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A qualitative framework for market evaluation

*Identifying key categories and factors for assessing market attractiveness
and feasibility in the electrification of heavy-duty road freight*

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Abstract

Title: A qualitative framework for market evaluation - Identifying key categories and factors for assessing market attractiveness and feasibility in the electrification of heavy-duty road freight

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Background: Heavy-duty road freight accounts for a significant share of global carbon emissions, yet the industry remains structurally inefficient, characterized by low margins and fragmented fleets. While electrification is essential for achieving climate targets, the transition introduces additional operational complexities, raising important concerns regarding profitability and scalability.

Purpose: To develop a qualitative market evaluation framework that identifies key categories and factors for evaluating market attractiveness and feasibility in the electrification of heavy-duty road freight.

Delimitations: This study focuses on fully electric heavy-duty trucks, thereby excluding hybrid solutions, alternative fuels, and autonomous vehicles. The primary objective is to develop a market evaluation framework, while its practical application is of secondary importance. Nevertheless, the framework was tested through a case study conducted with Partner Co. In doing so, the European market was central for the framework development and application.

Methodology: This study adopts a qualitative single-case methodology with Partner Co to enable a comprehensive, context-sensitive study under specific conditions. This approach facilitates the systematic identification of critical categories and factors that inform the framework. Further, the analysis is grounded in academic theory and empirical insights, ensuring grounded results.

Conclusion: This study develops a qualitative market evaluation framework for assessing the market attractiveness and feasibility in the electrification of heavy-duty road freight. By integrating academic market evaluation theory with empirical industry insights and a real-world case study, it demonstrates that traditional market evaluation frameworks must be adapted to account for the systemic and interdependent nature of the electric transition. These insights identified six key categories for market evaluation: aggregate market factors, transport operations, charging infrastructure, regulations, actors, and TCO.

For Partner Co, this study concludes that a dual-layered application is most effective: a narrow, quantitative framework application to support initial market screening and prioritisation, complemented by a broader, qualitative framework application to capture contextual depth. Ultimately, the study highlights that market attractiveness and feasibility in this industry - undergoing a technological transformation - is not only a technological question, but is equally dependent on e.g., regulatory conditions, and actor collaboration.

Keywords: Case study, Digitalisation, Electrification, Heavy-duty road freight, Market evaluation framework, Technology innovation

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Preface

The following Master Thesis study was written by the students Anna Bergman and Ebba Löndahl during the spring of 2026 as part of the master profile in Business and Innovation. It constitutes the final component of their five-year studies in Industrial Engineering and Management at the Faculty of Engineering LTH, Lund University, and comprises 30 hp per student. In doing so, we would like to thank several individuals for their commitment and contributions to the learning process at the core of this study, and its development process to date.

Engaging with the electrification of the heavy-duty road freight industry has deepened our understanding of the systemic complexities involved in sustainable innovation. This study has provided us with insights into how different perspectives must align to facilitate a large-scale socio-technical transition. Through the case study with Partner Co, we have also gained insights into how these dynamics manifest in practice across European countries today.

First, we are grateful to Partner Co for welcoming us into their organisation and its ongoing, real-world day-to-day business. A special thanks is directed to our supervisor and our shared master's thesis working group for engaging with us on a weekly basis and providing valuable insights and contacts. We would also like to thank all the additional employees at Partner Co who participated in interviews and shared their expertise, which was fundamental in testing the framework via its application and ensuring its practical commercial anchoring.

Next, we would like to thank our supervisor from Lund University, Ola Alexanderson, who has always been available with both time and patience to guide us throughout the study. Beyond this spring, we would also like to express our appreciation for his influence on our five-year studies, providing us with academic theory, perspectives, and more, to carry forward into the future.

Last but not least, we wish to thank all external industry actors - including 3PLs, associated organisations, carriers, OEMs, and shippers - who participated in our interviews. Their willingness to share perspectives on the challenges and opportunities of electrification provided a strong foundation for our learning process and was crucial in grounding this research in real-world practice.

Sincerely,

Anna Bergman and Ebba Löndahl
May 2026

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List of abbreviations

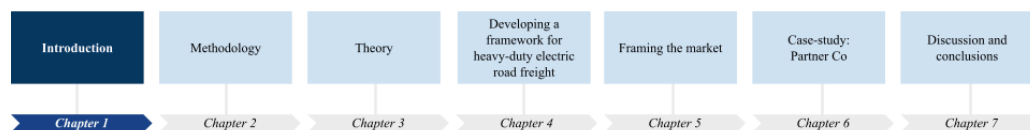
Abbreviation	Meaning
3PL	Third-Party Logistics
AC	Alternating Current
B2B	Business to Business
BET	Battery Electric Trucks
CCS	Combined Charging System
CNG	Compressed Natural Gas
CO₂	Carbon Dioxide
CSRD	Corporate Sustainability Reporting Directive
DC	Direct Current
EU	European Union
FMCG	Fast-Moving Consumer Goods
GHG	Greenhouse Gas
GTM	Go-To-Market
HDV	Heavy-Duty Vehicle
HDT	Heavy-Duty Truck
ICE	Internal Combustion Engine
KG	Kilogram
KPI	Key Performance Indicator
LDV	Light-Duty Vehicle
LEZ	Low-Emission-Zones
LNG	Liquefied Natural Gas
MCDA	Multi-Criteria Decision Analysis
MCS	Megawatt Charging System

MV	Mega-Watt
OEM	Original Equipment Manufacturer
SBTi	The Science Based Targets initiative
SWOT	Strengths, Weaknesses, Opportunities, and Threats
TCO	Total Cost of Ownership
TEN-T	Trans-European Transport Network
V2G	Vehicle-To-Grid
VECTO	Vehicle Energy Consumption Calculation Tool
ZEZ	Zero-Emission-Zones

Chapter 1

1. Introduction

This introductory chapter frames this Master Thesis study. It begins with an overview of market evaluation and an introduction to heavy-duty electric road freight, providing the contextual background for the study's purpose. In connection with this purpose, the research questions and sub-questions are presented, followed by a discussion of the study's academic contributions. Lastly, the limitations and delimitations of the study are outlined and discussed.



1.1. Background

1.1.1. Introduction to market evaluation

Market evaluation refers to the systematic assessment process of market conditions to support strategic decision-making. It typically involves assessing market size and growth potential, analyzing competitors, understanding customer needs and behaviors, and examining industry trends. By following a structured process, companies can identify opportunities, anticipate risks, and sustain long-term growth. Consequently, market evaluation is key in business strategy. (Kotler et al., 2024)

Market evaluation starts by *defining the process objectives*, including focused questions that align with these, such as assessing market size, customer preferences, competitors, or potential for a new product, to guide the data gathering and analysis process. Further, the market evaluation process typically involves *collecting and analyzing* both primary and secondary data. For analyzing data, quantitative approaches, including market sizing and demand forecasting, are often combined with qualitative approaches to achieve a comprehensive understanding of market dynamics. (Malhotra et al., 2019) Amongst, there are several supportive analytical frameworks, such as Customer value analysis, SWOT analysis, and Porter's Five Forces. (Kotler et al., 2024) Next, *interpreting data* reveals insights that impact companies business, by concluding market trends, customer preferences, and other related patterns from the analysis phase. These insights inform *creation of recommendations* aligned with companies goals, often supported by an implementation plan detailing steps, resources, and timelines required. After execution, *reviewing and adjusting* progress through e.g., KPIs ensure strategies remain effective and responsive to changing market conditions. (Kotler et al., 2024)

In summary, market evaluation strengthens strategic planning and helps companies to stay competitive over time by providing overall market insights.

1.1.2. Introduction to heavy-duty electric road freight

For over a century, heavy-duty road freight has relied almost exclusively on fossil diesel-powered ICE due to its high energy density and mechanical robustness. Today, however, the heavy-duty road freight industry is a major contributor to global CO₂ emissions, with growth outpacing most other end-use industries except industry. In response, the industry is undergoing a shift toward a zero emission target, driven by international climate agreements and stringent regional regulations. For example, European Union targets require a 45% reduction in CO₂ emissions from new HDVs by 2030, increasing to 90% by 2040, accelerating the transition away from fossil fuels. (ACEA, n.d.) This transition encompasses several solutions, with electrification as one option.

Electrification refers to the transition to vehicles powered by electricity, typically through battery-electric drivetrains. Hence, a key characteristic of BET is the use of large battery packs, which influence e.g., driving range, payload capacity, and charging requirements. Compared to ICE trucks, BETs produce zero CO₂ emissions, contributing to reduced operational GHG emissions and improved air quality. Furthermore, to fully realise the sustainability benefits, it is however important to ensure that the batteries are charged with renewable energy. (IEA, 2025b) However, electrification also introduces challenges, including limited driving range, longer charging times, and the need for extensive charging infrastructure. In addition, battery weight and cost remain considerations. Despite these challenges, rapid technological advancements, declining battery costs, and increasingly stringent environmental regulations are accelerating the transition. (McKinsey & Company, 2024)

Considering the European market, the heavy-duty road freight industry is a fragmented yet interdependent network of 3PLs, carriers, infrastructure providers, OEMs, shippers, and regulators. Successful transition towards

electrification requires a collaborative approach, with different actors to integrate financing, infrastructure charging services, battery lifestyles, and more, to create favourable circumstances. This transformation also relies on innovation across technologies, business models, and regulatory frameworks, to maximize e.g., operational, economical, and environmental benefits. (Skogfors, 2023) To exemplify, OEMs like Volvo and Scania are shifting their business models from pure hardware to providing energy management and charging services. (Hagleitner, N., 2025) At the same time, new entrants and partnering ventures are entering the industry, providing innovative solutions including charging networks for heavy-duty road freight. (Milance, 2026)

Looking forward, BETs are expected to be the dominant technology for the majority of road freight applications through 2050 and global forecasts suggest that BET could account for 30 to 40% of new sales by 2030. However, due to the mentioned complexity of the industry, achieving this future scenario will necessitate collaboration between actors. (IEA, 2025b)

1.2. Purpose

Based on this, the purpose of this study is as follows:

“To develop a qualitative market evaluation framework that identifies key categories and factors for assessing market attractiveness and feasibility in the electrification of heavy-duty road freight.”

1.2.1. Research questions

RQ1: How can a general framework for market evaluation be designed?

The first research question aims to establish a foundational theoretical structure for evaluating market opportunities. This study step seeks to identify the

overarching categories of market evaluation and the factors contained within each. By synthesizing established market entry theories and models from academia, this question will result in a standardized framework that serves as the baseline for the subsequent industry- and Partner Co-specific framework.

RQ2: How can this framework be tailored for heavy-duty electric road freight?

The objective of the second research question is to tailor the standardized framework to the unique requirements of the heavy-duty electric road freight industry. This involves identifying industry-specific categories and factors, which will be synthesized into the standardized framework to ensure it is sensitive to the nuances and considerations of the industry in question.

RQ3: How can this framework be leveraged to evaluate selected markets?

