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Developing Effective Long-Haulage Infrastructure in Sweden through the Lens of TEN-T

Insights into stakeholder preferences for truck stop safety, security, service, and alternative fuels

Master's thesis in Supply Chain Management

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Abstract

This thesis investigates how rest and refueling infrastructure for long-haul heavy goods vehicles (HGVs) in Sweden can be developed to better meet regulatory requirements and stakeholder needs, particularly in the context of the Trans-European Transport Network (TEN-T). The study applies a mixed-method approach combining a literature review, expert and haulage company interviews, and a driver survey. Key themes include safety and security, service availability, and the implementation of alternative fuels such as electricity and hydrogen.

Using the Kano model and Multi-Criteria Decision Analysis (MCDA), the research identifies which resting area features add the most value to truck drivers. The findings reveal that basic hygiene and health services, and secure parking features are considered essential. These preferred features differ slightly from the required features that the EU has defined in their safe and secure certification requirements. Moreover, demographic factors such as gender, nationality, and exposure to crime, affect how features are perceived and prioritized. These preferences were compared with qualitative data from expert and haulage company interviews, and literature. Slight variations were found in what the qualitative and quantitative data suggests as important features.

The report presents three development scenarios ranging from a core model focused on driver satisfaction to more advanced modules including alternative fuel infrastructure and a higher degree of safety and functionality. By comparing stakeholder preferences with EU certification criteria and funding opportunities, the study outlines practical and strategic recommendations for infrastructure investments. It concludes that aligning infrastructure development with user needs and funding eligibility is crucial to achieving both operational relevance and long-term sustainability in the Swedish transport sector.

Keywords: TEN-T, Long-Haulage Transport, Safe and Secure Parking, Service Design, Road Transport Infrastructure, Kano Model, Stakeholder Analysis

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Albin Linde
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Table of contents

List of figures

List of tables

List of acronyms

Below is the list of acronyms that have been used throughout this thesis listed in alphabetical order:

AFIR	Alternative Fuels Infrastructure Regulation
AHP	Analytic Hierarchy Process
CEF	Connecting Europe Facility
CINEA	European Climate, Infrastructure and Environment Executive Agency. Formerly known as INEA and NEA
CO_2	Carbon Dioxide
E85	A biofuel blend containing 85% ethanol and 15% gasoline
EU	European Union
HGV	Heavy Goods Vehicle
HVO/HVO 100	Hydrotreated Vegetable Oil (100% renewable diesel)
MCDA	Multi-Criteria Decision Analysis
SAW	Simple Additive Weighting
TAPA	Transported Asset Protection Association
TEN-T	Trans-European Transport Network

1. Introduction

This chapter outlines the need for improved road transport infrastructure in Sweden, driven by EU goals for safety, sustainability, and efficiency. It highlights current challenges such as transport safety and security, driver shortages, and the lack of secure rest areas. In this study safety refers to concerns regarding protection of drivers and vehicles from accidents or physical harm, whereas security refers to preventing crime and safeguarding against theft. The chapter also presents the study's aim: to describe what experts, haulage companies, and drivers prioritize in terms of safety, services, and alternative fuels. The research questions, scope, and structure of the report are introduced to frame the rest of the thesis.

1.1 An actualization of the transport industry

During the upcoming years, the transport infrastructure in Europe needs to be developed thoroughly. This has been stated by the European Union (EU) through their visions and goals involving the Trans-European Transport Network (TEN-T), considering traffic growth and increased amounts of bottlenecks (Regulation (EU) 2024/1679). The purpose of this strategically created network is to integrate and increase the efficiency of the transport infrastructure within the union. Development is important for all member countries to support the economic growth that smooth mobility of goods and people can bring (European commission, 2025). For this to work efficiently, there must be a territorial cohesion and a high standard independently of which nation the infrastructure belongs to. Current plans to improve infrastructure are divided into multiple stages, with everything set to be fulfilled in 2050. For road transport this means a transition into renewable fuels like electricity and hydrogen gas, while resilience and safety for roads and transport facilities will increase. However, plenty of investments from both public and private actors will be needed to achieve these ambitious goals.

In Sweden, Sveriges riksdag (2024) has set out a plan to invest in and upgrade road transport infrastructure. The nation has good possibilities to provide electric charging from renewable sources, and some electric charging stations have already been constructed (Energimyndigheten, 2025). Still, the development of infrastructure has not reached the targeted level yet. Safety and security wise, the development is lagging behind other countries in Europe, and there are only a few actors that currently can provide safe and secure parking for Heavy Goods Vehicles (HGV) along the roads (Martinelli, 2024).

Transport safety and security is a big part of the TEN-T agenda (European commission, 2025). Issues regarding crime, such as thefts and assaults, have been around even though criminals have changed their approaches over time. Consequences go further than only having to replace cargo. Cargo theft can also create disruptions in supply chains due to delayed delivery. Additionally, it costs the public sector both time and resources to report, investigate, and prevent crimes (Ekwall & Lantz, 2022). From an individual's perspective, cargo theft can also lead to either planned or unplanned physical assault (European commission, 2018). Between the years 2021 and 2023, there were 1 843 crimes reported in Sweden related to road transport and cargo theft (European commission, 2018). Resulting in an increase of 164% from the previous two-year period, although there is a big number of crimes that are never reported and presented in statistics (TAPA EMEA, 2023a).

There are clear trends in the demography of the road transport sector in Sweden. Nowadays, almost all long-haulage transports are carried out by international truck drivers from international haulage companies (Trafa, 2024). At the same time Swedish drivers are in general driving shorter distances per delivery. Statistics show that women are underrepresented as truck drivers, compared to men, despite an increase of female drivers in recent years (IRU, 2024).

Truck driver's roles have changed throughout the years. The work that previously had been associated with plenty of freedom has now been affected by technological advancements that give employers increasing power and control over the working routines (Ottosson, 2019). Europe currently faces a big driver shortage of approximately 400 000 drivers, due to an ageing workforce and deteriorating working conditions (IRU, 2022). Meanwhile, the demand for drivers is still increasing, because of an increased need for transportation from e-commerce and retail. At the same time there is a lack of services and comfort for the drivers, making the sector unattractive to work in. For truck drivers in general, and for female truck drivers in particular, the lack of safe and secure resting areas is one of the biggest factors why the work is unattractive (IRU, 2024). Currently, only 3% of parking places in the EU have certifications of being safe and secure.

To solve issues regarding safety, security, service, and sustainability, fuel station operators can have a big impact. With backing from the European Union's funding program Connecting Europe Facility, there is a possibility to get financial backing as a private actor (CINEA, 2025). To get the funding, certain criteria must be met. The projects need to follow the vision of the TEN-T regulations and thereby improve infrastructure that are of interest for multiple countries in the European Union. However, exact definitions and responsibilities are vague. To solve safety and security problems, safe and secure parking for heavy-goods vehicles would suitably be implemented. Because most crimes occur when trucks are not moving, there is a vulnerability for thefts when drivers take their daily rest (Ekwall, 2012). Therefore, safe and secure parking could possibly prevent many crimes. Fuel stations also play a big role in the development of infrastructure for alternative fuels. Current infrastructure made for fossil fuels cannot handle the likes of electricity and hydrogen, which has created an urge to build new types of stations (Preem, Personal communication, January, 2025). Finally, drivers are requiring services that can help improve their working conditions. This can include fresh restrooms and showers, availability of food, internet connection, and truck maintenance etc. (Krasniuk, 2024).

1.2 Problem formulation and purpose

While the need for infrastructure development is clear, there are still concerns about how implementation can be done in a sustainable way. Investments in new resources are capital intensive and there are concerns about how much customers are willing to pay for the added services and products (Preem, Personal communication, January, 2025). Prioritizing economically viable investments is another important issue to optimize resource utility. Many stakeholders need to be considered when making investment decisions. These include the haulage companies that pay for the services, the truck drivers that use the services and potentially make private transactions, and authorities together with the EU, which can provide parts of the funding. There are also concerns about what the market demands in terms of

safety, services, and alternative fuels. While experts and researchers strongly push for more safe parking areas, which can be seen in the EU and Transported Asset Protection Association (TAPA) guidelines (Regulation (EU) 2022/1012; TAPA EMEA, 2023b), users of the infrastructure might differ in their views of what safe and secure parking areas entail. Likewise, researchers stress the need to use more alternative fuels in the transport sectors while it may not economically viable for haulage companies to do so (Rajon Bernard, 2023). The aspect of international transport is relevant here, since the development varies between different European countries and therefore might result in varying expectations.

With this background, the report aims to identify and describe the needs and demands from industry experts, haulage companies, and truck drivers. Important topics are safety and security, service, and alternative fuels provided by resting area and fuel station operators. The result and analysis lead to insights in what infrastructure should be developed, where to place it, and for whom it should be built. Hence, conclusions are drawn around how resting area and fuel station operators can improve and expand their service offerings, while also discussing possibilities of making the infrastructural investments profitable. Another purpose is to show differences in how demographic changes the perception of transport safety, security, services, and alternative fuels, to propose improvements to make all professional drivers feel included and to make the transport sector more attractive to work in.

1.3 Research questions

To address the purpose, the study will focus on the following research questions:

RQ1: *What do experts prioritize in terms of safety and security, services, and alternative fuels at fueling stations or resting places for long-haul transport?*

Experts such as researchers, authorities and infrastructure planners often influence regulations, funding, and long-term strategies. This question explores which needs they see as most important when developing future stations that combine fueling and rest functions.

RQ2: *What do haulage companies prioritize in terms of safety and security, services, and alternative fuels at fueling stations or resting places for long-haul transport?*

Haulage companies are important customers of these locations. Their focus is often on smooth operations, cost efficiency, and the well-being of their drivers. This question aims to understand which features they value most in future station development.

RQ3: *What do truck drivers prioritize in terms of safety and security, services, and alternative fuels at fueling stations or resting places for long-haul transport?*

Truck drivers use these stations both as professionals and private individuals, and are therefore both customer and consumer of offered services at these locations. This question looks at which services and features matters most to them during stops.

RQ4: *Based on the priorities of experts, haulage companies and drivers, what infrastructure should be developed and where should fueling and resting stations be located?*

To make infrastructure investments effective, stations need to reflect the needs of different stakeholders and local conditions. This question will guide which stations should be built and in which areas they will create the most value.

1.4 Delimitations

While this study aims to provide actionable recommendations for resting area and fuel station operators, several limitations must be acknowledged. The study is geographically restricted to Sweden. While findings may have relevance beyond the Swedish market, all analysis and recommendations will be based on conditions specific to this region. The recommendations will focus on fixed infrastructure investments. This means that while security installations, hygiene facilities, and comfort-related infrastructure will be examined, service-related aspects such as specific goods will not be included. This is due to the increased importance of motivating non-flexible investments. The study will not address the development of new, currently unknown, fuel alternatives. Instead, it will focus on electricity and hydrogen, which are widely recognized for their high potential in the transition to sustainable transport, and require infrastructural investments to be distributed. Lastly, the research will not aim to determine specific quantities for implementation. Instead, it will focus on identifying what types of solutions should be provided, why they are necessary, and where they should be implemented.

1.5 Report structure

This report is organized into nine chapters. It begins with Chapter 1. Introduction, which outlines the background, purpose, and research questions. Chapter 2. Background and Chapter 3. Project company background follows, providing context on the development of truck stops, fuel stations, regulatory frameworks, and an introduction to the project company. Next, Chapter 4. Theory introduces the key models and frameworks used in the analysis, such as the Kano model and multi-criteria decision analysis. Chapter 5. Methodology comes after that and describes how the study was conducted, including literature reviews, interviews, survey data collection, and how the models and frameworks were applied. The core of the report lies in Chapter 6. Results and Chapter 7. Analysis, which presents and interprets the empirical findings based on stakeholder input. Results are also linked to existing literature. This is followed by Chapter 8. Discussion which reflects on the study's limitations and proposes areas for future research. Finally, Chapter 9. Conclusion summarizes key insights and offers practical suggestions for infrastructure development based on the findings.

2. Background

In the following chapter, the TEN-T policy is described followed by a background regarding the development of resting areas and fuel stations for long-haul transport. It outlines how European and Swedish regulations, shifting industry demands, and changes in truck driver demographics influence the need for safer, more service-oriented, and sustainable infrastructure. A background of how logistics-related crime has shaped the need and development of safety and security measures in road transport is also presented. The chapter further describes the historical development of fuel stations, the evolving role of alternative fuels, and how these elements together shape future requirements for combined resting areas and fueling stations.

2.1 The TEN-T policy

Transportation is strategically important to European business and global supply chains. The sector contributes to around 5% of the EU's gross domestic product and employs over 10 million people (Eurostat, 2025). It also stands for 25% of the EU's total greenhouse gas emissions. Today, international transport has become normalized and plenty of freight transports take place between country borders. However, Swedish truck drivers and their vehicles are rarely used for international transportation (Eurostat, 2025). Instead, the international transports that start or end in Sweden are carried out by international haulage companies and drivers. Poland is the most notable country in Europe regarding transportation. Over 20% of EU’s total transportation is done by Polish companies and drivers while over half of Polish transports end or start in another country. Polish trucks are also by far the most represented in Swedish freight traffic followed by Lithuanian and Norwegian trucks (Trafa, 2024). Trends show that the total amount of tonne-kilometres driven per year has increased in the EU over time. In Sweden road freight transport has increased by over 30% during the last 10 years (Eurostat, 2025).

While the transports are increasing, the infrastructure must be developed simultaneously to cope with the increasing traffic volumes. Actors on both national and international levels are therefore setting visions and targets for the future. TEN-T is an example of a strategic initiative by the European Union, with the aim of creating an integrated and efficient transport infrastructure across the whole of Europe. The goal is to enhance connectivity between member countries, support economic growth, and promote sustainable mobility within the union (EU, 2025). TEN-T covers various transport modes, including road, rail, air, inland waterways, and maritime routes. The TEN-T framework is governed by Regulation (EU) No 1315/2013, and further developed with the latest amendment being Regulation (EU) No 2024/1679, which outlines the development of a core network to be completed by 2030 and a comprehensive network by 2050, see Appendix A. Priority areas include standards for road safety, accessibility, and the promotion of greener and more sustainable transport modes to reduce carbon emissions (Regulation 1315/2013, Regulation 2024/1679).

As the Regulation (EU) NO 661/2010 explains, the road network within TEN-T plays an important role for long-distance traffic. The road network is supposed to provide a uniform and good standard of services, comfort, safety, and security throughout all of the EU. Active cooperation between international, national and regional traffic management together with

external providers of value-adding services is proposed to fulfill the goals and visions (Regulation (EU) NO 661/2010). Sweden also has domestic regulations and goals. According to the proposition 2008/09:93 of the Swedish parliament (2008) both functional goals and considerations are to be met by development of the transportation system. The proposition focuses on providing accessibility and usability with high quality to raise the development potential of the country. It also emphasizes safety, environmental goals, and health effects of the infrastructure users. Recent reports show that some goals are not being met by current measures, mainly because of a lack in infrastructure development (Andersson et al., 2019).

The European Climate, Infrastructure and Environment Executive Agency (CINEA) has the mission to implement parts of certain EU programs (CINEA, 2025). They support stakeholders and projects that are aiming to contribute to decarbonization and sustainable growth. Connecting Europe Facility (CEF) is one of CINEA's programs to financially support chosen actors. With €25.8 billion to distribute between 2021 to 2027, actors can request funding when building or upgrading transport infrastructure focused on cross-border projects. The fund can for example be used to increase safety and security of transports but also for developing and providing charging infrastructure for electric vehicles and hydrogen refueling stations (CINEA, 2025). It should be considered that CEF follows a special policy for the purchasing of land. This policy says that the investment cost for land must not be bigger than 10% of the full investment cost of the project to grant maximal subsidization for the land (European Commission, 2021a).

2.1.1 Safety and security with included services

Because of the need for safety and security, the EU has formulated a standard for safe and secure truck parking. The standard is created to build transparency and trust among users while more easily being able to direct long-term financial backing to those private actors that invest in the sector (EU Parking, 2025; EU Regulation NO 2022/1012). Three main safety areas covered by the standards are physical infrastructure, technology, and procedure. The EU also puts emphasis on service as an important element for the safety and well-being of drivers. Hence, personal hygiene, food service, communication, and other services are relevant for the standard. Depending on how many criteria are met, private actors can gain a bronze, silver, gold or platinum certification showing their commitment to offering a high-quality product. Criteria for safety, security, and services regarding the certifications are shown thoroughly in Appendix B.

Each certification level builds on the previous by requiring a progressively higher degree of implementation across key areas, such as parking area security, perimeter protection, entry/exit control, and operational procedures (EU Regulation NO 2022/1012). From bronze to platinum, the demands increase in terms of technical features, surveillance systems, and managerial measures, e.g. increased requirements on fencing height or further implementation of technical systems supporting entry/exit control. Regardless of certification level, all sites must meet a consistent baseline for service provision, including gender-separated sanitary facilities, access to food and beverages, communication services, power supply, and emergency contact procedures. For detailed requirements, see Appendix B.

Apart from the EU, other organizations also have an interest in secure parking. TAPA EMEA is one of the most widely recognized organizations, and they work towards minimizing losses

from its members' supply chain by providing industry standards and solutions (TAPA EMEA, 2025). Therefore, they have, similarly to the EU directives, developed a set of criteria for safe parking spaces which companies can live up to and get a certification. By gaining a TAPA certificate, it is implied that the applicant must live up to the EU targets but also meet some additional criteria.

Pre-studies to the regulatory change in the TEN-T regulation expected the cost of implementing a safe and secure parking that lives up to all requirements to roughly €4.5 million in 2015 (Schade et al., 2021). The studied individual cases varied heavily between €1.3 million and €10.8 million. An earlier study from 2007 showed that the cost of constructing a site for 100 trucks would cost somewhere between €1.6 to €5.1 million (NEA, 2007). Examples show that the buying and preparation of land are the costliest investments, making up between 75% to 85% of all total investment costs (annual variable costs excluded) (NEA, 2007). The proportions between the costs of buying land and land preparation varied heavily, mainly depending on the size of the parking area and the cost of land per square meter. Other investments related to the safe and secure parking with complementing services make up the rest of the total sum. A more recent study from 2019 calculated a cost of €3 million of investment costs. This included everything needed for the site to reach a silver certification according to the EU standards, including electric charging stations, which were a proposed requirement before the regulation was implemented (INEA, 2019). The time horizon for the investment was set to 30 years, without further upgrades.

2.1.2 Alternative fuels

Building on Directive (EU) No 2014/94, a new regulation (EU 2023/1804) was agreed in 2023 to support the EU 'Fit for 55' package, which is EU's legislative plan to reduce greenhouse gas emissions by at least 55% by 2030. The objective of the new regulation is to create infrastructure that is functional enough to enable the uptake of alternative fuel vehicles among member states. This includes setting mandatory national targets for deployment of alternative fuels infrastructure for many different transport modes including lorries. The regulations are supporting CEFs targets to provide a set amount of capacity of fuels like electricity, hydrogen, among others. The capacity is measured within each refueling facility but also over a distance or area. Within the TEN-T network there are different restrictions based on if the area belongs to the core, comprehensive network or urban nodes (EU Regulation NO 2023/1804). The TEN-T network in Sweden can be seen in Appendix A. Over the upcoming years, the regulations will make the requirements increasingly demanding, in line with the overall TEN-T vision (Rajon Bernard, 2023). The EU considers it appropriate to combine safe and secure parking areas with charging stations for heavy-duty vehicles (EU Regulation NO 2023/1804). This approach is motivated by the longer charging times associated with electric vehicles compared to conventional refueling processes.

2.2 Industry development in the context of truck drivers

Being a truck driver has historically been synonymous with a life of freedom and a high degree of decision-making autonomy (Ottosson & Wallengren, 2019). The lifestyle of constantly being on the road is unique, as the limited social context shapes a distinct professional identity. Today, the industry is increasingly characterized by deregulation,

transnationalism, and flexibility. Digitalization has significantly influenced how truck drivers interact with haulage companies, customers, and service providers. One of the most negative aspects of the profession, according to drivers, is the increasing level of monitoring, which contributes to a constant lack of time and associated stress (Fredenman, 2019). Additionally, the nature of the workforce is changing due to transnational influences, fewer physical demands because of technological advancements, and the growing presence of female drivers (Ottosson & Wallengren, 2019). The overall perception of a more diverse workforce is positive, and some drivers believe that women, in particular, help create a more social and civilized working environment (Fredenman, 2019).

The European Union's vision to have freedom of movement of goods, services, capital and people has facilitated the use of an international workforce (Thörnqvist, 2019). This has both increased the economic efficiency in the transport sector but has also come with problems related to fair worker rights. Due to the low margin and cost-competitive character of the transport sector, many loopholes are used to go around employee rights leading to bad working conditions for international drivers (Thörnqvist, 2019). At the same time, the role as a truck driver is more demanding than ever. The Covid-19 pandemic raised the demand of transports in general following an increase in online shopping (Crizzle et al., 2021) while also disturbing many supporting functions. Examples of these were, truck driving schools and restaurants being closed and facilities like toilets and showers not cleaned as frequently. Many older drivers also quit their job during this period. Moreover, digitalization generally puts additional pressure on drivers as it allows the haulage company to gain better insight in the driving operations, thus, reducing the freedom (Ottosson, 2019). However, the perception of technology varies considerably among drivers and is also related to the employment conditions. It should be emphasized that technology also can help the drivers in their work and increase the workspace safety.

Driver shortages have been affecting the transport industry for many years now. Even though the Covid-19 pandemic amplified the problem (Crizzle et al., 2021) many of the underlying issues are long-term challenges (Keckarovska, 2021). Factors such as an ageing workforce, insufficient recruitment, bad working conditions and image issues of the profession are part of the explanation (Keckarovska, 2021; Khan, 2023). Sweden has an expected shortage of 5 000 drivers but for countries nearby like Germany and Poland, the numbers are 60 000 and 124 000 respectively. While companies are in need of recruiting more drivers, the needed qualifications of a driver are higher than ever. Maturity, education level, and environmental awareness along with technical and behavioral skills are all requested to make the transports as efficient and environmentally friendly as possible (Dubey & Gunasekaran, 2015). For long-term attractiveness it is important with institutional and governmental input. The lack of convenient, safe and secure rest areas has become a key problem for drivers and is one reason why women and young talents avoid joining the industry (Keckarovska, 2021).

One of the most important factors to facilitate a sustainable career as a truck driver is the drivers' health and well-being (Aryal et al., 2023). Truck drivers have historically acquired physical diseases through their everyday operations, which can have long term negative consequences on the drivers well-being and thus indirectly affecting the transport sector. This is partly due to the challenges of eating healthy and the possibilities to engage in physical activity during the long working days (Passey et al., 2014). It is a two-sided problem, where a big proportion of truck drivers still lack knowledge and awareness about how to live healthy,

and their working environment has not been enabling them to do so. Some barriers to healthy eating and physical activity related to the transport infrastructure is the access to grocery stores close to roads, the lack of possibilities to cook or prepare healthy foods, the lack of workout facilities, the access to showers, and factors related to having a low sleeping quality (Passey et al., 2014; Ruettger et al., 2025). It is proposed that if rest stops are located in an area that has access to nature, bike rentals, and a fitness area, it could have a positive effect on drivers' physical health (Gawlik et al., 2024). Time in nature has also proved to decrease fatigue levels of drivers (Longman et al., 2021), which indirectly affects roadway safety (Mabry et al., 2022).

Mental health is also important for the sustainability of trucking. Many drivers today would like to work shifts that do not require sleeping away from their homes during night, however this is not a possibility for everyone due to the industry structure (Aryal et al., 2023). Reasons for this are that drivers could feel unsafe, lonely, or uncomfortable when sleeping in their truck. Sleeping locations vary heavily and there are many things that can disturb sleeping quality, including noises, sleeping schedules, and stress (Rocha et al., 2022). If resting area safety can be improved, it is suggested that it will attract more drivers to the industry and increase road safety indirectly through improved mental health (Aryal et al., 2023).

Studies also show that there is a lack of parking spaces in general, and high-quality parking spaces in particular (Banerjee et al., 2010). Drivers' preference for their daily rest is to rest in a private resting area. A problem is that it is often not the drivers' choice where to park. Either there are no good parking spaces available when a break is needed, or the time schedule has been broken and the driver does not reach the planned resting area before a break is forced by law. In these cases, drivers need to find a small space along the road that does not provide any necessary services or conveniences. Safety is also considered to be low along the roads and it is one of the reasons a private parking space is preferred.

Former research provides some evidence on what truck drivers value at truck stops (Krasniuk et al., 2024). Restrooms and toilets are ranked as one of the most important features. Having clean restrooms was seen as a feature that could make drivers prefer one truck stop over another. Showers and other hygiene features were also ranked as important. Food availability was seen as an important factor in a truck stop's overall attractiveness, with variety in food options considered important. How drivers prefer the food to be distributed can vary, where some prefer stores, and some prefer restaurants. Offering a parking space or resting area at a competitive price was considered to be important when drivers choose truck stops, especially if security also is provided for the area. Another study points at the importance of providing laundry services (McKeown & Crizzle, 2025). Truck drivers' consumption behavior at truck stops and resting areas tend to mostly focus on functional, emotional and epistemic values (Goel & Kumar, 2024). Offering a high functional value means providing goods and services that fulfill physical and operational needs for the driver. Emotional values can instead be created by offering a safe and homelike environment for the driver. Creating emotional values can also result in a strong customer loyalty. Finally epistemic value can be created through offering a new and exciting experience for the driver to experience the local culture.

Many previous studies have generalized truck drivers as one homogenous group, hence the voice of minorities is rarely heard. Narratives and cultures tend to spread and reproduce between workers, which keep certain groups out of the industry (Hopkins & Davidson, 2023).

Many perceptions of environment, eating, toileting, safety, and social relations differ between males and females (Hopkins & Davidson, 2023). Women also have a higher need for safety than males since they perceive threats that do not apply to the same extent for men, such as sleeping in areas where foreign men are present (Arora & Ovhagen, 2024). Previous research also shows that improving safety at rest areas can enhance the sense of security for young women (Arora & Ovhagen, 2024). During recent convents, hygiene, safety, and inclusiveness were brought up as key barriers to remove to attract more female drivers (IRU, 2024). Even though progress has been slow, drivers acknowledge that initiatives such as women-friendly design and industry inclusivity initiatives have increased. Technological advancements such as the internet also help to enable women to have more contact with their families (IRU, 2024).

2.3 The development of fuel in the transport sector

Despite Sweden's and Europe's current shift towards electric vehicles, most vehicles in the EU rely on fossil fuels. More attention has been aimed on personal transport, where emissions have been significantly reduced through policy measures and technical development. Meanwhile freight transport still has high emission levels that only recently has started to decrease slightly (EEA, 2023). Following an increased demand for transport, there is no longer a possibility to decrease emissions enough by only improving efficiency of current fuel usage. Instead, the freight sector needs to adapt renewable fuels to a higher extent. Both Sweden and EU countries have introduced stricter regulations, in hope of leading development in this way (EEA, 2023).

During the early 2000s, biofuels became a large point of focus. Sweden invested in ethanol and biodiesel as alternatives to traditional fuels. Ethanol (E85) became widely available across the country (Drivkraft Sverige, 2025). Biogas was also promoted as part of a sustainable future (Guo, Song, & Buhain, 2015). However, recent years have shown a drop in biofuel usage. A change in regulations reduced blending requirements, leading to a significant decline in the consumption of biodiesel, e.g. Hydrotreated Vegetable Oil (HVO) (Drivkraft Sverige, 2025; Lindblom & Selin, 2025). This shows that policies play a big role in shaping the future of transport fuels. In recent years, Sweden has made great progress in switching to electric vehicles. More than half of the cars registered in 2024 were plug-in models (Lindblom & Selin, 2025). Despite this, the total share of electric and hybrid cars remains below what is needed to meet the country's climate goals (IEA-AMF, 2022). One of the biggest challenges is expanding the charging infrastructure. While the number of charging stations has grown, more investment is needed to fully support an electric future (IEA-AMF, 2022).

Unlike personal vehicles, heavy trucks have not moved away from diesel at the same pace. Diesel is still the most common fuel for these types of vehicles because it is widely available and provides the energy density needed for longer trips (Trafikanalys, 2020). Some companies have started using biogas and HVO, but adoption remains low due to higher costs and limited fueling stations (Lindblom & Selin, 2025). Battery-powered trucks are becoming an option for short-haul deliveries, but current technology does not yet support long-distance freight transport (Trafikanalys, 2020). Hydrogen-powered trucks have also been tested, but infrastructure and production costs remain major barriers (EEA, 2023).

Sweden has set ambitious targets to reduce emissions from domestic transport. The goal is a 70% reduction by 2030 compared to 2010 levels (Trafikanalys, 2020). However, current trends suggest these targets may not be reached without further policy changes. The decrease in biofuel use, slower adoption of electric heavy vehicles, and infrastructure gaps are major hurdles (Lindblom & Selin, 2025). The transformation of Sweden's transportation fuel sector illustrates a shift from fossil fuel dependency to a more diversified energy mix that includes biofuels and electricity. These changes have been driven by advances in technology, new policies, and shifting demand in the market. However, while the changes have been relatively successful for passenger transport, the heavy goods vehicle sector lags behind in its adoption of alternative fuels, partly due to path dependency. A process is considered path dependent when early decisions or actions influence future ones in the same direction, meaning that the sequence of events shapes their outcomes. The way things evolve over time limits or hinders the options available later (Kay, 2005).

2.4 The development of fuel stations

The development of fuel stations throughout the 20th century was largely driven by technological innovation and shifting consumer demands. As cars became more common, fuel infrastructure evolved from basic systems to comprehensive service hubs (Drivkraft Sverige, 2025; Giddens, 1955; Shuman, 1940). This was due to regulatory changes, evolving vehicle technology, and the growing need for convenience and professional maintenance. Big changes happened in the last two decades of the 20th century, when stations moved from full service to self-service. This made operations cheaper and more efficient. By 2006, Sweden had more unmanned stations than staffed ones. By 2024, three out of four stations were self-service (Drivkraft Sverige, 2025). Over the last decades, stations also started selling snacks and drinks to increase profits, and as more people wanted quick and easy shopping, stations added more products. Many of today's purchases at gas stations have nothing to do with fuel (Azimont & Araujo, 2010). The retail side of fuel stations has become even more important in recent years. The role of retail is key to helping stations stand out from competitors. Customers now expect convenience, and gas stations have responded by offering more food, drinks, and other products. Many have even become package pick-up points, further expanding their role beyond fuel sales (KPMG, 2020). Fuel stations have changed a lot over time (Azimont & Araujo, 2010; Drivkraft Sverige, 2025; Giddens, 1955; KPMG, 2020; Shuman, 1940). They started as simple places to buy fuel and later added services and retail. These changes have happened due to the introduction of new technology, laws and regulations, geopolitical events, and changes in people's needs and wants. In the future, stations will likely need to continue to adapt and change depending on these external factors.

2.5 The development of security and safety in the transport sector

Transport security as a field of study, has changed over time as new risks have emerged and transport systems have grown. In the past, road transport faced challenges linked to theft and weak infrastructure. Criminals took advantage of these weaknesses, making cargo theft a serious issue. Security at that time relied on simple solutions like guards, locks, and storage areas with added protection. As transport networks expanded, criminals started to adapt by using inside information and exploiting gaps in logistics operations and the supply chain (Ekwall, 2012). By the middle of the 20th century, cargo theft had become more structured

than before. Criminal groups often used fraud and insider knowledge to bypass security. Research suggests that a large part of cargo losses involved employees or contractors who had direct access to transport details. Some reports estimate that insiders played a role in about 60% of theft incidents (Robinson, 2009). In response, companies introduced measures like background checks, better surveillance, and stricter handling of cargo. These changes improved security, but criminals kept finding ways to work around them (Europol, 2009).

Governments have since the start of the 21th century developed stricter regulations due to an increased number of crimes and the seriousness of crimes (Ekwall, 2012; Sheffi, 2001). These changes forced businesses to invest in compliance, technology, and security personnel, balancing trade efficiency with security (Waters, 2007). These measures aimed to prevent transport networks from being misused (Ekwall, 2012). And as cargo theft became more organized, the transport industry started developing security standards. TAPA introduced guidelines to protect high-value shipments. The TAPA proposed guidelines included better tracking, secure parking locations, and stricter access controls (Ekwall, 2012). Secure parking is also something that can be seen with the European Commission's project TEN-T (Regulation 1315/2013, Regulation 2024/1679). See Appendix B for guidelines.

Cargo theft has continued to be a big problem. In 2007, global losses due to cargo theft were estimated at over $30 billion. In the European Union alone, theft resulted in losses of about €8.2 billion, resulting in an average cost per trip of €6.72 for European transport companies (European Parliament, 2007). But estimates of financial losses from cargo theft vary widely, and most figures are considered unreliable due to significant underreporting. These estimations often only reflect the direct value of stolen goods even though the broader impact of a theft incident can be several times higher than the face value of the goods stolen (Ekwall & Lantz, 2022). Indirect costs, including those from disrupted operations, insurance premium increases, administrative processing, and damaged reputation, can push total losses to as much as six times the original product value (Burges, 2022). Despite this financial impact, it is often not prioritized and treated as the cost of doing business (Ekwall & Lantz, 2022).

The risk is highest at unsecured parking areas where trucks are temporarily stationary, these account for over 60% of all incidents and about 70% of thefts happen at night, when fewer security measures are in place (IRU, 2008; Ekwall, 2012). Insecure parking and predictable stopping points are especially vulnerable, a pattern that aligns with routine activity theory, which explains how offenders seek predictable opportunities to commit crime (Ekwall & Lantz, 2017). As terminals and depots strengthen their security, criminal activity has increasingly moved toward more vulnerable areas such as roadside rest stops and unsecured parking areas (Ekwall, 2009a). This is referred to as the displacement effect, when criminals adapt their strategies based on the weakest links in the chain (Ekwall, 2009b). Criminals do not just steal cargo, they also hijack vehicles and target drivers with varying kinds of assaults. About 17% of truck drivers had been attacked in the past five years. Of these, 30% had experienced more than one attack and 21% had suffered physical harm (IRU, 2008). These statistics show how transport security is no longer only about asset protection, it is also about driver safety and mental well-being. Exposure to crime increases individuals' demand for protective measures, including changes in behavior and environment to reduce perceived risk (Allen, 2013), reinforcing the urgency of providing visibly secure rest areas for vulnerable groups like truck drivers. In Figure 2.1 an overview of which areas, by country, have the largest share of national incidents can be seen (van Weenen et al. 2019). Showing the region

of Skåne and outside of Stockholm as having the highest share of national incidents in Sweden.

