Elain has a well to wheel (WTW) approach to calculate emissions and uses well to wheel emission factors that are collected either directly from the fuel provider, a governing body responsible for tracking emission factors on a per vendor level, or from GLEC default emission factors when none of the above are available.

Default emission factors

Fuel type	Renewable	Well to tank	Tank to wheel	Well to wheel	Unit
Diesel B7*	7%	0.8276	2.458	3.3106	kg CO_2e / l
HVO	100%	0.9702	0.0385	1.0087	kg CO_2e / l
Gasoline	0%	0.76	2.36	3.12	kg CO_2e / l
Ethanol E85**	85%	0.97	0.35	1.32	kg CO_2e / l
Compressed natural gas	0%	1.03	2.76	3.79	kg CO_2e / kg
Liquefied natural gas	0%	1.24	2.75	3.99	kg CO_2e / kg
Electricity	100%	0.3564	0	0.3564	kg CO_2e / kWh

PILOTEN HOS HAVI OCH MCDONALD'S