The final research question focuses on the practical application of the developed framework. This question is addressed through a real-world case study for Partner Co. It explores different methodologies for applying the framework, and examines how the outputs can be leveraged in a GTM strategy. Furthermore, it establishes a process for iterative review to ensure that the framework remains a dynamic tool, capable of being updated as the electrification evolves over time.

In order to achieve the purpose of this study, the above three main research questions are addressed. An overview of the questions is provided in *figure 1.1*.

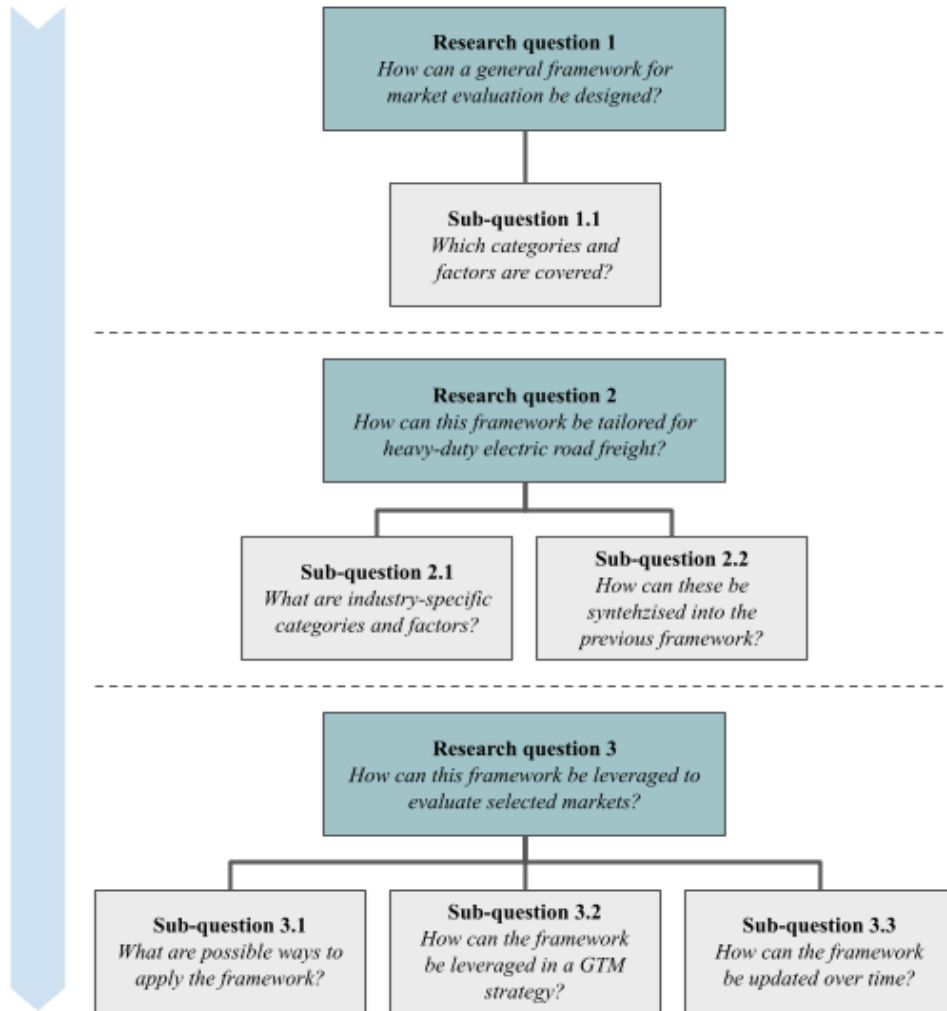


Figure 1.1: Overview of the research questions

1.2.2. Contributions

This study offers both theoretical and practical contributions by tailoring established market evaluation theory and models into an industry-specific market evaluation framework and applying it. First, this demonstrates a process

to develop industry-specific market evaluation frameworks that balance general market insights with industry-specific considerations. Hence, the study provides a transferable methodology for developing similar frameworks across other industries. In addition, it establishes a structured foundation for a practical market evaluation tool to support commercial decision-making. Finally, the study provides empirical insights into the current state of the European heavy-duty electric road freight industry, including data points and dynamics.

1.3. Limitations

This study is limited to the “market attractiveness and feasibility” of a broader GTM strategy. The framework does not represent a complete GTM tool, as it excludes strategic and operational elements such as implementation planning, commercial tactics, and market entry execution. Instead, the focus is confined to identifying and structuring key categories and factors for evaluation market attractiveness and feasibility. Consequently, the framework should be viewed as a component of a GTM strategy rather than a complete decision-making tool.

1.4. Delimitations

This study primarily focuses on *the process of developing a framework* for market evaluation in the electrification of heavy-duty road freight, identifying key categories and factors. Amongst, the scope is limited to the European market and battery electric HDTs with a gross vehicle weight exceeding 16 tonnes. Hybrid and other fuel alternatives are excluded from the scope. Further, a case study of Partner Co is included to demonstrate one possible approach to apply the evaluation framework, including both quantitative and qualitative analysis. However, the overall *process of applying the framework* is not a primary focus of this study.

This study separates market evaluation into two dimensions: market attractiveness, which measures external commercial potential, demand, and

economic variables; and market feasibility, which assesses the technical, practical, and regulatory viability of scaling operations. Evaluating both dimensions is essential, as a country can seem attractive but be structurally unfeasible due to barriers.

1.5. Collaboration

This study is conducted in collaboration with an anonymous partner company, referred to as “Partner Co”. Chapter 6. *Case study: Partner Co*, provides more information about the partner company as well as application of the framework.

1.6. Structure of the study

Chapter 1: Introduction

This introductory chapter frames this Master Thesis study. It begins with an overview of market evaluation and an introduction to heavy-duty electric road freight, providing the contextual background for the study’s purpose. In connection with this purpose, the research questions and sub-questions are presented, followed by a discussion of the study’s academic contributions. Lastly, the limitations and delimitations of the study are outlined and discussed.

Chapter 2: Methodology

This chapter begins by outlining the research purpose. It then presents the research design, including its rationale and implementation in this study, detailing the research approach, methodology, and strategies, sampling strategy, data collection and analysis procedures, and considerations of research credibility, ethics, and possible risks. It then finalizes with a summary.

Chapter 3: Theory

This chapter presents academic theories and models that guide the development of the theoretical market evaluation framework. It also provides theories and models for guiding the empirical part of the study and framework application.

Chapter 4: Developing a framework for heavy-duty electric road freight

This chapter contains empirical industry-insights from literature review and interviews with network actors. Based on these insights and following the methodological approach outlined in the previous chapter, the theoretically developed market evaluation framework was further developed to the industry.

Chapter 5: Framing the market

This chapter contextualises the theoretically and empirically developed framework within the European road freight industry, based on desk research. However, some data are limited to the European Union due to availability constraints.

Chapter 6: Case study: Partner Co

This chapter introduces Partner Co by outlining its core activities, business model, and strategic position within the road freight industry. It further examines the company's perspective on the market evaluation framework developed through theory and empirical insights. It then details the application of the framework in a real-world commercial context - first across countries using MCDA, followed by a qualitative illustration in one selected country.

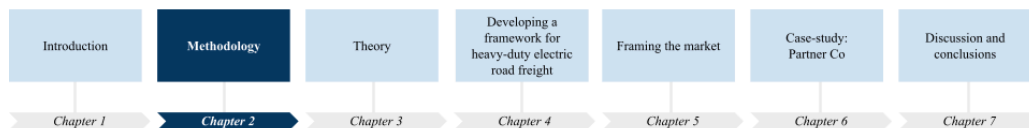
Chapter 7: Discussion and conclusions

This chapter discusses and concludes findings regarding the framework, as well as its development and application with Partner Co, in relation to the background, purpose, and research questions. It also suggests future research.

Chapter 2

2. Methodology

This chapter begins by outlining the research purpose. It then presents the research design, including its rationale and implementation in this study, detailing the research approach, methodology, and strategies, sampling strategy, data collection and analysis procedures, and considerations of research credibility, ethics, and possible risks. It then finalizes with a summary.



2.1. Research purpose

The purpose of research is to provide a direction for a study by shaping its design, guiding the formulation of research questions, and informing the selection of appropriate methods for data collection and analysis. A well-defined research purpose enables the researcher to approach a topic from relevant perspectives and ensures coherence between the research purpose, questions, and methodological choices. Traditionally, the research purpose is categorised as exploratory, descriptive, explanatory, or evaluative, or alternatively as a combination of those. Exploratory and descriptive approaches often build foundational understanding that supports subsequent explanatory or evaluative analysis. Accordingly, research can be structured to include multiple purposes, enabling a more comprehensive research. (Saunders et al., 2019).

The purpose of this study integrates exploratory and evaluative research. An exploratory approach is fundamental to this study as the electric truck industry is characterized by a complex and rapidly evolving landscape where established evaluation frameworks remain limited. According to Saunders et al. (2019), exploratory research is most appropriate when a topic is new or insufficiently understood, aiming to uncover initial patterns and formulate more precise questions. This is typically characterized by open-ended “what” or “how” questions and a flexible methodology that allows the direction to adapt as new understanding emerges. By using this approach, the study can identify, clarify, and categorize key industry-specific factors, ensuring that the proposed framework is grounded in a deep understanding of current industry dynamics.

Further, evaluative research focuses on assessing the effectiveness or impact of a strategy, policy, or process, often examining the extent to which objectives are achieved. Research questions typically address “to what extent” or “how well,” and may incorporate elements of description and explanation (Saunders et al., 2019). In this study, the development of the framework is inherently evaluative,

as it provides a structured basis for assessing the attractiveness and feasibility of selected markets against defined evaluation criteria. Through the framework application, the study moves beyond identifying categories and factors to evaluating their relative implications for strategic decision-making. By integrating exploratory insights with evaluative assessment, the research ensures that the framework is both grounded in an understanding of industry and designed as a practical tool for practical market evaluation and comparison.

2.2. Research design

Research design refers to the various approaches, methods, and strategies used in the systematic step-by-step investigation of a subject to address specific research questions or objectives, such as uncovering new information, improving knowledge, interpreting relationships, and more. (Saunders et al., 2019) In figure 2.1 below, each mentioned research design layer is illustrated.