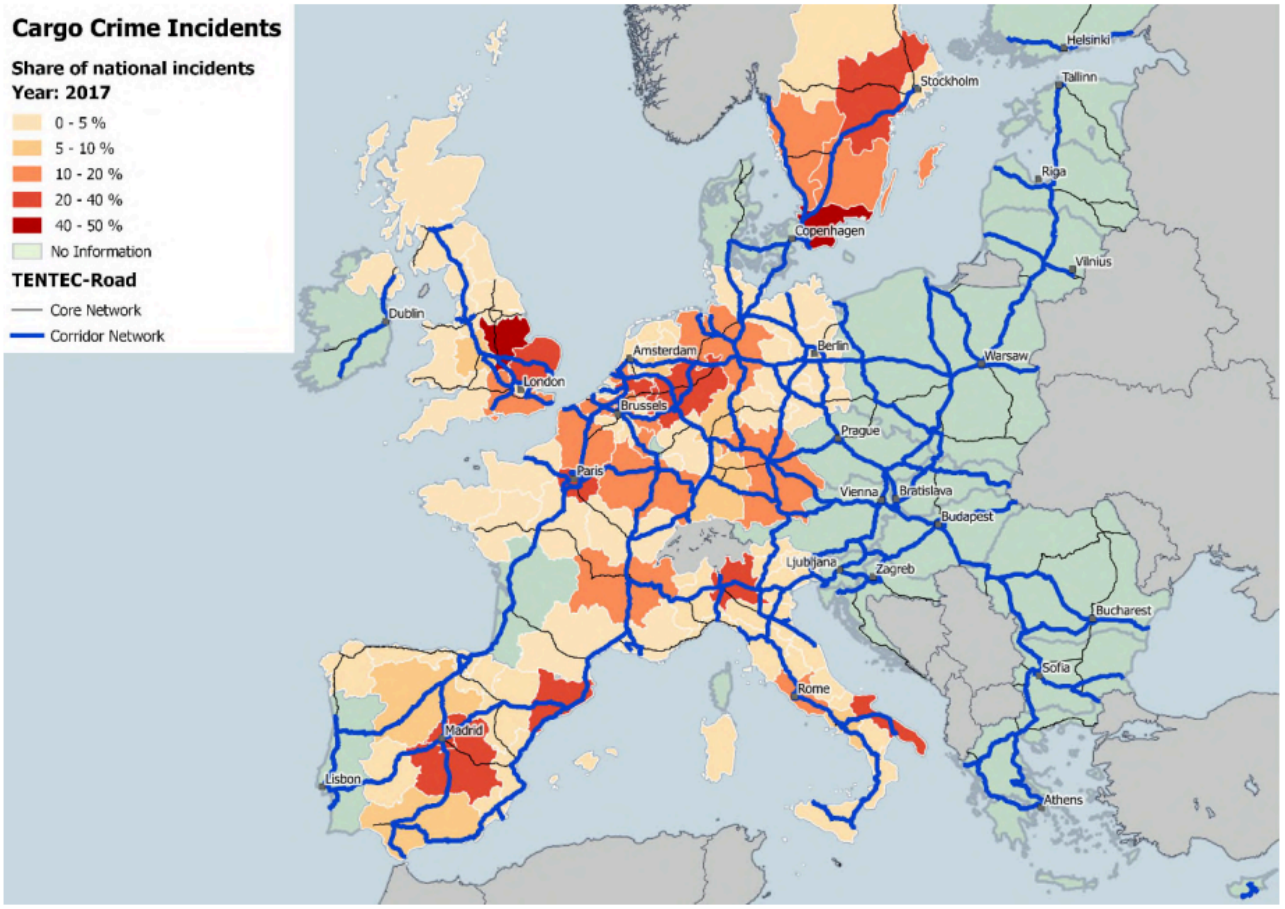


Figure 2.1: *An overview of which areas, by country, have the largest share of national incidents (van Weenen et al. 2019).*

3. Project company background

This thesis was done in collaboration with Preem to explore the evolving infrastructure needs of HGV fueling stations in Sweden. The focus lies on Preem Trucks and Preem Stationsfastigheter, given their roles in managing fueling services and station infrastructure for commercial transport. This is particularly relevant considering ongoing shifts in fuel types, driver needs, and safety requirements along major transport routes as described in Chapter 2. Background. Insights from this study aim to contribute to the understanding of how fuel providers can adapt existing station networks to meet future logistical and operational demands in the HGV sector.

3.1. Company description

Preem is Sweden's largest fuel provider, active across the full fuel supply chain, from refining and logistics to distribution and retail sales. Established in 1996, the company operates two large refineries in Lysekil and Gothenburg. These facilities supply approximately half of Sweden's fuel needs and also serve international markets. Preem's product portfolio includes gasoline, diesel, heating oil, and renewable fuels, such as HVO (Preem, 2024).

Preem Stationsfastigheter is a subsidiary responsible for managing the company's network of service stations across Sweden. It oversees ownership, development, and maintenance of the infrastructure supporting Preem's retail and distribution operations. This includes ensuring that stations are strategically located and meet operational standards for fuel handling, safety, and customer access. The division is also involved in facility upgrades to accommodate alternative fuels and electric vehicle charging (Preem, 2024; Preem, 2025a; Preem, 2025b).

Preem Trucks, formerly known as SÅIFA, focuses on fueling services for heavy-duty vehicles. It operates a dedicated network of stations tailored to the needs of transport companies and professional drivers. These sites offer high capacity fueling options for fuels such as diesel and HVO, and are positioned along key transport routes to ensure accessibility and efficiency. Preem Trucks also offers services such as fuel cards, customized pricing, and digital tools for tracking consumption (Preem, 2025a; Preem, 2025b).

3.2 Explanation of Preem's interest in the study

Preem has a strategic interest in understanding how their fueling infrastructure for heavy goods vehicles can be developed to meet future demands in the transport sector. With changing regulations and a shift toward alternative fuels along with growing attention to safety and driver needs, the company is looking at how its current network of truck stops and service stations can be adapted. This study supports Preem's broader efforts to improve its infrastructure and ensure it remains relevant as the logistics and energy landscape evolves.

Through this collaboration, Preem hopes to gain an outside perspective on future infrastructure needs from those who rely on it the most. These include transport- and haulage companies, drivers, and other actors connected to the heavy vehicle logistics industry. The study will provide insights into location planning, required services, and how to combine

conventional fuel services with new alternatives. It also gives the company an opportunity to explore how stations can become more safe and secure, while increasing the usefulness for drivers during rest periods or overnight stays. Preem is also interested in the financial side of these developments. The company wants to understand whether such investments are likely to be economically sustainable over time. This includes learning if users are willing and able to pay for improved services and whether there are opportunities to receive support or funding from other actors such as public authorities. Insights from the study aims to support Preem in making informed decisions about its future service offerings and the role that potential funding could play in infrastructure development.

3.3 Previous thesis at Preem

During the spring of 2024, a master's thesis was conducted at Preem that focused on how traditional fuel stations can be transformed to better meet the needs of a transport system moving toward electromobility (Arnberg & Kalmerström, 2024). The study, carried out by two students from Linköping University, explored how energy stations of the future could serve both passenger vehicles and heavy goods vehicles. It included the development of three business model concepts ranging from basic charging for passenger cars to more advanced stations that also support heavy vehicles and offer overnight parking. An important part of the study was to assess whether these station concepts could become profitable. To do this, the authors performed scenario-based profitability calculations that considered future electricity demand, price levels and infrastructure investment needs. The results showed that with the right setup of services and partnerships, such stations could be both financially viable and support the energy grid by offering services like battery storage and load balancing. Specifically for HGVs, the study suggests that depot charging will be the dominant solution, as only 5% of charging is expected to take place publicly, while approximately 80% will occur overnight at depots using lower power levels (Power Circle, 2021), indicating that charging at traditional fuel stations is unlikely to become the primary method in the future.

This earlier work provides a useful foundation for the current study by showing the importance of proactive infrastructure planning and highlighting key financial factors. While the previous thesis focused on electrification and broad business model design, this project takes a more specific look at heavy goods vehicles and their operational needs. By building on the insights from the 2024 study, this thesis aims to offer new perspectives on how service design, incorporating safety and security can be combined with alternative fuels to support the future development of truck-oriented fueling infrastructure. In addition, this study will include input from the intended users of these services to better understand their preferences, needs and willingness to pay.

4. Theory

This chapter presents the theoretical frameworks used to guide the analysis of stakeholder preferences and decision-making. The Kano model is introduced to categorize how different service and infrastructure features affect satisfaction among users, based on their expectations and needs. In addition, the chapter outlines multi-criteria decision analysis, which supports the evaluation of competing priorities by assigning weights to different criteria. Together, these models enable a structured understanding of how safety, security, services, and alternative fuels can be assessed and prioritized in infrastructure development.

4.1 The Kano model

Customer satisfaction is greatly built on the individual's perceived product quality (Sauerwein et al., 1996). By analyzing how much satisfaction different product features contribute with, the overall satisfaction of a product can be measured quantitatively. However, fulfilling individuals' own product requirements does not automatically result in a high customer satisfaction. The Kano model (Kano et al., 1984) shows that different product features use different mechanisms to create customer satisfaction. Explicitly expressed, customer needs can only measure satisfaction to a certain extent because some preferences either are taken for granted or unknown before they are fulfilled (Berger et al., 1993).

One-dimensional requirements are often expressed explicitly by the customer and give a linear increase in satisfaction compared to the degree of requirement fulfillment of the product (Berger et al., 1993). Attractive requirements instead give an exponentially increasing degree of happiness from fulfillment. They are also of a nature that customers often struggle to articulate or describe, making them difficult to identify. Must-be requirements have a logarithmic relation between satisfaction and fulfillment and have similar properties to attractive requirements in the way that the customers do not usually express them. However, the logic behind this is that the requirements often are obvious or taken for granted. The relation between the three categories can be seen in Figure 4.1, showing that different types of requirements give rise to different feelings. Must-be features do not create satisfaction, only dissatisfaction in the case when the features are under-implemented. The opposite applies to attractive features that instead can only generate satisfaction when they are well-implemented. One-dimensional features can create both dissatisfaction and satisfaction, depending on the degree of implementation. Some disagreements exist on how to classify the different requirements and features (Mikulic & Prebezac, 2011). Other methods mentioned are direct-classification, penalty-reward contrast analysis, and importance grid analysis. However, Kano's original method is regarded as the most reliable and valid method.

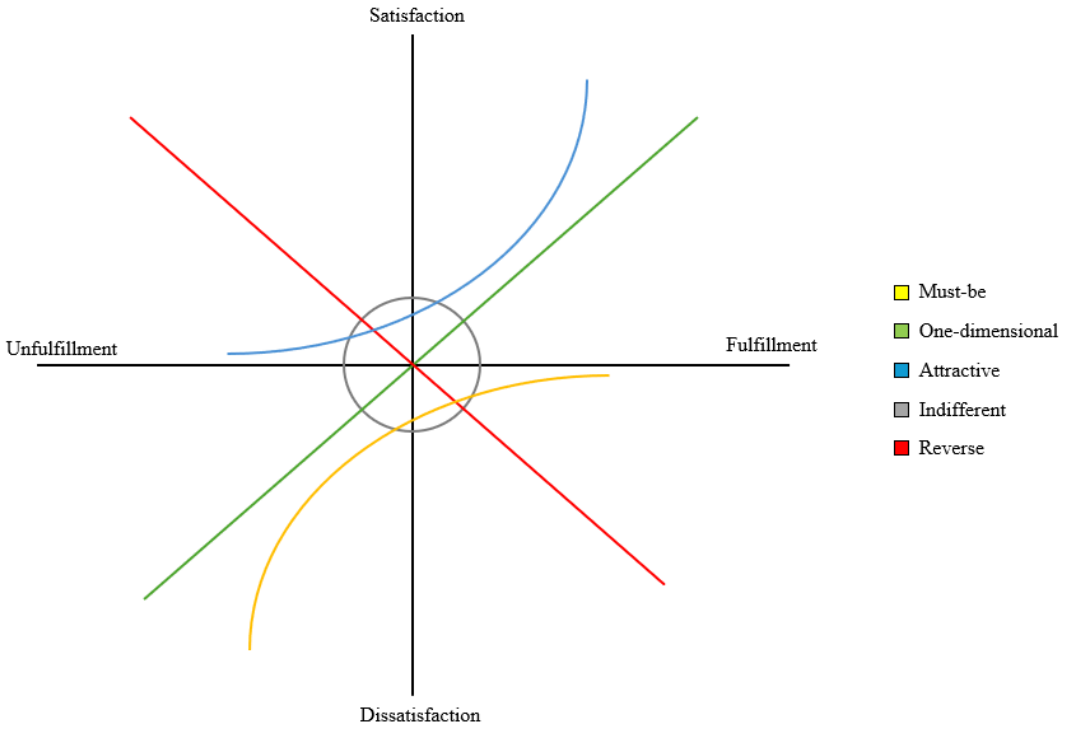


Figure 4.1: *Interpretation of the extended Kano model of quality attributes (Kano et al., 1984; Yang, 2005).*

In an extended version of the Kano model, two other types of requirements are added (Yang, 2005). These are indifferent features and reverse quality features. Indifferent features do neither result in a higher or lower degree of satisfaction through fulfillment. Reverse quality features however cause an increased dissatisfaction through fulfillment. These features can exist because of the dynamic nature of the Kano model. The applied model varies between different stakeholder groups because of diverse interests and can also change between different time periods considering stakeholders can change their preference over time. In uncommon cases, a sixth category called questionable quality is included which contain requirements that can be met through both low and high fulfillment. However, due to ambiguity it is difficult to interpret requirements in this category (Shahin et al., 2013). The refined model also introduces the concept of varying satisfaction gain within each attribute classification (Yang, 2005). This means that one attractive feature can create a higher or lower satisfaction than another attractive feature at the same level of fulfillment. How the features compare can be seen by identifying the importance of each quality attribute.

Advantages of using the Kano model are to understand and prioritize requirements and features, and to manage satisfaction levels between different customer segments (Sauerwein et al., 1996). The model can also be integrated in quality function deployment (QFD) and be used for product development (Tontini, 2007). Questions have been raised about how accurate a Kano model application should be compared to how difficult it is to gather data for. Here the researcher should aim for higher accuracy when using the original model and less difficulty when using the refined model (Madzik, 2018).

4.2 Multi-criteria decision analysis

Multi-Criteria Decision Analysis (MCDA) is a broad class of decision support methodologies aimed at evaluating alternatives in complex decision-making situations involving multiple, and often conflicting, criteria (Belton & Stewart, 2002). It is particularly relevant in domains where decision-makers must consider a variety of economic, environmental, technical, and social dimensions simultaneously. As such, MCDA enables a more structured and transparent evaluation process compared to traditional single-criterion methods.

The foundation of MCDA lies in decomposing a decision problem into a set of clearly defined criteria, assessing the performance of alternatives in relation to each of these, and assigning relative importance or weights to reflect the preferences of stakeholders (Ishizaka & Nemery, 2013). This process facilitates a comprehensive understanding of trade-offs and allows for the aggregation of multiple dimensions into an overall evaluation. MCDA methods can accommodate both quantitative data, such as costs or emissions, and qualitative judgments, such as stakeholder preferences or perceived attributes e.g. safety levels (Belton & Stewart, 2002).

There are several methodological approaches within the MCDA framework, including value-based methods such as the Simple Additive Weighting (SAW) technique, hierarchical models like the Analytic Hierarchy Process (AHP), and many more (Greco et al., 2016). The choice of method depends on the nature of the data, the decision context, and the desired level of stakeholder involvement. Across these variants, a central strength of MCDA is its capacity to integrate diverse and unequal criteria into a systematic decision framework while making the process explicit and justifiable (Ishizaka & Nemery, 2013). In recent years, MCDA has been widely adopted in areas such as infrastructure planning, environmental policy, transportation, and logistics (Greco et al., 2016). Its flexibility and transparency make it a valuable tool for public and private decision-makers seeking to balance multiple interests under conditions of uncertainty and complexity.

5. Methodology

To meet the study's objective a mixed-method approach was adopted. This approach integrates qualitative and quantitative data to build a comprehensive understanding of current regulations, stakeholder preferences, and practical constraints. The research began with a literature review to define the scope, identify research gaps, and establish theoretical foundations within transport security and safety, driver needs, and fuel infrastructure. This also included a review of EU regulations, which serve as an important background. Qualitative data was gathered through semi-structured interviews. These interviews explored stakeholder-specific priorities and allowed follow-up questions to be tailored to each respondent's expertise. All interviews were transcribed, then thematically categorized by topic and stakeholder group. To complement the interviews, a survey was distributed to truck drivers, considered both consumers and customers. Insights from both the literature review and interviews were used to formulate the survey questions. This ensured that the survey addressed not only theoretical gaps but also practical concerns raised by stakeholders. Responses were analyzed with respect to different demographic groups. Lastly, an analysis was made to evaluate the different features for safe and secure parking areas, service, and alternative fuels. Combining both the qualitative data, from interviews, and quantitative data, from the survey, results were put in perspective of previous research, current regulations, and theoretical considerations.

5.1 Literature search

While road transport is a common topic in research journals, the fields of transport safety and security, fuel station development, and truck driver needs are not frequently appearing in scientific papers. Before determining the definite methods for data gathering and analysis, a literature review was conducted to identify the existing research until now. The importance of such information gathering is emphasized in methodology literature to understand what research has already been done, what gaps new research could fill, and to be able to show extensive knowledge of the field (Hart, 2018; Kumar, 2018).

This study focuses mainly on the fuel station and parking area infrastructure for HGVs in Sweden within the context of the TEN-T network. Therefore, Swedish and European literature is seen as the most relevant to gain a view over the subject. However, American research in the industry is more extensive. It must be stressed that there are several regional differences between the European and American markets that create a need for different solutions. Still, fundamental issues such as criminality, personal health and hygiene, and the need for alternative fuels persist. Hence, regional literature was prioritized in gaining fundamental understanding of the industry environment. Following the theme of studying universal solutions, the approach to reading literature has gone beyond literature about transport safety and security, fuel station service, and alternative fuels. To come to the root of problems like transport security, there are many things to learn from other research fields, e.g. criminology (Ekwall, 2012). The same goes for understanding truck drivers' and haulage companies' needs where sociology, psychology, and economics are all relevant interdisciplinary fields (Caddick et al., 2017). Generally having an initially broad view of the research field is proposed to not limit potential findings (Kumar, 2018).

When finding both background and theory literature, academic sources of high quality have been prioritized. Background literature stems from both academic journals but also from reports published by authorities, organizations and institutions. An important part of the background is the set of regulations around the TEN-T network published by the European Union. This includes both the standards for safety and security but also rules about infrastructure for service and alternative fuels. Academic reports were gathered based on various relevancy criteria, e.g. time, geographical context, and academic journal reputation. Both database searches and snowballing were used when identifying articles. Google Scholar, Chalmers Library, and Transport Research Board (TRB) were used as databases. Using multiple databases to gather information is considered an effective way to achieve a broad and thorough literature review (Patel & Davidson, 2019). To select relevant literature for the study, it is also important to critically evaluate the sources (Patel & Davidson, 2019). Snowballing is defined as the process of either finding articles through references or citations from other articles (Badampudi et al., 2015). In this way it is easier to identify both central literature for the topic but also more specific applications of general concepts and models. When evaluating articles and theories, including well known theories from reputable authors, critical thinking is important (Hartman, 2004). There are always possibilities that new findings have affected even the most well-established theories and models, hence creating a new problem context.

5.2 Data gathering

To capture the perspectives of key stakeholders, three data collection methods were used: expert interviews, interviews with haulage companies, and a survey for drivers. Each method was tailored to its target group and provided complementary insights into current needs and conditions for safe and secure rest areas and alternative fuel infrastructure in Sweden.

5.2.1 Preparatory interview study

In this study, two sets of interviews were sequentially conducted. With the background of a limited amount of previous research done on fuel station and parking area infrastructure within Europe, there was a need to further gain understanding for the current situation of the industry. In addition to the literature review, the purpose with the first batch of interviews was to get insights from professors and researchers from universities, professionals working in the management of organizations providing similar infrastructure, experienced managers from stakeholder companies, and finally authorities that can shape the rules and incentives behind the decision making. A snowballing method was used to first actively contact a few participants, and then find contacts and relevant persons through their networks.

With interviews it is possible to get information that is not accessible without social interaction (Bell & Waters, 2016) and therefore they were needed to get a full view of the field. These interviews followed a semi-structured format with tailored questions designed to capture the most relevant insights based on each interviewee's specific background and expertise. Details on the questions can be found in Appendix C. Apart from the pre-made questions, the interviewees got the opportunity to elaborate both on topics related to the questions but also on subjects they felt were suitable for the occasion. Part of the interviewer's role was to create a friendly and open discussion climate to make the respondents comfortable with being honest and vast when answering. This is in line with best practice rules for conducting interviews (Trost, 2010; Lantz, 2015). During the period when

this first set of interviews were held, the knowledge of the field evolved. Through better knowledge later interviews could be increasingly based on previous findings and interesting topics (Trost, 2010). Although, adding questions based on previous interviews should be done in a way that does not lead the answers towards a preconceptual result. After some interviews, a saturation could be seen in the gathered information. Based on this together with the limitations and scope of the report, the first set of interviews were considered to be finished.

Ethical considerations were always present during all interviews. All interviews except one were held online, usually through Microsoft Teams, and were recorded and transcribed with help of software tools from Microsoft. In the beginning of each interview, the project's purpose and implications were presented to participants, before permission to record was requested. No participants denied this possibility. Having access to data in these forms helps to compile and present the results (Trost, 2010). Recordings were also only used during the project period and deleted afterwards. Respondents could choose to be anonymous in the report, which allowed for an open discussion. A list of all interviews will be presented in Chapter 6. Results and Appendix D. To structure a more readable report, decisions were made to keep experts that were not published as anonymous, and thus interviews for this step are labeled as Expert A to G, while Ekwall and Grahn are kept as not anonymous.

5.2.2 Qualitative interview study

The second set of interviews had a different character compared to the first one. With the purpose of understanding both consumers' and customers' perception of what type of infrastructure is needed at fuel stations and parking areas, interviews were held with multiple haulage companies. While a survey was seen as a good solution for gathering data on truck drivers' needs, interviews were better suitable for haulage companies based on less perceived diversity and different incentives. Since this report takes a transnational viewpoint of transportation it was important to both get the view from Swedish and International haulage companies. Statistical reports point towards international drivers and companies being highly influential in the long-haulage sector in Sweden (Trafa, 2024). Hence, the original intention was to conduct interviews with an equal number of international haulage companies from northern, eastern, and central Europe, as well as Swedish haulage companies. This approach aimed to gain a holistic understanding of what different actors value and to compare the similarities and differences between them. However, connecting to international haulage companies proved to be difficult, where almost 200 companies were contacted but none agreed to conduct an interview. By lacking the views of these companies, the results may become biased towards opinions of the local actors, thus reducing inclusivity. Therefore, efforts were put into designing interviews with experts and Swedish haulage companies to also consider the perspective of international haulage companies. Selection of Swedish companies was made to capture views of both smaller and bigger organizations, as well as to ensure a balanced geographical representation.

For these interviews, there was a more structured scheme of questions, and the interview guide was standardized among all haulage companies. This was done to better be able to compare and make conclusions about the different companies and their views (Lantz, 2015). Though the interviewees still got the opportunity to elaborate both on topics related to the questions but also on subjects they felt were suitable for the occasion (Trost, 2010; Lantz, 2015). Similarly to the previous set of interviews ethical considerations were always present and followed the same structure of transcription. Unlike the previous set of interviews, these

were decided on being fully anonymous. These interviews are therefore labeled as Hauler X, Y, and Z. More information can be found in Chapter 6. Results and Appendix D.

5.2.3 Survey study

To be able to gather information and insights from the third group of stakeholders, the drivers, a survey was prepared and published. The survey was designed using research-based guidelines to ensure questions were clear and unbiased. An important consideration was avoiding leading questions, as respondents might see them as manipulative even when the researcher's intent is genuine (Hagevi & Viscovi, 2020). To maintain neutrality, questions were carefully worded to prevent unintended influence. Memory recall was another challenge since people tend to forget details over time, especially when an event is not significant to them. To improve accuracy, time and frequency intervals were included in relevant questions to help respondents provide more precise answers (Hagevi & Viscovi, 2020; Trost, 2010).

Although truck drivers share some common traits, individual preferences can vary, especially as the population becomes more diverse with more international and female drivers. Therefore, the content of the survey includes a section on the respondent's demographic background, followed by questions exploring how truck drivers perceive safety and security in various situations. It also covers topics such as comfort and hygiene at fuel stations or truck stops. Finally, a set of questions addresses attitudes toward alternative fuels. These topics were derived from the previously read literature, and the two sets of interviews. The survey results will be analyzed by sub-groups, with nationality, gender, and exposure to crime, serving as the primary demographic categories. A respondent may be a part of several demographic groups, e.g. identifying as a man, being Swedish, and having been exposed to crime.

Most survey questions followed a closed-ended format to make it easier for respondents to answer while reducing the risk of missing data. Open-ended questions, while useful for capturing more detailed responses, often lead to higher dropout rates. This is particularly true for individuals who struggle with expressing their thoughts through writing or who have vague opinions on the topic (Hagevi & Viscovi, 2020; Trost, 2010). Open-ended responses also require extra processing through categorization, which counterintuitively can make the final analysis resemble that of structured, close-ended questions (Hagevi & Viscovi, 2020). To address this, open-ended questions were used as few times as possible and structured to guide responses without limiting them (Hagevi & Viscovi, 2020). Likert scales were applied for questions measuring attitudes since they provide a balanced range of positive and negative response options (Hagevi & Viscovi, 2020; Kano et al., 1984). However, a common issue with Likert scales is acquiescence bias, where respondents tend to agree with statements regardless of their actual opinions. This pattern is more likely among those with low engagement in the survey or limited familiarity with the topic (Krosnick & Presser, 2010). To counter this, opposing questions were included to detect and adjust for response patterns (Kano et al., 1984).

To improve readability and minimize confusion, questions were grouped thematically so respondents could follow a logical flow and better understand the context of each section (Hagevi & Viscovi, 2020). Clear instructions were placed at the beginning of each section to help respondents interpret and answer questions correctly. This approach reduced the risk of misinterpretation and ensured greater consistency in responses (Trost, 2010). Maintaining

uniformity in response formats was also important since too much variation in question structure can make a survey harder to complete, since too much variation can lead to fatigue or survey abandonment (Hagevi & Viscovi, 2020).

To ensure the survey results were representative of the target population, a probability-based cluster sampling method was applied, using the distribution channels Sveriges Åkeriföretag to reach out to Swedish drivers and varying forums to reach foreign drivers. This approach helped minimize selection bias by ensuring that the sample group reflects the larger population (Hagevi & Viscovi, 2020; Trost, 2010). Standardization was applied to improve comparability between responses. Using consistent wording across most questions helped reduce differences in interpretation (Trost, 2010). Structured response options were used in most cases, making data analysis more reliable and improving the overall quality of results (Trost, 2010).

High reliability and validity are important factors for ensuring accurate results. If respondents misunderstood a question, their answers would not reflect their actual views, which could affect the quality of the data (Trost, 2010). To prevent this, clear instructions, mentioned in Survey structure and instructions, were provided throughout the survey to help respondents answer correctly. Neutral response options were included when necessary, allowing those without strong opinions to select an accurate answer rather than choosing something that did not reflect their views (Hagevi & Viscovi, 2020). The survey concluded with an open-ended question where respondents could share additional thoughts or perspectives that may not have been covered in the structured sections. This approach mirrored follow-up questions in interviews, allowing for further insights (Trost, 2010).

5.3 Method for analyzing data

After the survey was completed, the next step was to organize and analyze the responses. To make the dataset easier to interpret, we began by presenting the answers in frequency tables. These showed how often each response occurred and made it easier to spot patterns in the data. Absolute frequencies were used since the number of observations was low (Lantz, 2020). For questions involving two variables, cross-tabulations were used to show how different groups answered in relation to each other (Lantz, 2020).

Visual presentation played an important role in making the data more understandable. Bar charts and similar diagrams were created depending on the type of variable. Ordinal data, which has a clear ranking but no fixed distance between values, was most often presented using bar charts with frequencies (Barmark & Djurfeldt, 2019). When multiple groups were compared, these groups were presented side by side to highlight differences between them (Lantz, 2020). Care was taken to avoid misleading visuals, i.e. diagrams were not manipulated in ways that could exaggerate or hide patterns, and care was taken to make sure to present the data honestly without selecting only favorable results (Lantz, 2020). Although the number of responses was limited, several groups had close to or more than 30 answers, an amount often considered a rule of thumb for when tendencies can begin to be observed (Lieber, 1990). However, groups with fewer than 30 responses were interpreted with greater caution, as their patterns may be more sensitive to individual variation. In study, the groups with fewer responses than 30 were women and foreigners. Throughout the process, care was taken to select analysis methods that matched the nature of our data. Parametric methods were avoided when assumptions such as equal distances or normal distribution were not met. Instead,

non-parametric methods and descriptive tools were prioritized to ensure a more accurate interpretation (Lantz, 2020). Performed calculations are displayed in Appendix E.

5.3.1 Application of the Kano model

When using the Kano model in practice, there is a well-established method framework to follow. It originates from the inventors of the model (Kano et al., 1984) and has been reviewed and enhanced by other researchers (Mikulic & Prebezac, 2011; Madzik, 2018). There are possibilities to combine analysis from the Kano model with other theoretical frameworks within quality management (Rashid, 2010), i.e. AHP rankings (Li et al., 2009), which allows for a broader overview of product attribute importance. Surveys are seen as suitable tools to gather data needed to use the Kano model because of the need for quantitative data (Kano et al., 1984).

Apart from standard questions about respondent background and confidentiality, the questionnaire should follow a structure including functional and dysfunctional questions (Kano, 1984). Both these types of questions aim to examine how the respondent is feeling about a certain feature or scenario. In a survey format, each question in the Kano-centric part is designed to ask “How would you feel if X is/is not present” in the final product or service. The question if something is present is then called a functional question, while the question about something not being present is called a dysfunctional question. The whole point of the analysis method is to gain answers from both a functional and a dysfunctional question, regarding the same feature or scenario. Answers are limited to five options which moreover are the same for both functional and dysfunctional questions. The options are “I dislike it”, “I can accept it”, "I am neutral”, “I expect it”, and “I like it”. The answers from both the functional and dysfunctional question are then matched through a matrix shown in Figure 5.1, where the couple of answers represent a suitable attribute category. For example, if the respondent answers “I like having a safe and secure parking area at the fuel station”, followed by “I am neutral to not having a safe and secure parking area at the fuel station”, then the feature of having a safe and secure parking area would be counted as an attractive feature (Kano, 1984). Since it is relatively easy for respondents to default to a neutral or indifferent answer, especially in survey formats, the calculations were adjusted to better reflect the underlying preferences. Specifically, if indifferent appeared as the most common classification for a certain feature but another category was a close second, this considered in the final categorization. This adjustment aimed to reduce the risk of overestimating indifference and provided a more nuanced picture of respondent preferences.

		Answer to dysfunctional questions				
		I like it	*I expect it*	*I am neutral*	*I can accept it*	*I dislike it*
Answer to functional question	*I like it*	Questionable	Attractive	Attractive	Attractive	One-dimensional
	I expect it	Reverse	Indifferent	Indifferent	Indifferent	Must-be
	I am neutral	Reverse	Indifferent	Indifferent	Indifferent	Must-be
	I can accept it	Reverse	Indifferent	Indifferent	Indifferent	Must-be
	I dislike it	Reverse	Reverse	Reverse	Reverse	Reverse

Figure 5.1: Interpreted Kano matrix (Kano, 1984; Yang, 2005).

Through the transformation from answers into attribute characteristics, conclusions can be drawn of what features are important for the respondents. Referring to the refined Kano model (Yang, 2005), after attribute characteristics are decided, there is still uncertainty about how important they are, or rather how much effect an increase of implementation has. This is in some cases decided by a third question regarding a feature of how important the feature is for the respondent. Hence, this will give the slope of the given curve in the Kano model graph. However, the importance question can be seen as exhausting for respondents when used in the survey (Madzik, 2018). Therefore, it is not included in this adaptation of the model. Regarding information about importance, there is a final part of the survey where questions are asked about how important some sub-features are, e.g. how important it is to be able to eat heated food at the truck stop, in comparison to the general feature that the station could provide food. Instead of providing the Kano analysis on how important features are, these questions are rather aiming towards understanding if certain aspects of a feature are affecting the perception of the feature in general.

5.3.2 Application of multi-criteria decision analysis

To interpret the survey results in a structured way, this study applied MCDA specifically using the SAW technique. MCDA is a family of decision-making methods that enables the evaluation of alternatives across multiple criteria, particularly useful in complex contexts involving both qualitative and quantitative factors (Belton & Stewart, 2002; Ishizaka & Nemery, 2013).

The criteria used in the analysis were directly derived from the grouped categories in the survey, each reflecting aspects of safety, security, service, or alternative fuels, identified as features of interest during the data gathering phase. For each criterion, the mean value of the responses was calculated to represent the average perceived importance or satisfaction. To center the analysis around the neutral midpoint of the Likert scale and emphasize functional (rather than dysfunctional) responses, each mean was adjusted using the formula: (mean – 3). This ensured that values above the midpoint contributed positively and those below negatively. The weighting of each criterion was informed by a Kano analysis performed on the same set of survey responses. Based on their classification as one-dimensional, must-be, or attractive, different Kano weights were assigned (Li et al., 2009). Criteria not categorized into these classes were excluded from the final calculation, since these features would affect the contribution negatively, or not at all, if implemented. The final performance score for each criterion was calculated using the formula:

$$Performance\ Score\ = \frac{(mean-3) \times Kano\ weight}{\Sigma(mean-3) \times Kano\ weight}$$

This formula allowed both the perceived importance of each criterion and its underlying customer satisfaction classification to be integrated into a single normalized value. By aggregating these weighted scores, a final prioritization was created, highlighting which features and services the consumers valued most. This combination of MCDA and Kano analysis provided a transparent and methodical way to interpret the survey results and compare preferences across demographic groups. The approach also enabled the identification of features that could deliver the highest perceived value if prioritized in infrastructure development (Greco et al., 2016; Ishizaka & Nemery, 2013).

5.4 Ethical aspects

The study has been thoroughly controlled to follow established ethical standards. The choice of topic for the report brings with it a responsibility to consider the perspectives of multiple stakeholders. Each actor has their own perception of problems and potential solutions, making it difficult to define a universal answer. Additionally, certain minority groups are limited by current structures in their ability to express their needs and wants. In this study, the focus has been to bring together the opinions of different providers, customers, consumers, and researchers to improve fuel station infrastructure. These were considered the direct stakeholders of the problems. Indirect stakeholders like third-party organizations, local institutions, and the public were also seen as important. Due to the scope of the report, these were not contacted for an interview but still present in mind when forming interview questions.

The current regulations set in 2022 (EU Regulation NO 2022/1012) are based on extensive pre-research (Schade et al., 2021), which shows the seriousness and credibility of the framework. Although many stakeholders are already included in the decision-making process, the framework fails to explain more than just general views of infrastructural development. To be able to further understand the opinions of sub-groups such as different genders and nationalities is therefore central to promote inclusivity. Since the TEN-T regulations do not force infrastructural changes, there is a need for supporting the development through studies and research, making implementations possible. Otherwise, access to good working

conditions could become unequal. As the study focuses on Swedish infrastructure, it is also important to consider foreign workers operating in Sweden when implementing measures.

Throughout the process of writing this report, many decisions were made to improve the reliability and transparency of the research. All literature sources were reviewed before being included as background or theoretical references to gain a solid foundation for interviews and survey. Theoretical frameworks were selected based on relevance, with emphasis placed on using established and trusted frameworks. The study followed an iterative structure in which earlier insights were repeatedly challenged and revised throughout the process. This approach enabled the development of more precise and relevant questions for both interviews and the survey. In both interviews and the survey, respondents could freely answer all questions and could always choose not to answer perceived sensitive questions. By using audio recordings, it was ensured that the results were presented in a way that accurately reflected the data gathered from interviews. Furthermore, all important data is presented either as part of the main report, or in appendices to show transparency. All participants in the study have received full information about the purpose of the study and were treated with respect and appreciation regardless of their background. Data was handled carefully and responsibly to ensure that no confidential information was disclosed from any participant.

6. Results

This chapter presents the empirical results of the study and aims to answer Research Questions 1, 2, and 3. All assumptions and statements included in this section are based directly on data collected through interviews and the survey. The findings are reported without interpretation and serve as the foundation for the analysis that follows.

Name/Pseudonym	Profession	Areas of discussion	Other information	Interview length	Date of interview	Digital	Recorded
Daniel Ekwall	Professor, University of Borås	Safety and security	Extensive knowledge of safety and security in the transport sector. Docent in Supply Chain Security.	60 minutes	7/2/2025	Yes	Yes
Maria Grahn	Docent, Chalmers University of Technology	Alternative fuels	Extensive knowledge of the challenges and opportunities of alternative fuels.	60 minutes	19/2/2025	Yes	Yes
Expert A	Gatekeeper, Trelleborgshamn	Safety and security Service Alternative fuels	Extensive knowledge from an important transport node included in the TEN-T network.	60 minutes	25/2/2025	Yes	Yes
Expert B	Project Manager, Trafikverket	Safety and security Service Alternative fuels	Extensive knowledge from leading rest area projects in Sweden.	60 minutes	26/2/2025	Yes	Yes
Expert C	National coordinator, Trafikverket	Financing of infrastructure	Works for Trafikverket, but more specifically the CEF-secretariat for transport.	30 minutes	28/2/2025	Yes	Yes
Expert D	Safety manager, Schenker	Safety and security Service Alternative fuels	Extensive knowledge from working as a safety manager at one of Swedens largest logistics companies.	60 minutes	5/3/2025	Yes	Yes
Expert E	Safety manager, DHL	Safety and security Service Alternative fuels	Extensive knowledge from working as a safety manager at one of Swedens largest logistics companies.	60 minutes	14/3/2025	Yes	Yes
Expert F	Entrepreneur	Safety and security Service Alternative fuels	Extensive knowledge from starting and developing companies in the logistics sector.	60 minutes	8/4/2025	Yes	Yes
Expert G	Safety advisor	Safety and security	Retired crime commissioner with 25 years of experience in transport safety and security.	90 minutes	28/4/2025	No	No
Hauler X	Owner of a swedish haulage company	Safety and security Service Alternative fuels	Middle sized haulage company based in Jönköping. Operating mostly in the southern parts of Sweden and Norway	30 minutes	7/4/2025	Yes	Yes
Hauler Y	Owner of a swedish haulage company	Safety and security Service Alternative fuels	Middle sized haulage company based in Jämtland. Operating mostly in the northern parts of Sweden.	30 minutes	8/4/2025	Yes	Yes
Hauler Z	Owner of a swedish haulage company	Safety and security Service Alternative fuels	Larger sized haulage company based at multiple locations. Operating all over Sweden, mostly supplying temperated goods	30 minutes	11/4/2025	Yes	Yes

Table 6.1: *Overview of the interviews conducted in the study.*

6.1 Safety and security

Experts within the transport safety sector distinguish the concepts of “safety” and “security”. Ekwall and Expert D emphasized that while safety often refers to the protection of the driver and vehicle from physical harm or accidents, security instead refers to specifically target crime prevention and protection against theft. These two terms can often be conflated in practice though they carry different operational implications for infrastructure design and investment. As Expert D said, there is often a trade-off between creating a safe vs. secure environment for the drivers and vehicles. This chapter is divided into several parts that describes criminality within the transport sector. It further describes why crimes occur, how it occurs, how to prevent the crimes, and how organizations and individuals are affected by the criminality.

6.1.1 Criminality in the transport sector

The security experts described a complex picture of how crimes affect the logistics sector. Ekwall and Expert G both said that thefts in the transport business have been a problem for a very long time, and that it will continue to be a problem far into the future. They pointed out that it is almost impossible from a criminology perspective to make all crimes disappear. It is only possible to direct the crimes to less serious situations and to reduce the consequences of the crimes. Ekwall continued to explain the patterns behind the criminals' behavior. He emphasized that crime within the transport sector tends to be highly concentrated geographically, often occurring repeatedly in the same few locations. If security measures are implemented in a high-risk area, criminal activity often relocates rather than disappears. Ekwall said that this pattern is rooted in criminological theory and that it is important to have interdisciplinary knowledge to be able to solve criminality issues in an effective way. Expert G agreed with Ekwalls point about geographical concentration and presented a map of southern Sweden indicating the regions with the highest incidence of reported logistics-related crime. 25% of logistics-related crimes occur in the northwestern part of the Skåne region, specifically in and around Helsingborg. This map can be seen in Figure 6.1.

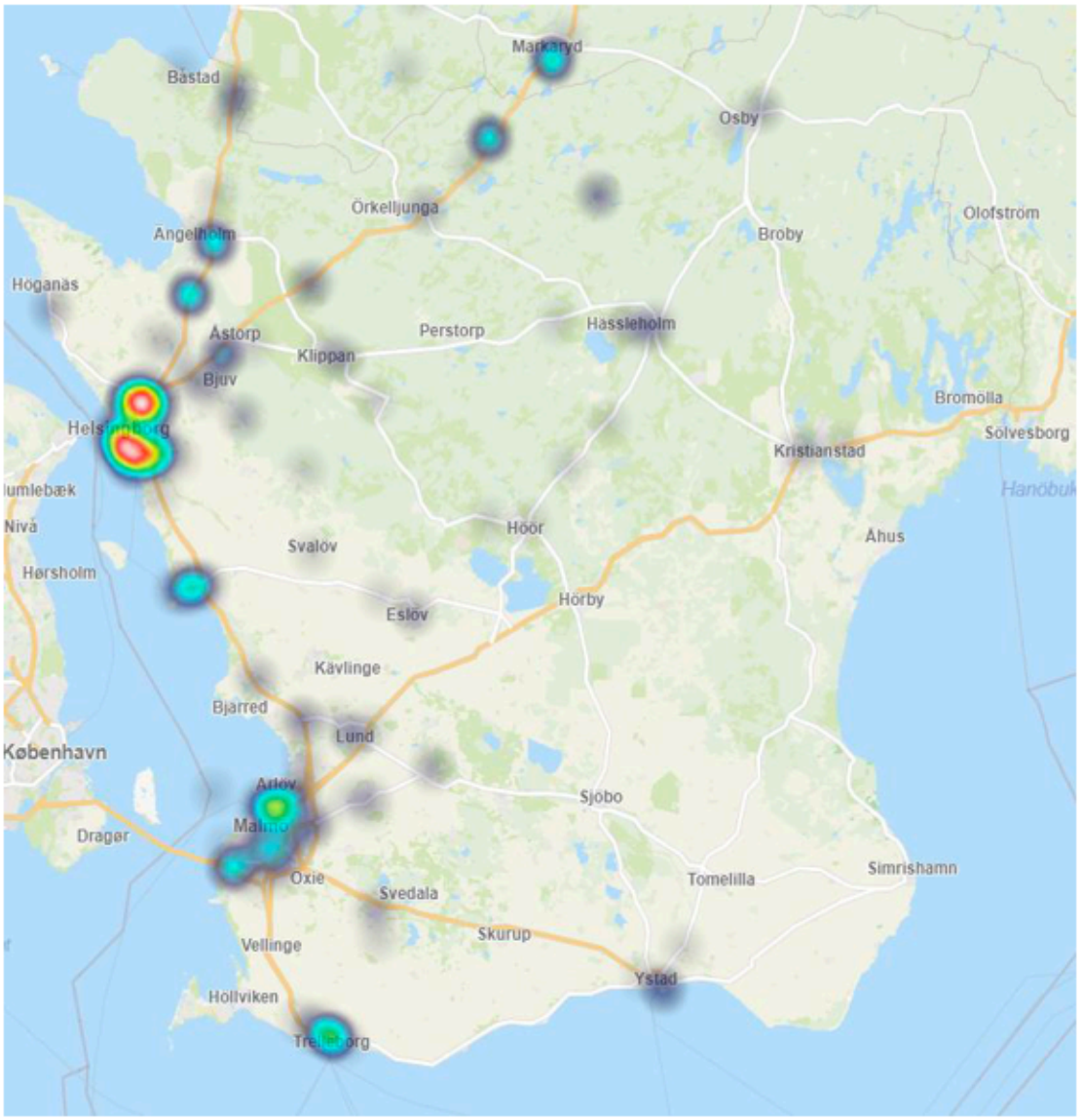


Figure 6.1: *Geographic distribution of reported logistic-related crimes in southern Sweden provided by Expert G.*

Another pattern that is commonly observed, according to Ekwall and Expert G, is that crimes are concentrated in high density areas. The number of crimes that occur in a specific place rises exponentially with the population. This is especially visible in urban areas and high population regions. According to Ekwall, the public perception of safety does not always align with actual crime statistics. He pointed out that there are many occasions where someone can have a feeling of being safe, while in practice being highly exposed to crimes or vice versa. An example could be when a parking space has a security camera but no other security equipment. The driver might then feel safe because of the camera, but there are no physical barriers preventing a crime from happening, and the criminals might not even be aware of the camera. Expert D added that safety and security often intersect as workplace issues for drivers, and stressed that security demands are increasing over time, both due to evolving threats and raised expectations from clients and insurers.

When a crime occurs, it is usually reported to authorities and documented, however according to Ekwall there is a big number of crimes that are never properly reported or investigated.

Expert G agreed with Ekwall but emphasized that most of logistics-related crimes are never reported, and when they are, the report is often lacking in vital information.

All the security experts said that canvas slashings are the most common crime, although they can be done with different intentions. Sometimes the criminals know what type of goods that are inside a trailer and target that specific trailer to acquire the goods, while other times they arrive at a parking space and slashes multiple trailer's canvases just to see if there are valuable goods in any of them. Expert A agreed that canvas slashing is a big and annoying problem, but also mentioned fuel theft as a common problem at the terminal in the port of Trelleborg. Expert G agreed with Expert A and said that it is a problem throughout the country, but also added that nowadays it is less of a problem than what it has previously been.

The security experts mentioned different types of goods that are commonly targeted for thefts. Expert E said that electronics historically was the most targeted category of goods, but that this has changed due to the marking and tracking of goods. Now instead he mentioned clothes to be a viable option. Ekwall agreed that it is beneficial for the criminals to steal goods that are not marked and mentions durable food as a possible target. Expert E said that the type of goods stolen also can be influenced by the geographical opportunities to flee across country borders.

Other types of crimes mentioned by the experts were sexual harassment. Ekwall said that this type of crime is more difficult to predict when and where it is going to happen and expresses concerns regarding how to reduce them. Expert F agreed that sexual harassment is a problem and pointed it out as one of the reasons to why the industry is failing to attract female truck drivers. Ekwall also said that assaults from other drivers happen from time to time, but that it generally is quite rare.

According to Ekwall, routine activity theory can help explain why crimes happen. If a motivated offender and a suitable target meet in an area without proper security measures, the likelihood of a theft increases. Ekwall said that a cause of these parameters to be filled is that both drivers and criminals are driven by routines and habits. Drivers typically follow set delivery schedules and are required to take regular rest breaks. When these routines become predictable, it allows criminals to learn their patterns and exploit them. Ekwall emphasized that unpredictability makes the criminals less likely to commit crimes.

Another factor is where drivers take their rest. Ekwall explained that statistics show that some streets and areas are more vulnerable than others, partially due to the lack of people passing by, the limited visibility around the parking space, and the proximity to goods terminals. These statistics were backed up by Expert G, an example can be seen in Figure 6.1. Expert E said that criminals are watching terminal operations closely and are ready to strike if the driver must take a rest outside the terminal area. Expert D added that being inside a terminal does not guarantee high safety and security. This is due to some criminals being, according to Ekwall, Expert D, and Expert G, good at infiltrating terminals and getting insider access or knowledge. Ekwall agreed, while saying that corruption is a bigger problem in other countries but that organizations in Sweden still need to be aware of the possibility of some persons giving out confidential information to criminals.

The haulage companies echoed many of the experts' concerns. Hauler Y and Hauler X emphasized that fuel theft, canvas slashing, and trailer break-ins are the most common types

of crimes. They reported that when they do happen it often affects the drivers' sense of safety. Hauler Z, on the other hand, said that they instead have identified van break-ins as the most common crime and that they therefore focus on the drivers' safety and not the cargo. He also added that they have had a theft of a vehicle at one point. All of the haulage companies confirmed that crime often concentrates in specific geographical areas, often in the south of Sweden and along larger transport routes, while Hauler Y added that larger cities should be included in these high-risk geographical areas as well. Which Hauler Z echoed by explaining that cites are where most of the crimes that they have been a victim of have happened. All of the haulage companies said that the cargo that is transported is one of the most determining factors when it comes to the risk of crimes. Hauler X explained that they had tried to use larger locks on their trailers to decrease the risk, but this had the opposite effect, since it signaled to criminals that the cargo was more valuable. All haulage companies could agree that there are currently too few secure rest areas in Sweden. Hauler X added that public infrastructure often lacks adequate safety measures, forcing companies to plan their own secure stopping points. As a result, drivers are frequently diverted from their most efficient routes to reach these safer locations.

All haulage companies expressed frustration over the fragmented approach to rest areas and secure parking. They criticized Trafikverket for not having the tools or willingness to drive development of new rest areas even though Sveriges Åkeriföretag have tried to influence and work together with Trafikverket. Hauler X implied that Trafikverket's approach tends to over complicate things, such as building big projects instead of focusing on the needs, such as basic safety measures and geographical relevancy. All haulage companies agreed that there is a need for external actors to support the development in regard to secure rest areas.

According to the surveys almost half of all drivers have been the victim of a crime when on duty. See Figure 6.2. Many of the survey comments echoed what the haulage companies said regarding there currently being too few secure resting areas.

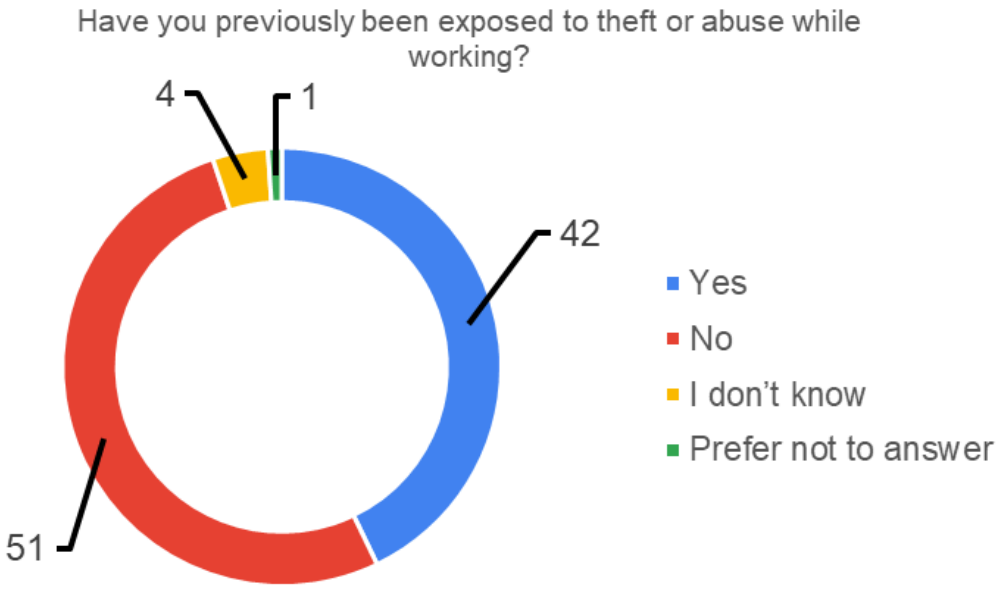


Figure 6.2: *Reported exposure to theft or abuse during work, from survey answers.*

6.1.2 Technical and tangible solutions to prevent crime

One part in improving safety and security at parking areas is to introduce technical and tangible measures. A range of technical and physical interventions were discussed as necessary to improve security. Sufficient lighting was recommended by both Ekwall and Expert E who see it as a basic safety measure. Expert B agreed with this and said that motion-controlled lighting is enough to live up to Trafikverkets lowest security level. Another basic measure touched upon with all security experts is parking space perimeters. Everyone said that having a physical border, e.g. a fence, will raise the security. Expert D went even further and suggested that electricity fences are useful for high value terminals. Expert B agreed that fences raise the security but that it is not a measure that Trafikverket considers for their parking spaces, since the space must be available to everyone according to law. However, Expert B said that the parking space provider can close off potential escape routes for criminals even without fences. Expert F did not share the view that fences are as important for a secure truck stop, as the other experts thought. He played down the role of the security part being important, and instead pointed towards the availability of parking spaces being a bigger problem.

Usually, a fence comes together with some kind of gate. Expert A explained that in the port of Trelleborg, there has always been a need for an access control system at the gate to identify what vehicles and drivers are coming into the port. Earlier they had a manual system, but recently they introduced an automated system where a camera scans the registration number of the vehicles. Expert A explained that this change was necessary to improve the flow of traffic and to be able to handle more vehicles. An automated passing system was also recommended for secure parking spaces according to Expert D so that drivers that have access easily can pass the gate.

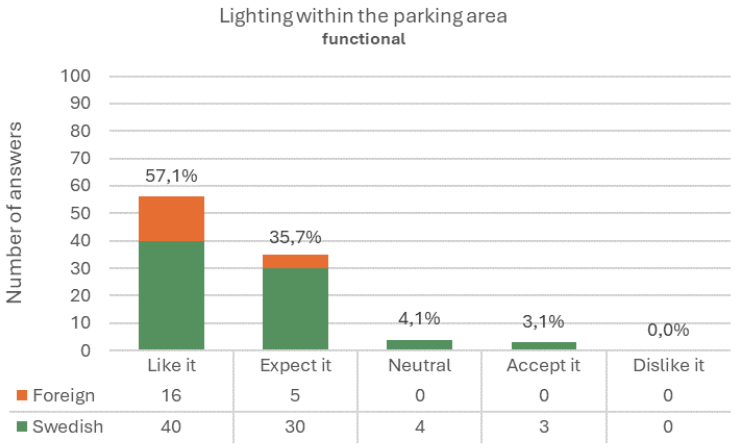
The last common security measure that was identified in the interviews was camera surveillance. The experts agreed that camera surveillance contributes to getting a high safety and security standard, however the implementation can differ substantially. Expert E explained that if the camera is not actively monitored, it does not affect the security but it can still prevent criminals from considering thefts. Expert B said that cameras are statistically effective and therefore Trafikverket uses cameras to a high extent. Ekwall mentioned that the possibility to use cameras differs between countries. In Sweden it is for example not allowed to use face recognition technologies, which is fine in some other countries. Expert D said that a high value terminal should use guard surveillance together with cameras, and even use thermal cameras to guard the parking space. Thermal cameras are very effective from a security viewpoint but, according to Expert D, less so for safety since truck drivers cannot be present within the parking area when they are active, since it is impossible to distinguish between a truck driver that is allowed to be at the parking area and one that is not..

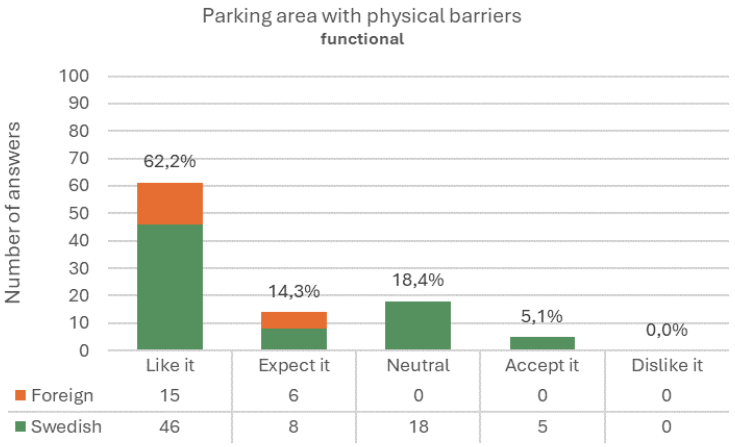
Technical solutions are often effective to prevent crimes, but both Ekwall and Expert G emphasized that no technical system could protect fully from crimes. They continued explaining that there will always be new ways for criminals to get around them. Although, together with Expert D they described the importance for creating credibility towards stakeholders through the use of varying solutions, thus improving the perceived safety. Technical solutions also help move away security responsibilities from the drivers, who instead can shift focus towards keeping themselves safe. Many of the experts emphasized that

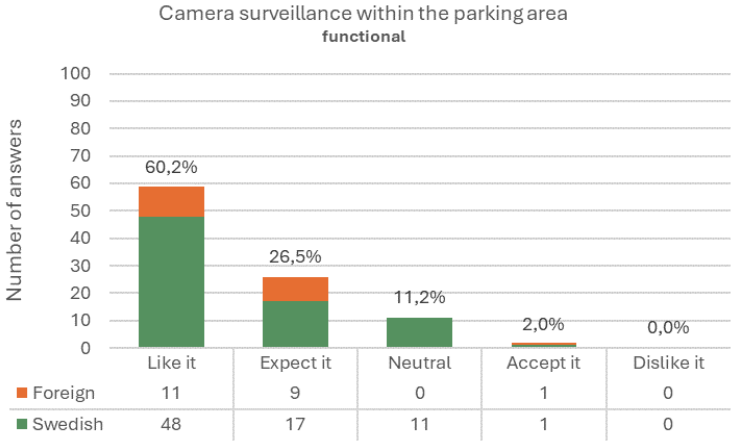
when considering introducing technical measures actors must also keep in mind that these measures can decrease the operational efficiency.

All haulage companies strongly supported physical security upgrades, particularly better lighting, fencing, and visible surveillance systems, and emphasized that they are especially important in the geographical areas where crime is concentrated. According to them, the further north you go the less important these security measures become. Although, all haulage companies highlighted that when using fencing there is a risk of congestion, which Hauler Z pointed out is further increased when taking Sweden's larger cargo dimensions into consideration. Hauler X also added that in a confined space with a smaller area, having a surveillance system can have a second use case, other than crime prevention. Since in these spaces the risk of vehicle or infrastructure damage due to mishandling of a vehicle increases and that haulage companies value highly that these potential accidents can be recorded. All haulage companies highlighted the same risk that many of the experts did, with the potential for a logistical bottleneck, getting in and out of a rest area. But Hauler X emphasized that the consequence of bad logistics flows due to non-optimal rest spot locations, chosen because of crime risk, is worse than the potential bottleneck that can occur inside a rest area. All haulage companies liked the idea of license plate recognition as a way to access the areas. Hauler Z added that at some places there is no possibility to access during the night and that license plate recognition could be a possible solution to control access without there being any personnel there.

The surveys showed that features such as lighting, barriers, and camera surveillance, were all rated highly. This can be seen due to the high amount of “Like it” and “Expect it”. Security guard monitoring had a high amount of “Like it” ratings, but also an increased number of “Neutral” answers compared to the other three, previously mentioned features. See Figure 6.3.







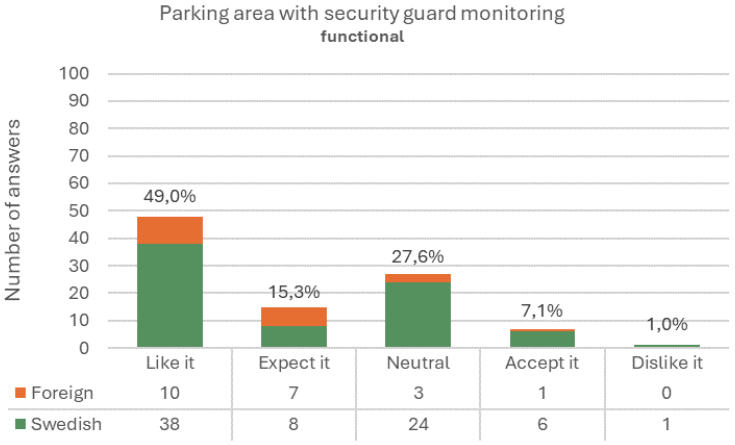


Figure 6.3: *Ratings of lighting within the parking area, parking area with physical barriers, camera surveillance within the parking area, and parking area with security guard monitoring, from survey answers.*

6.1.3 Systematic and intangible solutions to prevent crime

Beyond technical solutions, experts discussed systematic and behavioral strategies to enhance safety. Ekwall believes that having other people nearby acts as a deterrent and hence leads to fewer crimes. Most experts agreed that it is important to only allow professional drivers into the secure parking areas, and to not let other vehicles in. The reason being that it would decrease personal safety for both truck drivers and other people. It would also allow criminals to easier get inside access to the parking areas, which both Ekwall and Expert G elaborated on, saying that most crimes are so called insider crimes. Expert E did not see this as too much of a risk and had the perspective that if more people are allowed the business will have a better chance of scaling up the operations and to become profitable, thus assuring the increased safety and security over time.

Big shippers like Schenker and DHL both use route planning to make sure that their transports can reach secure rest areas before the drivers have to take their rest. Expert D explained that Schenker aims to always enable their drivers to park within their own terminals, to protect the goods. For this to work, route planning is necessary. Expert E had a similar mindset and said that route planning is important, even if it at times is difficult to succeed in practice, due to delays. A pre-booking system can, according to Expert D, help with route planning and therefore also help with the overall security of the transport. Ekwall mentioned that a pre-booking system together with an automated entry procedure would not require any cash or credit cards, thus reducing the risk of crime by reducing the possible reward.

All haulage companies confirmed what Ekwall said regarding drivers feeling safer when other people are nearby. Therefore, many drivers, according to the haulage companies, often chose well-used truck stops. Hauler X and Hauler Y also expressed interest in pre-booking systems, primarily to mitigate the risk of arriving at a rest area that is full and being unable to relocate due to mandatory rest regulations. Hauler Y added that it is important that this pre-booking system is easy to use so that all drivers can navigate it, especially if there is a need to book on route. However, Hauler Z was skeptical since the unpredictability of traffic and cargo delays often prevent precise scheduling, resulting in not being able to reach the pre-booked rest area. But he also noted the challenges of finding parking for larger vehicle combinations, which can lead to delays or unsafe alternatives, which he said could be reduced if pre-booking larger parking spaces were a possibility. All haulage companies agreed that if there is a pre-booking system or if the rest area employs some use of license plate recognition, the billing needs to be connected to the haulage companies. Since the drivers themselves are often not willing to pay.

According to the surveys, the drivers did not rate the closeness to other drivers as an overwhelmingly important feature, in line with what Ekwall and the haulage companies thought. Instead, around a third of the drivers rated it as “Like it”, “Expect it”, and “Neutral” respectively. This can be seen in Figure 6.4, where the most answered answer is a neutral stance. The survey takers also showed some interest in pre-booking systems. In Figure 6.4 a split between “Like it” and being “Neutral” can be seen. Many of the survey takers

commented, similar to Hauler Z, that it is important to accommodate parking spots for larger cargo. It is also important, according to the survey, that rest area access is exclusive to professionals/truck drivers.

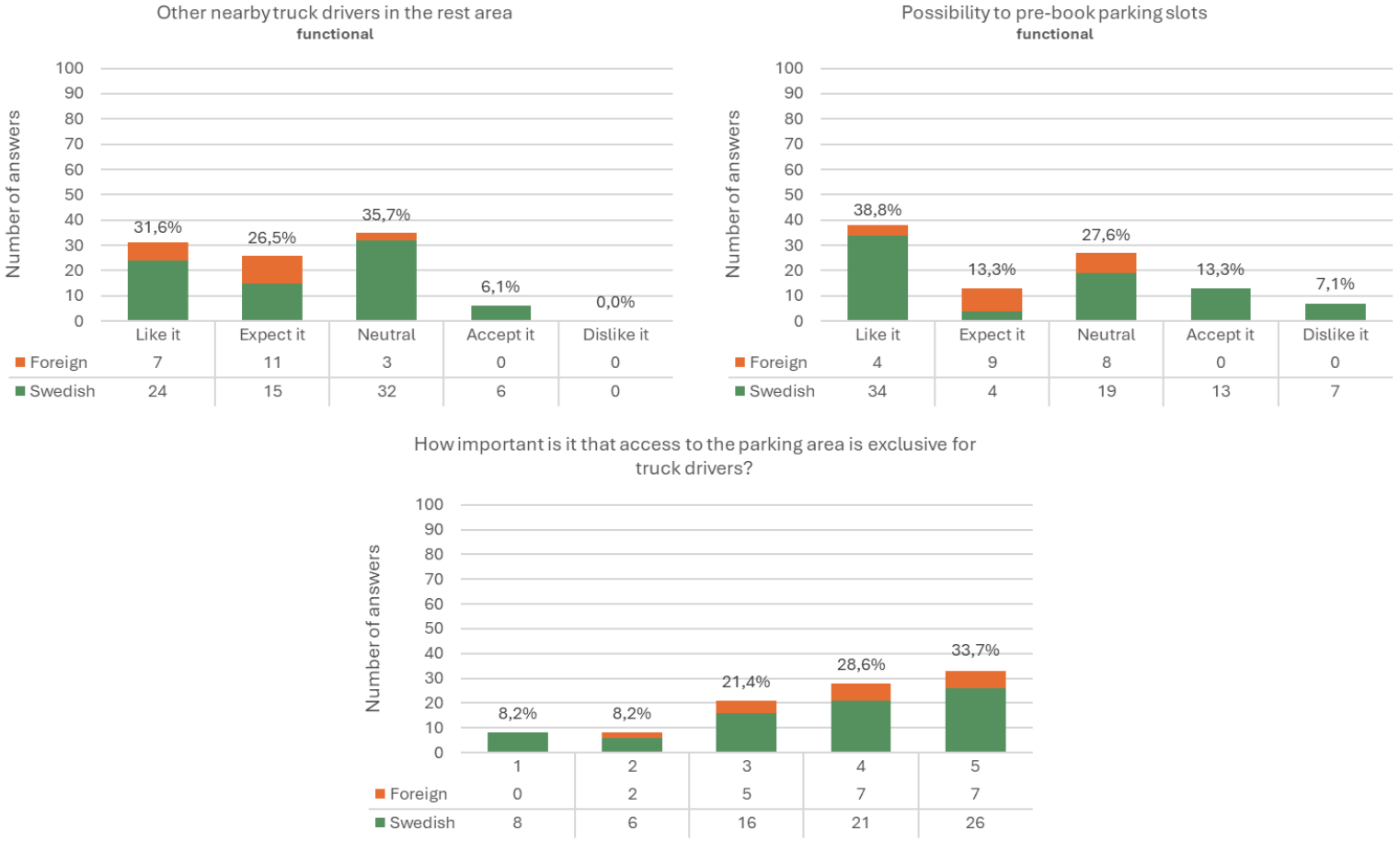


Figure 6.4: *Ratings of other nearby truck drivers in the rest area, possibility to pre-book parking slots, and how important is it that access to the parking area is exclusive for truck drivers, from survey answers.*

A sixth of drivers said that they could not influence which rest area they stop at, see Figure 6.5. The overwhelming answer was that time limitations stemming from legislation was the determining factor, which is in line with what some of the experts and the haulage companies mentioned. While some answers say that the haulage company determines the resting location ahead of time, similar to what Schenker and DHL had explained.

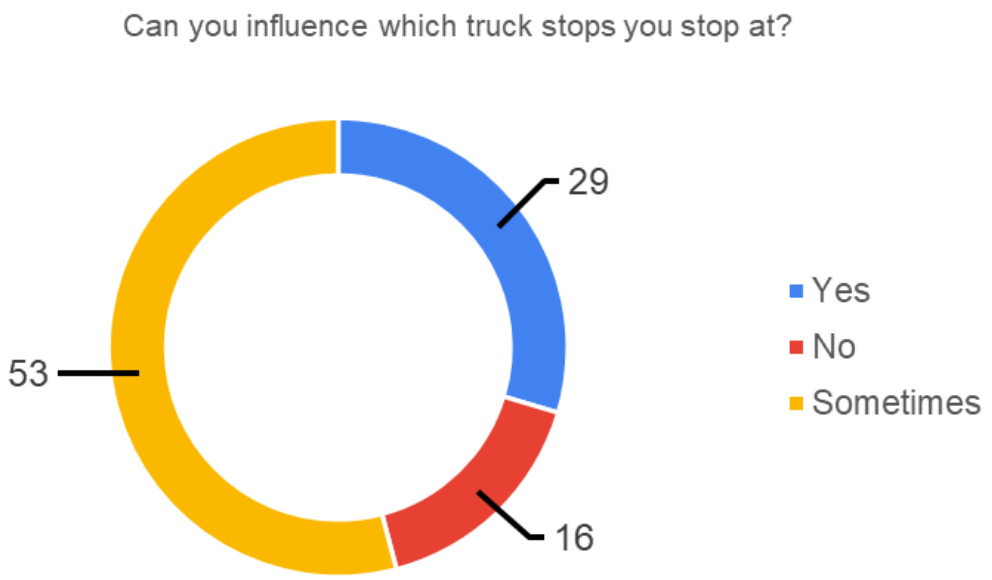


Figure 6.5: *Reported ability of drivers to influence which truck stops they stop at, from survey answers.*

6.1.4 Business impacts of crime in the transport sector

According to Ekwall, the expenses from transport crime spans further than only the cost of the stolen goods. He proceeded to explain that the cost of theft often exceeds the value of the stolen goods by up to six times, because of the costs of delays, repair expenses, and other related costs. If the transport is insured, it is mostly up to the insurance company to pay for these costs. Expert E said that DHL has been in contact with their insurance company to discuss the premiums for insurance related to using secure parking to prevent crimes. Surprisingly, he said that insurers are neutral to the decision of using secure parking and that their premiums are non-negotiable.

For Schenker, the impact of crime together with the lack of safe and secure parking have led to the company establishing a network of secure terminals that also can act as secure parking. Expert D explained that this network is necessary to protect their drivers and goods that they have responsibility for. Even if the infrastructure is costly, Expert D sees this as beneficial from a strategic perspective, where Schenker can offer high security to their customers. Schenker's terminals have implemented many but not all security measures to be able to get an EU or TAPA safety certification. According to Expert D this is due to the certification not giving Schenker any value, and that it is more cost efficient and flexible to just implement what is needed for their own operations. Even though Schenker currently has a network of terminals, Expert D still sees a need for external actors to provide safe and secure parking, since according to him, Schenker could utilize these when their own network does not cover the whole transport distance.

The haulage companies highlighted several cost drivers associated with crime, including trailer repairs, fuel replacement, driver overtime, damaged and stolen goods, and missed delivery windows.

6.1.5 Personal impacts on drivers from crime in the transport sector

There is a huge difference between being a manager at a transport company compared to being a truck driver out in the field. The topic of transport security highlights this difference according to all experts. Ekwall emphasized that the managers will never be able to feel the fear of the drivers. He explained that it is a very strange situation for a driver to be in, waking up in the middle of the night somewhere along the roads, and hearing that someone has broken into the trailer behind you. The drivers do not get any bonuses from trying to defend their goods from thieves but can sometimes be forced to resist depending on what company they work for. Expert D said that Schenker always wants to live up to the standards for regulated working conditions, but that Sweden is falling behind the rest of Europe in implementing such regulations. Both Ekwall, Expert G and Expert E emphasized that it is not the responsibility of the driver to engage in dangerous situations and that they should avoid contact with thieves to the greatest possible extent, to reduce the risk of escalation. The only thing that companies usually ask of the driver is to call the police afterwards and report what has happened.

Drivers are also affected by the infrastructure provided for keeping the goods and themselves safe and secure. Compared to earlier, drivers are now more strongly expected to follow the security procedures set by their haulage companies. They are also supervised to a greater extent both by their vehicles but also security cameras. According to Expert D, cameras were previously argued to encroach upon drivers' freedom, but that they have since become increasingly accepted over time. Expert D also added that even if many companies say that they work with social sustainability in form of decent working conditions, there are many different interpretations of what that means, hence it does not necessarily have to be as good as it sounds.