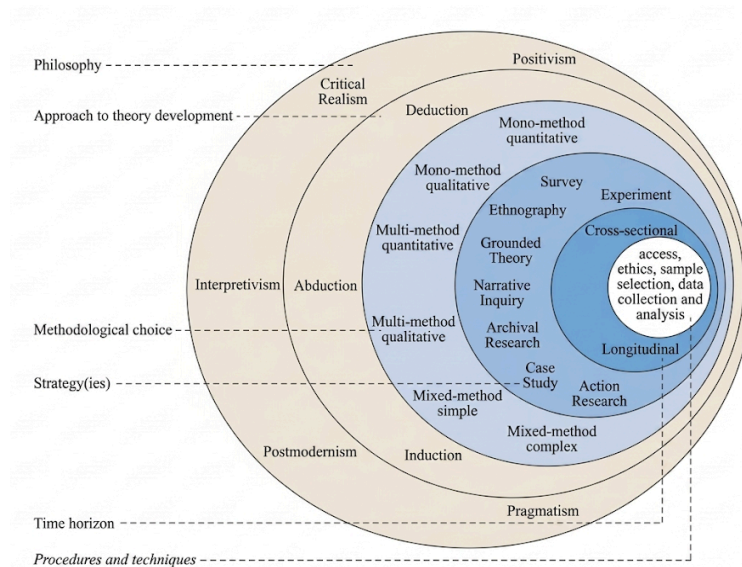


Figure 2.1: Illustration of research design layers

2.2.1. Research approach to theory development

The extent to which a study seeks to test or build theory determines its research approach. Broadly, there are three main approaches to theory development: deductive, inductive, and abductive. A deductive approach begins with existing theory and derives hypotheses or premises that are empirically tested. Conclusions are considered valid if the premises are true and supported by data. In contrast, an inductive approach starts with the collection and analysis of data to explore a topic. Patterns and themes are identified and used to generate new theoretical insights, often in the form of a conceptual framework. An abductive approach combines elements of both, as it begins with the observation of a surprising fact and then seeks the most plausible explanation by generating possible theoretical premises. This may lead to the development or modification of theory, which can be tested through further data collection. The choice between these approaches depends on whether the research primarily aims to test existing theory, build new theory, or iteratively move between theory and data to refine explanations. (Saunders et al., 2019)

Given the purpose and design of this study, its approach to theory development is best described as abductive. The study initially drew on academic market evaluation theory to provide a starting point, reflecting a deductive element. However, rather than directly testing predefined hypotheses, the process involved simultaneous engagement with empirical literature and interviews with. This iterative move between theory and data enabled the identification of industry-specific categories and factors that could confirm, extend, and challenge existing theoretical assumptions. The abductive logic was further reflected in the subsequent adjustment and application of the framework in collaboration with Partner Co, where categories and factors were qualitatively analysed, and translated into quantitative measures.

2.2.2. Research method

Research design can broadly be categorised as qualitative, quantitative, or mixed methods, depending on the nature of the data collected and the analytical techniques applied. A qualitative research design involves the collection and analysis of non-numerical data, such as words, images, audio recordings, video material, or observational notes. Methods such as interviews, unstructured observations, narrative analysis, and grounded theory generate rich, descriptive data aimed at understanding meanings, experiences, and contextual dynamics. In contrast, a quantitative research design relies on numerical data and includes data collection procedures and analytical techniques that generate or use statistical information. This may involve surveys with closed-ended questions, experiments, or other structured instruments designed to measure variables systematically. A mixed methods design combines both qualitative and quantitative approaches within the same study. When more than one qualitative or more than one quantitative method is used, the design may be described as multi-qualitative or multi-quantitative as in *figure 2.2*. (Saunders et al., 2019)

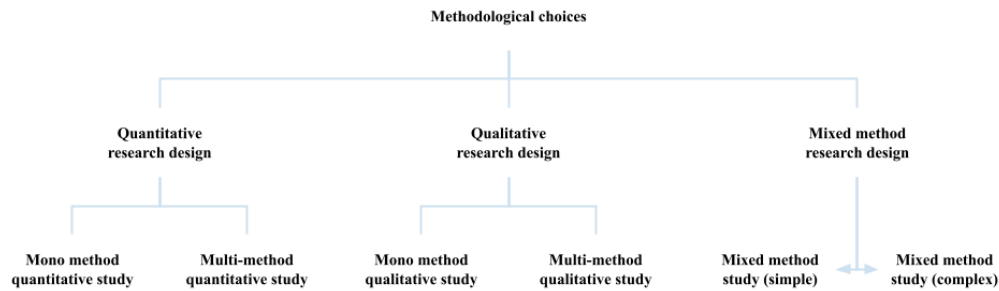


Figure 2.2: Methodological choices

This study is primarily qualitative in nature, as the collection and analysis of non-numerical data were required, to achieve its core objective of identifying

key categories and factors for the framework. A qualitative design was therefore appropriate as it facilitated descriptive insights through in-depth exploration of industry dynamics and challenges, including different actors' roles and perspectives. Although predominantly qualitative, the later stage of the study included translation into quantitative measures. However, the overall orientation remained qualitative, as its primary objective was based on qualitative insights.

2.2.3. Research strategy

Research strategy refers to the methodological link between the underlying research philosophy, the chosen approach to theory development, and the subsequent selection of methods for data collection and analysis. (Denzin et al., 2018) It provides the overall plan for how the research question is addressed and how the study's objectives are achieved. The appropriateness of a strategy depends on its alignment with the research question and its ability to generate insights that meet the purpose of the study. (Saunders et al., 2019)

This study adopts a case study research strategy. A case study is defined as an empirical investigation of a contemporary phenomenon within its real-world setting, particularly when the boundaries between the phenomenon and its context are not clearly evident. (Yin, 2018) According to Saunders et al. (2019), a case study is appropriate for challenging existing theories and generating new research questions, which is in line with our research. In this study, the phenomenon under investigation is the development and application of a market evaluation framework, which is closely intertwined with its industry context and actor network. The case study, conducted in collaboration with Partner Co, was particularly valuable in addressing the third research question by enabling the application of the developed framework. This included interviews with employees from Partner Co, which contributed to both insights and guidelines.

2.2.4. Sampling strategy

This study adopted a non-probability sampling strategy, specifically purposive sampling, consistent with its qualitative case study design and abductive approach to theory development. As the objective of the research was not to achieve statistical generalisation, but rather to develop a theoretically grounded and empirically informed framework, this was appropriate. Further, the case was chosen based on its relevance, access, and potential to provide insights to support the research purpose, as proposed by Saunders et al., (2019).

2.2.4.1. Case selection

The case was selected through reasoned judgment to ensure it would meaningfully address the study's research purpose and, in particular, support the investigation of the third research question. Following established case study principles, a single commercial organisation was chosen to provide a real-world setting in which the phenomenon under investigation could be studied in depth. (Denscombe, 2018) This approach allowed for insights while enabling development and piloting of data collection procedures, empirical data gathering, and validation of findings. The focused scope of the case also aligns with the aim of analytical rather than statistical generalisation. (Saunders et al., 2019) Moreover, the case study both anchored the framework in real-world industry dynamics and strengthened its applicability for market evaluation.

2.2.4.2. External interviews

The sampling of external participants followed a purposive, heterogeneous strategy to capture a wide range of perspectives within the road freight value chain. Accordingly, key actors, including associated organizations, 3PLs, carriers, OEMs, and shippers, were selected. A brief overview of the actor types, including their business models and position within the network, is

provided in **table 2.1**, while a list of interviewees is presented in **table 2.2**. It should be noted that all external interviewees were Swedish participants, selected to ensure a shared exposure to similar industry and network conditions.

While the framework has a European scope, the external interviews were not intended to map local markets - which was instead achieved through literature review - but to qualitatively contextualize the universal barriers and drivers identified in the literature. Furthermore, some of the selected interviewees operate within integrated cross-border supply chains, providing them insights and experience that extend well beyond national boundaries.

Table 2.1: Network actors

Actor type	Business model	Network position
3PL	Plan and manage logistics flows and transport operations, often subcontracting carriers	Coordination layer between shippers and carriers
Associated organization	Facilitate collaboration, knowledge sharing, and policy dialogue, etc.	Cross-network support layer
Carrier	Provide physical transport of goods using owned or leased vehicle fleets	Operational layer of freight transport
OEM	Design, manufacture, and sell trucks and related services such as maintenance	Upstream supply side
Shipper	Produce or sell goods and purchase freight transport services from logistics providers	Demand side of freight transport

Table 2.2: Long list of external interviewees

Actors type	Interviewee role	Interview date
3PL #1	Chief of Transports	17 March 2026
3PL #2	Project Manager Sustainability	20 March 2026

Associated organization #1	Political Specialist	5 March 2026
Associated organization #2	Sustainability Manager	16 March 2026
Carrier #1	CEO	3 March 2026
Carrier #2	CEO	4 March 2026
Carrier #3	CEO	5 March 2026
OEM #1	Head of Sales International	10 March 2026
Shipper #1	Logistics Operation Manager	12 March 2026
Shipper #2	Fleet Manager	16 March 2026
Shipper #3	Chief of Transports	20 March 2026

In non-probability sampling, the emphasis lay less on the number of participants and more on choosing those who are most informative. (Saunders et al., 2019) First, the companies were selected with the requirement of having electrification in their strategies. To ensure data saturation and diverse perspectives, the study initially aimed to interview at least one representative of each actor type, based on recommendation from our supervisors. Hence, we contacted approximately three to five companies per actor type. Partner Co shortened this identification process of target companies due to their deep insight into this actor network, regardless of whether they had existing commercial relationships with them. However, some of our proposed companies had to be removed from the selection due to ongoing commercial discussions. Furthermore, individual participants were selected based on their expertise and experience in electrification within their respective companies. At the stage of contact, we also clarified our relation to Partner Co, in order to be transparent and allow for their consideration. Due to this reason, we experience some shortfall due. So on, additional participants were approached to meet the initial target. Also, we decided to contact more participants when we

experienced data gaps. This iterative approach to data collection and sampling supported the attainment of saturation. Although not suitable for statistical generalisation, the overall selection supported analytical generalisation that was theoretically meaningful, by identifying patterns. (Saunders et al., 2019)

2.2.4.3. Internal interviews at Partner Co

The internal interviews conducted within Partner Co followed a purposive, homogeneous sampling strategy. The purpose of these interviews was to adjust the framework to suit Partner Co and their position in the industry in terms of prioritizations and weights of different categories and factors. This was important to ensure the framework application was meaningful for Partner Co.

The interview process was conducted in two steps. First, we sought expertise across the proposed framework to get input on specific company/technical details, e.g., employees within charging especially contributed to inputs on our proposed charging category. Once we had adjusted the factors within each category, we wanted an overall opinion to validate them and to set the weights. For this, we targeted different managers of commercial and central functions. These were approached as they had more say, responsibility, and interest in the outcome of the application. However, this was not a linear process, as we had to balance internal prioritisation and align stakeholders across their different inputs. Hence, **table 2.3** provides an overview of employees interviewed during the first rounds of interviews. Later, we had the opportunity to remain in contact with them iteratively through meetings and internal chat channels, in order to gather additional input - from experiences to opinions, data sources, and more - to enable the framework - especially quantitative - application. This ensured that the application incorporated organisational knowledge necessary to contextualise and operationalise the developed framework for commercial use.

Table 2.3: Long list of internal interviewees

Interviewee role	Interview date	Reconnected (Yes/No)
Business Development Director	30 March 2026	Yes
Carrier Relations	1 April 2026	No
Head of Special Projects	1 April 2026	Yes
Public Affairs Director	7 April 2026	Yes
Strategy Manager #1	8 April 2026	Yes
Strategy Manager #2	9 April 2026	Yes
Charging Operations Development Manager	8 April 2026	Yes
Data Analyst, Energy Solutions	9 April 2026	Yes
Public Funding and Policy Manager	9 April 2026	Yes
Data Scientist, Solution Development	22 April 2026	Yes

In addition to the semi-structured interviews conducted during the framework development and application process, we also held a demo presentation of our current insights after the first round of interviews and the quantitative framework application. In this session, we aimed to gather input for further development. **Table 2.4** provides Partner Co employees attending this session.