Hauler X reported that drivers often feel deflated after experiencing theft or some other crime. Hauler Y acknowledged that drivers often feel a sense of uneasiness when parking in unprotected areas, often near roads. Hauler Y also added that parking in unsafe areas has other consequences than just being at a higher risk of being subjected to crime. It also affects the drivers’ sleep since these locations are often situated near large roads, such as road pockets. Hauler Z emphasized the importance of driver wellbeing and that they therefore prioritize the drivers’ safety over protecting cargo. Hauler X and Hauler Y said that avoiding confrontation during a crime is the safer choice and thus agreed with Hauler Z's point about prioritizing the drivers’ safety.

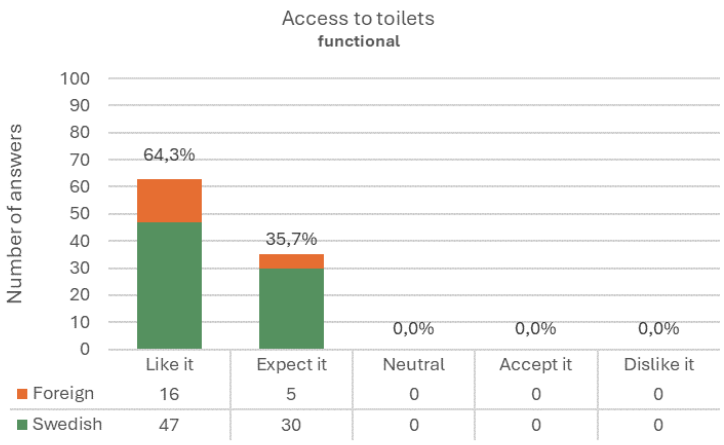
6.2 Services

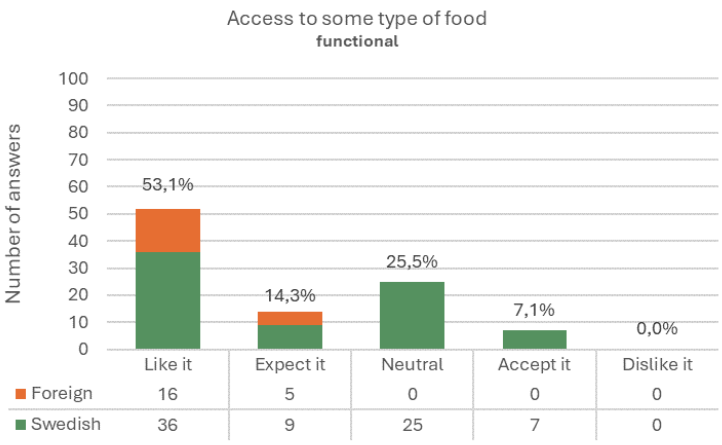
Experts agreed that service offerings at rest areas are essential not only for operational efficiency but also for improving driver wellbeing and supporting long-term sustainability. While opinions varied on which services are most important, there was consensus that the overall quality of service infrastructure in Sweden is insufficient when compared to other parts of Europe. For truck drivers to consider staying at a resting area, some essential services need to be provided. Many of the experts, including Expert A and Expert B pointed at showers and restrooms being highly important. Although Expert A agrees with these services, he added that providing these services are not enough to satisfy the drivers, these services also need to be well-maintained. While many of the security experts say that only the basic services are essential, Expert F had different thoughts. He agreed that toilets are very

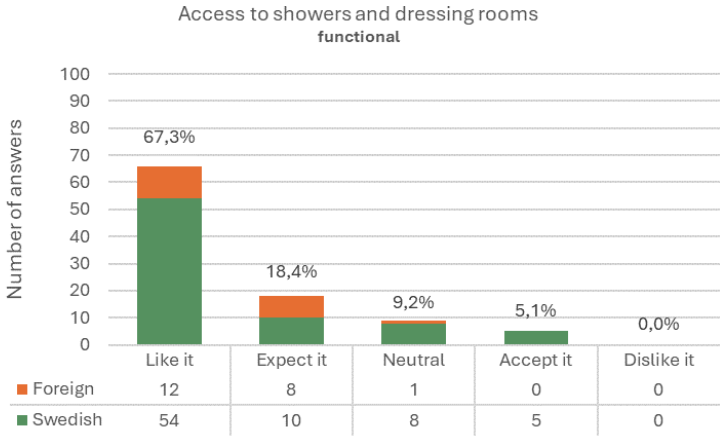
important, no matter where in the world you are, but also said that it has become more important to provide products and services that can enable a healthy lifestyle. This means providing healthy food from stores or cafes, and Expert F continued explaining that he has seen trends of workout facilities becoming more requested. But Expert F agreed with Expert A by saying that it is highly important to keep facilities fresh and clean.

All haulage companies echoed the importance of improving health-related services, emphasizing the value of clean showers and bathrooms, noting that their availability directly impacts driver satisfaction and the willingness to pay. Hauler Z mentioned that high-quality food is often one of the biggest success factors when it comes to rest areas. Hauler Y did not agree that it is the biggest success factor and that most drivers are fine with basic food, such as food that can be bought from vending machines. But Hauler Y also added that they have experience from rest areas that have breakfast packages as an add on service, which was much appreciated. Hauler X did mention food as appreciated but not necessary, mostly as a value-adding service that they would be willing to pay more for. None of the haulage companies mentioned the need for proper rest area facilities but Hauler Y emphasized the challenges of sleeping in uncomfortable and noisy environments.

The survey showed that basic services such as toilets, access to some type of food, showers, and access to drinking water were all important features, see Figure 6.6. What the survey also shows is that, similar to what both Expert A, Expert F, and the haulage companies said, it is of high importance that the facilities feel fresh and are cleaned regularly. However, when asked follow-up questions about the importance of gender-separated restrooms and showers, as well as access to heated or freshly cooked food, the responses were evenly divided, with a neutral position being the most common. All these survey answers can be seen in Figure 6.7 below.







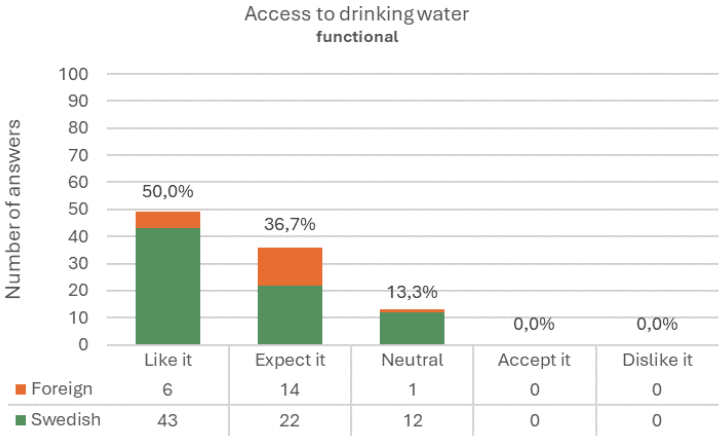


Figure 6.6: *Ratings of access to toilets, access to some type of food, access to showers and dressing rooms, and access to drinking water, from survey answers.*

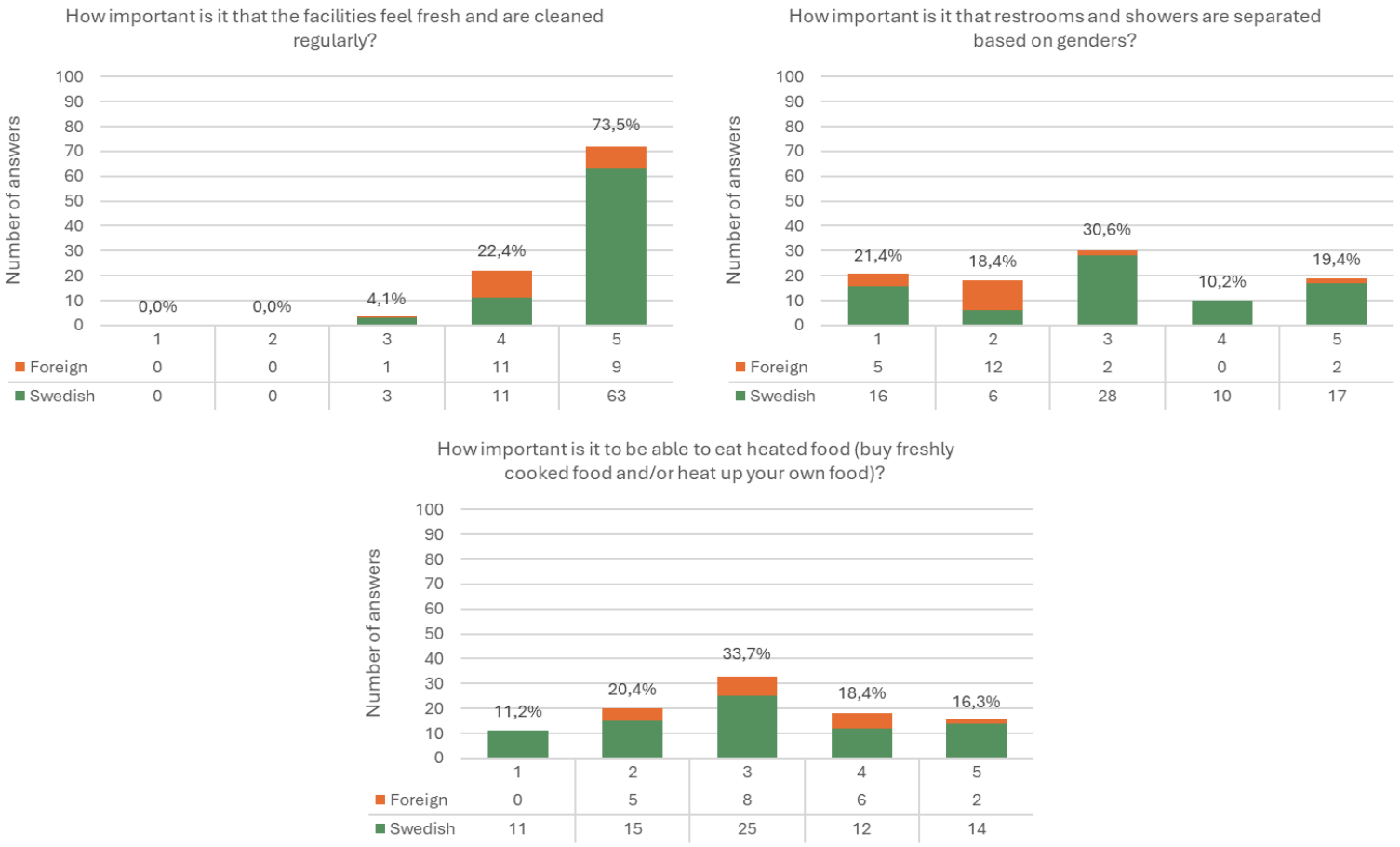


Figure 6.7: *Ratings of how important is it that the facilities feel fresh and are cleaned regularly, how important is it that restrooms and showers are separated based on genders, and how important is it to be able to eat heated food (buy freshly cooked food and/or heat up your own food), from survey answers.*

Another highly rated feature was the access to a nearby store. Other convenience features, such as access to laundry, internet, and electricity for personal use had mostly neutral answers. See Figure 6.8.

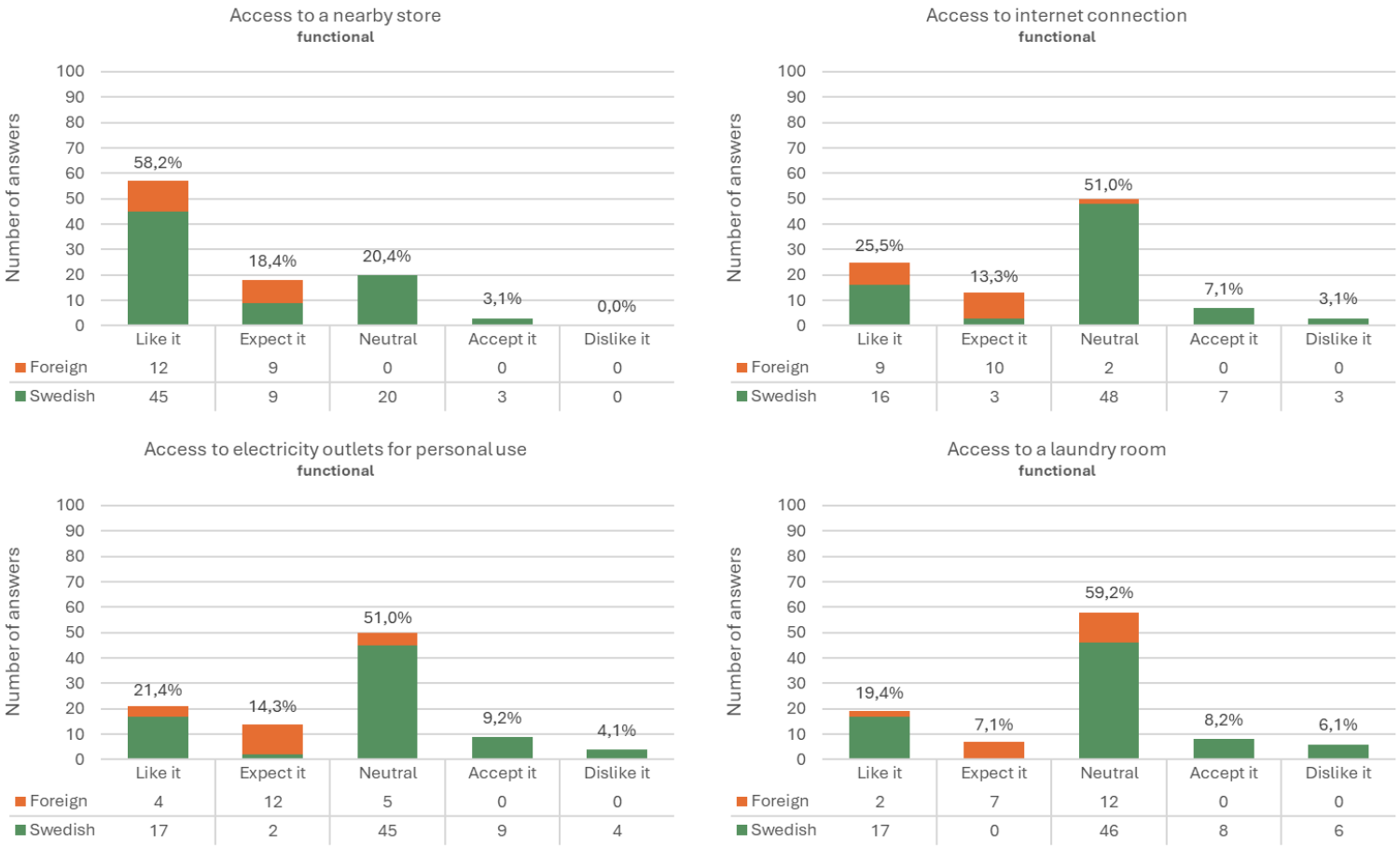


Figure 6.8: *Ratings of access to a nearby store, access to internet connection, access to electricity outlets for personal use, and access to a laundry room, from survey answers.*

Two features that had clearly divided answers were access to electricity for refrigerated goods and access to reparation and service of vehicles. The feature of being able to sleep in other places than the driver's truck was rated as almost exclusively neutral. See Figure 6.9.

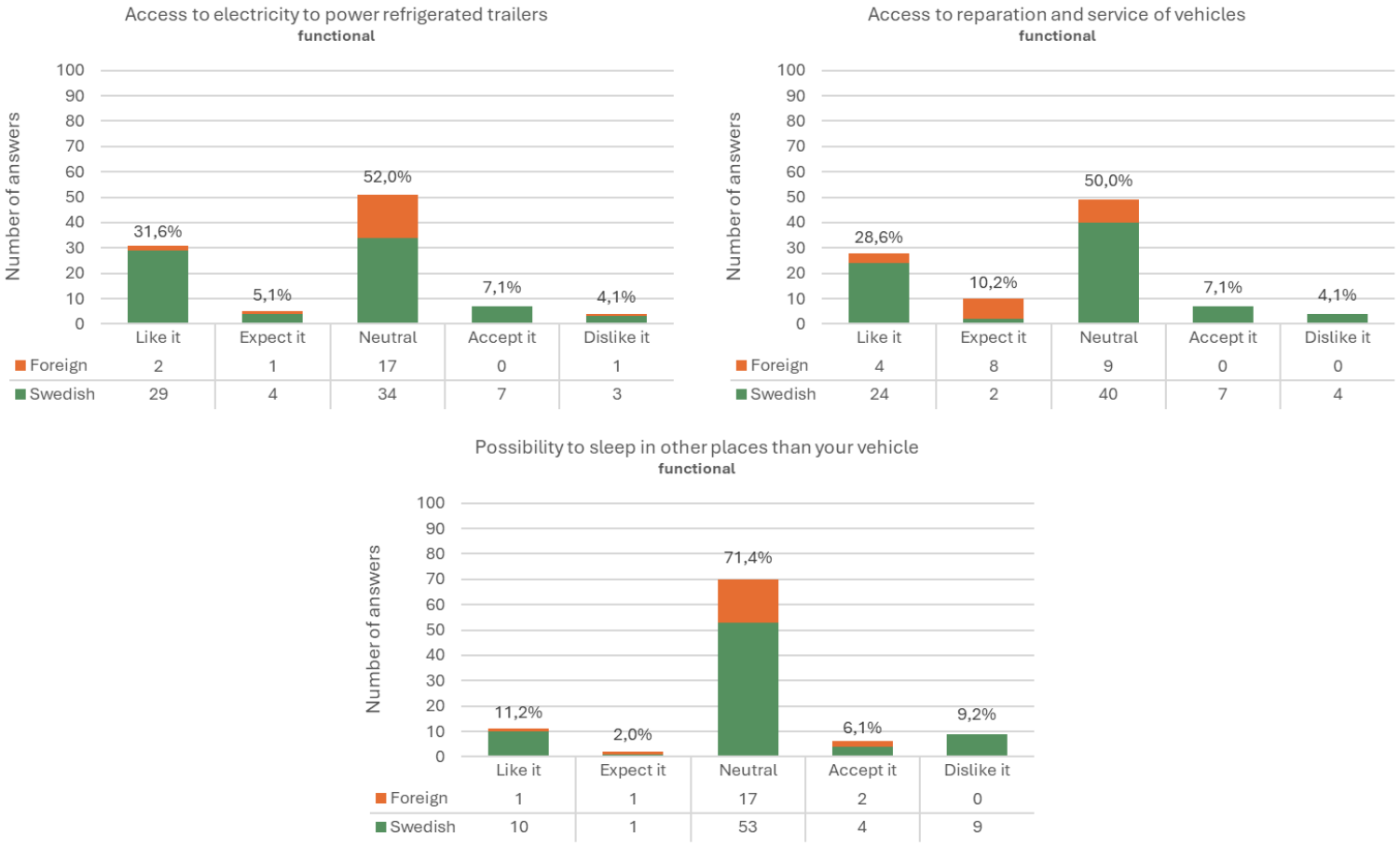


Figure 6.9: *Ratings of access to electricity to power refrigerated trailers, access to reparation and service of vehicles, and possibility to sleep in other places than your vehicle, from survey answers.*

Recreational services were viewed as a secondary priority by the haulage companies, but in some cases still appreciated. Hauler X mentioned that attention to drivers' comfort beyond basic needs can make rest areas more attractive but did not elaborate. Hauler Y mentioned that drivers appreciate small additions but these need to be seen as valuable to the driver and should not be mandatory to pay for.

In the survey there were four recreational services suggested. These were the possibility to spend time in nature, possibility to exercise/workout, access to entertainment (TV, games, etc.), and access to a dining room, or lounge. For three out of four recreational services, the answers were divided. The one that the answers were clearly neutral was the access to entertainment, according to the survey, this was not something that the drivers were interested in. All these survey answers can be seen in Figure 6.10 below.

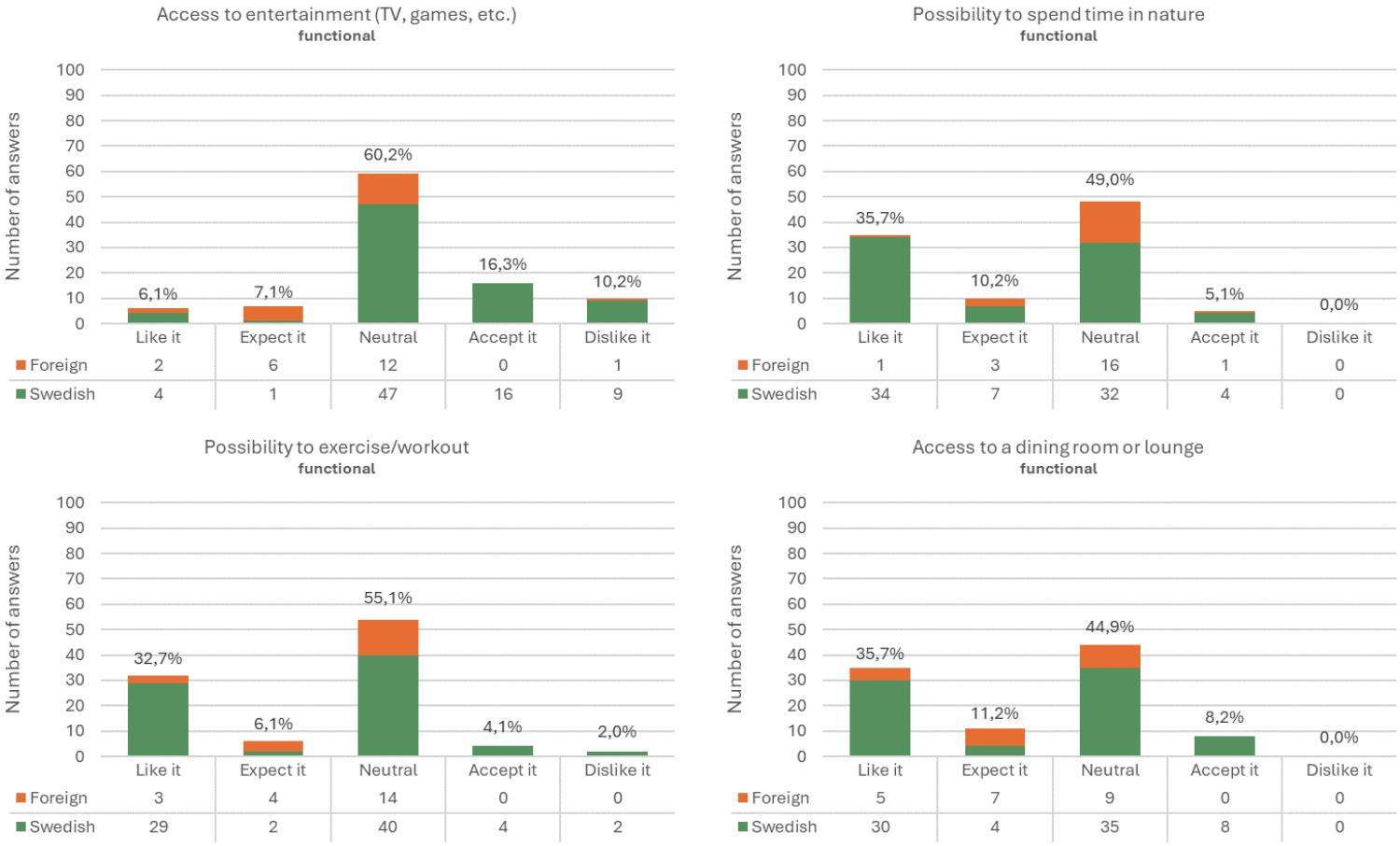


Figure 6.10: *Ratings of access to entertainment (TV, games, etc.), possibility to spend time in nature, possibility to exercise/workout, and access to a dining room or lounge, from survey answers.*

6.3 Alternative fuels

The view of alternative fuels differed between the experts depending on their background and working role. Different actors also have different incentives to advocate for certain future scenarios regarding alternative fuels. Grahn spoke about alternative fuels in a positive way. When describing the current conditions, she explained that technical development is not the bottleneck in the transition towards alternative fuels. There are multiple fuels, such as electricity, hydrogen, and HVO, that are viable to use. According to her, fuel density has been a technical problem historically but that the development has been rapid during the last years, enabling the vehicles to reach far enough that they are able to go between current refueling points, thus no longer acting as the main barrier. Her view is that it is better to develop multiple different fuel solutions simultaneously rather than focusing on one single solution. She explained that every fuel type has its own advantages and disadvantages and that it also could be difficult to scale up production of any fuel to that extent that it could replace all other fuel types. From a sustainability perspective that goes beyond only CO_2-emissions, all fuels could become problematic in their own way, such as plant-based fuels competing for space with food crops.

Grahn acknowledged that it is not only up to the users of the fuel to work towards a transition. According to her, a big part of developing alternative fuels is to be able to produce them at a cost that lets the fuels be economically viable for the buyer while also making them easily available to the users. If the price is too high, companies rarely consider it if it decreases their profits. In economic dilemmas like this, Grahn noted that it is important for actors on different levels to cooperate to enable the transition. It is especially important for actors that are either producing the fuel, building the infrastructure, or using the fuel to coordinate the development with each other, so that the development speed is similar for everyone. According to Grahn, problems could also arise due to bad coordination if one actor develops a solution that is not compatible with the other actor's operations. Then, the following operational and technical changes could become costly. Grahn also sees the EU as an important actor to create a stable framework for the use of these fuels and reduces the risk of varying solutions that do not support each other.

Expert C, who has insights in regulations and decisions made on both national and international levels, explained that the EU is incentivizing actors to buy more sustainable vehicles as well as developing charging infrastructure for them. Grahn emphasized that incentives play a big role in the development of infrastructure. She expressed concern that many actors are too hesitant to take the first steps towards a transition. The reason being that many companies, according to her, have calculated a forecasted loss if they are first to enter the market.

The experts have varying views on the current and future use of alternative fuels. Grahn explained that she thinks that alternative fuels will grow but is still realistic in her expectations of the share of use compared to fossil fuels. She also believes that there will be a heterogenous split between different fuels and that no fuel will completely dominate the market. Expert F on the other hand thinks that electricity has a very bright future and that it will dominate among the fuel types. Expert A had a different view compared to both Grahn and Expert F, and pointed towards how the usage of fuels looks today. He thinks it will take a long time before alternative fuels become commonly used in long-haulage, especially by haulage companies from central and eastern Europe. Instead, he believes that fossil fuels will continue to be the most common fuel solution for at least the next 20 years, a statement backed by the port of Trelleborg's internal reports. However, during that time period, the use of alternative fuels is still expected to grow slowly for each year. Expert A explained the projected development by the fact that it takes such a long time to fully replace the current pool of vehicles, and that it would not be sustainable to rush the replacement process.

All the haulage companies confirmed that alternative fuels are becoming increasingly important but emphasized that cost remains the most decisive factor. Hauler X and Hauler Z noted that while sustainability is discussed frequently, it rarely outweighs budget constraints when choosing fuels. They pointed out that customer requirements play a major role in determining fuel type, and until more clients demand higher sustainability and are willing to pay for it, adoption will remain limited. Hauler Y added that the geographic location, that the haulage company is active in, is of utmost importance in terms of adoption.

According to the survey the drivers are split in their view on alternative fuels, with an almost equal number of drivers reporting a negative view on driving a truck fueled by alternative fuels, as those who had a positive view. The same split can be seen in how likely they think it

is that they will drive a truck fueled by alternative fuel in the coming 10 years. See Figure 6.11.

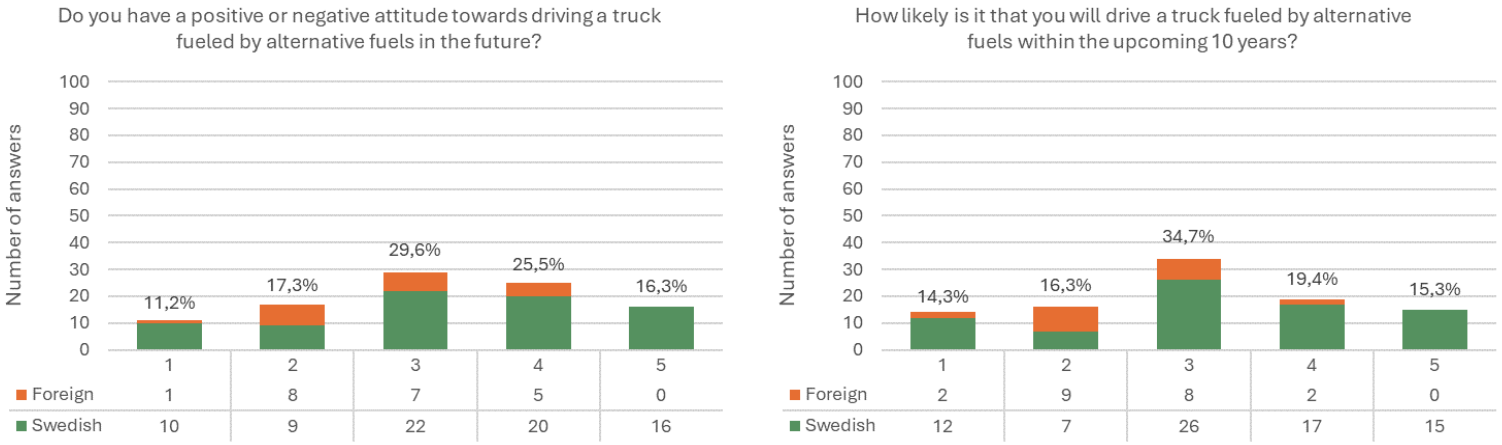


Figure 6.11: *Ratings of do you have a positive or negative attitude towards driving a truck fueled by alternative fuels in the future and how likely is it that you drive a truck fueled by alternative fuels within the upcoming 10 years, from survey answers.*

6.3.1 Hydrogen

Due to its characteristic of not emitting any CO_2, Grahn said that green hydrogen has its spot in the mix of alternative fuels. Compared to other fuel types like HVO, methanol, and even electricity (if produced from fossil sources), green hydrogen releases very few if any CO_2-molecules into the atmosphere during its lifecycle. Therefore, it is of good use to live up to EU regulations around CO_2-emissions. Grahn explained that in theory trucks can drive far enough before they need to refuel, but that a problem is to store the large volume, currently needed, on the truck, to be able to reach the next refueling location. From a provider's perspective, hydrogen requires well executed operations to not cause safety issues. Firstly, it is, according to Grahn, difficult to move hydrogen efficiently. Usually, the gas needs to be cooled down to very low temperature during transport to be able to concentrate the energy. However, maintaining these temperatures during transport is challenging, and a controlled release of gas is necessary to prevent pressure buildup in the tank. Secondly the hydrogen must be stored in a safe way at the fuel station. Grahn explained that hydrogen needs to be stored quite far away from any humans because of the fire and explosion risk. An option is to produce the hydrogen on-site which Grahn thinks is better than producing off-site. That way, the total costs and emissions will become lower. The downside of this method is that the technique is not very common yet, and that clear regulations are yet to be developed.

The experts agreed that they do not believe hydrogen will be a dominant fuel for long-haulage in the future. Grahn explained that it has some potential, while other alternative fuels also should be developed. Expert F said that he did not have a strong belief in the fuel and estimated the market share to be around 5%. His reasoning was based on the long-term strategies of truck manufacturers, which, according to him, are focused on the future sale of electric trucks. Expert C agreed that electricity probably will be more common than hydrogen in the future but added that hydrogen could have an impact in the northern parts of Sweden where electric trucks do not operate as well as in the southern parts of Sweden.

The haulage companies expressed cautious interest in hydrogen. Hauler Y noted its long-term potential but raised concerns about the current lack of fueling infrastructure and the reduced truck capacity with current hydrogen technology, similarly to what Grahn mentioned. Hauler Y also noted that he does not know any company in the northern part of Sweden that currently uses a hydrogen fueled truck. Hauler X said that while hydrogen is talked about a lot right now, it will most likely be part of a mix of alternative fuels and not a "be all end all-solution".

The survey showed that there currently is no need for hydrogen fueling solutions, since most survey respondents have rated this feature as "Neutral". This can be seen in Figure 6.12.

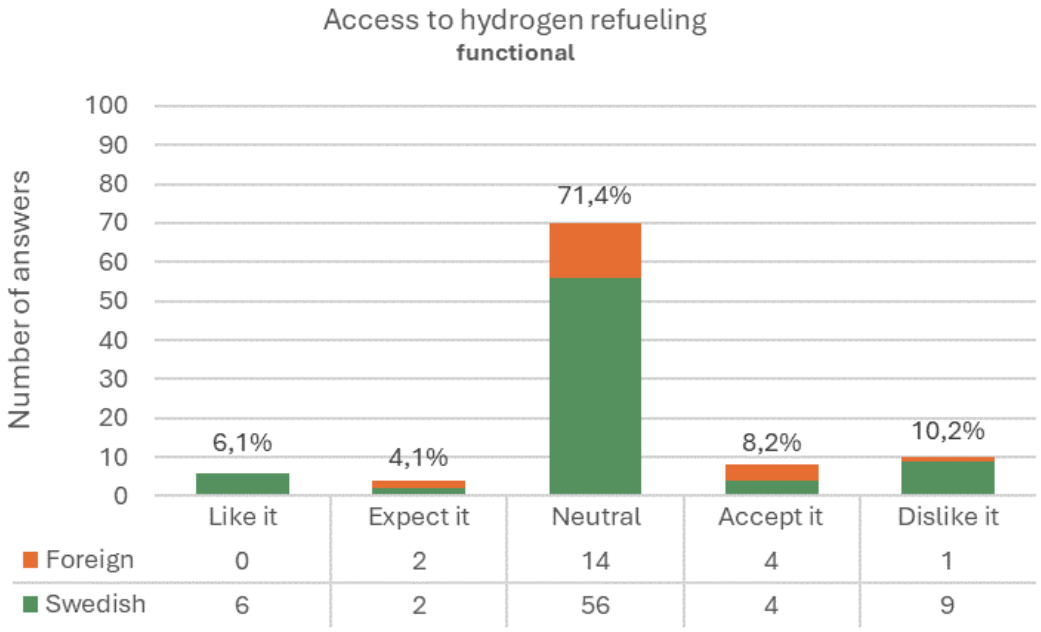


Figure 6.12: *Rating of access to hydrogen refueling, from survey answers.*

6.3.2 Electricity

Many experts see electricity as one of the most promising alternative fuels. Grahn emphasized that electric trucks are already viable in many scenarios, and further improvements in battery technology will extend their range and affordability. Grahn said that lighter vehicles can use electricity to a higher extent than large vehicles, but that development will enable most vehicles to utilize it over time. Expert B explained that the development of electric vehicles has advanced significantly over the past 15 years. Expert F also noted that many vehicle manufacturers are committed to developing electric trucks as their primary product in the future.