Table 2.4: Long list of employees attending demo presentation

Attendee role	Provided feedback (Yes/No)
Business Development Director	Yes
General Manager, Electric Mobility	Yes
Head of Commercial Contracts	No
Head of Special Projects	Yes
Intern, Autonomous Projects	Yes
Master Thesis Student #1	No
Master Thesis Student #2	No
Public Affairs Director	Yes
Strategy Manager #1	No
Strategy Manager #2	Yes
Strategic Growth Director	Yes
Vice President Growth and Solutions	No

2.2.5. Data collection

As introduced, this study was based on a case and had a qualitative nature, focusing on collecting empirical data from research via literature review, complemented by external and internal interviews. Hence, two main data collection methods were used: literature review and semi-structured interviews.

2.2.5.1. Empirical literature

The empirical literature was used to identify industry-specific insights relevant for market evaluation, to adjust the framework based on academic theories and models. The literature search included both academic and non-academic sources. Academic sources were identified through systematic searches in databases such as Finn and Google Scholar, using keywords including “digitalisation”, “electrification”, “heavy-duty”, and “road freight”. These searches revealed both individual studies and systematic literature reviews. Linked searches were also used to identify relevant publications. Non-academic sources, such as industry reports, company websites, and trade publications, were also included to capture practical and up-to-date market information.

After reviewing the search results, we decided to proceed with two systematic literature reviews, as they had already synthesized individual contributions from other sources identified in the search. This approach was efficient, as the primary aim at this stage was to gain an understanding of broad industry concepts rather than to conduct an in-depth analysis of specific ones. Furthermore, the selected literature both complemented and validated each other by approaching electrification of heavy-duty road freight from slightly different perspectives while reaching comparable conclusions on key concepts. This helped to adjust the theoretical framework to suit the industry in question.

2.2.5.2. Interviews

The interviews were semi-structured to provide a balance between consistency across interviews and flexibility to explore emerging insights that arose during the interview process, in line with Saunders et al. (2019). This format was well suited to capture the differences and similarities in perspectives of external industry actors. To ensure consistency, a pre-defined interview guide was followed (see *Appendices A-E*), initially developed based on insights from the literature review and supervisory discussions. Similarly, the subsequent internal

interviews with Partner Co followed a comparable semi-structured agenda (see *Appendix F*). However, in both cases, the focus of the interviews evolved slightly in response to emerging insights from the external interview process, as well as differing expert areas in Partner Co interviews. In the latter, the process became more iterative and problem-solving oriented, leading to more open-ended discussions despite a solid foundation in the pre-defined questions.

2.2.6. Data analysis

The empirical data in this study consisted of two main types of qualitative data: textual data and verbal data. Textual data include written materials, such as notes, reports, literature, and other documents gathered during the empirical research. On the other hand, verbal data originated from spoken words expressed during interviews and were captured through audio recordings, which were transcribed and reviewed as well as complemented with our own notes.

This data was analyzed with the *thematic analysis technique*, as it enabled the identification and organisation of recurring patterns and provided a systematic yet flexible procedure for analysing data. According to Saunders et al. (2019), the thematic analysis process consists of six stages: data familiarisation, data coding, theme generation and development, theme review and refinement, theme definition and structuring, and interpretation and reporting.

The analysis began with becoming familiar with the collected data through repeated reviewing and reading of transcripts and notes. This helped document patterns, recurring ideas, and relevant concepts before formal coding started.

In the coding stage, transcripts and notes were systematically labeled with short phrases to summarize specific content units, proposed by Saunders et al. (2019). Coding combined both “a priori” labels from theory and literature review with “in vivo” codes taken from participant terminology, see *figure 2.3* for details.

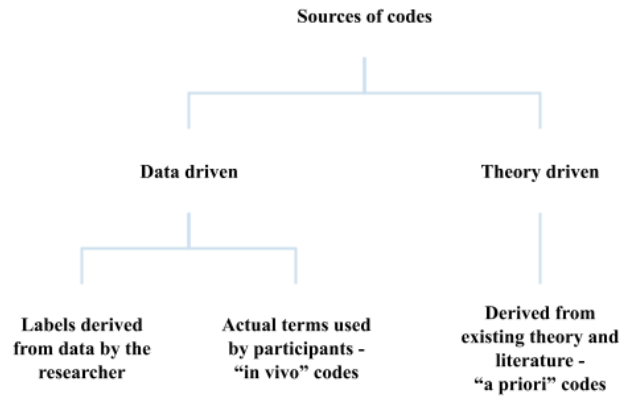


Figure 2.3: Sources of codes

Following coding, related codes were grouped into broader categories that represented meaningful patterns across the gathered data. Codes with similar meanings were grouped into representing key categories to consider for the industry, forming the foundation of the qualitative framework and highlighting the main considerations influencing market attractiveness and feasibility. For each identified category, the codes were organized as our corresponding factors.

Preliminary categories were then iteratively reviewed and refined to ensure they accurately represented the data. Patterns were merged or redefined where necessary to create a coherent set of factors that aligned with the empirical data.

Next, each theme was defined, described, and organised into a structured framework. This stage established distinct framework categories and factors.

Lastly, the framework was interpreted to explain how categories and factors impact market attractiveness and feasibility in the electrification of heavy-duty road freight. This was done through the case study application with Partner Co.

2.2.7. Research credibility and validation

Qualitative research is inherently more challenging to validate than quantitative research, as it cannot be exactly replicated. According to Saunders et al. (2019), qualitative research also requires more attention to the consistency and trustworthiness of data and findings. Therefore, it is important to document the methods, analysis, and other decisions throughout the research process to ensure credibility and transparency, and allow for external reviewing. While the case study design implies that the findings are context-dependent, limiting their generalisability and transferability, the documentation of the methodology supports its transferability to similar contexts. (Saunders et al., 2019)

Triangulation was applied by comparing perspectives from both external interviews themselves, but also with internal Partner Co interviews, allowing cross-verification of emerging patterns. This also contributed to mitigate potential bias arising from participants' professional and company perspectives.

2.2.8. Research ethics and risks

Ethical considerations were addressed throughout the research process in accordance with Saunders et al. (2019). Participants were informed about the purpose of the study, the use of the data, and their rights prior to the interviews, and informed consent was obtained. Confidentiality and anonymity were ensured throughout the study, and all collected data were securely stored to protect sensitive personal and commercial information. This also helped mitigate the potential risks of unintentional disclosure of confidential insights and misinterpretation of participant perspectives. In addition, the iterative and reviewing research process supported continuous validation of interpretations, thereby reducing bias and enhancing the accuracy of the empirical findings.

2.3. Summary of methodology

This study used a qualitative, single-case design with an abductive approach to theory development. It combined a review of existing market evaluation theory with empirical data collected through literature as well as semi-structured interviews with external network actors and internal Partner Co participants. Data collection and analysis were conducted concurrently, allowing emerging insights to guide subsequent interviews and adjust the framework. Amongst, qualitative data, both textual and verbal, were transcribed and coded into categories and factors in line with the thematic analysis technology, which was later operationalised through internal interviews to translate the framework into a quantitative assessment model. To summarize this, following is an overview:

Firstly, this study consists of seven chapters, as illustrated in **figure 2.4** below:

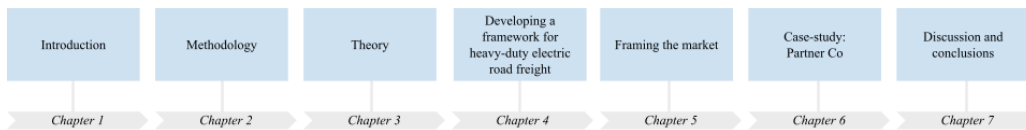


Figure 2.4: This study consists of seven chapters

At the highest level, the chapters are linked to three study “phases” - an introduction, a main, and a final phase - as illustrated in **figure 2.5** below. The introduction phase, including the *Introduction* and *Methodology* chapters, provides the general background and research approach for the study. The subsequent main phase is structured as an incremental framework development, leading to the final framework and its application with a Partner Co case study.

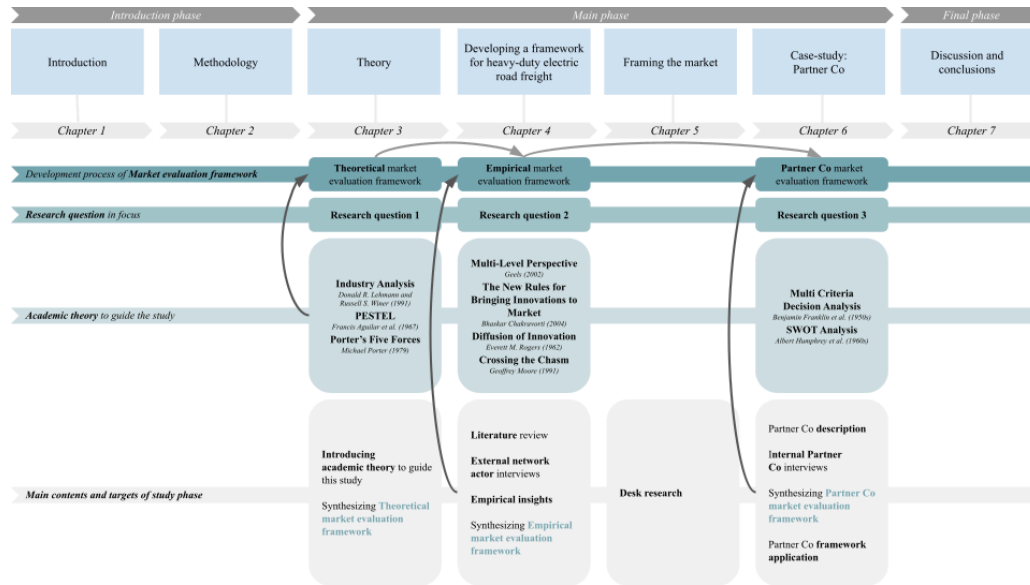


Figure 2.5: Overview of this study and interconnections

The *Theory* chapter is divided into two parts: first, it presents academic theory to support the development of a theoretical market evaluation framework; second, it introduces additional theories related to industry dynamics - particularly those linked to innovation, technology, and systemic networks - as well as theory relevant for the later framework application and market analysis.

Further, chapter 4. *Developing a framework for heavy-duty electric road freight* presents empirical insights from both literature and external actor interviews regarding the industry. Building on the *Theoretical market evaluation framework*, these insights contribute to the development of a framework tailored to the industry: *Empirical market evaluation framework*. This is then contextualised around the European market through desk research in the chapter *Framing the market*. Finally, through a case study with Partner Co in chapter 6, the framework is further contextualised in a real-world commercial setting and

applied in practice, resulting in a *Partner Co market evaluation framework*. This incremental development - from theory, to empirics, to Partner Co case study - is shown in **figure 2.6**, which also highlights framework application.

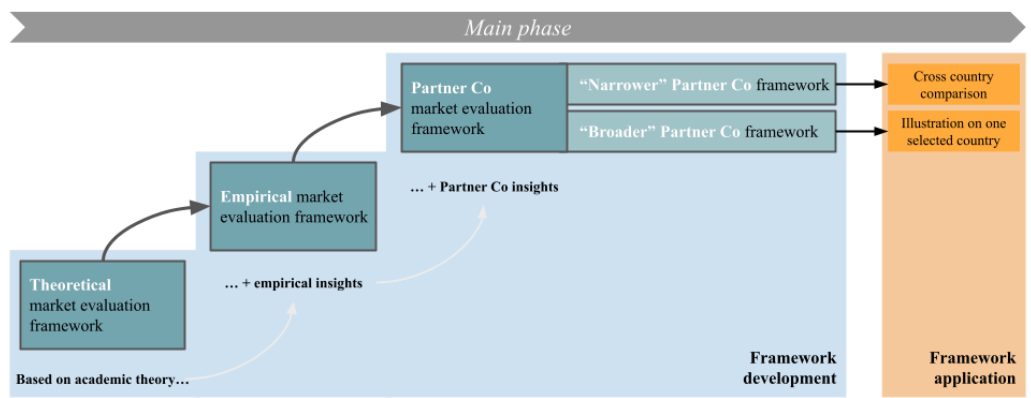
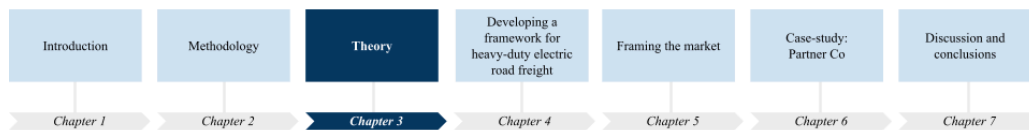


Figure 2.6: Incremental framework development and application

Chapter 3

3. Theory

This chapter presents academic theories and models that guide the development of the theoretical market evaluation framework. It also provides theories and models for guiding the empirical part of the study and framework application.



3.1. Introduction

The academic contributions to guide this study have been tailored through a combination of selected academic theories and models, with certain modifications, to align with the study's purpose and research questions. As an overview, the selected “sets” of theories and models are illustrated in *figure 3.1*.

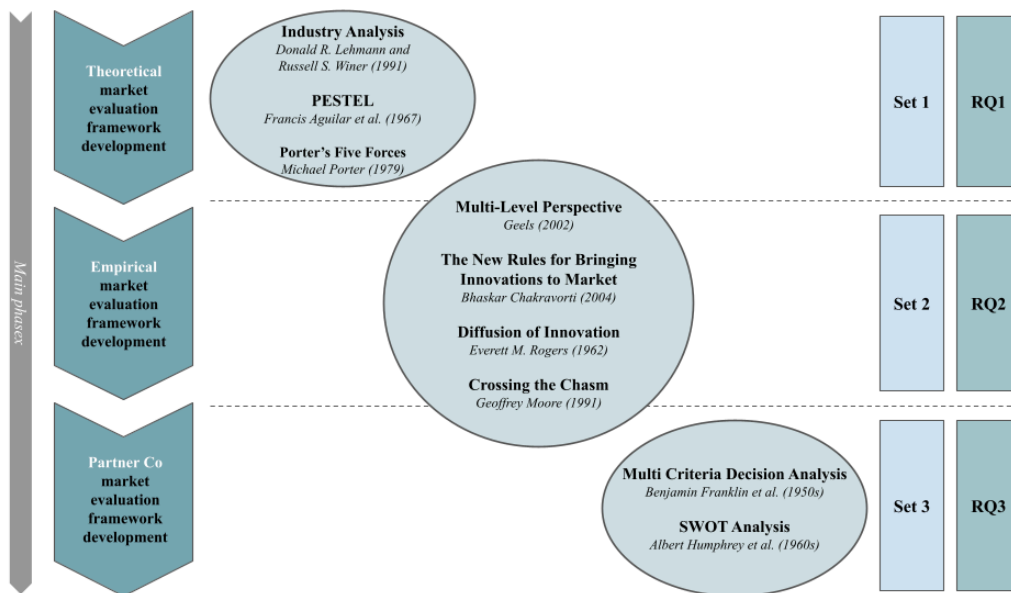


Figure 3.1: Overview of sets of academic theories and models

As illustrated, the first set of academic theories and models was especially linked to the step of developing the market evaluation framework and to the first research question. The second set of academic theories and models spanned more broadly across all three development steps of the market evaluation framework, even though the concepts were mainly relevant for the empirical and industry-specific step, as well for framing the market in chapter 5. *Framing the market*. The third set of academic theories and models was - like the first set

- more closely linked to a single, isolated development step of the market evaluation framework and to one research question - the third Partner Co one.

The development of the theoretical market evaluation framework - outlined in 3.2. *Theoretical market evaluation framework development* - was structured using a combination of core concepts from Donald R. Lehmanns et al.'s *Industry analysis*, the *PESTEL framework*, and *Porter's Five Forces*. Rather than a strict traditional analytical application, this combination resulted in a comprehensive set of factors to include a general market evaluation framework. Furthermore, the subsequent step of gathering industry-specific insights and tailoring (i.e., developing) the framework was guided by a set of theories and models on market dynamics, innovation adoption, and technology. As in the previous step, these theories and models were not applied in a strictly traditional analytical sense. Instead, they were used as structuring tools to organise the collection and analysis of both primary (interviews) and secondary (literature) insights, thereby enabling a more robust and systematic empirical analysis. As the insight collection was guided by overlapping frameworks, some degree of overlap occurred. These were also considered during the desk research for the market framing, and were revisited in the final phase to support the discussion.

Lastly, for chapter 6, additional academic theories and models were introduced to support the case study with Partner Co. Here, framework-based models guided both the quantitative and qualitative analyses. In contrast to the previous steps, theoretical models such as MCDA and SWOT analysis were applied more closely to their traditional uses, although they were slightly tailored to better fit Partner Co as well as the purpose and research questions of this study.

3.2. Set 1: Guiding theoretical market evaluation framework

This chapter presents a foundation of theories and models to develop the theoretical market evaluation framework. It builds on the "Industry Analysis"

framework introduced by Donald R. Lehmann and Russell S. Winer in “Analysis for Marketing Planning”, where industry analysis is positioned as a tool for evaluating the potential of an investment opportunity in a market or industry.

Among others, Donald R. Lehmann and Russell S. touch on established frameworks, including PESTEL and Porter’s Five Forces. Together, these provide a foundation for evaluating market attractiveness and feasibility, supporting this study’s analysis by offering a broad market perspective, highlighting structural trends, and capturing the dynamics among key actors.

3.2.1. Aggregate market factors

The evaluation of a market’s attractiveness - by Donald R. Lehmann and Russell S. Winer (1991) begins with an analysis of six primary aggregate factors: market size, market growth, stage of product life cycle, sales cyclicality, seasonality, and profits. Together, those six aggregated factors represent the overall characteristics of a market. In this chapter, these factors are described.

3.2.1.1. Market size

Market size, measured by both volume and financial value, is the first factor to consider as it indicates if a sector’s revenue potential can justify an investment. Generally, larger markets are more desirable for both major companies due to higher profit potential and larger segmentation opportunities. However, market size alone does not guarantee market attractiveness. Massive categories often attract powerful competitors with the resources for heavy defensive spending, making the competitive environment hard for smaller companies to respond.

3.2.1.2. Market growth

Market growth should reflect both current growth and future growth forecasts. Rapidly expanding product categories and markets are generally desirable as

they support healthy profit margins and sustain long-term growth. However, high growth rates inevitably attract new competitors, which can lead to volatile markets and shifts in market share. In high-technology environments, this growth can even result in displacement of existing products by new rivals.

3.2.1.3. Stage in Product life cycle

The Product life cycle provides a framework (see *figure 3.2*) for understanding how product category size and growth evolve along four distinct stages: introduction, growth, maturity, and decline. Each stage offers a profile of attractiveness based on the trade-off between current volume and future potential - amongst, growing and mature product categories are most attractive.

In the introduction stage, both product category size and growth are initially low, which is often seen as unattractive, though it presents the potential for first mover advantages. As sales accelerate in the growth stage, the product category becomes attractive due to expansion opportunities, though this phase often draws in competitors that can cause shifts in market share. Attractiveness in the maturity phase is often ambiguous because growth slows down, but the product category volume usually reaches its peak, meaning the large sales volume often makes up for the lack of fast growth. Finally, while most competitors leave as sales drop during the decline stage, profitability is possible for companies that provide specialized or legacy products.

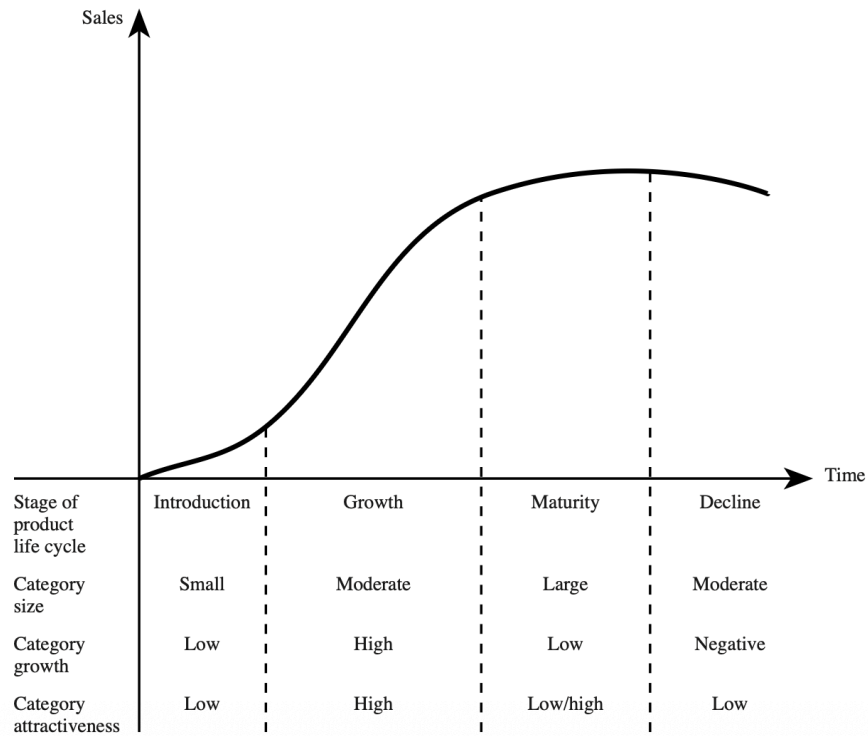


Figure 3.2: Stages of the Product Life Cycle

3.2.1.4. Sales cyclicity

Attractiveness is often diminished by interyear demand fluctuations, particularly in capital-intensive or interest-rate-sensitive product categories like automotive or real estate. These cycles are often tied to broader economic conditions, with sales varying with GDP or climatic conditions, which create instability in cash flow, employment, and investment capacity. To mitigate the risks associated with these peaks and valleys in sales, companies seek to diversify their portfolios by acquiring other categories that have less cyclicity.