It is important that infrastructure matches the development of electricity as a fuel. Expert B explained that electric trucks use a different business model compared to current fossil-driven trucks. He says that uptime is crucial and thus charging opportunities must be both available and time efficient. Earlier, when batteries had lower capacity, different solutions were tried to increase the range of the transports. One example is the conductive charging wires that were piloted on a few highways in Sweden. The thought of these was to be able to charge the truck while driving, hence avoiding stopping at fuel stations to refuel. However, with the current development of battery sizes and energy density, this project is now scrapped. Which

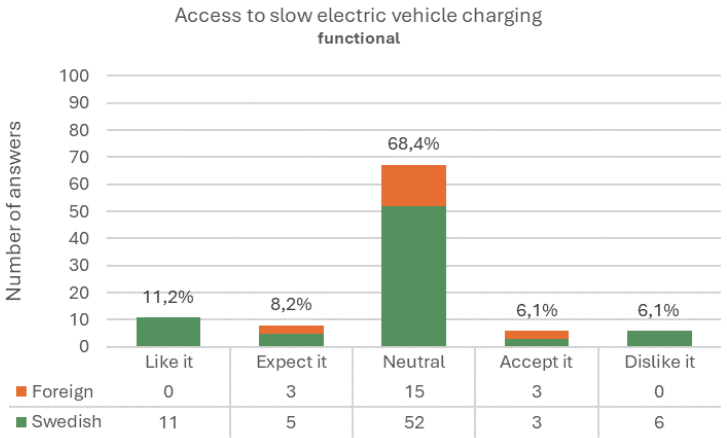
according to Expert B is due to the fact that conductive charging is too costly to implement and that it has no role to play in supporting the technology anymore. Grahn agreed that conductive charging is not a suitable option and added that battery swapping has also been tried without any major success.

Expert F sees a clear relation between parking possibilities and electric charging, especially in the future. He said that a parking area will be less attractive for drivers if it cannot also provide charging opportunities. He proceeded to explain that the problem is not the amount of total charging points throughout the country, but rather the low utilization rate of each charging spot. Expert A expressed a fear that energy providers will not be able to provide enough electricity to parking facilities if the number of electric trucks rose too quickly. He finds it important that the electricity grid will be able to deliver the needed energy. The charging rate also plays a part in shaping the service. Slow charging requires drivers to carefully plan their trips and according to Expert A pre-book their parking spots to ensure full charging during resting periods, while also not reducing uptime. Fast charging enables more flexible decision-making from the driver's perspective.

The haulage companies were generally more optimistic about electricity than hydrogen. Hauler Z explained that they currently possess nine electric trucks which are used for local operations. The reason for only using them for local operations is because they face barriers related to charging infrastructure and uncertainty around charging times, which Hauler X agreed with. Hauler Y echoed what Hauler Z said regarding local operations being best suited for electric trucks, which unfortunately is not something Hauler Y does now. It is therefore not viable to use electric trucks for Hauler Y. All haulage companies also expressed concerns similar to what Expert A mentioned, that the electric grids would not be able to handle a quick transition towards electrification of the whole transport fleet.

All haulage companies mentioned that government incentives and clearer standards would help justify the investment in electric trucks. Extra focus was put on the massive investment that is currently attached to electric trucks compared to combustion trucks, which no customer is currently willing to pay for.

Similarly to hydrogen, the survey showed that there currently is no need for either fast or slow electric charging solutions, since the most survey respondents have, similar to hydrogen fueling solutions, rated these features as "Neutral". This can be seen in Figure 6.13.



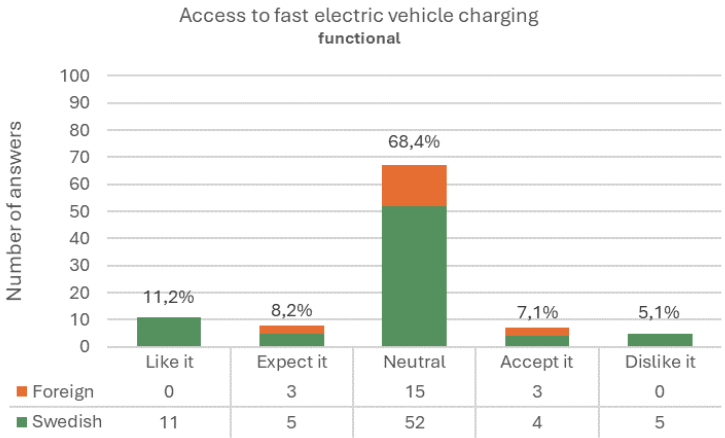


Figure 6.13: *Ratings of access to slow electric vehicle charging and access to fast electric vehicle charging, from survey answers.*

6.3.3 Other alternative fuels

Beyond electricity and hydrogen, experts discussed the role of biofuels such as HVO and biogas. Expert A highlighted HVO as a promising transitional solution for heavy-duty transport. It can, according to Grahn, be used in existing diesel engines and leverages current distribution infrastructure, allowing for easier scaling in the short term. Expert A sees a bigger potential for HVO than electricity and believes electricity is more suitable for delivery vans. Expert F also sees HVO as a relevant fuel that will play a role for many years to come, while transitioning into electricity.

The haulage companies showed interest in HVO as a cost-effective, compared to other alternative fuels, and immediately implementable solution. Hauler Z noted that they already use HVO in about twenty of their vehicles and appreciate its compatibility with existing infrastructure. Although, he stated that price and availability are limiting factors, because similar to other alternative fuels, customers are not willing to pay extra. Hauler Y mentions that his company has four trucks running on biogas, and acknowledges its nationwide availability, making it operationally feasible even for long routes. However, Hauler Y expressed skepticism due to frequent policy changes, especially related to taxes and EU standards. All haulage companies warned that regulatory instability makes long-term investments in alternative fuels risky for Haulers. Hauler X echoed Maria Grahn, seeing a mixed fuel landscape as the most likely future scenario. Hauler X suggested that ongoing improvements to combustion engine efficiency and fuel consumption also play an important role in moving towards a more sustainable future.

6.4 Demographic differences

Considering transport safety, the experts agreed that there are demographic differences between both Swedish and foreign drivers, and between female and male drivers. Swedish and foreign haulage companies usually have different policies for working conditions according to Ekwall, who says that foreign drivers possibly could have a bigger responsibility for protecting the goods. Several experts mention that foreign drivers face greater vulnerabilities, particularly due to language barriers and limited knowledge of local safety conditions. Ekwall explained that these drivers may unintentionally expose themselves to higher risk by parking in unsuitable locations or misunderstanding safety protocols. Expert D added that drivers unfamiliar with Swedish geography tend to prefer certified secure parking areas, as these offer reassurance and predictability. Expert D also pointed out that the working environment in Sweden looks different compared to the rest of Europe. There is a difference in the fuel station infrastructure, where Sweden offers plenty of small facilities with only basic services. In comparison, European highways usually offer bigger resting areas with access to both stores, restaurants, and motels. Expert E finds these differences logical because of the significantly lower levels of traffic on Swedish roads. However, foreign drivers are also more used to more serious crime. Expert D explained that crime within the transport sector is more organized in central Europe, where thefts are well planned and executed. Criminals tend to work in bigger groups and therefore they get the possibility to coordinate more advanced thefts. Expert E agreed with this view and added that England also has had the same problems as central Europe with these crimes.

Expert A said that the distribution between Swedish and foreign drivers through the port of Trelleborg has changed during the last decades, and that it is almost exclusively foreign drivers that pass through the port nowadays. One reason for it could be the lack of drivers in Sweden, a problem that both Expert A and Expert F mentioned. Expert F emphasized that it is highly important to make the industry more attractive for female drivers to be able to hire more workers. Even if he sees more women in the industry now than before, women usually face problems that men do not face. Expert F, Expert G and Ekwall, all said that women are more vulnerable than men to person-related crimes. An example from Ekwall is that women are more likely to be assaulted, and Expert F has seen cases where women get stalked through industry related internet forums. Due to the increased risk of crime, particularly affecting women, Expert F suggested that safe and secure parking should be offered through different product packages designed to meet varying safety needs. He also said that he believes that there should be no problem for haulage companies to pay more for security for women. Service-wise experts see that women have higher standards than men, although according to Expert F the service in Sweden is generally too bad compared to other places in central Europe.

The haulage companies confirmed many of these demographic patterns. Hauler Z emphasized the significant difference in wages between Swedish and foreign drivers, which he thinks will affect the willingness to pay for rest areas. He also mentioned that it is common for foreign drivers to take their weekly rest in their vehicles, which as far as he knows is very uncommon in Sweden. Hauler Y did not entirely agree with Hauler Z's point of view on the willingness to pay. Hauler Y instead thinks that the use of secure parking by foreign haulers varies greatly depending on company seriousness and country of origin. He suggests that some companies will use secure parking responsibly, while others will avoid it entirely. Hauler X disagreed entirely with Hauler Z and instead agreed with what Expert D had said. Hauler X thinks that there is a way higher willingness to pay from foreign actors, out of caution, as they do not know which areas that are safe and which areas that are not safe. A secure rest stop near Jönköping, which has a higher price than average and is mostly used by foreign trucks, was used by Hauler X as an example to further support the idea that international drivers actively seek safer locations, even at a higher price point.

Hauler Z acknowledged that the number of women in the industry is increasing and noted that they often have higher expectations for hygiene and comfort compared to men. As a result, he suggested that future rest areas should offer separate zones for showers and toilets, with dedicated female facilities to make the environment safer and more inclusive.

6.5 Economical considerations for an investment decision

An investment decision of infrastructure is complex and builds upon many factors. The responsibilities of providing infrastructure are split between different actors, and the incentives for customers and consumers to use and pay for the infrastructure are affected by third-party actors. Investment decisions can also be based on how competitors act on the market. Further this section describes how revenue streams can be created, and how investment costs could be reduced with the help of public funding.

6.5.1 The financial structure behind an investment decision

Many actors are involved in the decisions around building transport infrastructure. A problem according to all experts has been the financing dilemma about who is responsible for paying for the establishment of safe and secure parking. While the establishment of services has been a market driven process and the establishment of infrastructure for alternative fuels have been targeted by many subsidiaries, safe and secure parking has not been an area that has gotten much attention from neither private nor public actors up until recently. Trafikverket has an overhanging responsibility to provide parking and resting areas for truck drivers. However, according to Expert B they are restricted in the actions they can take. Since Trafikverket is financed by public funds, the parking areas must be available to everyone, meaning that they cannot build a safe area that is only accessible for the professional drivers. Therefore, it is up to private actors to provide higher security parking if they want to. Municipalities also play a role as landlords according to Expert B and Expert G. They usually own the land required for building a rest area and both experts explained that the municipalities are generally not educated enough about the problems of transport security to take active and supporting decisions. As a result, truck drivers are forced to park along streets and throughout cities instead of using designated areas, which creates challenges for the municipalities.

Another dilemma according to many of the experts is the nature of the transport sector. Ekwall said that everyone likes cheap transports while Expert D added that the sector is defined by low marginals and that the industry is price sensitive. Expert F was the only one who disagreed with this view, arguing that while a few large companies secure most of the profits, the structure of the industry involves many intermediaries. As a result, haulage companies at the lower end of the chain often see limited profit margins after larger transport firms have taken their share. Additionally, some haulage companies can force their drivers to pay for operational costs that the company does not class as relevant. Hence, the experts see a problem where those who need safe and secure parking the most are not able to pay for it. The standard then becomes to not use secure parking, unless companies are forced to use it by customer contracts. According to Expert E, the willingness to pay also depends on the type of goods that are transported.

Insurance companies are a type of actor that is mentioned recurrently by experts. Ekwall explained that it is the insurer that usually must pay for the economic consequences of a crime. Expert G added that, although this is true, a portion of the cost is ultimately passed back to the haulage company through increased insurance premiums. Expert E said that DHL have previously been in contact with their insurer to discuss secure parking related to the premium they pay for insurance, but all proposals have been rejected. Expert F shared the experience of insurance companies not caring about secure parking, even if it would lower the risk for a crime to occur. However, he added that clear responsibilities in transport contracts can also make the incentives clearer. In total, the inaction from the insurance companies' side is yet another hurdle to be able to incentivize safe and secure parking. Expert B thinks that secure parking itself is a kind of insurance and can help reduce both economical and societal costs. However, he also explained that it is very difficult to be able to measure the impact of implemented security features at parking areas. Expert G agreed that societal costs would be reduced but noted that this holds true for any measure that leads to a decrease in crime and is not exclusive to secure parking.

These problems create a difficult decision for actors wanting to establish safe and secure parking. All experts agreed that safe and secure parking is something that is needed on the Swedish roads, and most of them think it is necessary to build new infrastructure. Expert F also sees the need but explained that he thinks the problem lies in the matching between supply and demand, or with other words that parking space owners and haulage companies must communicate better to utilize existing resources, which is something that Expert G also noted. Expert F added that it is important to make the parking areas attractive by strategic placement and to combine the safe parking with charging spots for electric trucks.

For alternative fuels, the incentive structure is slightly different. Grahn emphasized the challenge of predicting future developments as one reason actors today might hold back investments. Because no one knows what infrastructure will be the most needed, it could be more profitable to wait with investing until the situation is more predictable. At the same time, the relationship between truck manufacturers', infrastructure developers', and fuel producers' development must keep the same pace for optimal development speed.

All haulage companies agreed with the point of view that most transport operators operate on thin margins. Although they did say, similarly to Expert E, that there is an increased justification to use secure rest areas when transporting cargo of higher value, even though it may impact this margin. On Expert F's point regarding the possibility to utilize already existing infrastructure better, Hauler Z agreed. But Hauler X did not fully agree with this and said that, although that might be the case in some geographical areas, it is not true throughout the country.

6.5.2 Revenue opportunities and willingness to pay

Some sort of profits are needed to make an investment attractive. Whether the income comes directly from the parking business, fuel business, or service business does not matter greatly. Expert A, B, D, E, and F, all said it is contextual how much an actor would be willing to pay for the services. Expert B believes companies are likely to pay more if their goods are vulnerable to theft. Both Expert D and Expert F discussed potential variations in the service offering as a key to make many customers find safe and secure parking attractive. Expert D proposed suppliers to have a clear strategy behind what technical and systematic solutions are included in the service, while also having a focus on either safe or secure parking. The offering could then vary between different venues. Expert F agreed with this and added that different service levels must be available to attract different types of customers. Expert E even proposed that safe parking could be provided to wider market segments such as private caravan owners to gain more customers. Reasoning behind this is that Expert E believes each parking area must have around 300 parking spaces to utilize economies of scale. This idea was however criticized by other experts saying that it could have safety implications mixing professional and private customers in the same parking area.

Expert A had a very pessimistic view of the potential for developing safe and secure parking. He said that the market is not ready for it and that actors are not willing to pay much for the service. Especially foreign drivers are, according to him, not willing to pay but he mentions a few solutions to consider. He believes it is more efficient to establish a relationship with the haulage companies rather than the individual drivers to create business agreements. This is because he does not see the drivers having any influence over the decision of using any services. He also sees a potential in providing basic services for free, just to make the business

more attractive in general. Expert D pointed out that it is very important to use marketing when providing services to expose the parking areas to potential customers. He also said it is important to show haulage companies and drivers how they can benefit from using the services and what financial value it could provide. Expert A added that customers generally do not care about sustainability factors too much and suggests that economical value is more important.

The willingness to pay was discussed with the experts, who have different views on the amount a customer would be willing to pay for one night of safe and secure parking. Expert E believes 250 SEK per night is a reasonable amount and compares it to the European market where prices can reach upwards of 700 SEK. Expert B said that current actors have experimented with the pricing, and that a level of 100 SEK attracted many customers while a level of 500 SEK did not. Related to different service levels, Expert F proposed that a basic service package only should cost around 50 SEK, while an advanced service package could cost up to 500 SEK. Expert A did not mention an amount but says that the willingness to pay is low, and that foreign haulage companies cannot be expected to pay more than around 50 SEK.

The haulage companies also emphasized the importance of matching pricing to service quality. They suggested that transparency in what is offered can encourage broader adoption. The haulage companies agreed that cost remains the primary barrier to using premium rest stops. Hauler Z pointed out that paying a high price is not economically feasible for many operators, particularly those carrying less valuable cargo. But they themselves could justify upwards of 500-700 SEK per night for their transports with high value cargo. Hauler X said that between 150-250 SEK per night is fine if it is justifiable in terms of provided services. Hauler Y said that since they mostly operate in the northern parts of Sweden, paying for safety is hard to justify. But he also said that his company was willing to pay as much as 200 SEK for a rest area without any safety measures, if it included basic services such as toilets, showers, and was in close proximity to a store. None of the haulage companies expressed that they were currently willing to pay extra if the rest area provided the possibility to fuel/charge with alternative fuels.

According to the survey, the majority of drivers are willing to spend no more than 19 €, with a few willing to spend upwards of 39 €. But none of the answers were in line with the amount that Hauler Z was willing to pay. This can be seen through the absence of answers for the 40+ € option, see Figure 6.14. The survey did also show some difference to what Expert A said regarding drivers having no say in if the service will be used or not. This can be seen in Figure 6.5 and shows that quite a large percentage of the drivers do have a say in where to stop, but there could be a difference in stopping for rest and using a safe and secure service. Important to note is that, according to the survey, a majority of drivers answered “Like it” on the feature of having access to a free parking area without security features. See Figure 6.15.

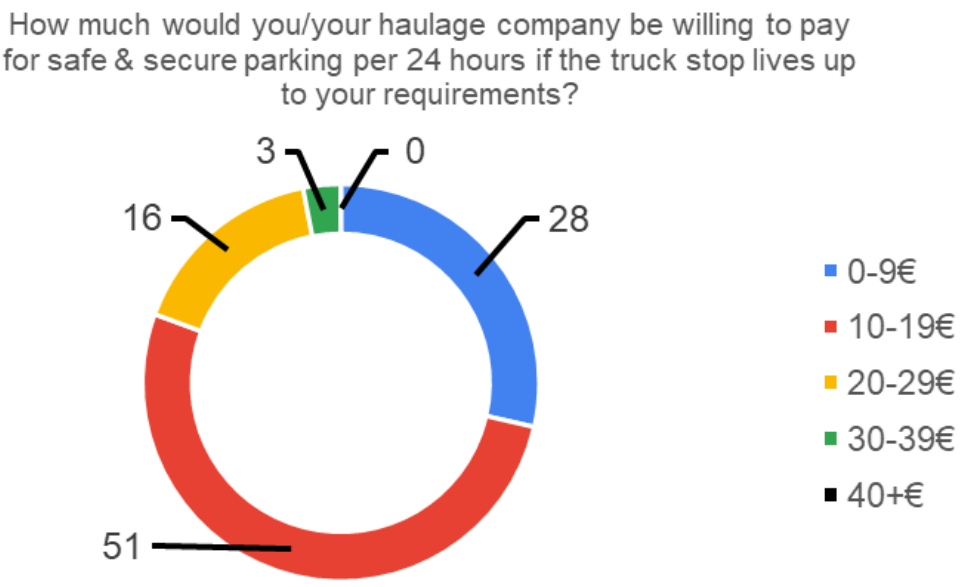


Figure 6.14: *Reported willingness to pay for 24 hours of access to a safe and secure rest area, from survey answers.*

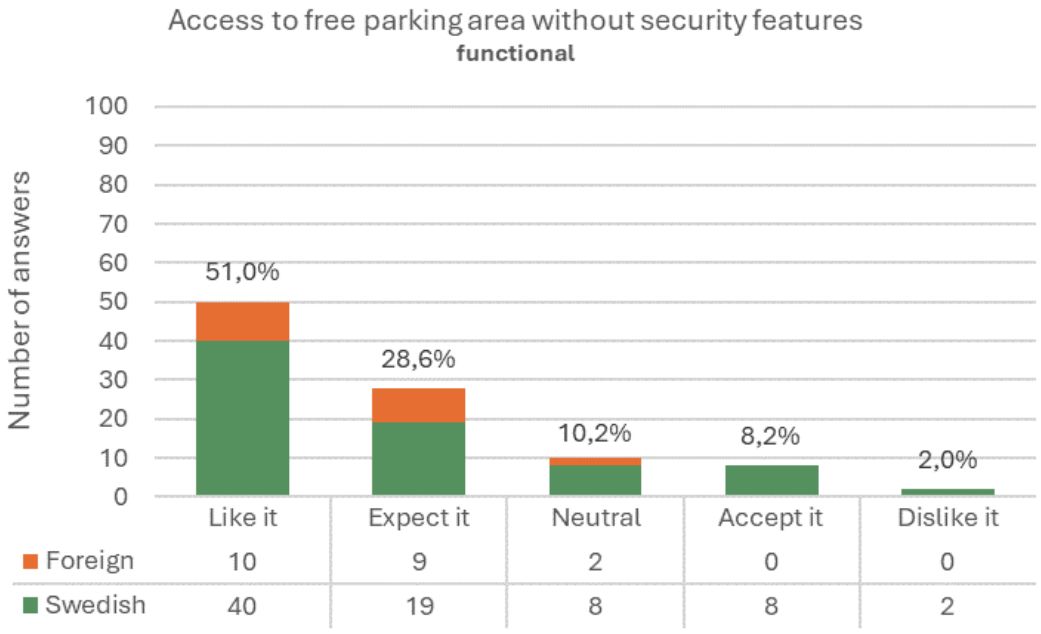


Figure 6.15: *Rating of access to free parking area without security features, from survey answers.*

6.5.3 Costs related to infrastructure development and potential funding

From a cost perspective, plenty of investments are needed to either build new infrastructure, or upgrade already existing ones. Expert B stressed that the costs of building new parking areas are high and added that it could take time before being able to recoup the investment. One strategy according to Expert F could be to invest in increments and not commit too much

money early on. Earlier, private actors needed to finance the infrastructure solely themselves, but since a couple of years back, the EU can help with security projects related to the TEN-T network. Expert C elaborated on this possibility by explaining that the EU, through its organ CEF, has a pot of 160 million SEK to spend each year on the area. From this pot, any actor can apply for financial aid, and projects will get funding if there is money left in the pot. For safe and secure parking, the requirement of getting funding is to reach any of the EU's security levels bronze, silver, gold, or platinum. The applicant then gets upwards of 50% of the projected investment sum paid by CEF, independent of which security level that is reached. However, in absolute terms a higher security level should lead to more money granted since the investment likely will be higher. The financial aid for safe and secure parking does not require establishment in specific places. The idea of the framework is according to Expert C that market actors will find competitive places to establish the infrastructure themselves.

Financial aid for alternative fuels differs slightly compared to the one for safe and secure parking. CEF has a separate pot for alternative fuel infrastructure. This includes charging stations for electric vehicles and infrastructure related mainly to the distribution of hydrogen. Production of hydrogen could also be financed if it follows requirements and only is distributed through the station it is produced at. According to Expert C, unlike safe and secure parking, alternative fuel infrastructure is subject to placement criteria, requiring stations to be located in areas of Sweden with sufficient demand for the specific fuel type while remaining connected to the TEN-T network. Expert C stated that Tesla is one example of a company that has previously benefited from financial support, having received substantial co-investment from CEF when developing its charging infrastructure for electric vehicles. Like safe and secure parking, CEF can cover up to 50% of the investment costs for alternative fuel infrastructure. Financial aid is available during specific time windows, each dedicated to a particular focus area. Expert C emphasized that only projects that align with the theme of the respective window, e.g. charging infrastructure, are eligible for funding during that period. New funding windows open shortly after the previous ones close but may target a different focus area than the one before.

6.6 Placement of facilities

The placement of fuel stations and parking areas is key to the success of the concept. Ekwall, Expert E, and Expert G stressed that certain areas in Sweden are significantly more vulnerable to theft and crime. Expert E points out regions like Skåne, especially around Helsingborg and Malmö to be the most important areas to cover with safe and secure parking. Reasons for this being that most crimes happen there according to statistics. He reflects on the high number of thefts being a consequence of the proximity to other countries, where criminals easily can flee to, with the stolen goods. These statistics were backed up by Expert G and can be seen in Figure 6.1. Expert E said that DHL has had problems with theft in the Stockholm region. He also adds that the bigger European highways E4, E20, and E6 are the most vulnerable, mostly because they go through many of Sweden's bigger cities and high-density areas. Following the same logic, the northern parts of Sweden are not exposed to the same kind of criminality, even though it occurs occasionally.

Just because there is more criminality in certain areas does not necessarily mean that the safe and secure parking should be centered around these areas only. However, the experts have different views on this. Ekwall emphasized that secure parking should have a geographical

consistency since criminal activity could disperse after implementing measures in a few critical places. Expert D also advocated a consistent level of security throughout the country and had the opinion that it is important for the customers of the parking lot to get a predictable level of service at each of their stops. It would, according to him, strengthen the reliability and credibility of such a system to provide security everywhere. Expert E and Expert G were in opposition to these statements and instead thought that the most optimal way of placement is targeting the high-risk areas. Expert F stressed that the placement of secure facilities must also consider driver rest regulations to ensure availability aligns with legal and biological rest needs.

Experts were unified in their view that the rollout of alternative fuel infrastructure must be adapted to geography and transport flows. Expert B explained that electric charging is best suited for urban or regional transport, where distances are shorter, and energy demand is more predictable. Grahn noted that hydrogen may be more suitable for long-haul routes due to its fast refueling process and potentially higher energy density. Expert C stressed that the location of refueling infrastructure must align with what the European commission labels as important hubs and corridors to ensure both convenience and efficiency. He added that EU funding for charging infrastructure is location-dependent, requiring proximity to the above mentioned hubs and corridors, which must be factored into investment decisions.

The haulage companies supported prioritizing high-risk transport corridors and near larger cities. All of them argued that southern Sweden is particularly exposed and should be prioritized for secure rest infrastructure. However, all haulage companies also cautioned that inflexible rest stop placements may clash with real-world routing demands. Hauler X and Hauler Z emphasized that haulers must often adapt routes in response to delays or load changes, which could make a widespread network more valuable than isolated secure hubs.

The haulage companies agreed that services need to be available throughout the country, not just at a few key nodes. They highlighted that drivers require consistent access to hygiene and rest facilities to meet regulatory and personal needs. Hauler Y emphasized that rest stop spacing should allow for proper planning of rest breaks, especially when driving long distances across sparsely populated regions. No haulage company suggested that the provided non-security services should differ depending on geographical location, but Hauler Y added that the security services are not required, to the same extent, in northern Sweden. They all pointed out that the required services are often rudimentary, such as toilets, showers, and some type of possibility to eat or buy food.

The haulage companies echoed the need for geographically targeted fuel infrastructure. Hauler Z stated that charging stations are most useful in or near major urban areas, where shorter distribution routes dominate, thus being more suited for electric trucks. Hauler Y agreed, adding that remote areas currently lack the grid capacity and demand to justify heavy infrastructure investments. All three haulage companies stressed that location decisions must be made based on actual transport flows and not just policy incentives or land availability.

The survey finished by allowing the survey respondents to answer an open question, if they wanted to add something that was not asked in the structured questions. Several comments pointed towards the southern Swedish corridors as the region with the greatest need for safe and secure rest areas.

7. Analysis

This chapter presents the analysis of the study, where the empirical findings are interpreted using the frameworks introduced in Chapter 4 Theory. By combining the results with the MCDA and Kano model, and then comparing these findings with the literature, the aim is to uncover patterns, assess priorities, and provide a deeper understanding of Research Question 1, 2, and 3, in order to answer Research Question 4.

7.1 Evaluation of features for a safe and secure parking area

The results have shown that some features of a resting area and fuel station are more important than others to stakeholders. In this section, the features are analyzed from an importance perspective, where evidence of importance is related to background and theory to explain why the features are important. The features are also compared to the EU's requirements, seen in Appendix B, for certified safe and secure parking areas. This is done to identify if there are any important services missing or unimportant features included in the current framework. The discussion also includes how the features may contribute to the overall business concept, taking into account broad economic considerations such as potential value creation, willingness to pay, and other contextual factors. All service ratings and scores from the survey can be seen in Table 7.1.

Customer requirments	Quality attribute	Performance Score
Access to toilets	One-dimensional	0,14
Access to some type of food	Attractive	0,08
Access to showers and dressing rooms	Attractive	0,10
Access to drinking water	One-dimensional	0,12
Access to electricity outlets for personal use	Indifferent	0,00
Access to electricity to power refrigerated goods	Indifferent	0,00
Access to internet connection	Indifferent	0,00
Access to dining room or lounge	Indifferent	0,00
Access to a laundry room	Indifferent	0,00
Access to reparation and service of vehicles	Indifferent	0,00
Access to a nearby store	Attractive	0,09
Access to entertainment (TV, games, etc.)	Indifferent	0,00
Lighting within the parking area	One-dimensional	0,13
Parking area with physical barriers	Attractive	0,09
Camera surveillance within the parking area	Attractive	0,10
Parking area with security guard monitoring	Attractive	0,07
Other nearby truck drivers in the rest area	Indifferent	0,00
Possibility to pre-book parking slots	Indifferent	0,00
Access to free parking area without security features	Attractive	0,08
Possibility to spend time in nature	Indifferent	0,00
Possibility to exercise/workout	Indifferent	0,00
Possibility to sleep in other places than your vehicle	Indifferent	0,00
Access to hydrogen refueling	Indifferent	0,00
Access to slow electric vehicle charging	Indifferent	0,00
Access to fast electric vehicle charging	Indifferent	0,00

Follow up questions	Rating
How important is it that access to the parking area is exclusive for truck drivers?	3,71
How important is it to be able to eat heated food (buy freshly cooked food and/or heat up your own food)?	3,08
How important is it that the facilities feel fresh and are cleaned regularly?	4,69
How important is it that restrooms and showers are separated based on genders?	2,88
Do you have a positive or negative attitude towards driving a truck fueled by alternative fuels in the future?	3,18
How likely is it that you will drive a truck fueled by alternative fuels within the upcoming 10 years?	3,05

Table 7.1: *Kano ratings and performance scores of all suggested services in the survey, extended version with calculations in Appendix E.*

7.1.1 Services

As expected, toilets were seen as an important feature by experts, haulage companies, and drivers. According to the Kano model, the feature is of a one-dimensional character, which implies that a higher degree of implementation is required, to not cause dissatisfaction and instead give satisfaction to consumers. One-third of survey respondents rated the feature as a must-be, indicating that many drivers demand a toilet at truck stops. Therefore, it was scored as the most important feature of all proposed features with a performance score of 0,14. Given that these parking areas should be designed for long-haulage traffic and daily or weekly rest periods, it is logical that the drivers need toilets. The high importance of toilets can be seen to provide a strong functional value to drivers, as described by Goel & Kumar (2024), meeting a basic physiological need and enabling them to perform their work effectively. Haulage companies also have a derived interest in toilets to fulfill work environment laws and to keep their workers happy. It is stated in the EU guidelines (EU Regulation NO 2022/1012) that toilets are needed, and that the toilets should be separated based on genders. In contrast, this study showed that the interest in gender-separated hygiene areas was not particularly high (rating 2,88 out of 5), but this varied between different demographic groups, as can be seen in section 7.2 below.

There is also an aspect of how well maintained the toilets are. Here, EU guidelines (EU Regulation NO 2022/1012) state that daily regular checkups and cleanings should be made. However, quality could be interpreted differently between actors. This study shows that drivers find cleanliness highly important (rating 4,69 out of 5), and together with Expert F's view that well-maintained toilets are a universal preference, the execution of this feature may be essential towards reaching a high degree of customer satisfaction. The emphasis from all actors on cleanliness aligns with earlier findings that hygienic restrooms significantly influence stop preferences (Krasniuk et al., 2024), reinforcing the competitive advantage of having well-maintained facilities.

Showers and dressing rooms were, just like toilets, emphasized as important by experts, haulage companies, and rated highly by drivers. However, while drivers like to have showers and dressing rooms at their resting places, they showed a higher acceptance of not having it, compared to e.g. toilets. This led to the feature being classified as attractive according to the Kano model, with a performance score of 0,10. These results are similar to earlier reports (Krasniuk et al., 2024; McKeown & Crizzle, 2023). This could possibly show that showers are not a current standard. Showers are not needed as frequently as toilets either, which potentially limits the use for these facilities to only the long-haulage customer segment to a higher extent than toilets. It can be partially confirmed by the majority of respondents of the survey driving more than 300 km per delivery (around 85%). This segment should however not be neglected, since it is one of the most important segments to consider when creating long-term workplace sustainability (Aryal et al., 2023). Nonetheless, gender-separated showers and dressing rooms are requirements from the EU (EU Regulation NO 2022/1012). The same reasoning for gender-separation of toilets also applies for showers and dressing rooms. Finally, showers could be co-located with toilets to potentially save space and some costs.

Drivers agreed that water taps providing drinking water were important, but opinions were split about how important this feature is. About a fourth of the drivers saw it as an attractive, one-dimensional, and must-be feature respectively. Since it is appreciated to at least some extent by the majority, and the difficulty of implementation is rather low, it should be seen as a worthwhile feature to implement. The feature was given a performance score of 0,12 which suggests it is one of the most important services to provide, according to the survey. Considering the working conditions of truck drivers, tap water should be provided for both health and hygiene reasons. Arguably, drinking water from a tap could be seen competing with the option of buying something to drink from a store or vending machine, but results suggest that customer satisfaction would decrease by not implementing it. It is also a requirement from the EU (EU Regulation NO 2022/1012) to get certification, which also requires the tap to provide warm water.

Earlier research has shown that there is an increasing demand for food, healthy food in particular (Passey et al., 2014). This stems from truck drivers acquiring physical diseases from work-related conditions, e.g. obesity. From this study's results, stakeholders have different views on this topic, although everyone thinks food of some sort is important. Experts that had a background in security management tended to play down the role of food variety, saying that only basic services are needed. Expert F, who has an entrepreneurial background, saw a completely different potential for both restaurants and cafés to provide fresh food. Similar disagreements could be seen among haulage companies and drivers, where it was important for some to have access to a large selection of high-quality food, while others did not see a need for more than a vending machine with some snacks. Drivers saw food as an attractive feature and it had a performance score of 0,08, which means it is not necessary, but appreciated where it is provided. These results may depict the two-sided problem of drivers not being aware of what is regarded as healthy for them, while current infrastructure has set a standard of supplying a certain type of food (Passey et al., 2014). EU regulations also give plenty of freedom in implementation, stating that snacks and drinks should be available for purchase at any time (EU Regulation NO 2022/1012). This could mean anything from a small vending machine, an unmanned store, a fuel station shop, or a bigger highway restaurant. Although it could be viable to only provide a small selection of basic food without causing dissatisfaction, it can undermine the drivers' health and performance over time. However, as both the results and the regulations imply a split view, there is a possibility to tailor the offering to sites where there is a high demand for certain foods. This can be evaluated through looking at traffic density and local customer preferences.

Related to the availability of food, the majority of drivers think a store is an attractive feature, resulting in a performance score of 0,09. A shop fulfills a range of food demands as well as potentially providing other commodities to customers. If a shop was implemented, the food criteria could likely be solved to suit the majority of customers. However, it is usually expensive to build and operate manned stores. The interest for a dining room or lounge was generally low, with over 60% of the survey takers being indifferent to its existence. Around a third of drivers saw it providing some value for them. Features considered being of the indifferent kind add no particular value to the majority of customers and are therefore given the performance score of 0 following the MCDA method (Li et al., 2009). However, in cases where the provider wants to target a specific customer segment or create an improved overall experience, it can still be considered depending on the context. Complexity is added since a dining area is required by the EU to get certified (EU Regulation NO 2022/1012). In cases

when a store is present, this criterion could be solved by adding seats and tables for drivers to eat at in the store. When a store is not present, the parking operator must consider how costly a dining area is to invest in compared to the benefits of giving value to a smaller customer segment and to be able to get certified by the EU.

Implementation of food, stores, and dining rooms or lounges can be seen as related to each other. The results show that it is important to have at least a vending machine, or a small, unmanned store to fulfill the basic needs of the drivers. A variety of food could still be supplied through these facilities. Due to the investment costs of building a store, it would likely be more relevant to focus these infrastructure investments to areas where traffic flows are denser, and where more customers are expected. Dining rooms or lounges are not considered to be a priority among investment options but could give some synergies together with safe and secure parking. A dining room or lounge would check off some criteria to get certified, allowing the operator to gain funding for its construction together with the parking. This is however only valid for features required by the EU. Any extra investments must be covered by the provider. It could possibly create a better overall experience if a store together with a dining room were provided, but the effects of this synergy needs further research to be identified.