3.2.1.5. Seasonality

Unlike cyclicality, seasonality refers to intrayear fluctuations in sales. These are typically viewed as a negative, because they can cause companies into intense price wars during narrow windows of peak demand. While most product categories experience some degree of seasonality, extreme seasonality complicates year-round operational efficiency. To mitigate this, companies attempt to reduce the reliance on seasonal periods to balance sales over the year.

3.2.1.6. Profits

The attractiveness of a product category is influenced by both the average level of profitability and the consistency of those returns. Between different product categories, margins can vary significantly due to differences in factors such as manufacturing technology, labor intensity, competitive rivalry, and more.

3.2.2. Industry factors

While aggregate factors are indicators of a product category attractiveness, they do not reveal the deeper structural elements that shape the product category. To address this, Porter developed a well-known model - Porter's Five Forces - that provides a structured approach to analyzing the competitive environment of a market or product category using five key factors: threat of new entrants, bargaining power of buyers, bargaining power of suppliers, intensity of competition within the category, and threat of substitute products or services (Porter, 1979) In addition to Porter's Five Forces, Lehmann and Winer also introduce a sixth factor for deeper product category analysis: capacity.

3.2.2.1. Threat of new entrants

Threats of new entrants reduce product category attractiveness by increasing capacity, intensifying competition, and compressing profit margins. Entry is

largely shaped by structural barriers established by incumbents, which - while legal - strategically deter competition. Key barriers include economies of scale, strong product differentiation and brand loyalty, substantial capital requirements in production or marketing, high switching costs that lock in customers, restricted access to distribution channels, and the likelihood of aggressive incumbent retaliation. These barriers vary over time, often weakening with technological change or patent expiration. However, companies can mitigate these threats through differentiation, increased investment requirements, customer lock-in, control of distribution, and credible competitive responses.

3.2.2.2. Bargaining power of buyers

Bargaining power of buyers assesses the influence that customers have on prices, quality, and terms of purchase. Buyers are individuals or organizations that receive finished goods or services, including e.g., distributors, OEMs, or end-customers. High buyer power reduces product category attractiveness, as buyers can demand lower prices, better service, or play competitors against one another. Buyer power is stronger when the product category is a large part of their costs, undifferentiated, or when buyers earn low profits. It also increases when buyers can backward integrate, have full information, or when substitutes exist. While individual consumers usually exert limited power, collective organization - such as purchasing cooperatives or advocacy groups - can amplify influence. Companies can mitigate the bargaining power of buyers via product differentiation, value-added services, or increasing switching costs.

3.2.2.3. Bargaining power of suppliers

Bargaining power of suppliers evaluates the ability of suppliers to influence the cost and availability of inputs. Supplier power is high when suppliers are highly concentrated, that is, dominated by a few alternative sources, there is no substitute for the product supplied, the supplier has differentiated its product or built in switching costs, and when supply is limited, meaning that buyers have a

little opportunity to extract special terms. However, the bargaining power of suppliers can be reduced by searching for new supply sources or substitutes.

3.2.2.4. Industry rivalry

Industry rivalry refers to the intensity of competition among existing players. High rivalry typically occurs in product categories with slow growth, low differentiation, or high exit barriers, leading to price competition, increased marketing expenses, and overall reduced profit margins.

3.2.2.5. Pressure from substitutes

Pressure from substitutes considers the extent to which alternative products or services can replace existing offerings. The presence of readily available substitutes limits pricing power and may reduce demand, forcing companies to innovate or differentiate to maintain competitiveness.

3.2.2.6. Capacity

Capacity refers to the maximum level of output a product category or operation can produce sustainably using its available resources over a given period. Chronic overcapacity signals potential long-term profitability challenges, whereas product categories that operate below capacity offer less than its maximum - in other words, resources like staff, equipment, or facilities are not being fully utilized. Therefore, companies should aim to operate near capacity to maintain low costs and high product category bargaining power with buyers.

3.2.3. Environmental factors

The environment consists of external factors beyond company's control that influence strategic and marketing decisions. While high sensitivity to these factors can reduce attractiveness, most industries are inevitably exposed to

them. These influences are typically grouped into five categories: technological, political, economic, regulatory, and social - also relating to the PESTEL framework (Aguilar F.J. et al., 1967). Assessing these factors is essential for evaluating product category attractiveness and anticipating market shifts.

3.2.3.1. Technological

Technological factors shape both the pace and direction of product category transformation. Technological change may be understood across three interconnected processes: invention which involves the creation of new products or systems; innovation, referring to their commercial introduction; and diffusion, describing their adoption across markets and populations. Amongst, significant technological advancements are e.g., observed in markets such as energy systems, advanced materials, transportation, information technologies, and bioengineering. The typology of technology development is illustrated in **figure 3.3**. Companies and product categories that fail to invest in emerging technologies face increased competitive pressure from technologically advanced incumbents. In contrast, actively adopting modern technologies - as digital services - tend to maintain stronger competitiveness.

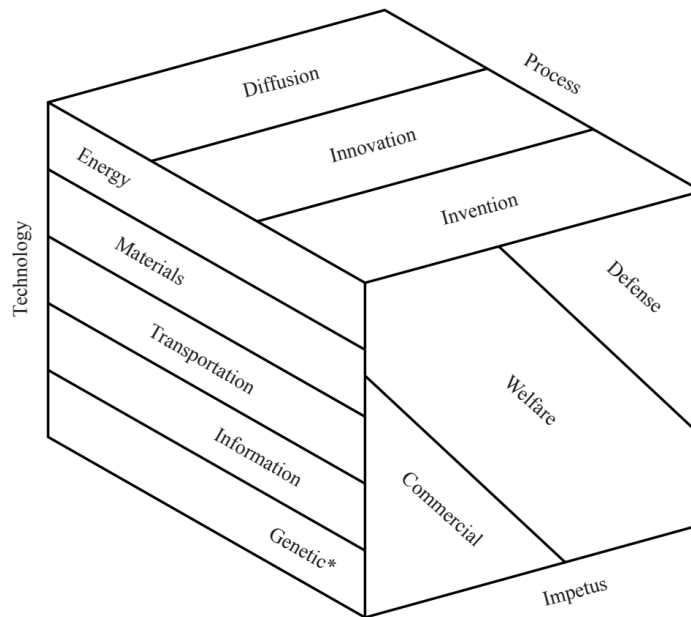


Figure 3.3: Typology of technology development

**Includes agronomic and biomedical developments*

However, excessive technological reliance may generate resistance among users when automation reduces personal interaction. Consumer preferences often balance efficiency with human engagement, suggesting that technological adoption should consider social acceptance alongside performance. Overall, product categories that effectively integrate technological invention, innovation, and diffusion are better positioned to sustain in rapidly evolving markets, especially in technology-intensive environments with short product life cycles.

3.2.3.2. Political

Political factors impact product category performance, especially for those with substantial international exposure. Political risk arises from e.g., ideological differences, governance structures, social instability, and shifts in international relations. Such risks can lead to asset loss, regulatory constraints, contract instability, and threats to operational continuity and employees.

Emerging and reform-oriented economies often present both growth opportunities and heightened political uncertainty. Consequently, systematic evaluation of political environments is essential to avoid excessive reliance on politically unstable regions that may reduce overall product category attractiveness. On the other hand, although political risk is generally lower in developed domestic markets, it remains influential through changes in government priorities and policy orientations. Shifts in political leadership can alter trade protections, public spending, and regulatory frameworks, thereby affecting competitiveness. For instance, shifts in defense expenditure and trade policies have historically influenced product category performance in response to evolving geopolitical conditions. Overall, political factors are fluid and require continuous monitoring to inform decision-making.

3.2.3.3. Economic

Economic conditions influence product category performance, particularly through interest rates, inflation, and labor markets. Capital-intensive industries, such as machine tools, agricultural equipment, and mainframe computers, are highly sensitive to interest rate changes, as buyers often rely on short-term financing. Similarly, consumer durables - including homes, automobiles, and electronics - are affected by both interest rates and broader economic cycles, though consumer credit costs tend to be less responsive than commercial borrowing rates. Inflationary trends are linked to these financial dynamics.

International operations introduce additional economic considerations, including e.g., currency exchange rate volatility, which can impact profitability and competitiveness over time. Labor market conditions also play a role, especially for service-oriented product categories. High employment levels can create wage pressures and labor shortages, as observed in product categories dependent on specialized technical skills. For example, the availability of engineers can constrain innovation in high-technology product categories.

Also, products with broad consumer bases, such as automobiles, exhibit demand sensitivity to overall economic growth. Recessions typically reduce sales, whereas periods of economic expansion support higher consumption.

3.2.3.4. Regulatory

Regulatory frameworks significantly influence product category attractiveness by shaping the operational and marketing environment. Legal restrictions can increase costs or limit managerial discretion, reducing the appeal of certain products. Conversely, government intervention can enhance attractiveness. Trade restrictions, such as limits on automobile exports, or subsidies for specific commodities, can create favorable conditions for domestic industries. However, the nature and effect of regulation vary across markets and product categories, necessitating a tailored analysis to assess how regulatory affect strategic decision-making and market potential.

3.2.3.5. Social

Trends in demographics, lifestyles, attitudes, and personal values influence both consumer and B2B product categories. For consumer products, new offerings and features increasingly cater to dual-career and busy households, while advertising targets generational segments including Baby Boomers, Generation X, and Generation Y. On the other hand, for B2B, the overall demand is often

derived from consumer trends. Hence, companies performing well are typically aligned with expanding consumer product categories.

Also, until today, the rise of the Internet has shifted power to consumers by increasing information accessibility and reducing shopping costs, enabling customers to compare options more effectively. Although predicting specific trends remains difficult, fundamental demographic and socioeconomic changes make adaptation essential to maintain sustained company strategy.

3.2.4. Framework synthesization

Building on the industry analysis theoretical perspectives introduced in this chapter, a synthesized market evaluation framework - provided in *table 3.1* - is developed to structure the assessment of market attractiveness in a comprehensive way. The synthesis integrates complementary analytical lenses - market-level dynamics, industry structure, and broader environmental conditions - into a single framework that can support market evaluation. Rather than treating these perspectives in isolation, the framework consolidates them into three categories: aggregate market factors, industry factors, and environmental factors. This also reflects the understanding that market attractiveness is not determined by a single factor, but by the combined influence of demand-characteristics, competitiveness, and macro-environment.

Table 3.1: Theoretical market evaluation framework

Categories	Factors
Aggregate market factors	Market size Market growth Stage in product life cycle Sales cyclicality Seasonality Profits Technology adoption rate
Industry factors	Threats of new entrants Bargaining power of buyers Bargaining power of suppliers Industrial rivalry Pressure from substitutes Capacity
Environmental factors	Technology Political Economic Regulatory Social

3.3. Set 2: Guiding empirical collection, analysis, and discussion

This chapter presents academic theories and models that guide the empirical collection, analysis, and discussion of this study. In particular, it introduces the Multi-Level Perspective theory, Chakravorti's framework on the New Rules for Bringing Innovations to Market, the Diffusion of Innovation theory, and the concept of Crossing the Chasm, which together provide comprehensive and complementary perspectives on technological transitions and market adoption.

3.3.1. Multi-Level Perspective

The Multi-Level Perspective theory is used to analyze how technological transitions come about. (Geels, 2002) Technological transitions are defined as

major, long-term technological changes in the way societal functions are fulfilled. These transitions do not only involve changes in technology, but also changes in user practices, regulation, industrial networks, infrastructure, and symbolic meaning or culture. MLP addresses how the shift from one socio-technical system to another occurs via the interplay of three levels: the sociotechnical landscape, regimes, and niches. These levels are structured as a “nested hierarchy” - regimes within landscapes, and niches within regimes.

3.3.1.1. Landscape

The sociotechnical landscape represents the external environment, consisting of slow-moving, overarching factors that shape the context of an industry that cannot be influenced directly by individual actors. These heterogeneous factors can be oil prices, cultural values, macroeconomic shifts, and political ideologies that act as a guiding force for technological development. When these trends conflict with the status quo, they create an opening for new innovations to move from small niches into the mainstream.

3.3.1.2. Regime

The sociotechnical regime represents the established way of fulfilling a societal function and accounts for the stability of existing systems. It is characterized by a shared set of rules carried by different social groups, such as engineers, users, policy makers, and scientists. Within a regime, technology changes develop through small, incremental steps along a predictable path. This stability creates lock-in mechanisms, where existing laws, infrastructure, and user practices are aligned to existing technologies. Therefore, the regime acts as a filter that rejects innovations that do not fit in the current system.

3.3.1.3. Niche

Technological niches are protected spaces, such as R&D labs or subsidized pilot projects, where new technologies can develop without having to compete immediately with the efficiency of the dominant regime. In their early stages, these innovations are unrefined, inefficient and expensive compared to established alternatives. Because they cannot yet compete on price or performance, they rely on these protected environments to facilitate vital learning processes, such as learning by doing, using, and interacting. These spaces also allow pioneers to build the necessary social networks and supply chains. Over time, an innovation can gain enough momentum to break out of its initial circle. This is a stepwise process where the technology proves itself in one specialized application before moving to larger, more demanding markets.

3.3.2. The New Rules for Bringing Innovations to Market

While traditional market evaluation often focuses on the structural characteristics of an industry, Chakravorti (2004) introduces a perspective grounded in game theory, emphasizing that the more networked a market is, the harder it is for an innovation to take hold and gain widespread acceptance. This theory is particularly relevant for understanding why established markets are resistant to change and how a new “equilibrium” can be orchestrated.

3.3.2.1. Market equilibrium and resistance to change

Chakravorti argues that markets resist innovation because they seek equilibrium, a state where all players believe their choices are optimal relative to others. Markets naturally seek this stability because it validates behaviours and reinforces expectations, making the system naturally resistant to change.

In networked markets, this resistance is amplified by interdependencies. A market takes on the characteristics of a network when the value of a product and

the decision to adopt it are dependent on the connections between participants and the spread of virtual, social, or physical infrastructures. A single actor is unlikely to switch to a new technology autonomously; they will only do so if they believe their partners and peers will also make the switch. This codependent behavior creates a “status quo” that is often hostile to innovation.

3.3.2.2. Orchestrating a new status quo

To break through this resistance to change, Chakravorti proposes a four-part framework to shift the market from a foe to an ally as in *table 3.2*.

Table 3.2: Chakravorti’s proposed four-part framework

Reason back from a target endgame	Innovators should not focus on immediate benefits but should instead envision a plausible future equilibrium where the innovation has become the standard. By working backward from this endgame, the company can identify and implement the strategies that trigger the necessary responses from other players.
Complement the power players	Within every network, interconnections cluster around “hubs” - players with significant influence and connectivity. Rather than confronting these hubs, innovators should position their products as complements to the power players’ existing offerings. This allows the innovator to leverage the hub’s network to gain rapid access to a larger pool of players.
Offer coordinated switching incentives	An innovation fails if it only targets the end-user. Momentum is created only when the innovator aligns the incentives of three core groups: the adopters, the channel partners, and the “complementors” (those who add to the innovation’s benefits). When adoption becomes a matter of common interest, a virtuous cycle begins.
Preserve flexibility	Because market responses are often uncertain, innovators must maintain flexibility in their product and marketing plans. This allows them to adapt to market changes and refine their approach as they learn how the network reacts to the initial disruption.

3.3.3. Diffusion of Innovation

*The “Diffusion of Innovation” theory explores how, why, and at what rate new ideas, practices, or technologies spread through populations. The concept originated in the early 20th century within anthropology and rural sociology, but was systematically formulated by the American sociologist Everett M. Rogers in his book *Diffusion of Innovations* (1962). He defined “diffusion” as: “Diffusion is the process through which an innovation is communicated via certain channels over time among the members of a social system”.*

3.3.3.1. Core concept

An innovation is defined as any idea, practice, or object that is perceived as new by an individual or another adoption unit, such as an organization. Importantly, the novelty of an innovation is subjective; it is determined by the adopter’s perspective rather than by objective measures of newness. This perception of newness influences the likelihood of adoption, as what is innovative to one person may be familiar to another. Further, the diffusion of an innovation is shaped by several key attributes according to **table 3.3**. These attributes help explain why some innovations spread widely while others do not manage too.

Table 3.3: Key attributes shaping the diffusion of an innovation

Attribute	Description of attribute
Relative advantage	Perceived improvement over alternatives
Compatibility	Fit with existing values and experiences
Complexity	Ease of understanding and use
Trialability	Ability to experiment with the innovation
Observability	Visibility of outcomes to others

3.3.3.2. The diffusion process

Diffusion unfolds as a communication process over time among members of a social system. Communication channels are vital in transmitting information about the innovation. As outlined in *table 3.4* below, Rogers described a five-stage diffusion process that illustrates that diffusion is not instantaneous but evolves through cognitive and social steps.

Table 3.4: Five-stage diffusion process according to Rogers

Stage	Description of stage
Knowledge	Learning that an innovation exists
Persuasion	Forming an attitude toward the innovation
Decision	Choosing to adopt or reject
Implementation	Putting the innovation to use
Confirmation	Seeking validation of the decision

3.3.3.3. Adopter categories, the S-curve, and social systems

A central component of Rogers's theory is the categorization of adopters according to their propensity to adopt new innovations. Individuals are typically classified into five groups: innovators, early adopters, early majority, late majority, and laggards. Innovators are characterized by a willingness to take risks and a strong openness to novel ideas. Early adopters, often serving as opinion leaders, are influential within their social networks and help facilitate broader acceptance of innovations. The early majority adopts innovations more deliberately but remains receptive to change, whereas the late majority tends to be more skeptical and requires substantial social proof before adopting. Finally, laggards are resistant to change and adopt innovations only when necessary.

When the cumulative adoption of an innovation is plotted over time, the resulting curve typically exhibits an S-shaped curve (see **figure 3.4**). The initial phase shows slow adoption, followed by a period of rapid uptake as early adopters influence the early and late majority. Adoption eventually slows as the remaining laggards embrace the innovation. Within this context, the concept of critical mass is particularly significant, representing the point at which adoption becomes self-sustaining and the innovation gains widespread acceptance.

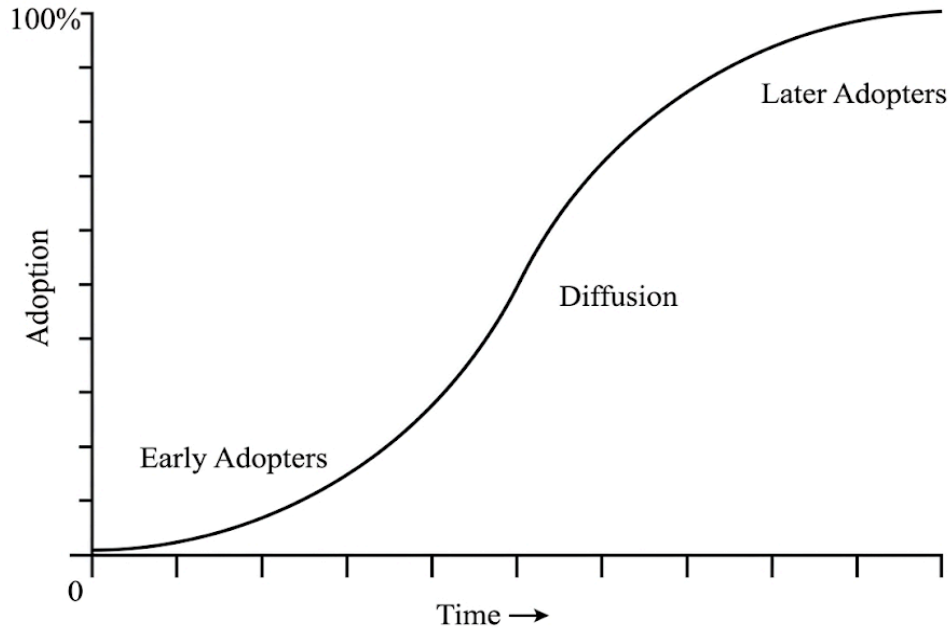


Figure 3.4: The S-curve

Further, the diffusion occurs within the context of social systems, which encompass shared norms, established roles, and interconnected networks. The effectiveness and speed of diffusion are heavily influenced by the structure of these systems and the actors within them. Key facilitators for diffusion include

opinion leaders, who exert influence over actors in the network, and change agents, who promote and support the adoption of innovations. Additionally, the degree of homophily and heterophily plays a critical role in determining how information flows through the system.

3.3.4. Crossing the Chasm

Further, building upon Roger's "Diffusion of Innovation" theory, "Crossing the Chasm: Marketing and Selling High-Tech Products to Mainstream Customers" by Geoffrey A. Moore (1991) further develops the dynamics of technology adoption by emphasizing the critical transition between early adopters and the early majority. While Everett M. Rogers presents adoption as a continuous process across adopter categories, Moore argues that a significant discontinuity exists between technology enthusiasts and visionaries on one side and more pragmatic mainstream users on the other. This "chasm" represents a major barrier to widespread market acceptance, as these groups differ substantially in their expectations, risk tolerance, and purchasing behavior. Moore therefore proposes targeted strategic approaches - such as focused market selection, positioning around complete product solutions, and tailored marketing and distribution strategies - to facilitate this transition. By sequentially establishing adoption within specific market segments and leveraging early success to build momentum, Moore emphasizes that companies can create a bandwagon effect - where individuals adopt behaviors, styles, or attitudes simply because others are doing so - that enables innovations to become mainstream standards.