An option to do laundry was mentioned by literature as a potentially value-creating service (McKeown & Crizzle, 2025). However, in reality neither experts, haulage companies, or drivers showed any interest in this service. Therefore, it is not a feature that can be recommended to implement. This could be a case of a cultural difference, where former research has not been compatible with Swedish culture. Like the former discussion of toilets and showers being used at different frequencies, laundry has an even lower frequency of use, making it only relevant for drivers that are away from their homes for longer periods than what is common in Sweden. There are no certification requirements about being able to do laundry, and thus funding can still be received without this feature (EU Regulation NO 2022/1012).

Technology used for private purposes was in general not considered important by many drivers. There were only a few drivers that rated having electricity outlets and internet connection provided as important. Drivers may not necessarily need these features since they can use their own mobile connection and electricity outlets in their trucks. However, both features are needed from EU certification (EU Regulation NO 2022/1012). It is not stated explicitly that wi-fi is needed to be provided but the provider of safe and secure parking should at least ensure that the area has a strong 4G or 5G connection. It is also in the provider's interest to have good mobile connections if they aim to implement a digital customer platform and digital payment solutions. Entertainment like TVs, games, etc. was suggested by some previous studies to have a positive and relaxing effect on drivers (Krasniuk et al., 2024), but the survey shows that it is of no interest in practice. Some drivers even saw it as a negative feature they rather not see at the site. As the trend shows, drivers lose decision-making autonomy with time (Ottosson & Wallengren, 2019) and feel an increased level of monitoring from their haulage company (Fredenman, 2019). This may have led to driver's work schedules becoming too busy for them to enjoy entertainment and could possibly instead be a stressing distraction for some drivers. It might also be a case where drivers bring their own entertainment items in their trucks.

From the start of 2027, electricity connection for refrigerated trailers is necessary to get EU certification, and thus also a necessity to receive funding (EU Regulation NO 2022/1012). It is only a specific segment that transports refrigerated goods, hence the feature is shown to be of indifferent character in the survey. However, it could be seen as an important feature for the specific segment that transport refrigerated goods. If this feature is implemented, haulage companies have mentioned the challenges of the coolers' noise levels. It could be a negative experience to sleep close to a truck that has a cooler connected and the provider could therefore look at the possibilities of separating parking lots between those that have cooling units from those without, thus reducing the risk of it negatively affecting drivers (Rocha et al., 2022; Aryal et al., 2023).

Trends have previously shown that younger truck drivers aim to live healthier (Aryal et al., 2023), and having the possibility to work out and to be in the vicinity of a nature area has been suggested by other researchers (Gawlik et al., 2024; Longman et al., 2021) to be factors that the new generation of drivers could prefer. The survey showed that there is only a smaller segment that values this, but that most of the survey respondents are indifferent to it. No correlations between age, gender and the features could be seen either. This could possibly be a similar phenomenon as for the supply of food, where drivers either are not aware of the importance of healthy habits, or are so used to current infrastructure not providing enough possibilities for them to live healthy (Passey et al., 2014). From a security perspective, the parking space should not be located too close to nature since it can limit the visibility around the parking space. According to Ekwall, reduced visibility can heighten safety and security risks, which makes locations too close to nature less suitable.

A last service feature to be evaluated was the possibility to sleep in another place than the truck, for example in a motel. Sleep quality has been emphasized as one of the most important factors for good mental health (Rocha et al., 2022), suggesting that sleeping in a motel would make the driver feel safer and more comfortable. However, the interest from the drivers for this was low, which means that it should not be implemented. This could be a consequence of truck drivers' culture and habits of sleeping in their vehicle (Ottosson and Wallengren, 2019). It could also have to do with this service adding extra cost for the driver or haulage company. External living options could enable the parking area to focus more on security than safety, adding extra features like thermal cameras and motion alarms to protect the trailers. However, this design is not following the set requirements from the EU since the regulations emphasize the safety of the drivers as crucial (EU Regulation NO 2022/1012).

7.1.2 Safety and security

A major focus in this study has been on the security and safety of transported goods and truck drivers. It is important to remember the difference between security and safety, since according to Expert D, different measures could give different consequences for security and safety. Implementing physical barriers is one of the most common measures, and its implementation ranges from having a hedge around the parking area to having electric fences. In this study it has been pointed out as an effective measure to increase both security and safety. With fences, criminals cannot get access to the trucks as easily, cannot spend as much time near the trucks, and cannot escape as easily. It can also be a symbol for signaling that the parking space is exclusive to some people and that it is a safe environment. One key point is how to handle the entrance and exit. If gates are not in place, people could still enter the area, which lowers the efficiency of fences. As Ekwall says, technical solutions can always be

passed by criminals somehow, but they at least make it more difficult for them in the process. Access control systems, like registration number scanning can be implemented to further ensure that only allowed people can enter and exit the area. Compared to service requirements, security requirements must not only be present but meet certain quality levels to reach different certification levels (EU Regulation NO 2022/1012). It is only for higher level certifications that high fences are needed, since all types of perimeters could lower the impact of a crime to some extent. However, a high fence would probably also lower the possibility for crimes to occur. When choosing an implementation method, the provider of the safe and secure parking should combine fences with other measures like lighting and cameras to effectively deter criminals. Fences were seen as an attractive feature by drivers, saying that it is preferable to having an open parking space. It was given a performance score of 0,09. This is further emphasized with the drivers rated having an exclusive parking only for professional drivers somewhat highly (rating 3,71 out of 5). So, while the experts say that fences can raise security, results from the survey can be interpreted as fences raising the feeling of safety for drivers. Improving the feeling of safety for drivers is expected to increase mental health (Rocha et al., 2022), and further help solving the issue of driver shortages (Keckarovska, 2021).

Lighting was also pointed out, in the study, as a basic measure to create security and safety. Being able to spot suspicious activity from a distance can create a sense of control for drivers and parking space operators, while criminals can perceive the environment as more controlled or observed. It also adds comfort when using the facilities. Lighting could possibly be a feature that contributes more to the experienced safety, rather than real safety, but there is too little evidence to settle such conclusions without further investigations. Synergies can be identified with other measures such as cameras and safeguards where it is easier to use those when having extensive lighting in the area. EUs certification levels generally differ in the required strength of light, and where, within the area, lighting is implemented (EU Regulation NO 2022/1012). When implementing lighting, it can be implemented with motion sensors in some areas to save energy and to help focus the light where it is needed. The drivers perceived lighting as a one-dimensional feature, meaning they value having it to a high degree of implementation. The feature got a performance score of 0,13 and none of the drivers had a negative view of lighting.

Cameras are the last feature proposed by experts, haulage companies, and drivers to implement. A preconception can usually be that cameras also could have a negative impact on drivers because of the integrity and privacy aspect. However, the interviews show that this is generally not the case, and that the drivers have a good understanding and appreciation for cameras overall. This view is confirmed by the drivers rating it as an attractive feature. It got a performance score of 0,10 and no drivers thought it was a negative feature, potentially meaning that drivers do not see cameras as intruders on their privacy. It could also reflect a prioritization over personal safety over privacy, especially in high-risk environments. For certification from the EU, cameras are needed, with use of better cameras and monitoring routines for higher certifications (EU Regulation NO 2022/1012). Cameras work in a deterring way, while also strengthening the feeling of safety of drivers. As with lighting, cameras could in the worst case also only contribute to the experienced safety of the area. They add no physical hindrance to stealing, but with the right use, criminals can be identified and captured by law enforcement. This is especially important since crime reporting and investigating need to become more consistent as many crimes are not reported. As Expert G

says, the police do not currently prioritize this area of criminality because there is not enough representative evidence of how much impact it has on victims.

Guard surveillance could be used to further strengthen the security. It is also seen as an attractive feature by survey respondents, although not as important as fences, lighting and cameras. The performance score for having guard monitoring was slightly lower at 0,07. Security staff could offer a direct enquiry to any crime and possibly act as a deterring feature. Security staff could also provide direct information and assistance to drivers. In the EU regulations, it is only required to have security staff at the highest certification level (EU Regulation NO 2022/1012), which means that it could be suitable if a state-of-the art parking area is built. In other cases, the option could seem costly because of salary payments. Having a group of drivers within a parking area could potentially act as a sort of surveillance. The survey shows that drivers are indifferent to having other people around, which means they are not against it. Some survey respondents find it attractive to have other people close, potentially as a safety mechanism to protect each other or as a social aspect. Ekwall also mentioned having a group of drivers together as a deterrent feature for criminals. This can lead to an increased likelihood of a criminal being spotted ahead of time. Naturally, a safe and secure parking area must contain many vehicles and drivers to become profitable.

Among systematic measures, pre-booking was the most discussed solution. It could be seen that many drivers' and truck's safety rely on being able to follow the schedule set for the transport. If transporters and haulage companies can predict where the drivers need to take their rest, it makes it easier to ensure that they are in a safe area to do so. However, in reality many things can happen along the way, and many actors express that the sleep- and resting rules for drivers are to be followed strictly, since this is required by law. Hence a pre-booking system would create value in making sure that the route planning in best case could work. It could also be a tool to measure capacity needs for the operator and a way to connect with their customers as a marketing tool. While the survey shows that the majority of drivers are indifferent to a pre-booking system, it could potentially have a bigger impact on the management side of companies. Finally, for higher certification levels, a digital pre-booking system is required by the EU, as a way of ensuring consistency in the transport's safety (EU Regulation NO 2022/1012).

While safe and secure parking is needed to some extent, it can be seen in the survey that the need for non-secure parking is also high. Trafikverket says that the capacity of parking along the road network is big enough, but drivers do not seem to agree. Many drivers currently find it difficult to find a resting place in general, making them park dangerously along big roads, and in areas they are more exposed to thefts, in order to comply with rest regulations. Here the communication between actors like Trafikverket, municipalities, and the industry seems to be weak. Municipalities have also limited the possibilities to park in certain areas of cities to further complicate the parking situation. This shows that when planning a network of parking areas, some spots could from the industry's perspective benefit from having a low safety level, but instead provide parking and basic services at a competitive price. This demand could be seen to have a correlation with the geographical regions, where haulage companies from the north of Sweden expressed a deficit of parking space, but not necessarily secure parking.

7.2 Demographic differences in feature preferences

The analysis of the survey responses, using the combined MCDA and Kano model, reveals noticeable differences in how drivers with different backgrounds prioritize rest area features. The studied demographic groups include women, men, Swedish and foreign nationals, as well as individuals with and without prior experiences of crime. Although some of these groups provided fewer responses than what is generally required to identify distinct patterns (Lieber, 1990), the tendencies are still included in the analysis, with awareness that they may be less reliable.

7.2.1 Gender-based preferences

All gender-based preference ratings and scores from the survey can be seen in Table 7.2.

When comparing male and female survey respondents, the clearest contrasts appear around hygiene-related services. Women place the highest score on access to toilets and it is the only feature in the survey rated as a must-be (performance score of 0,16), and a rating of 4,93 and 4,57 out of 5 in facility cleanliness and separated spaces in hygiene-related facilities. This supports what Expert F and the haulage companies highlighted, the importance of privacy and cleanliness to attract and retain female drivers. Men also prioritize access to toilets, but to a slightly lesser extent than women, rating it as a one-dimensional feature (performance score of 0,14) and a rating of 4,65 and 2,60 out of 5 in facility cleanliness and separated spaces in hygiene-related facilities. This is further shown when taken into account that men have fewer required features, resulting in an average higher score per feature than women. The extra requirements that the female survey respondents had were the possibility to spend time in nature, and pre-booking of parking slots, which they rated as attractive features. The only other difference in rating was that men put access to drinking water as a one-dimensional feature, while women rated it as an attractive feature. Interestingly, all other features were similarly rated by both groups, though women assigned slightly lower performance scores on average, likely due to women having more required features than men, resulting in a lower average score per feature. This result differs from what experts, haulage companies, and previous literature have stated about preferential differences between men and women. Opinions regarding women having an increased standard for cleanliness and access to restrooms holds true, according to the survey results, but perceptions such as the increase in safety standards that many of the experts and previous studies (Hopkins & Davidson, 2023; Arora & Ovhagen, 2024) emphasize does not seem to hold true, even though one could argue that the possibility to pre-book can be seen as a safety feature, in the sense that it allows the driver to make sure that they have other safety measures while resting. Arora & Ovhagen (2024) also explains that women can perceive other drivers, specifically other male drivers, as a possible threat. If this was the case the survey results would show female responses rating closeness to other drivers as a reverse feature, but this does not show to hold true, since the responses showed females as indifferent to this feature, same as male survey respondents. Thus, implying that this perception does not fully hold true. Therefore, the statement of Hopkins and Davidson (2023), that many perceptions of environment, eating, toileting, safety, and social relations differ between males and females, seem to hold true to some degree, but according to the survey results not to the full extent that they argue.

	Women		Men	
Customer requirments	Quality attribute	Performance Score	Quality attribute	Performance Score
Access to toilets	Must-be	0,16	One-dimensional	0,14
Access to some type of food	Attractive	0,07	Attractive	0,08
Access to showers and dressing rooms	Attractive	0,08	Attractive	0,10
Access to drinking water	Attractive	0,07	One-dimensional	0,12
Access to electricity outlets for personal use	Indifferent	0,00	Indifferent	0,00
Access to electricity to power refrigerated goods	Indifferent	0,00	Indifferent	0,00
Access to internet connection	Indifferent	0,00	Indifferent	0,00
Access to dining room or lounge	Indifferent	0,00	Indifferent	0,00
Access to a laundry room	Indifferent	0,00	Indifferent	0,00
Access to reparation and service of vehicles	Indifferent	0,00	Indifferent	0,00
Access to a nearby store	Attractive	0,07	Attractive	0,09
Access to entertainment (TV, games, etc.)	Indifferent	0,00	Indifferent	0,00
Lighting within the parking area	One-dimensional	0,11	One-dimensional	0,13
Parking area with physical barriers	Attractive	0,09	Attractive	0,09
Camera surveillance within the parking area	Attractive	0,10	Attractive	0,10
Parking area with security guard monitoring	Attractive	0,06	Attractive	0,07
Other nearby truck drivers in the rest area	Indifferent	0,00	Indifferent	0,00
Possibility to pre-book parking slots	Attractive	0,05	Indifferent	0,00
Access to free parking area without security features	Attractive	0,07	Attractive	0,08
Possibility to spend time in nature	Attractive	0,06	Indifferent	0,00
Possibility to exercise/workout	Indifferent	0,00	Indifferent	0,00
Possibility to sleep in other places than your vehicle	Indifferent	0,00	Indifferent	0,00
Access to hydrogen refueling	Indifferent	0,00	Indifferent	0,00
Access to slow electric vehicle charging	Indifferent	0,00	Indifferent	0,00
Access to fast electric vehicle charging	Indifferent	0,00	Indifferent	0,00

	Women	Men
Follow up questions	Rating	Rating
How important is it that access to the parking area is exclusive for truck drivers?	3,79	3,70
How important is it to be able to eat heated food (buy freshly cooked food and/or heat up your own food)?	3,07	3,08
How important is it that the facilities feel fresh and are cleaned regularly?	4,93	4,65
How important is it that restrooms and showers are separated based on genders?	4,57	2,60
Do you have a positive or negative attitude towards driving a truck fueled by alternative fuels in the future?	3,29	3,17
How likely is it that you will drive a truck fueled by alternative fuels within the upcoming 10 years?	3,29	3,01

Table 7.2: *Gender-based Kano ratings and performance scores of all suggested services in the survey, extended version with calculations in Appendix E.*

7.2.2 Nationality-based preferences

All nationality-based preference ratings and scores from the survey can be seen in Table 7.3.

Swedish and foreign drivers also show notable differences. The largest identified difference is the amount of features the groups have classified as relevant. Foreign drivers have rated 8 out of the 25 features as relevant, while Swedish drivers have rated 12 of the features as relevant. The 4 features that Swedish drivers think are relevant but foreign drivers disagree on, are access to drinking water, security guard monitoring, pre-booking, and possibility to spend time in nature. This results in a higher average performance score per feature for foreign drivers. This is also shown by foreign drivers rating all but 2 of their relevant features as one-dimensional while Swedish drivers rated all but 3 of their relevant features as attractive. The biggest difference can be seen in the performance score of access to food. Swedish drivers rated it as an attractive feature with a performance score of 0,06 and foreign drivers rated it as a one-dimensional feature with a performance score of 0,14. This is consistent with

insights from the haulage companies, who noted that foreign drivers often prioritize basic survival needs, likely reflecting more intense cost constraints. This difference can be linked to the structural issues that Thörnqvist (2019) points out in the sector. Derived from low-margins, the cost-competitive nature of road transport, the less-than-ideal employee rights, all resulting in poorer working conditions for international drivers. Which could affect the expectations from foreign drivers, or which features these drivers are willing to pay for.

Foreign drivers also scored the security features higher than Swedish drivers. This higher score could be due to the fact that foreign drivers, reported by the experts and haulage companies, most often act in the southern parts of Sweden, and are therefore, according to statistics from TAPA (van Weenen et al., 2019) and Expert G, more exposed to risk. Noteworthy is that although foreign drivers generally score security features higher, they do not see security guard monitoring as a relevant feature, which in contrast Swedish drivers do.

Neither of the groups rate the alternative fuel options as relevant features, which could be because as both experts and haulage companies say, the haulage sector lags behind in transitioning towards alternative fuels, supported by both Trafikanalys (2020) and internal reports from the port of Trelleborg. But where it differs is the future outlook on alternative fuels. Swedish drivers generally had a more positive outlook on using alternative fuels in the future, rating it as 3,30 and 3,21 out of 5. Foreign drivers had a bit less with ratings of 2,76 and 2,48 out of 5.

	Swedish		Foreign	
Customer requirments	Quality attribute	Performance Score	Quality attribute	Performance Score
Access to toilets	One-dimensional	0,13	One-dimensional	0,14
Access to some type of food	Attractive	0,06	One-dimensional	0,14
Access to showers and dressing rooms	Attractive	0,09	Attractive	0,10
Access to drinking water	One-dimensional	0,11	Indifferent	0,00
Access to electricity outlets for personal use	Indifferent	0,00	Indifferent	0,00
Access to electricity to power refrigerated goods	Indifferent	0,00	Indifferent	0,00
Access to internet connection	Indifferent	0,00	Indifferent	0,00
Access to dining room or lounge	Indifferent	0,00	Indifferent	0,00
Access to a laundry room	Indifferent	0,00	Indifferent	0,00
Access to reparation and service of vehicles	Indifferent	0,00	Indifferent	0,00
Access to a nearby store	Attractive	0,08	Attractive	0,10
Access to entertainment (TV, games, etc.)	Indifferent	0,00	Indifferent	0,00
Lighting within the parking area	One-dimensional	0,11	One-dimensional	0,14
Parking area with physical barriers	Attractive	0,08	One-dimensional	0,14
Camera surveillance within the parking area	Attractive	0,09	One-dimensional	0,12
Parking area with security guard monitoring	Attractive	0,06	Indifferent	0,00
Other nearby truck drivers in the rest area	Indifferent	0,00	Indifferent	0,00
Possibility to pre-book parking slots	Attractive	0,04	Indifferent	0,00
Access to free parking area without security features	Attractive	0,07	One-dimensional	0,11
Possibility to spend time in nature	Attractive	0,06	Indifferent	0,00
Possibility to exercise/workout	Indifferent	0,00	Indifferent	0,00
Possibility to sleep in other places than your vehicle	Indifferent	0,00	Indifferent	0,00
Access to hydrogen refueling	Indifferent	0,00	Indifferent	0,00
Access to slow electric vehicle charging	Indifferent	0,00	Indifferent	0,00
Access to fast electric vehicle charging	Indifferent	0,00	Indifferent	0,00

	Swedish	Foreign
Follow up questions	Rating	Rating
How important is it that access to the parking area is exclusive for truck drivers?	3,66	3,90
How important is it to be able to eat heated food (buy freshly cooked food and/or heat up your own food)?	3,04	3,24
How important is it that the facilities feel fresh and are cleaned regularly?	4,78	4,38
How important is it that restrooms and showers are separated based on genders?	3,08	2,14
Do you have a positive or negative attitude towards driving a truck fueled by alternative fuels in the future?	3,30	2,76
How likely is it that you will drive a truck fueled by alternative fuels within the upcoming 10 years?	3,21	2,48

Table 7.3: *Nationality-based Kano ratings and performance scores of all suggested services in the survey, extended version with calculations in Appendix E.*

7.2.3 Experience with crime

All crime experience-based preference ratings and scores from the survey can be seen in Table 7.4.

The most pronounced difference between those who have experienced crime during duty and those who have not is that those who have been a victim of a crime rate the possibility to pre-book as an attractive feature (performance score of 0,05), while the drivers that has not been a victim of a crime does not see pre-booking as relevant. The most surprising finding was that there was not a noticeable difference in how the groups scored security related features. There were some slight differences such as those who had been a victim of a crime scoring camera surveillance and guard monitoring a bit higher (performance score of 0,12 and 0,08 against 0,10 and 0,06), while those who had not been a victim of a crime rated lightning (performance score of 0,13 against 0,12), and the last feature, physical barriers were similarly rated by the groups. Noteworthy is that the importance of having the parking area reserved exclusively for drivers is rated nearly the same by both groups. These differences were not in line with what the literature, experts, and haulage companies had implied. Experts like Ekwall and Expert A , and previous studies such as the one performed by Allen (2013), had suggested that personal exposure to crime would significantly raise the demand for stronger security features in order to reduce perceived risk, but the survey results suggest that general concerns about safety are widespread among drivers, regardless of direct experience. This could be attributed to the high proportion of drivers who have been exposed over time, as shown in Figure 6.2, resulting in nearly every driver either having personally experienced victimization or knowing a colleague who has. Thus making it hard to judge if the missing increase in safety preference after having been a victim of a crime is due to the previous claims being false or if the long-haulage sector is so affected by crime (IRU, 2008) that the general mindset towards safety is therefore skewed, independent of previous exposure to crime. One could argue that the possibility to pre-book can be seen as a safety feature, in the sense that it allows the driver to make sure that they have safety measures while resting. Thus, giving some credence to the claims that safety preferences increase for those who have been a victim of a crime.

	Experience of crime		No experienced of crime	
Customer requirments	Quality attribute	Performance Score	Quality attribute	Performance Score
Access to toilets	One-dimensional	0,12	One-dimensional	0,15
Access to some type of food	Attractive	0,07	Attractive	0,07
Access to showers and dressing rooms	Attractive	0,10	Attractive	0,10
Access to drinking water	One-dimensional	0,11	Attractive	0,09
Access to electricity outlets for personal use	Indifferent	0,00	Indifferent	0,00
Access to electricity to power refrigerated goods	Indifferent	0,00	Indifferent	0,00
Access to internet connection	Indifferent	0,00	Indifferent	0,00
Access to dining room or lounge	Indifferent	0,00	Indifferent	0,00
Access to a laundry room	Indifferent	0,00	Indifferent	0,00
Access to reparation and service of vehicles	Indifferent	0,00	Indifferent	0,00
Access to a nearby store	Attractive	0,08	Attractive	0,09
Access to entertainment (TV, games, etc.)	Indifferent	0,00	Indifferent	0,00
Lighting within the parking area	One-dimensional	0,12	One-dimensional	0,13
Parking area with physical barriers	Attractive	0,09	Attractive	0,09
Camera surveillance within the parking area	One-dimensional	0,12	Attractive	0,10
Parking area with security guard monitoring	Attractive	0,08	Attractive	0,06
Other nearby truck drivers in the rest area	Indifferent	0,00	Indifferent	0,00
Possibility to pre-book parking slots	Attractive	0,05	Indifferent	0,00
Access to free parking area without security features	Attractive	0,07	Attractive	0,10
Possibility to spend time in nature	Indifferent	0,00	Indifferent	0,00
Possibility to exercise/workout	Indifferent	0,00	Indifferent	0,00
Possibility to sleep in other places than your vehicle	Indifferent	0,00	Indifferent	0,00
Access to hydrogen refueling	Indifferent	0,00	Indifferent	0,00
Access to slow electric vehicle charging	Indifferent	0,00	Indifferent	0,00
Access to fast electric vehicle charging	Indifferent	0,00	Indifferent	0,00

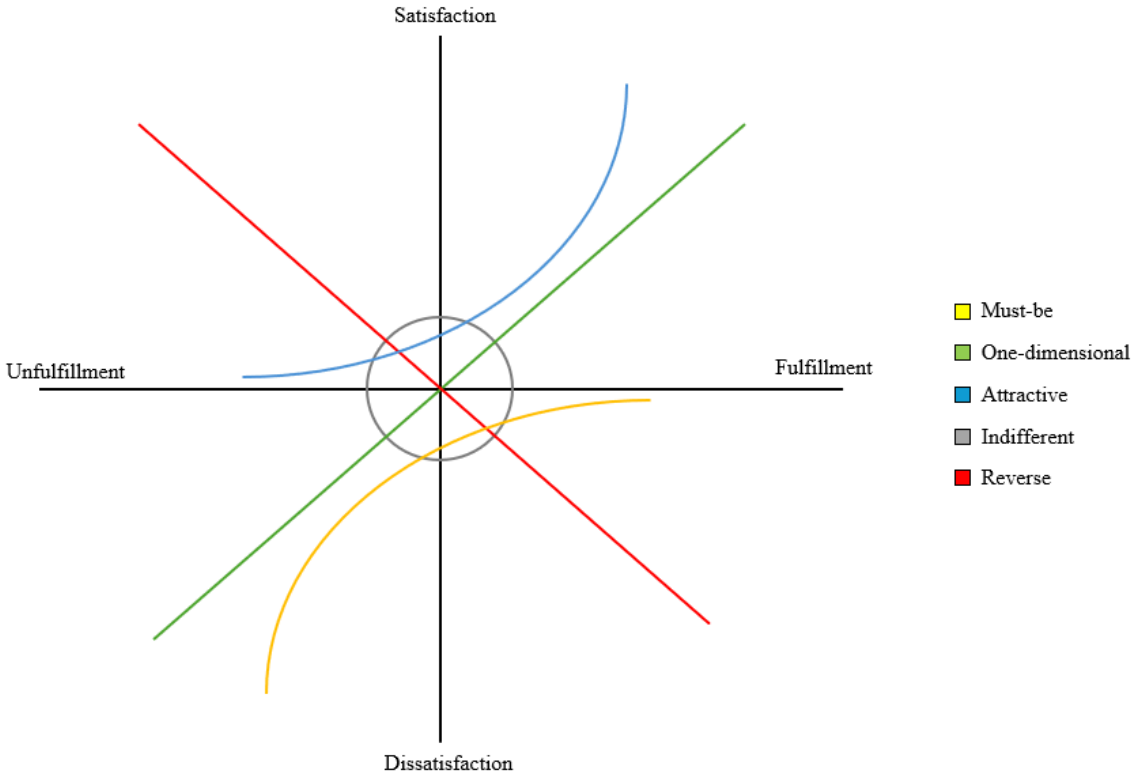
	Experience of crime	No experienced of crime
Follow up questions	Rating	Rating
How important is it that access to the parking area is exclusive for truck drivers?	3,76	3,78
How important is it to be able to eat heated food (buy freshly cooked food and/or heat up your own food)?	3,05	3,06
How important is it that the facilities feel fresh and are cleaned regularly?	4,60	4,76
How important is it that restrooms and showers are separated based on genders?	2,62	3,10
Do you have a positive or negative attitude towards driving a truck fueled by alternative fuels in the future?	3,12	3,25
How likely is it that you will drive a truck fueled by alternative fuels within the upcoming 10 years?	2,90	3,25

Table 7.4: *Crime experience-based Kano ratings and performance scores of all suggested services in the survey, extended version with calculations in Appendix E.*

7.3 Summarization of service, safety, and security

As this study has shown, there are several features of safety, security, and services that can be implemented at fuel stations and resting areas to improve customer and consumer satisfaction. The features that were rated by drivers to be valuable either had the characteristics of a one-dimensional or an attractive feature, hence following the behaviors described by the Kano model (Kano et al., 1984). All other features were rated as indifferent by the drivers, meaning they do not create any value for them. No features were rated as reverse features by any demographic group, meaning that an implementation of one feature liked by the majority should not have a negative impact on a demographic group of drivers. Implementation of features aims to do two things, firstly reducing dissatisfaction and secondly increasing satisfaction. The service features that were rated as one-dimensional were toilets and restrooms, and having access to drinking water. The service features that were rated as attractive were access to food, showers and dressing rooms, and having access to a nearby store. For safety and security features, lighting was rated as a one-dimensional feature.

Physical barriers surrounding the parking area, camera surveillance, and security guard monitoring were rated as attractive features. Additionally, cheap parking without security services was rated as an attractive feature. Experts and haulage companies agreed in the view that these features are important to create a safe and secure environment for truck drivers to be in. Figure 7.1 summarizes which features should be implemented to satisfy the average truck driver.

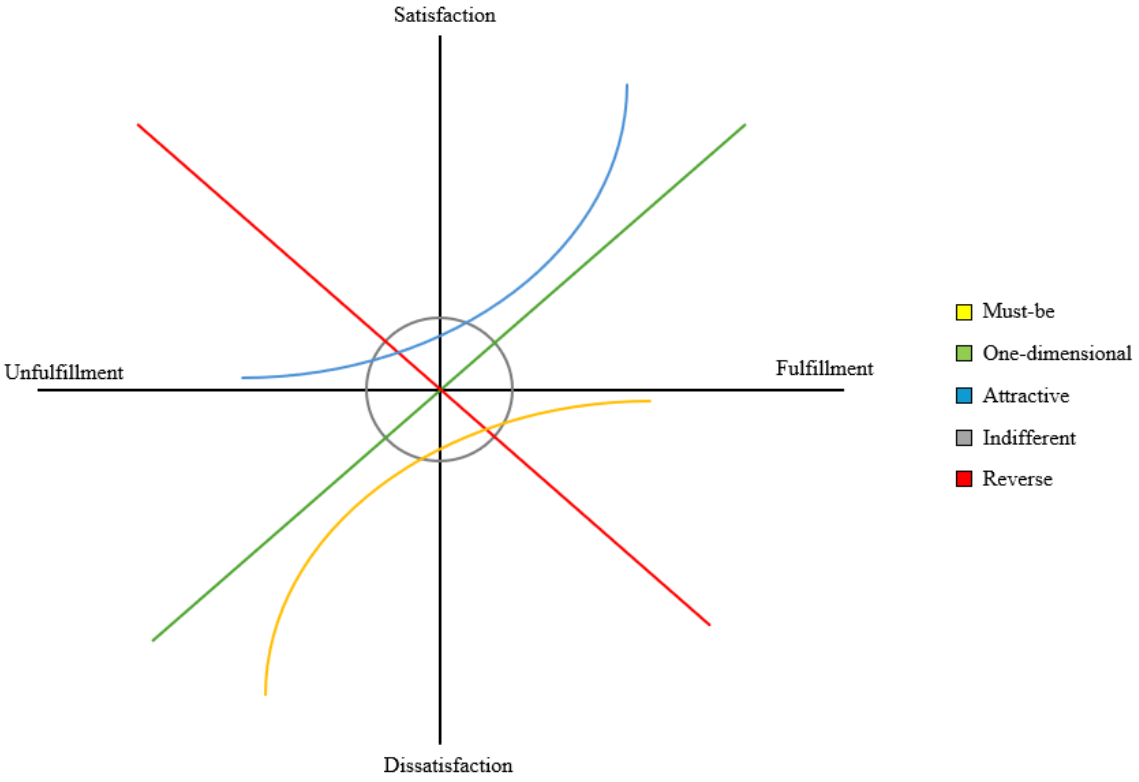


Must-be	One-dimensional	Attractive
	Access to toilets	Access to some type of food
	Access to drinking water	Access to showers and dressing rooms
	Lighting within the parking area	Access to a nearby store
		Parking area with physical barriers
		Camera surveillance within the parking area
		Parking area with security guard monitoring
		Access to free parking area without security features

Figure 7.1: *Kano model feature classifications of a resting area meeting general customer needs.*

Some features were shown to be more important to a specific demographic group or customer segment. Features that were rated by the whole population as indifferent, but rated higher by certain demographic groups were the possibility to pre-book parking slots and the possibility to spend time in nature. These were not seen as reverse features by any demographic groups, hence not creating dissatisfaction if implemented, but could create value for those groups that do think the features are important. Some other features that were already important to the whole population were rated even higher by specific demographic groups, showing that exceptional value could be created for those groups if further implemented. This could, according to Keckarovska (2021) have a high degree of impact in order to motivate certain

demographic groups to join the transport sector. In Figure 7.2 a modified summarization is shown, of which features are needed to create a state-of-art facility, maximizing the satisfaction generated for each demographic group.



Must-be	One-dimensional	Attractive
Access to toilets	Access to some type of food	Access to showers and dressing rooms
	Access to drinking water	Access to a nearby store
	Lighting within the parking area	Parking area with security guard monitoring
	Parking area with physical barriers	Possibility to pre-book parking slots
	Camera surveillance within the parking area	Possibility to spend time in nature
	Access to free parking area without security features	

Figure 7.2: *Kano model feature classifications of a resting area meeting customer needs for the studied demographic groups.*

An important aspect of the implementation of features is the profitability. Since public actors cannot provide safe and secure parking, and some other service features due to regulatory limits, private actors must find their own way of making implementations viable. An opportunity to make the case profitable is to use the funding granted by CEF, which can cover up to 50% of the investment costs of all features required for a bronze, silver, gold, or platinum certified parking area. This study however suggests that the infrastructural demand from experts, haulage companies, and truck drivers differ slightly compared to the certification requirements. To reach any certification level, internet connection, electric outlets, electricity for refrigerated trailers, and a dining area for truck drivers must also be implemented in addition to the previously mentioned features. Some other requirements not

examined in this study's results must also be met, i.e. having clear information signs, waste bins, and various staff procedures.

From previous studies, approximations of costs for building certified rest areas have been performed (Schade et al., 2021; NEA, 2007; INEA, 2019). These projects have varied a lot in investment costs, hence it is impossible to suggest an expected cost for an implementation without further research. However, the studies show that the costliest investments are the purchase of land and the preparation of land. The costs of implementing safety, security, and services only constitute a smaller part of the total investment. Since CEF rules state that the cost of purchasing land is only eligible for full subsidization if it does not exceed 10% of the total project cost, while the remaining costs may be fully subsidized by up to 50%, the cost of land becomes a critical factor in the investment decision. Therefore, the financial decision of implementing safe and secure parking areas could be very dependent on the local prices of buying land. For providers of safe and secure parking, it is therefore important to be efficient with the usage of land. It could for instance be beneficial for a fuel station provider, such as Preem, to use already existing infrastructure to provide the required facilities for services, while only buying new land if necessary for the construction of the parking spaces. It could also be beneficial to optimize the usage of current owned land. If there is excessive land at current facilities, these areas can be used to partly cover the land needs for a safe and secure parking.

The relationship between different costs must be considered when evaluating the economic implications of investing in safety, security, and service features. Because these features are critical to the value creation for customers, they may also increase the willingness to pay for using the parking areas. Each feature characteristic comes with economic implications. Must-be features are often required to be implemented to not upset customers and consumers. Here, investment costs must be compared to the alternative costs of damaging the brand and reduction of customer loyalty. Attractive features work the opposite way, where no direct costs are related to not choosing to implement the feature. However, implementing these features can instead create new revenue streams through attracting new customers, strengthening the brand, and creating competitive advantages. One-dimensional features share economic implications with both must-be-, and attractive features. Therefore, implementing the suggested features could increase overall customer satisfaction, and depending on the cost and revenue potentials for the individual case help to make it profitable.

Knowing what customers would be willing to pay is difficult because of varying customer perceptions. Experts estimate the potential revenues for one night of parking to somewhere between 50 SEK and 700 SEK. This range is relatively wide, but the willingness to pay stems both from the expectations of services, and the needs of the individual customer. In the lower spectrums of the range, only basic services and parking are expected to be offered, and in the upper spectrums, the resting area is expected to have advanced security systems. Likely, customers with high value goods are willing to pay more, given they gain security and service benefits. The results also show signs that geographical location plays a role in how much customers are willing to pay, where companies operating in crime exposed areas value the services higher. Results suggest that the provider of services can offer different service packages to different customers, based on needs and willingness to pay. Careful considerations need to be taken here whether the provider wants to satisfy all potential customers, or only a smaller segment. To understand the revenue side of the financial

calculation better, the provider should also do estimations of how many customers a resting area in a certain location would attract.

The results show that due to a lack of regular parking spaces around Sweden, haulage companies and truck drivers would like providers to offer them cheap parking areas without any safety and security features. However, because the investment costs for this kind of parking area likely will be almost as high as the investment cost for a certified safe and secure parking area due to the costs of land and land preparation, these will likely not be profitable (NEA, 2007).

7.4 Placement of safe and secure parking

From an investment perspective it is understandable that high safety and security cannot be provided to all parking areas in Sweden at once, and that the implementation of facilities needs to be done gradually. Firstly, interviews with experts and haulage companies show that there is mostly a demand of resolving safety and security in high crime areas. These are according to the results of this study the areas around Helsingborg, Malmö, Gothenburg, Stockholm, and Jönköping. Many experts point out that the needs are especially big in the urban areas of Skåne. Statistics from TAPA confirms these views, where the most southern parts of Sweden are the most critical (van Weenen et al., 2019). This is also in line with how criminology describes the problem with urban areas, and with the design of the TEN-T network. The corridors of the TEN-T network, seen in Appendix A, indeed seem to suit the implementation of parking areas well. It could be argued that implementation of safe and secure parking areas in other locations also can be valuable. Ekwall argued that the perception of safety does not always align with crime statistics, hence safety features can still be appreciated by the consumers in less vulnerable areas.

A limitation of this study has been the lack of pure data about where different types of crime occur, since much data is undisclosed due to confidentiality. Here, the underreporting of crimes is also problematic, since it could hide information about where crimes are more frequent (Ekwall & Lantz, 2022). However, experts, haulage companies, and drivers seem to agree with the mentioned places being the most critical ones. According to routine activity theory, the roads that connect these cities are important to cover because of the high flows of traffic and the vulnerability of theft (Ekwall & Lantz, 2017). These roads, which all are European roads, thus also part of the TEN-T network, are named E4, E6, and E20.

Parking areas could beneficially be placed close to the big roads, as suggested by the TEN-T regulations (EU Regulation No 2024/1679), making them easy to find and access. It is important for drivers to not have to detour to get to the parking area, and according to experts, almost all long-haulage traffic goes along the big European roads. Results also show that it could be good to place parking areas close to terminals and logistics centers, since the drivers then can rest after finishing a delivery. These places have also been described as vulnerable, where criminals await drivers exiting sites with high-value goods. However, a placement near terminals could potentially require a higher security level to be implemented, since the parking space could be more vulnerable to criminal activity. Decisions around specific placement of the safe and secure parking are dependent on the management of municipalities, where they play an important role as landlords according to Expert B and Expert G.

How frequent safe and secure parking should be is mostly decided by working- and resting regulations. It is difficult to judge exactly how this affects, and further research could be done on what places drivers need to rest in today. Ultimately some demand can be predicted, and some is randomly distributed. Alignment and integration with logistics scheduling is important. If haulage companies and drivers can plan their routes, including rests, the placement of demand can partially be controlled. Flexibility still needs to be built into the coordination because of unexpected events. Parking operators could provide flexibility to customers with booking systems and easy all-around-the-clock access to facilities.

After gradual implementation in critical places, a network will start to form. How extensive this network is can only be decided by the provider of the parking areas, unless changes are made to the TEN-T regulations. Expert C also stated that it is up to private actors to find competitive places to establish infrastructure. However, a recommendation from experts has been to stretch the safety and security package outside the most critical areas to reduce the likelihood of displacement effects (Ekwall, 2009b). It could, according to Expert D, also create trustworthiness, customer loyalty, and a strong brand to offer high quality services consistently within bigger geographical areas, mainly in the south of Sweden. Non-security related services could be provided at existing truck stops to create a better overall experience for drivers, and to enable customers to always use the operators' facilities instead of using competitors' services. The placement of regular services could be further investigated with the help of sales data.

7.5 Alternative fuels

The shift toward alternative fuels in the heavy transport sector remains a complex and uneven process, shaped by regional, political, and operational dynamics. Although many experts and haulage companies express optimism about the long-term role of alternative fuels, current market conditions reflect a sector still constrained by uncertainty and fragmentation, a point supported by Trafikanalys (2020) and IEA-AMF (2022).

Several uncertainties stand in the way of rapid development. Interviewees repeatedly cited political instability and shifting regulatory frameworks as major barriers. For instance, this can be seen with biogas, where fluctuating tax policies and uncertain long-term incentives create a volatile environment, similar to what Lindblom & Selin (2005) shows with the significant decline in consumption of biofuel, in recent years, due to reductions in blending requirements. As experts and haulage companies noted, coordination between infrastructure developers, fuel providers, policymakers, and vehicle users is essential, but currently insufficient, a gap also identified by the European Environment Agency (EEA, 2023) as limiting progress toward EU emissions targets. This lack of predictability and fragmentation discourages investment and prolongs the transition.

Survey results further reinforce the picture of a fragmented market. Swedish drivers generally report a more positive attitude compared to foreign drivers, see Table 7.3. However, feasibility varies by geography. In northern Sweden, dominated by Swedish drivers, longer distances, lower traffic density, and limited grid capacity, all pose limitations to alternative vehicle use and charging/fueling infrastructure (Trafikanalys, 2020). Conversely, southern Sweden, with its higher traffic density, shorter distances, and more suited weather conditions, presents a better fit for alternative fuels. Yet, the irony lies in the fact that southern corridors are dominated by international haulers, which according to the survey is less positive about

alternative fuels, thus possibly reducing actual uptake despite better infrastructure readiness. Though, one could argue that even though the uptake would be lower, the sheer amount of traffic in the south of Sweden compensates for this. This highlights the misalignment between infrastructure readiness and user adaptation, a concern mirrored in the AFIR regulation's emphasis on coordinated rollout (EU Regulation 2023/1804).

This is where Preem, as a fuel station operator and project company, has a strategic role to play. Positioned along the TEN-T corridors, Preem has the potential to catalyze infrastructure development. However, as some of the experts and haulage companies emphasized and what the survey answers have shown, Preem cannot rely on demand to develop on its own. Instead, infrastructure must be treated as a long-term investment aligned with wider strategic goals, including increased service revenue, brand positioning in sustainability, and the ability to attract high-value logistics clients. Importantly, experts and haulage companies stressed that profitability would not stem from fuel sales alone, but from bundled services that offer value beyond refueling, in line with Azimont's and Araujo's (2010), KPMG's (2020), and Drivkraft Sverige's (2025) analysis of the development and changing role of fueling stations. To support these investments, Preem could also explore external financing tools such as those provided by CEF (CINEA, 2025). As an EU funding mechanism aimed at supporting the development of sustainable and efficient transport infrastructure along the TEN-T network, CEF could help offset initial investment costs. This could enable Preem to develop strategically located fueling stations that align with EU priorities while mitigating financial risks and accelerating project implementation. It is important to note that, as Expert C said, this would not interfere with any funding previously received for implementation of secure rest areas, since this funding comes from separate pots, thus enabling the possibility of incremental development of combined secure rest areas with access to alternative fuel, aligning with EU strategy (EU Regulation NO 2023/1804) while mitigating financial risks.

It is also important to address the existing dominance of diesel infrastructure and fleet investments that create a structural inertia that favors current fuel types, what is also called path dependency (Kay, 2005). As experts and haulage companies pointed out, replacing the entire vehicle pool is a long-term effort, and rushing this process would not be economically viable. This means that even if, as Grahn explained, many sustainable alternatives are technically ready, actors are still locked into legacy systems, both physically and financially. For Preem, recognizing and addressing this path dependency is crucial when selecting locations for new infrastructure (IEA-AMF, 2022). Rather than waiting for market readiness, Preem may need to guide it, by combining secure parking, high service levels, and fuel flexibility at key nodes (EU Regulation 2023/1804) where future demand can be anticipated, even if not fully present today. Another option is to focus on developing depot charging as suggested by the previous thesis done at Preem (Arnberg & Kalmerström, 2024; Power Circle, 2021).

8. Discussion

The kano model is a proven model to evaluate different product features according to their potential to create satisfaction (Kano et al., 1984). It has also been refined over time (Yang, 2005), making it more precise. It provides a clear methodology of usage, where features are evaluated through a survey with functional and dysfunctional questions. While the framework is widely established, there are still some flaws that potentially could affect the interpretations of the results. Transforming the survey answers through the matrix provided in the Kano framework easily puts opinions in the "indifferent" category. This is the nature of the matrix, which requires survey respondents to express strong and clear opinions about the feature to be shown in the "must-be", "one-dimensional", or "attractive" category. For instance, if respondents answer that they expect a feature to be implemented, while accepting if the feature is not implemented, this will, according to the model, make them indifferent about the topic even though they might have a stronger opinion about it. This may be particularly true for respondents unfamiliar with the feature, and it raises the question of how decision-makers should act on features placed in the indifferent zone. Just because a feature is not currently valued highly does not necessarily mean it would not generate satisfaction if implemented or better understood. Therefore, there is reason to reanalyze the data using a matrix that is more accommodating of moderate or less strongly held opinions.

When creating the survey, a choice was made to include functional and dysfunctional questions, and exclude questions about how important each feature is to the survey respondent. This was done to balance accuracy in results and difficulty of answering the survey (Madzik, 2018). If the importance question could be included without exhausting the respondents, results would more precisely show how important a feature, hence making the prioritization between features even clearer.

To evaluate and prioritize the features, MCDA was used along with the Kano model. While MCDA helped prioritize features based on perceived importance, it does not account for interaction effects between features (Belton & Stewart, 2002). For instance, lighting was considered important, but it is not clear whether its value increases or decreases when other measures, such as, on-site guards are present. The results have shown tendencies that some features have synergies when implemented together, but future research could apply conjoint analysis or similar tools to explore these interdependencies more accurately. The current method evaluates features in isolation, which may not fully reflect how drivers experience them in real-world settings.

An important consideration in interpreting the results is understanding who the respondents are, and how that may influence the findings. Surveys often attract individuals who have stronger opinions or specific experiences related to the topic, which can lead to response bias. For example, drivers who feel unsafe or have experienced security issues may be more inclined to participate, potentially skewing the data toward more negative perceptions. Similarly, those who are more engaged may be overrepresented, while groups such as foreign drivers with less decision-autonomy may be underrepresented. This means that while the survey offers valuable insights, it may not fully reflect the views of the broader population of long-haul drivers.

The issue of driver diversity is another area that deserves attention. Addressing the driver shortage will likely require attracting more women and foreign drivers, yet their needs remain underrepresented. Only 14 women responded to the survey, making statistical analysis of gender-specific preferences difficult (Lieber, 1990). Nonetheless, their responses indicate that hygiene and privacy are more heavily scored than in the male sample. Similarly, few responses were gathered from drivers working for foreign haulage companies, despite their significant presence in Swedish transport corridors. Reaching these groups remains a challenge and should be a priority for further study.

When planning the study, many stakeholders were identified as having some interest in either safety and security, services, or alternative fuels in relation to infrastructure at fuel stations and resting areas. Many of them were included in the study either by participation in interviews or surveys. However, due to the scope of the project some were not included in the gathering of data. Among these indirect stakeholders, municipalities and insurance companies were identified to play a role in how incentives are created in the sector. By gaining further understanding of decisions taken by these actors and how they must adapt to industry conditions, other perspectives on the value of features can be obtained. Also, results have shown that there is a need for all industry actors to be coordinated to fulfill the safety, security, service, and fuel infrastructure needs. Since the latest adaption of the TEN-T regulations are relatively new (EU Regulation No 2024/1679), further research can be done on how responsibilities of implementing these regulations are distributed among actors.

Considering the generalizability, this study focuses on the long-haulage customer segment. While this group is central to the issue of safe and secure rest areas, other users of rest stops, such as short-haul drivers, bus drivers, light duty vehicles, and private motorists have not been included. This scope of focus limits the generalizability of the findings and may overlook infrastructure needs specific to other user groups. Moreover, infrastructure decisions often need to account for multi-user environments, where features must be balanced among different customer segments. Future studies could therefore include a broader range of road users to build a more complete understanding of fuel station and rest area functionality. In particular how different synergies can be seen between different features and customer segments.

Although cargo theft causes substantial economic losses each year (European Parliament, 2007), it is still not treated as a major policy issue (Ekwall & Lantz, 2022). Available statistics suggest that large amounts of money are at stake, yet the response, in Sweden, has been limited compared to countries with more developed rest area infrastructure. Research in this area is sparse, especially within the EU and even more so in the Swedish context. As a result, the reasons behind Sweden's relative underdevelopment remain unclear and further studies in this field is recommended.

Investment decisions are further complicated by the economic realities of the transport sector. Infrastructure that meets high safety standards typically requires significant capital, and the return on such investments is hard to quantify, particularly if safety improvements reduce crimes that are already underreported (Ekwall & Lantz, 2022). The involvement of financial tools such as EU grants through CEF, may offer some relief, but profitability concerns remain a barrier. Therefore, further studies are needed to determine more precise costs of developing the proposed features, so that more informed and accurate investment decisions can be made.

An important risk highlighted during the study is that increased use of secure rest areas by some drivers may lead to unintended consequences. If secure parking is adopted unevenly, criminal activity may become concentrated on unprotected trucks, further exposing smaller operators or foreign drivers who lack access. This phenomenon, known as crime displacement (Ekwall, 2009b), has been observed in other security contexts and should be factored into development strategies to ensure no group is left behind.

9. Conclusion

This thesis has explored how rest and refueling infrastructure for long-haul transport in Sweden can be developed to align with both user needs and regulatory goals. By analyzing the perspectives of experts, haulage companies, and truck drivers, three realistic infrastructure scenarios emerge, each reflecting different levels of ambition and investment.

Core: Driver-focused safe and secure station

This version includes only the most essential features identified through the MCDA and Kano models as creating clear functional value, while taking into account demographic preferences. Toilets, drinking water, and showers with dressing rooms are required. Hygiene facilities are gender-separated and maintained with a high standard of cleanliness. Lighting is added for basic safety, along with fencing, camera surveillance, and security guard monitoring. Food services are offered through vending machines or a nearby store, and a pre-booking system is available to support demographic groups that benefit from planning and predictability. Lastly, the opportunity to spend time in nature is included by placing the site in relative proximity to a forest or similar natural environment. Although, this station would not meet EU certification criteria since it only addresses the most valued needs, thus excluding it from CEF funding. Due to high land and preparation costs, even this minimal solution may struggle with profitability, unless integrated into existing infrastructure networks. Hence, funding could help reduce the total costs and make the investment more profitable.

Module 1: EU-certified safe and secure station

This module aims to fulfill all bronze-level EU certification requirements, making the station eligible for up to 50% co-financing from the CEF program. It therefore has all required features from the Core-station, since these features add the most value, and adds internet connectivity, electric outlets, refrigerated trailer connections, and a designated dining/lounge area. These additions reflect certification demands, since although these features are rated as indifferent by most drivers, their inclusion is necessary for certification and funding. This added module requires the station to be built along the TEN-T network and could therefore suit high-risk geographical areas. Profitability may improve due to CEF support and broader service offerings, though land acquisition remains a key cost driver.

Module 2: Future-oriented safe and secure station with alternative fuels

This module can be added to the station independently on if Module 1 has been added to the Core-station or not, since its primary function is to add infrastructure for alternative fuels such as electric charging and hydrogen refueling. While current demand remains low, particularly among foreign drivers, this development aligns with AFIR regulations and long-term EU climate targets. An important advantage is that the funding stream for alternative fuel infrastructure is separate from the funding available for secure rest areas. This means that operators can apply for support to implement alternative fuel infrastructure independently of whether they have previously used funding for security-related upgrades, as suggested by Module 1. It gives flexibility to expand or upgrade the site at a later stage, when market readiness or strategic priorities shift, without affecting past funding decisions. Given the high investment required, the use of public-private partnerships and incremental development is essential.

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Appendix A - TEN-T Core and Comprehensive Network Map

TEN-T Core and Comprehensive Network Map, by European Commission, 2021b, https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:52021PC0812, Copyright 2021 by European Commission

Appendix B - EU guidelines

EU guidelines for safe and secure rest areas, by European Commission, 2022, https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32022R1012, Copyright 2022 by European Commission

A. Minimum level of service

Safe and secure parking areas certified to Union standards shall meet the minimum level of services described in Table 1.

Table 1

Gender-friendly sanitary facilities	— Separate toilets and showers for male and for female users shall be available and working. Showers shall provide warm water. — Water taps shall be available and working and providing warm water. Hand soap shall be provided free of charge. — Waste bins shall be available on site and be regularly emptied. — Toilets, showers and water basins shall be cleaned and checked daily at regular intervals. The cleaning schedule shall be displayed.
Food and beverage purchasing and consumption options	— Snacks and drinks shall be available for purchase 24 hours a day, 7 days a week. — A dining area for drivers shall be available.
Communication connections	— Internet connection shall be available free of charge.
Power supply	— Electrical sockets shall be available for personal use. — By 31 December 2026, electric power facilities for refrigerated road transport vehicles shall be available on-site.
Emergency contact points and procedures	— Clear signs shall be provided in order to ensure safe traffic movement at the parking facility. — Emergency contacts shall be displayed at the parking facility at least in the national official language and in English. They shall be supported by easily understandable pictograms.

a. *Bronze level*

Table 2

BRONZE LEVEL	
Perimeter	— The perimeter of the safe and secure parking area shall be secured via a visual deterrent. The visual deterrent shall be located on the ground to indicate the perimeter of the safe and secure parking area and that only freight vehicles and authorised vehicles are allowed in the parking area. — The perimeter of the safe and secure parking area shall be lit at 15 Lux. — Any vegetation around the perimeter of the safe and secure parking area shall be trimmed to ensure good visibility.
Parking area	— Appropriate signage shall indicate that only freight vehicles and authorised vehicles are allowed in the parking area. — Physical or remote surveillance checks shall be conducted minimum once every 24 hours. — Any vegetation in the parking area shall be trimmed to ensure good visibility. — Any existing vehicle and pedestrian lanes of the parking area shall be lit at 15 Lux.
Entry/Exit	— Entry and exit points of the safe and secure parking area shall be lit at 25 Lux. — CCTV providing good image quality shall be installed and working at all entry and exit points of the safe and secure parking area. — The CCTV system shall have a minimum digital continuous recording (5 frames per second) or based on motion detection with pre- and post-recording and true day and night HD resolution cameras with 720 pixels. — The safe and secure parking area operator shall carry out a CCTV routine check once a week, of which a record must be kept for one week. The safe and secure parking area operator shall carry out a functional CCTV system check at least every 48 hours. — The CCTV data shall be kept for a period of 30 days unless the applicable national or Union legislation requires a shorter retention period. In that case, the longest retention period permitted by law shall apply. — The safe and secure parking area shall have a CCTV warranty, service level agreement in place or demonstrate own maintenance capabilities. The CCTV systems at the safe and secure parking area shall always be operated by qualified technicians.
Staff procedures	— Based on an annual risk assessment and without prejudice to national legislation establishing additional requirements, a security plan, which includes all aspects from risk prevention and mitigation to response in collaboration with law enforcement, shall be in place. — The safe and secure parking area shall appoint a person responsible for staff procedures in case of incidents. The safe and secure parking area staff must have access to a full list of local law enforcement at all times. — A procedure shall be in place for cases where unauthorised vehicles are parked in the safe and secure parking area. That procedure shall be clearly displayed on the safe and secure parking area. — The reporting of incidents and crimes to the staff and police shall be facilitated thanks to the display of a clear procedure at the safe and secure parking area.

b. ***Silver level***

Table 3

SILVER LEVEL	
Perimeter	— The perimeter of the safe and secure parking area shall be secured via at least a physical deterrent which hinders the passage and only allows entrance and exit of the safe and secure parking areas via the defined entry and exit points. The perimeter of the safe and secure parking area shall be secured via continuous video monitoring and recording as well as by a visual deterrent. — The CCTV system shall have a minimum continuous digital recording of 5 frames per second or based on motion detection with pre- and post-recording and true day and night HD resolution cameras with 720 pixels. — The safe and secure parking area operator shall carry out a CCTV routine check every 72 hours, of which a record must be kept for one week. — The safe and secure parking area operator shall carry out a functional CCTV system check at least every 48h. — The CCTV data shall be kept for a period of 30 days unless the applicable national or Union legislation requires a shorter retention period. In that case, the longest retention period permitted by law shall apply. — The safe and secure parking area shall have a CCTV warranty, service level agreement in place or demonstrate own maintenance capabilities. The CCTV systems at the safe and secure parking area shall always be operated by qualified technicians. — The perimeter of the safe and secure parking area shall be lit at 20 Lux. — Any vegetation around the perimeter of the safe and secure parking area shall be trimmed to ensure good visibility.
Parking area	— Appropriate signage shall indicate that only freight vehicles and authorised vehicles are allowed in the parking area. — Physical or remote surveillance checks shall be carried out minimum twice every 24 hours, and at least once during the day and once during the night. — Any existing vehicle and pedestrian lanes of the parking area shall be lit at 15 Lux. — Any vegetation in the parking area shall be trimmed to ensure good visibility.
Entry/Exit	— Entry and exit points of the safe and secure parking area shall be lit at 25 Lux and be secured by barriers. Those barriers shall be equipped with a voice intercom system and ticketing system. — CCTV providing good image quality shall be installed and working at all entry and exit points of the safe and secure parking area. Requirements for CCTV under the section 'perimeter' of this level of security shall also apply for the purpose of CCTV at entry and exit points.
Staff procedures	— Based on an annual risk assessment and without prejudice to national legislation establishing additional requirements, a security plan shall be in place to examine the particular risks faced by the safe and secure parking area due to factors such as its location, types of users traffic safety conditions, crime rates and general security considerations. — The safe and secure parking area shall appoint a person responsible for staff procedures in case of incidents. The safe and secure parking area staff must have access to a full list of local law enforcement at all times. — A procedure shall be in place for cases where unauthorised vehicles are parked in the safe and secure parking area. That procedure shall be clearly displayed on the safe and secure parking area. — The reporting of incidents and crimes to the staff and police shall be facilitated thanks to the display of a clear procedure at the safe and secure parking area. — Assistance to users shall be available 24/7.

c. *Gold level*

Table 4

GOLD LEVEL	
Perimeter	— The perimeter of the safe and secure parking area shall be secured by a physical barrier of at least 1,8 metres high. There shall be a clear zone of 1 metre between the barrier and the parking area. — Measures to prevent unintentional damage to the barriers shall be put in place. — The perimeter of the safe and secure parking area shall be lit at 25 Lux. — The entire perimeter of the safe and secure parking area shall be monitored by continuous video surveillance, leaving no blank spots. — The CCTV system shall have a minimum continuous recording of 5 frames per second or based on motion detection with pre-and post-recording and true day and night HD resolution cameras with 720 pixels. — The safe and secure parking area operator shall carry out a CCTV routine check every 48 hours, of which a record must be kept for one week. — The safe and secure parking area operator shall carry out a functional CCTV system check at least every 24 hours. — The CCTV data shall be kept for a period of 30 days unless the applicable national or Union legislation requires a shorter retention period. In that case, the longest possible retention period permitted by law shall apply. — The safe and secure parking area shall have a CCTV warranty or service level agreement with at least one service visit by a qualified specialised organisation per year in place, or demonstrate own maintenance capabilities. The CCTV systems at the safe and secure parking area shall always be operated by qualified technicians. — The CCTV and access events shall be synchronised through a common noting software. — In case of a network outage all CCTV and access events shall be locally stored and uploaded once the connections are re-established to the central registration equipment. — Any vegetation around the perimeter of the safe and secure parking area shall be trimmed to ensure good visibility.
Parking area	— Appropriate signage shall indicate that only freight vehicles and authorised vehicles are allowed in the parking area. — Physical or remote surveillance checks shall be carried out minimum twice every 24 hours and at least once during the day and once during the night. — Lanes of the parking area and pedestrian lanes shall be marked and be lit at 15 Lux. — Any vegetation in the parking area shall be trimmed to ensure good visibility.
Entry/Exit	— Entry and exit points of the safe and secure parking area shall be lit at 25 Lux and be secured by barriers with under-climbing and over-climbing protection and traffic lights. — CCTV providing good image quality shall be installed and working at all entry and exit points of the safe and secure parking area. The entry and exit points shall be equipped with license plate recognition technology. Records of entering and exiting vehicles shall be saved in accordance with the applicable national or Union legislation. — Entry and exit points of the safe and secure parking area shall be secured through intrusion prevention and detection mechanisms such as turnstiles for pedestrians at minimum 1,80 metres high. Points of access to services such as toilets, restaurants and shops shall be equipped with tripod turnstiles when there is a direct access between the parking area and those services.

Staff procedures	— Based on an annual risk assessment and without prejudice to national legislation establishing additional requirements, a security plan shall be in place to examine the particular risks faced by the safe and secure parking area due to factors such as its location, types of clients, traffic safety conditions, crime rates and general security considerations. — Based on an annual risk assessment and without prejudice to national legislation establishing additional requirements, a business continuity plan shall be in place. It shall include detailed measures on how to respond to disruptive incidents and maintain delivery of critical activities during an incident. The management of the safe and secure parking area shall be able to demonstrate the implementation of those measures. — A procedure shall be in place for cases where unauthorised vehicles are parked in the safe and secure parking area. That procedure shall be clearly displayed on the safe and secure parking area. — Assistance to users shall be available 24/7 — The reporting of incidents and crimes to the staff and police shall be facilitated thanks to the display of a clear procedure at the safe and secure parking area. — A person responsible for staff procedures shall be appointed. — The parking area management system shall be prepared for DATEX II data transfer.

d. *Platinum level*

Table 5

PLATINUM LEVEL	
Perimeter	— The perimeter of the safe and secure parking area shall be secured by means of a continuous barrier of at least 1,8 metres high with deterrents to climb over. There shall be a clear zone of 1 metre between the barrier and the parking area. — Measures to prevent intentional and unintentional damage to barriers shall be put in place. — The perimeter of the safe and secure parking area shall be lit at 25 Lux. — The entire perimeter of the safe and secure parking area shall be monitored by continuous video surveillance, leaving no blank spots. — The CCTV system shall have a minimum continuous digital recording of 5 frames per second or based on motion detection with pre- and post-recording and true day and night HD resolution cameras with 720 pixels. — The safe and secure parking area operator shall carry out a CCTV routine check every 48 hours, of which a record must be kept for one week. — The safe and secure parking area operator shall carry out a functional CCTV system check at least every 24 hours. — The CCTV data shall be kept for a period of 30 days unless the applicable national or Union legislation requires a shorter retention period. In this case, the longest possible retention period permitted by law shall apply. — The safe and secure parking area shall have a CCTV warranty or service level agreement with at least two service visits by a qualified specialised organisation per year in place or demonstrate own maintenance capabilities. The CCTV systems at the safe and secure parking area shall always be operated by qualified technicians. — The CCTV and access events shall be synchronised through a common noting software. — Security CCTV events on the parking shall be reviewed by personnel using web-based clients. In case of a network outage all CCTV and access events shall be locally stored and uploaded once the connections are re-established to the central registration equipment. — CCTV images shall be remotely controlled (24/7) by an external monitoring and alarm receiving centre, unless security staff is on site. — The CCTV system shall provide intrusion as well as over climbing alarms, and raise alarm by audio or light signalling on the parking as well as in monitoring and alarm receiving centres. — Any vegetation around the perimeter of the safe and secure parking area shall be trimmed to ensure good visibility.
Parking area	— Appropriate signage shall indicate that only freight vehicles and authorised vehicles are allowed in the parking area. — Lanes of the parking area and pedestrian lanes shall be marked and be lit at 15 Lux. — Any vegetation in the parking area shall be trimmed to ensure good visibility. — The site shall be manned or video-controlled 24/7. — Requirements for CCTV under the section 'perimeter' of this level of security shall also apply for the purpose of CCTV at the parking area.

Entry/Exit	— Entry and exit points of the safe and secure parking area shall be lit at 25 Lux and be secured by gates with under-climbing and over-climbing protection or by barriers with over and under climbing protection supplemented by bollards. — CCTV providing good image quality shall be installed and working at all entry and exit points of the safe and secure parking area. Entry and exit points including pedestrian entry and exit points shall be monitored in real time. — Requirements for CCTV under the section 'perimeter' of this level of security shall also apply for the purpose of CCTV at entry and exit points. — Entry and exit points of the safe and secure parking area shall be secured through intrusion prevention and detection mechanisms such as turnstiles for pedestrians at minimum 1,80 metres high. Points of access to services such as toilets, restaurants and shops shall be equipped with tripod turnstiles when there is a direct access between the parking area and those services. — The entry and exit points of the safe and secure parking area shall be equipped with license plate recognition technology. When exiting the safe and secure parking area, the security staff shall verify if the license plate matches the entry and exit verification system identifier, e.g. tickets, RFID readers or QR codes. Records of vehicles entering and exiting the safe and secure parking area shall be saved in accordance with the applicable national or Union legislation. — The entry and exit points of the safe and secure parking area shall be secured via a two-step verification system comprising the checks of the licence plate and an additional relevant method chosen by the safe and secure parking area which would allow identification and verification of the drivers, any person accompanying a driver and any other authorised person entering the parking. — Any potential gatehouse shall be able to withstand an external attack, including a closing mechanism for the doors of the guardhouse.
Staff procedures	— Based on an annual risk assessment and without prejudice to national legislation establishing additional requirements, a security plan shall be in place to examine the particular risks faced by the safe and secure parking area due to factors such as its location, types of clients, traffic safety conditions, crime rates and general security considerations. — Based on an annual risk assessment and without prejudice to national legislation establishing additional requirements, a business continuity plan shall be in place. It shall include detailed measures on how to respond to disruptive incidents and maintain delivery of critical activities during an incident. The management of the safe and secure parking area shall be able to demonstrate the implementation of those measures. — A procedure shall be in place for cases where unauthorised vehicles are parked in the safe and secure parking area. That procedure shall be clearly displayed on the safe and secure parking area. — Assistance to users shall be available 24/7 — The reporting of incidents and crimes to the security staff and police shall be facilitated thanks to the display of a clear procedure at the safe and secure parking area. — A person responsible for staff procedures shall be appointed. — A technical user manual shall be used. — Alarm response procedures shall be put in place. — The parking area management system shall be prepared for DATEX II data transfer. — Secure pre-booking shall be available via phone, contact forms, email, apps or booking platforms. If pre-booking is offered via apps or similar booking systems, data transmission must happen in real time.

Appendix C - Interview Questions

In this Appendix the questions asked during the interview study will be displayed

C.1 Interview 1, Daniel Ekwall

1. Is it okay to record this interview, and are we allowed to use your name in the report?
2. How do you classify safety, what is secure versus non-secure parking?
    a. Is this definition shared through the field?
3. Which actions can be taken to increase the safety in and around rest areas and fuel stations?
    a. Are there any actions that have been proven as less effective than anticipated?
    b. Are there any actions that have been proven as more effective than anticipated?
4. What does the future look like for transport theft?
    a. Are there trends that indicate an increase or decrease in the amount of transport theft in the future?
5. What does the incentive structure look like for the provision of security in transport?
6. What are the effects of subpar safety and which actors take the consequences of this?
    a. In some of your papers you mention that the consequences in terms of money can be upwards of 6 times more than just the value of the stolen goods, please elaborate on this.
7. If the safety is increased at a specific location, what are the consequences of this?
    a. Are there any negative consequences?
8. Are there reasons to prioritize certain geographical areas or should all areas be treated equally?
    a. If there are reasons to prioritize, where are these places and what should be done?
9. Is transport theft equal throughout Europe or are there differences?
10. How do criminals choose which cargo they will target?
11. Is there a difference in how men and women report crimes?

12. Are there differences in safety thinking between drivers and haulage companies?

C.2 Interview 2, Maria Grahn

1. Is it okay to record this interview, and are we allowed to use your name in the report?
2. Which alternative fuel do you consider as most promising?
3. What do you consider as major barriers and pushing factors affecting alternative fuel development?
4. What are the implications of only choosing one alternative fuel as the only future solution?
5. What are the consequences of investing in alternative fuel infrastructure, considering that it is developing so rapidly?
6. Why should an actor consider getting involved in alternative fuels at the early stage that we are currently in?
7. How much of current fueling-/charging infrastructure can be used when moving into alternative fuels (HVO, Hydrogen, Electricity, LNG, etc.)?
8. Why is there a difference in the development of alternative fuels in personal vehicles and heavy goods vehicles?
9. What are the biggest factors that will play a role in the future of alternative fuels?
    a. Which problems need to be figured out in order to progress the development at a quicker pace?
10. Which actors/stakeholders are most important for the progression of alternative fuels?
    a. Do you think these actors/stakeholders are currently acting in an optimal way, if not what can be improved?

C.3 Interview 3, Expert A

1. Is it okay to record this interview, and are we allowed to use your name in the report?
2. How many trucks pass through the port of Trelleborg?
3. How many of these drivers are Swedish and how many are non-Swedish?
4. How many of these drivers are women and how many are men?
5. What security measures are used in the port of Trelleborg?
    a. Has this changed over time, and what has the consequence of these implementations been?

6. Which kind of crimes happen in the port of Trelleborg?
    a. Has the amount of crime changed over time?
    b. Has the kind of crime changed over time?
7. Which services, other than safety services, are offered in the port?
8. What are the needs and wants of your customers?
9. What is your outlook on alternative fuels?
    a. What number of trucks going through the port of Trelleborg use alternative fuels?
    b. Does the port of Trelleborg have an estimate of how this will change in the future?
    c. What changes will you do to take this estimate into account?
10. Can you describe how the port of Trelleborg is affected by legislated rest breaks?

C.4 Interview 4, Expert B

1. Is it okay to record this interview, and are we allowed to use your name in the report?
2. How do Trafikverket define a rest area?
3. How do Trafikverket define a secure rest area?
4. What role does Trafikverket have in the development and maintenance of secure rest areas?
    a. What are the biggest challenges currently?
5. Can you describe Trafikverket's decision process when it comes to choosing what to do and where to do it?
6. Which actors do Trafikverket involve in this process?
7. Which are the most common risks at rest areas?
    a. What has Trafikverket done to reduce these risks?
8. What do Trafikverket think are important factors or services that should be available at a rest area?
    a. Are these factors and services Trafikverket's responsibility?
    b. Do these change depending on geography?
9. Do Trafikverket think there are differences in wants and needs depending on which demographic group the user is a part of?

10. How is Trafikverket adapting its rest areas to alternative fuels?

C.5 Interview 5, Expert C

1. Is it okay to record this interview, and are we allowed to use your name in the report?
2. Can you please describe the EU commission and CEFs role within transport infrastructure.
    a. Specifically regarding secure rest areas for heavy goods vehicles.
3. How is Trafikverket and CEF related?
4. Which types of projects are eligible for financing through CEF?
    a. Can you give any examples from Sweden?
5. If a project consists of several eligible components, can an actor apply for funding for each of the components or is there a max limit?
6. What demands are put on an actor applying for funding?
    a. Which factors are relevant when CEF is considering giving funding?

C.6 Interview 6 & 7, Expert D & Expert E

1. Is it okay to record this interview, and are we allowed to use your name in the report?
2. Can you please describe Company A?
3. How big is Company A and in which countries does Company A operate?
4. How does Company A work with safety for drivers and goods during transports through Sweden and Europe?
5. Does Company A use rest areas or secure rest areas?
    a. How do you assess the current level of safety at these rest areas?
    b. Which safety measures would you like to see improved upon?
    c. Which safety measures do you think are overrated?
    d. How much do your drivers have a say in where they stay?
6. What are according to Company A the challenges for safety in transport?
    a. Has this changed over time?
7. Which kind of crimes have Company A been a victim of?
    a. Has the amount of crime changed over time?
    b. Has the kind of crime changed over time?

8. What have the consequences been to these crimes?
    a. How does Company A calculate economic consequences due to these crimes?
9. Has Company A identified specific high-risk areas and locations in Sweden where safety is particularly challenging?
    a. If so, how does Company A account for these areas and locations?
    b. Would you rather see safety being improved at these specific areas or for there to be a broader implementation strategy?

C.7 Interview 8, Expert F

1. Is it okay to record this interview, and are we allowed to use your name in the report?
2. What is your view of the current situation regarding safety and services for drivers on the road?
    a. What do you see as the greatest safety risks for truck drivers today?
3. What problem does Truck Trust solve?
    a. What has the interest been like from both service providers and users?
4. What needs or challenges do your users commonly mention regarding rest areas, safety, and available services?
5. What requirements do you place on location owners to be included on the platform?
6. Have you noticed any differences in wants and needs between Swedish and foreign truck drivers?
7. Can you describe how Truck Trust tackles the problem of willingness to pay for safety?
8. What is your view on alternative fuels within the Heavy Goods Vehicle sector?
9. Has Truck Trust identified specific high-risk areas and locations in Sweden where safety is particularly challenging?
    a. If so, how does Truck Trust account for these areas and locations?
    b. Would you rather see safety being improved at these specific areas or for there to be a broader implementation strategy?

C.8 Interview 10, 11, 12, Hauler X, Y, Z

1. Is it okay to record this interview, and are we allowed to use your name in the report?
2. How do you perceive safety within the transport industry?
3. Has your company ever been affected by a crime during transport?

    a. If so, what happened?
    b. What were the consequences for your company?
    c. How was the driver affected by the company?
    d. What do you think could have been done to prevent it from happening again?
4. How often do your drivers spend the night during work trips?
    a. What do these overnight stays usually look like?
5. How do you decide where to take breaks and overnight rests?
    a. Are rest stop locations planned before each trip, or decided along the way?
6. What is your view on secure rest areas, is this something you find important?
    a. How much do you currently use secure rest areas?
    b. How much would you use secure rest areas if they were more accessible?
7. In your opinion, what are the most important safety aspects for creating a "successful" secure rest area?
8. Besides safety, what other services or features should a rest area provide?
9. Are you satisfied with the service offerings at fuel stations today? What's missing?
10. Where is it most important for you to have access to secure rest areas and fueling stations?
11. What's your view on alternative fuels in the trucking industry?
    a. Are you currently using any alternative fuels? Do you think you will in the next 10–15 years?
12. If there were a provider offering the services and safety you're looking for, what would you be willing to pay for it?
    a. How would you prefer to pay?
13. Since the majority of long-distance transport in Sweden is carried out by foreign haulers, do you think the needs you mentioned differ between Swedish and foreign companies?

Appendix D - Interview Table

Name/Pseudonym	Profession	Areas of discussion	Other information	Interview length	Date of interview	Digital	Recorded
Daniel Ekwall	Professor, University of Borås	Safety and security	Extensive knowledge of safety and security in the transport sector. Docent in Supply Chain Security.	60 minutes	7/2/2025	Yes	Yes
Maria Grahn	Docent, Chalmers University of Technology	Alternative fuels	Extensive knowledge of the challenges and opportunities of alternative fuels.	60 minutes	19/2/2025	Yes	Yes
Expert A	Gatekeeper, Trelleborgshamn	Safety and security Service Alternative fuels	Extensive knowledge from an important transport node included in the TEN-T network.	60 minutes	25/2/2025	Yes	Yes
Expert B	Project Manager, Trafikverket	Safety and security Service Alternative fuels	Extensive knowledge from leading rest area projects in Sweden.	60 minutes	26/2/2025	Yes	Yes
Expert C	National coordinator, Trafikverket	Financing of infrastructure	Works for Trafikverket, but more specifically the CEF-secretariat for transport.	30 minutes	28/2/2025	Yes	Yes
Expert D	Safety manager, Schenker	Safety and security Service Alternative fuels	Extensive knowledge from working as a safety manager at one of Swedens largest logistics companies.	60 minutes	5/3/2025	Yes	Yes
Expert E	Safety manager, DHL	Safety and security Service Alternative fuels	Extensive knowledge from working as a safety manager at one of Swedens largest logistics companies.	60 minutes	14/3/2025	Yes	Yes
Expert F	Entrepreneur	Safety and security Service Alternative fuels	Extensive knowledge from starting and developing companies in the logistics sector.	60 minutes	8/4/2025	Yes	Yes
Expert G	Safety advisor	Safety and security	Retired crime commissioner with 25 years of experience in transport safety and security.	90 minutes	28/4/2025	No	No
Hauler X	Owner of a swedish haulage company	Safety and security Service Alternative fuels	Middle sized haulage company based in Jönköping. Operating mostly in the southern parts of Sweden and Norway	30 minutes	7/4/2025	Yes	Yes
Hauler Y	Owner of a swedish haulage company	Safety and security Service Alternative fuels	Middle sized haulage company based in Jämtland. Operating mostly in the northern parts of Sweden.	30 minutes	8/4/2025	Yes	Yes
Hauler Z	Owner of a swedish haulage company	Safety and security Service Alternative fuels	Larger sized haulage company based at multiple locations. Operating all over Sweden, mostly supplying temperated goods	30 minutes	11/4/2025	Yes	Yes

Appendix E - Extended Kano ratings and performance scores

Appendix E.1 - Extended Kano ratings and performance scores of all suggested services in the survey

	Customer requirments	Attractive	Must-be	One-dimensional	Reverse	Questionable	Indifferent	Total	Category	Category / Total	Highest / Second Higest	Adjusted Category	Kano Factor	Mean	Mean / Total	Factor x (Mean / Total)	Performance Score
Total	Access to toilets	12	33	50	1	1	1	98	O	0,51	1,52	O	1,00	1,64	0,09	0,09	0,14
	Access to some type of food	34	7	17	1	1	38	98	I	0,39	1,12	A	0,80	1,13	0,06	0,05	0,08
	Access to showers and dressing rooms	43	9	23	0	0	23	98	A	0,44	1,87	A	0,80	1,48	0,08	0,06	0,10
	Access to drinking water	22	23	27	1	0	25	98	O	0,28	1,08	O	1,00	1,37	0,07	0,07	0,12
	Access to electricity outlets for personal use	16	1	5	4	0	72	98	I	0,73	4,50	I	0,00	0,40	0,02	0,00	0,00
	Access to electricity to power refrigerated goods	25	5	5	4	1	58	98	I	0,59	2,32	I	0,00	0,53	0,03	0,00	0,00
	Access to internet connection	17	2	7	3	1	68	98	I	0,69	4,00	I	0,00	0,51	0,03	0,00	0,00
	Access to dining room or lounge	31	2	4	1	0	60	98	I	0,61	1,94	I	0,00	0,74	0,04	0,00	0,00
	Access to a laundry room	16	0	3	7	0	72	98	I	0,73	4,50	I	0,00	0,26	0,01	0,00	0,00
	Access to reparation and service of vehicles	23	0	5	4	0	66	98	I	0,67	2,87	I	0,00	0,52	0,03	0,00	0,00
	Access to a nearby store	40	7	17	0	0	34	98	A	0,41	1,18	A	0,80	1,32	0,07	0,05	0,09
	Access to entertainment (TV, games, etc.)	5	2	1	12	0	78	98	I	0,80	6,50	I	0,00	-0,17	-0,01	0,00	0,00
	Lighting within the parking area	10	19	45	0	1	23	98	O	0,46	1,96	O	1,00	1,47	0,08	0,08	0,13
	Parking area with physical barriers	42	8	19	0	0	29	98	A	0,43	1,45	A	0,80	1,34	0,07	0,06	0,09
	Camera surveillance within the parking area	37	9	22	1	0	29	98	A	0,38	1,28	A	0,80	1,45	0,08	0,06	0,10
	Parking area with security guard monitoring	38	5	10	2	0	43	98	I	0,44	1,13	A	0,80	1,04	0,05	0,04	0,07
	Other nearby truck drivers in the rest area	22	3	8	0	1	64	98	I	0,65	2,91	I	0,00	0,84	0,04	0,00	0,00
	Possibility to pre-book parking slots	32	1	5	7	1	52	98	I	0,53	1,63	I	0,00	0,63	0,03	0,00	0,00
	Access to free parking area without security features	25	16	24	2	1	30	98	I	0,31	1,20	A	0,80	1,18	0,06	0,05	0,08
	Possibility to spend time in nature	30	1	5	0	0	62	98	I	0,63	2,07	I	0,00	0,77	0,04	0,00	0,00
	Possibility to exercise/workout	24	1	7	2	1	63	98	I	0,64	2,63	I	0,00	0,63	0,03	0,00	0,00
	Possibility to sleep in other places than your vehicle	8	0	3	9	0	78	98	I	0,80	8,67	I	0,00	0,00	0,00	0,00	0,00
	Access to hydrogen refueling	4	1	2	12	0	79	98	I	0,81	6,58	I	0,00	-0,12	-0,01	0,00	0,00
	Access to slow electric vehicle charging	10	5	1	6	0	76	98	I	0,78	7,60	I	0,00	0,12	0,01	0,00	0,00
	Access to fast electric vehicle charging	10	5	1	5	0	77	98	I	0,79	7,70	I	0,00	0,13	0,01	0,00	0,00

Appendix E.2 - Extended Kano ratings and performance scores of all suggested services in the survey for Swedish answers

	Customer requirments	Attractive	Must-be	One-dimensional	Reverse	Questionable	Indifferent	Total	Category	Category / Total	Highest / Second Higest	Adjusted Category	Kano Factor	Mean	Mean / Total	Factor x (Mean / Total)	Performance Score
Swedish	Access to toilets	8	30	39	0	0	0	77	O	0,51	1,30	O	1,00	1,61	0,09	0,09	0,13
	Access to some type of food	28	4	8	0	0	37	77	I	0,48	1,32	A	0,80	0,96	0,05	0,04	0,06
	Access to showers and dressing rooms	37	8	17	0	0	15	77	A	0,48	2,18	A	0,80	1,47	0,08	0,06	0,09
	Access to drinking water	21	18	22	0	0	16	77	O	0,29	1,05	O	1,00	1,40	0,08	0,08	0,11
	Access to electricity outlets for personal use	14	1	3	4	0	55	77	I	0,71	3,93	I	0,00	0,25	0,01	0,00	0,00
	Access to electricity to power refrigerated goods	25	3	4	3	0	42	77	I	0,55	1,68	I	0,00	0,64	0,03	0,00	0,00
	Access to internet connection	14	0	2	3	0	58	77	I	0,75	4,14	I	0,00	0,29	0,02	0,00	0,00
	Access to dining room or lounge	27	2	3	0	0	45	77	I	0,58	1,67	I	0,00	0,73	0,04	0,00	0,00
	Access to a laundry room	15	0	2	7	0	53	77	I	0,69	3,53	I	0,00	0,18	0,01	0,00	0,00
	Access to reparation and service of vehicles	21	0	3	4	0	49	77	I	0,64	2,33	I	0,00	0,45	0,02	0,00	0,00
	Access to a nearby store	34	2	11	0	0	30	77	A	0,44	1,13	A	0,80	1,25	0,07	0,05	0,08
	Access to entertainment (TV, games, etc.)	4	2	0	11	0	60	77	I	0,78	5,45	I	0,00	-0,32	-0,02	0,00	0,00
	Lighting within the parking area	9	17	31	0	0	20	77	O	0,40	1,55	O	1,00	1,39	0,08	0,08	0,11
	Parking area with physical barriers	38	6	8	0	0	25	77	A	0,49	1,52	A	0,80	1,23	0,07	0,05	0,08
	Camera surveillance within the parking area	34	7	14	0	0	22	77	A	0,44	1,55	A	0,80	1,45	0,08	0,06	0,09
	Parking area with security guard monitoring	33	5	5	1	0	33	77	A	0,43	1,00	A	0,80	0,99	0,05	0,04	0,06
	Other nearby truck drivers in the rest area	18	3	5	0	1	50	77	I	0,65	2,78	I	0,00	0,74	0,04	0,00	0,00
	Possibility to pre-book parking slots	30	0	4	7	0	36	77	I	0,47	1,20	A	0,80	0,58	0,03	0,03	0,04
	Access to free parking area without security features	22	13	18	2	0	22	77	A	0,29	1,00	A	0,80	1,13	0,06	0,05	0,07
	Possibility to spend time in nature	29	1	5	0	0	42	77	I	0,55	1,45	A	0,80	0,92	0,05	0,04	0,06
	Possibility to exercise/workout	23	1	6	2	0	45	77	I	0,58	1,96	I	0,00	0,68	0,04	0,00	0,00
	Possibility to sleep in other places than your vehicle	7	0	3	9	0	58	77	I	0,75	6,44	I	0,00	-0,01	0,00	0,00	0,00
	Access to hydrogen refueling	4	1	2	10	0	60	77	I	0,78	6,00	I	0,00	-0,10	-0,01	0,00	0,00
	Access to slow electric vehicle charging	10	5	1	6	0	55	77	I	0,71	5,50	I	0,00	0,16	0,01	0,00	0,00
	Access to fast electric vehicle charging	10	5	1	5	0	56	77	I	0,73	5,60	I	0,00	0,17	0,01	0,00	0,00

Appendix E.3 - Extended Kano ratings and performance scores of all suggested services in the survey for foreign answers

	Customer requirments	Attractive	Must-be	One-dimensional	Reverse	Questionable	Indifferent	Total	Category	Category / Total	Highest / Second Higest	Adjusted Category	Kano Factor	Mean	Mean / Total	Factor x (Mean / Total)	Performance Score
Foreign	Access to toilets	4	3	11	1	1	1	21	O	0,52	2,75	O	1,00	1,76	0,08	0,08	0,14
	Access to some type of food	6	3	9	1	1	1	21	O	0,43	1,50	O	1,00	1,76	0,08	0,08	0,14
	Access to showers and dressing rooms	6	1	6	0	0	8	21	I	0,38	1,33	A	0,80	1,52	0,07	0,05	0,10
	Access to drinking water	1	5	5	1	0	9	21	I	0,43	1,80	I	0,00	1,24	0,05	0,00	0,00
	Access to electricity outlets for personal use	2	0	2	0	0	17	21	I	0,81	8,50	I	0,00	0,95	0,04	0,00	0,00
	Access to electricity to power refrigerated goods	0	2	1	1	1	16	21	I	0,76	8,00	I	0,00	0,14	0,01	0,00	0,00
	Access to internet connection	3	2	5	0	1	10	21	I	0,48	2,00	I	0,00	1,33	0,06	0,00	0,00
	Access to dining room or lounge	4	0	1	1	0	15	21	I	0,71	3,75	I	0,00	0,81	0,04	0,00	0,00
	Access to a laundry room	1	0	1	0	0	19	21	I	0,90	19,00	I	0,00	0,52	0,02	0,00	0,00
	Access to reparation and service of vehicles	2	0	2	0	0	17	21	I	0,81	8,50	I	0,00	0,76	0,03	0,00	0,00
	Access to a nearby store	6	5	6	0	0	4	21	A	0,29	1,00	A	0,80	1,57	0,07	0,06	0,10
	Access to entertainment (TV, games, etc.)	1	0	1	1	0	18	21	I	0,86	18,00	I	0,00	0,38	0,02	0,00	0,00
	Lighting within the parking area	1	2	14	0	1	3	21	O	0,67	4,67	O	1,00	1,76	0,08	0,08	0,14
	Parking area with physical barriers	4	2	11	0	0	4	21	O	0,52	2,75	O	1,00	1,71	0,08	0,08	0,14
	Camera surveillance within the parking area	3	2	8	1	0	7	21	O	0,38	1,14	O	1,00	1,43	0,06	0,06	0,12
	Parking area with security guard monitoring	5	0	5	1	0	10	21	I	0,48	2,00	I	0,00	1,24	0,05	0,00	0,00
	Other nearby truck drivers in the rest area	4	0	3	0	0	14	21	I	0,67	3,50	I	0,00	1,19	0,05	0,00	0,00
	Possibility to pre-book parking slots	2	1	1	0	1	16	21	I	0,76	8,00	I	0,00	0,81	0,04	0,00	0,00
	Access to free parking area without security features	3	3	6	0	1	8	21	I	0,38	1,33	O	1,00	1,38	0,06	0,06	0,11
	Possibility to spend time in nature	1	0	0	0	0	20	21	I	0,95	20,00	I	0,00	0,19	0,01	0,00	0,00
	Possibility to exercise/workout	1	0	1	0	1	18	21	I	0,86	18,00	I	0,00	0,48	0,02	0,00	0,00
	Possibility to sleep in other places than your vehicle	1	0	0	0	0	20	21	I	0,95	20,00	I	0,00	0,05	0,00	0,00	0,00
	Access to hydrogen refueling	0	0	0	2	0	19	21	I	0,90	9,50	I	0,00	-0,19	-0,01	0,00	0,00
	Access to slow electric vehicle charging	0	0	0	0	0	21	21	I	1,00	INF	I	0,00	0,00	0,00	0,00	0,00
	Access to fast electric vehicle charging	0	0	0	0	0	21	21	I	1,00	INF	I	0,00	0,00	0,00	0,00	0,00

Appendix E.4 - Extended Kano ratings and performance scores of all suggested services in the survey for female answers

	Customer requirments	Attractive	Must-be	One-dimensional	Reverse	Questionable	Indifferent	Total	Category	Category / Total	Highest / Second Higest	Adjusted Category	Kano Factor	Mean	Mean / Total	Factor x (Mean / Total)	Performance Score
Women	Access to toilets	2	6	6	0	0	0	14	M	0,43	1,00	M	1,50	1,57	0,07	0,11	0,16
	Access to some type of food	6	0	3	0	0	5	14	A	0,43	1,20	A	0,80	1,21	0,06	0,05	0,07
	Access to showers and dressing rooms	7	1	3	0	0	3	14	A	0,50	2,33	A	0,80	1,43	0,07	0,05	0,08
	Access to drinking water	5	3	2	0	0	4	14	A	0,36	1,25	A	0,80	1,36	0,06	0,05	0,07
	Access to electricity outlets for personal use	3	0	0	0	0	11	14	I	0,79	3,67	I	0,00	0,43	0,02	0,00	0,00
	Access to electricity to power refrigerated goods	5	0	0	0	0	9	14	I	0,64	1,80	I	0,00	0,64	0,03	0,00	0,00
	Access to internet connection	2	0	1	0	0	11	14	I	0,79	5,50	I	0,00	0,50	0,02	0,00	0,00
	Access to dining room or lounge	5	0	0	0	0	9	14	I	0,64	1,80	I	0,00	0,64	0,03	0,00	0,00
	Access to a laundry room	5	0	0	0	0	9	14	I	0,64	1,80	I	0,00	0,71	0,03	0,00	0,00
	Access to reparation and service of vehicles	4	0	0	1	0	9	14	I	0,64	2,25	I	0,00	0,50	0,02	0,00	0,00
	Access to a nearby store	6	1	2	0	0	5	14	A	0,43	1,20	A	0,80	1,36	0,06	0,05	0,07
	Access to entertainment (TV, games, etc.)	0	0	0	1	0	13	14	I	0,93	13,00	I	0,00	-0,36	-0,02	0,00	0,00
	Lighting within the parking area	2	4	7	0	0	1	14	O	0,50	1,75	O	1,00	1,64	0,08	0,08	0,11
	Parking area with physical barriers	11	0	1	0	0	2	14	A	0,79	5,50	A	0,80	1,71	0,08	0,06	0,09
	Camera surveillance within the parking area	9	0	3	0	0	2	14	A	0,64	3,00	A	0,80	1,86	0,09	0,07	0,10
	Parking area with security guard monitoring	7	0	1	0	0	6	14	A	0,50	1,17	A	0,80	1,14	0,05	0,04	0,06
	Other nearby truck drivers in the rest area	1	1	2	0	1	9	14	I	0,64	4,50	I	0,00	0,71	0,03	0,00	0,00
	Possibility to pre-book parking slots	7	0	0	1	0	6	14	A	0,50	1,17	A	0,80	1,00	0,05	0,04	0,05
	Access to free parking area without security features	4	1	4	1	0	4	14	A	0,29	1,00	A	0,80	1,21	0,06	0,05	0,07
	Possibility to spend time in nature	6	1	0	0	0	7	14	I	0,50	1,17	A	0,80	1,07	0,05	0,04	0,06
	Possibility to exercise/workout	4	0	1	0	0	9	14	I	0,64	2,25	I	0,00	0,86	0,04	0,00	0,00
	Possibility to sleep in other places than your vehicle	0	0	0	3	0	11	14	I	0,79	3,67	I	0,00	-0,43	-0,02	0,00	0,00
	Access to hydrogen refueling	1	1	0	2	0	10	14	I	0,71	5,00	I	0,00	-0,07	0,00	0,00	0,00
	Access to slow electric vehicle charging	1	2	0	1	0	10	14	I	0,71	5,00	I	0,00	0,21	0,01	0,00	0,00
	Access to fast electric vehicle charging	2	1	0	1	0	10	14	I	0,71	5,00	I	0,00	0,21	0,01	0,00	0,00

Appendix E.5 - Extended Kano ratings and performance scores of all suggested services in the survey for male answers

	Customer requirments	Attractive	Must-be	One-dimensional	Reverse	Questionable	Indifferent	Total	Category	Category / Total	Highest / Second Higest	Adjusted Category	Kano Factor	Mean	Mean / Total	Factor x (Mean / Total)	Performance Score
Men	Access to toilets	10	27	44	1	1	1	84	O	0,52	1,63	O	1,00	1,65	0,09	0,09	0,14
	Access to some type of food	28	7	14	1	1	33	84	I	0,39	1,18	A	0,80	1,12	0,06	0,05	0,08
	Access to showers and dressing rooms	36	8	20	0	0	20	84	A	0,43	1,80	A	0,80	1,49	0,08	0,06	0,10
	Access to drinking water	17	20	25	1	0	21	84	O	0,30	1,19	O	1,00	1,37	0,07	0,07	0,12
	Access to electricity outlets for personal use	13	1	5	4	0	61	84	I	0,73	4,69	I	0,00	0,39	0,02	0,00	0,00
	Access to electricity to power refrigerated goods	20	5	5	4	1	49	84	I	0,58	2,45	I	0,00	0,51	0,03	0,00	0,00
	Access to internet connection	15	2	6	3	1	57	84	I	0,68	3,80	I	0,00	0,51	0,03	0,00	0,00
	Access to dining room or lounge	26	2	4	1	0	51	84	I	0,61	1,96	I	0,00	0,76	0,04	0,00	0,00
	Access to a laundry room	11	0	3	7	0	63	84	I	0,75	5,73	I	0,00	0,18	0,01	0,00	0,00
	Access to reparation and service of vehicles	19	0	5	3	0	57	84	I	0,68	3,00	I	0,00	0,52	0,03	0,00	0,00
	Access to a nearby store	34	6	15	0	0	29	84	A	0,40	1,17	A	0,80	1,31	0,07	0,06	0,09
	Access to entertainment (TV, games, etc.)	5	2	1	11	0	65	84	I	0,77	5,91	I	0,00	-0,14	-0,01	0,00	0,00
	Lighting within the parking area	8	15	38	0	1	22	84	O	0,45	1,73	O	1,00	1,44	0,08	0,08	0,13
	Parking area with physical barriers	31	8	18	0	0	27	84	A	0,37	1,15	A	0,80	1,27	0,07	0,05	0,09
	Camera surveillance within the parking area	28	9	19	1	0	27	84	A	0,33	1,04	A	0,80	1,38	0,07	0,06	0,10
	Parking area with security guard monitoring	31	5	9	2	0	37	84	I	0,44	1,19	A	0,80	1,02	0,05	0,04	0,07
	Other nearby truck drivers in the rest area	21	2	6	0	0	55	84	I	0,65	2,62	I	0,00	0,86	0,05	0,00	0,00
	Possibility to pre-book parking slots	25	1	5	6	1	46	84	I	0,55	1,84	I	0,00	0,57	0,03	0,00	0,00
	Access to free parking area without security features	21	15	20	1	1	26	84	I	0,31	1,24	A	0,80	1,18	0,06	0,05	0,08
	Possibility to spend time in nature	24	0	5	0	0	55	84	I	0,65	2,29	I	0,00	0,71	0,04	0,00	0,00
	Possibility to exercise/workout	20	1	6	2	1	54	84	I	0,64	2,70	I	0,00	0,60	0,03	0,00	0,00
	Possibility to sleep in other places than your vehicle	8	0	3	6	0	67	84	I	0,80	8,38	I	0,00	0,07	0,00	0,00	0,00
	Access to hydrogen refueling	3	0	2	10	0	69	84	I	0,82	6,90	I	0,00	-0,13	-0,01	0,00	0,00
	Access to slow electric vehicle charging	9	3	1	5	0	66	84	I	0,79	7,33	I	0,00	0,11	0,01	0,00	0,00
	Access to fast electric vehicle charging	8	4	1	4	0	67	84	I	0,80	8,38	I	0,00	0,12	0,01	0,00	0,00

Appendix E.6 - Extended Kano ratings and performance scores of all suggested services in the survey for those who have experienced crime

	Customer requirments	Attractive	Must-be	One-dimensional	Reverse	Questionable	Indifferent	Total	Category	Category / Total	Highest / Second Higest	Adjusted Category	Kano Factor	Mean	Mean / Total	Factor x (Mean / Total)	Performance Score
Experience of crime	Access to toilets	5	13	23	0	0	1	42	O	0,55	1,77	O	1,00	1,67	0,08	0,08	0,12
	Access to some type of food	16	4	9	0	0	13	42	A	0,38	1,23	A	0,80	1,26	0,06	0,05	0,07
	Access to showers and dressing rooms	20	5	12	0	0	5	42	A	0,48	1,67	A	0,80	1,69	0,08	0,06	0,10
	Access to drinking water	9	11	14	0	0	8	42	O	0,33	1,27	O	1,00	1,50	0,07	0,07	0,11
	Access to electricity outlets for personal use	5	0	3	2	0	32	42	I	0,76	6,40	I	0,00	0,38	0,02	0,00	0,00
	Access to electricity to power refrigerated goods	8	3	1	3	0	27	42	I	0,64	3,38	I	0,00	0,26	0,01	0,00	0,00
	Access to internet connection	5	0	4	1	0	32	42	I	0,76	6,40	I	0,00	0,43	0,02	0,00	0,00
	Access to dining room or lounge	14	2	2	0	0	24	42	I	0,57	1,71	I	0,00	0,86	0,04	0,00	0,00
	Access to a laundry room	7	0	2	5	0	28	42	I	0,67	4,00	I	0,00	0,24	0,01	0,00	0,00
	Access to reparation and service of vehicles	13	0	2	2	0	25	42	I	0,60	1,92	I	0,00	0,64	0,03	0,00	0,00
	Access to a nearby store	19	3	9	0	0	11	42	A	0,45	1,73	A	0,80	1,45	0,07	0,06	0,08
	Access to entertainment (TV, games, etc.)	3	1	1	7	0	30	42	I	0,71	4,29	I	0,00	-0,14	-0,01	0,00	0,00
	Lighting within the parking area	3	7	26	0	0	6	42	O	0,62	3,71	O	1,00	1,62	0,08	0,08	0,12
	Parking area with physical barriers	16	6	13	0	0	7	42	A	0,38	1,23	A	0,80	1,48	0,07	0,06	0,09
	Camera surveillance within the parking area	12	4	16	0	0	10	42	O	0,38	1,33	O	1,00	1,60	0,08	0,08	0,12
	Parking area with security guard monitoring	19	2	6	0	0	15	42	A	0,45	1,27	A	0,80	1,36	0,06	0,05	0,08
	Other nearby truck drivers in the rest area	12	1	4	0	0	25	42	I	0,60	2,08	I	0,00	1,12	0,05	0,00	0,00
	Possibility to pre-book parking slots	17	0	2	2	0	21	42	I	0,50	1,24	A	0,80	0,81	0,04	0,03	0,05
	Access to free parking area without security features	10	9	10	1	0	12	42	I	0,29	1,20	A	0,80	1,12	0,05	0,04	0,07
	Possibility to spend time in nature	14	0	2	0	0	26	42	I	0,62	1,86	I	0,00	0,86	0,04	0,00	0,00
	Possibility to exercise/workout	12	1	3	2	0	24	42	I	0,57	2,00	I	0,00	0,62	0,03	0,00	0,00
	Possibility to sleep in other places than your vehicle	4	0	2	5	0	31	42	I	0,74	6,20	I	0,00	-0,02	0,00	0,00	0,00
	Access to hydrogen refueling	3	0	0	5	0	34	42	I	0,81	6,80	I	0,00	-0,10	0,00	0,00	0,00
	Access to slow electric vehicle charging	5	1	0	3	0	33	42	I	0,79	6,60	I	0,00	0,10	0,00	0,00	0,00
	Access to fast electric vehicle charging	5	2	0	3	0	32	42	I	0,76	6,40	I	0,00	0,12	0,01	0,00	0,00

Appendix E.7 - Extended Kano ratings and performance scores of all suggested services in the survey for those who have not experienced crime

	Customer requirments	Attractive	Must-be	One-dimensional	Reverse	Questionable	Indifferent	Total	Category	Category / Total	Highest / Second Higest	Adjusted Category	Kano Factor	Mean	Mean / Total	Factor x (Mean / Total)	Performance Score
No experience of crime	Access to toilets	6	18	25	1	1	0	51	O	0,49	1,39	O	1,00	1,63	0,09	0,09	0,15
	Access to some type of food	17	1	6	1	1	25	51	I	0,49	1,47	A	0,80	0,98	0,05	0,04	0,07
	Access to showers and dressing rooms	22	3	10	0	0	16	51	A	0,43	1,38	A	0,80	1,33	0,07	0,06	0,10
	Access to drinking water	12	10	12	1	0	16	51	I	0,31	1,33	A	0,80	1,25	0,07	0,06	0,09
	Access to electricity outlets for personal use	10	1	1	2	0	37	51	I	0,73	3,70	I	0,00	0,39	0,02	0,00	0,00
	Access to electricity to power refrigerated goods	17	2	4	1	1	26	51	I	0,51	1,53	I	0,00	0,82	0,05	0,00	0,00
	Access to internet connection	11	1	2	2	1	34	51	I	0,67	3,09	I	0,00	0,55	0,03	0,00	0,00
	Access to dining room or lounge	14	0	2	1	0	34	51	I	0,67	2,43	I	0,00	0,59	0,03	0,00	0,00
	Access to a laundry room	7	0	1	2	0	41	51	I	0,80	5,86	I	0,00	0,18	0,01	0,00	0,00
	Access to reparation and service of vehicles	10	0	2	1	0	38	51	I	0,75	3,80	I	0,00	0,43	0,02	0,00	0,00
	Access to a nearby store	20	3	7	0	0	21	51	I	0,41	1,05	A	0,80	1,24	0,07	0,06	0,09
	Access to entertainment (TV, games, etc.)	1	1	0	5	0	44	51	I	0,86	8,80	I	0,00	-0,25	-0,01	0,00	0,00
	Lighting within the parking area	7	11	17	0	1	15	51	O	0,33	1,13	O	1,00	1,35	0,08	0,08	0,13
	Parking area with physical barriers	26	2	4	0	0	19	51	A	0,51	1,37	A	0,80	1,25	0,07	0,06	0,09
	Camera surveillance within the parking area	25	5	5	0	0	16	51	A	0,49	1,56	A	0,80	1,39	0,08	0,06	0,10
	Parking area with security guard monitoring	18	3	3	1	0	26	51	I	0,51	1,44	A	0,80	0,84	0,05	0,04	0,06
	Other nearby truck drivers in the rest area	9	1	4	0	1	36	51	I	0,71	4,00	I	0,00	0,61	0,03	0,00	0,00
	Possibility to pre-book parking slots	15	1	3	5	1	26	51	I	0,51	1,73	I	0,00	0,53	0,03	0,00	0,00
	Access to free parking area without security features	15	5	12	0	1	18	51	I	0,35	1,20	A	0,80	1,27	0,07	0,06	0,10
	Possibility to spend time in nature	15	0	3	0	0	33	51	I	0,65	2,20	I	0,00	0,71	0,04	0,00	0,00
	Possibility to exercise/workout	11	0	4	0	1	35	51	I	0,69	3,18	I	0,00	0,65	0,04	0,00	0,00
	Possibility to sleep in other places than your vehicle	3	0	1	4	0	43	51	I	0,84	10,75	I	0,00	-0,02	0,00	0,00	0,00
	Access to hydrogen refueling	1	1	2	6	0	41	51	I	0,80	6,83	I	0,00	-0,12	-0,01	0,00	0,00
	Access to slow electric vehicle charging	5	3	1	3	0	39	51	I	0,76	7,80	I	0,00	0,14	0,01	0,00	0,00
	Access to fast electric vehicle charging	5	2	1	2	0	41	51	I	0,80	8,20	I	0,00	0,14	0,01	0,00	0,00

Appendix E.8 - Answers to all follow up questions in the survey

	Total	Swedish	Foreign
Follow up questions	Rating	Rating	Rating
How important is it that access to the parking area is exclusive for truck drivers?	3,71	3,66	3,90
How important is it to be able to eat heated food (buy freshly cooked food and/or heat up your own food)?	3,08	3,04	3,24
How important is it that the facilities feel fresh and are cleaned regularly?	4,69	4,78	4,38
How important is it that restrooms and showers are separated based on genders?	2,88	3,08	2,14
Do you have a positive or negative attitude towards driving a truck fueled by alternative fuels in the future?	3,18	3,30	2,76
How likely is it that you will drive a truck fueled by alternative fuels within the upcoming 10 years?	3,05	3,21	2,48

	Women	Men	Experience of crime	No experienced of crime
Follow up questions	Rating	Rating	Rating	Rating
How important is it that access to the parking area is exclusive for truck drivers?	3,79	3,70	3,76	3,78
How important is it to be able to eat heated food (buy freshly cooked food and/or heat up your own food)?	3,07	3,08	3,05	3,06
How important is it that the facilities feel fresh and are cleaned regularly?	4,93	4,65	4,60	4,76
How important is it that restrooms and showers are separated based on genders?	4,57	2,60	2,62	3,10
Do you have a positive or negative attitude towards driving a truck fueled by alternative fuels in the future?	3,29	3,17	3,12	3,25
How likely is it that you will drive a truck fueled by alternative fuels within the upcoming 10 years?	3,29	3,01	2,90	3,25

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