3.3.4.1. Customer psychographic profiles

Geoffrey Moore's *Crossing the Chasm* reframes the traditional technology adoption life cycle by identifying a critical gap between early adopters and the mass market. While models such as those by Rogers suggest a smooth, continuous adoption, Moore argues that high-tech products often face a

significant break in this transition. His model instead groups customers based on psychographic profiles - their response to innovation - outlined in **table 3.5**:

Table 3.5: Different customer psychographic profiles

Customer profiles	Description of customer profile
Innovators → <i>The tech enthusiast</i>	These are the first to adopt any new technology, often for the sake of the technology itself. They serve as the gatekeepers for a product's entry into the market, providing early feedback and validation.
Early adopters → <i>The visionaries</i>	Unlike enthusiasts, visionaries are looking for a strategic leap forward. They are willing to endure bugs and incomplete features if the technology promises to give them a significant competitive advantage in their industry.
Early majority → <i>The pragmatists</i>	This group marks the beginning of the mainstream market. They do not want disruptive change; they want incremental improvement and reliability. They buy only when they have a strong reference base from peers within their own industry.
Late majority → <i>The conservatives</i>	This group is skeptical of technology. They only adopt new products when they have become an industry standard and when the risk of not using the technology outweighs the risk of the technology itself.
Laggards → <i>The skeptics</i>	These individuals avoid high-tech products altogether, often arguing that technology rarely delivers on its promises.

3.3.4.2. The “Chasm”

While traditional model assumes that adopter groups are positioned as adjacent segments along a continuous bell curve, implying that firms can transition from one group to the next through accumulated market momentum, Moore's challenges this assumption by arguing that while minor discontinuities exist

between all adopter categories, a substantial and critical gap emerges between early adopters and the early majority - referred to as the “chasm” in *figure 3.5*.

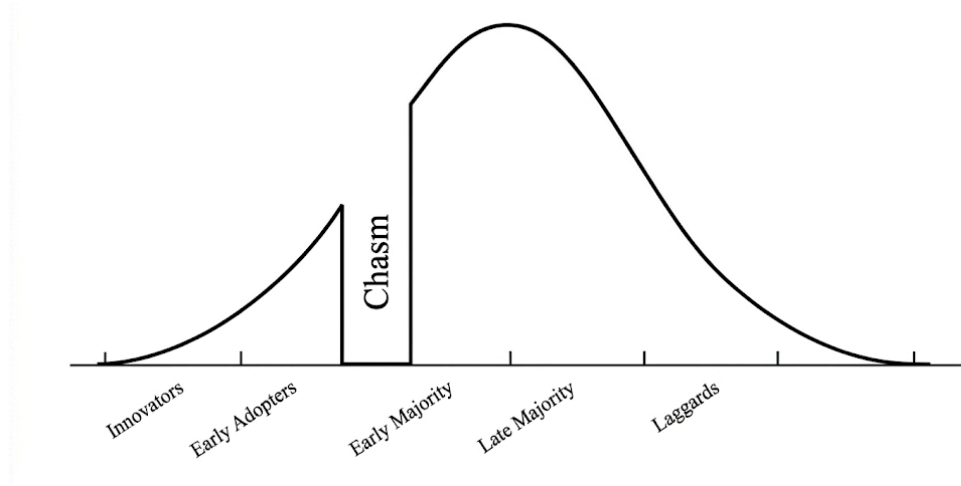


Figure 3.5: The “Chasm”

This gap stems from fundamental differences in expectations and behavior between the two groups. Early adopters (visionaries) seek disruptive potential and are willing to accept immature solutions, whereas the early majority (pragmatists) prioritize reliability, low risk, and proven performance. Because pragmatists rely on peer validation - often lacking from early adopters - innovations frequently struggle to gain mainstream legitimacy, causing many high-tech ventures to stall before achieving scale.

3.3.4.3. Crossing the Chasm strategy

To address the challenge of the chasm between early adopters and the early majority, Moore proposes a highly focused market-entry approach called the *D-Day* strategy. Rather than attempting to penetrate the entire mainstream market simultaneously, the company should concentrate on a selected niche,

referred to as the “beachhead”, with the goal of achieving dominance within that segment. The strategy follows as described in *table 3.6*. By executing this niched-focused strategy, companies increase their likelihood of bridging the chasm and creating a foundation for mainstream market adoption over time.

Table 3.6: Crossing the Chasm strategy

Step	Description of step
1	The first step is to target the point of attack, identifying a niche where the pain of the current situation is sufficiently acute that pragmatic customers are compelled to act. By focusing resources exclusively on this niche, the firm can establish itself as the market leader, generating credible references that facilitate expansion into adjacent segments.
2	The second step is the concept of the Whole Product. While the generic product constitutes the core technology, pragmatic customers require a comprehensive solution that includes professional services, installation, customer support, integration with existing systems, and compliance with relevant regulations and security standards. The Whole Product ensures that the innovation provides a compelling reason for adoption.
3	The third step focuses on the fact that companies must define the market and competitive landscape. In Crossing the Chasm, the primary competition is not other start-ups but the status quo. Success requires positioning the product relative to both the current market alternative - the way problems are currently addressed - and any competing solutions that do not fully meet the niche’s specific needs.
4	The fourth step includes that distribution and pricing strategies must align with the expectations of pragmatic customers. Distribution channels should be those already trusted by the target segment, and pricing should reflect the value delivered to the niche rather than the underlying cost of the technology.

In summary, Moore’s theory emphasizes a shift from product-driven to market-driven strategies, requiring firms to focus on a single niche rather than all segments at once. By securing this “beachhead,” companies can build momentum to enter the mainstream and achieve sustainable growth over time.

3.4. Set 3: Guiding framework application

This chapter presents academic theories and models that guide the application of the market evaluation framework in this study. In particular, it introduces two analytical frameworks - MCDA and SWOT analysis - which together provide complementary perspectives for structuring and evaluating decision-making.

3.4.1. Multi Criteria Decision Analysis

MCDA is a structured analytical framework used to evaluate and rank multiple options when faced with several, often conflicting, objectives. Unlike traditional decision-making models that may prioritize a single factor, MCDA integrates a broad spectrum of both quantitative and qualitative factors. In a market evaluation context, this systematic approach is designed to reduce subjectivity by providing a transparent, data-driven basis for strategic decision-making. An MCDA model consists of four fundamental elements, as outlined in *table 3.7*.

Table 3.7: Fundamental elements according to a standard MCDA

Element	Description of element
Alternatives	The various options, such as different geographical markets or product categories, that are evaluated and ranked.
Criteria	The specific standards or measures used to assess the alternatives (e.g., market size, regulatory support, or technological maturity).
Weights	Numerical values assigned to each criterion to reflect its relative importance in the overall decision.
Scores	Assessments of how well each alternative performs against each specific criterion.

Further, the application of MCDA follows a series of logical steps (see *table 3.8*) that guide the process from a complex problem to prioritized solutions.

Table 3.8: Typical logical steps for MCDA

Step	Description of step
Problem structuring	Clearly defining the objective and identifying relevant stakeholders and alternatives.
Determining criteria and weights	Selecting the key evaluation factors and assigning weights (often summing to 1 or 100%) to reflect their relative importance.
Evaluating alternatives	Rating each option against the criteria using data or expert judgment. Qualitative factors can be operationalized through measurement scales (e.g., nominal, ordinal, or interval-like), often involving normalization to ensure comparability.
Aggregation and ranking	Multiplying the scores by their respective weights and summing them to calculate an overall performance score for each alternative.
Sensitivity analysis	Testing how changes in weights or scores affect the final ranking to ensure robustness and identify the most influential factors.

While MCDA provides a more comprehensive output than single-factor evaluations, its meaningfulness depends on the quality of its inputs. The processes of assigning weights and scoring qualitative criteria rely on human judgment, which can introduce subjectivity into the model. Moreover, as the number of factors or alternatives increases, the model becomes more complex, requiring careful management to ensure that the results remain transparent and easy to communicate to stakeholders. To summarize, an overview of the MCDA concept is illustrated and presented in *figure 3.6* below. (ScienceDirect, n.d.)

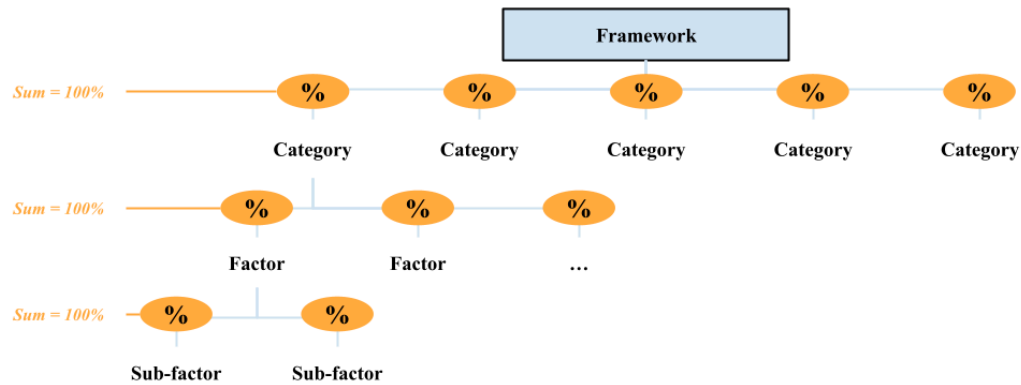


Figure 3.6: Overview of the MCDA application

3.4.2. SWOT analysis

SWOT analysis is a strategic framework for identifying and evaluating internal and external factors that influence an organization, market, or specific decision context. The acronym SWOT refers to Strengths, Weaknesses, Opportunities, and Threats, which together provide a structured overview of both advantageous and adverse conditions. Unlike purely quantitative models, SWOT analysis integrates qualitative insights, making it particularly useful in early-stage assessments and strategic discussions, e.g., for market evaluation.

Furthermore, for market evaluation, SWOT analysis supports decision-making by systematically organizing key insights related to a specific market, industry, or strategic option. The framework distinguishes between internal factors - strengths and weaknesses -, which are typically within the control of the organization, and external factors - opportunities and threats -, which arise from the broader environment. By structuring these elements, SWOT analysis contributes to an understanding of strategic positioning and potential risks. A standard SWOT analysis consists of four fundamental elements, see **table 3.9**.

Table 3.9: Fundamental elements in a SWOT analysis

Element	Description of element
Strengths	Internal attributes and resources that support a favorable position (e.g., strong brand, technological capabilities, or cost advantages).
Weaknesses	Internal limitations or deficiencies that may hinder performance (e.g., lack of resources, limited market knowledge, or operational inefficiencies).
Opportunities	External conditions that could be leveraged to create value or competitive advantage (e.g., market growth, regulatory support, or emerging technologies).
Threats	External factors that could negatively impact performance or increase risk (e.g., competition, regulatory barriers, or economic uncertainty).

Furthermore, the SWOT analysis typically follows a structured yet flexible process, allowing it to be adapted to different studies and decision-making contexts. These typical logical steps are presented in *table 3.10* here below:

Table 3.10: Typical logical steps for SWOT analysis

Step	Description of step
Defining the objective	Clearly specifying the purpose of the analysis, such as evaluating a market or supporting a strategic decision.
Identifying internal factors	Assessing strengths and weaknesses based on available data, resources, and organizational capabilities.
Identifying external factors	Analyzing opportunities and threats by examining industry trends, market conditions, and the competitive environment.
Structuring the matrix	Organizing the identified factors into the four SWOT categories to create a clear and comparable overview.

Interpreting results	Evaluating how internal and external factors interact, often to identify strategic implications or priorities.
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While SWOT analysis provides a clear and intuitive framework for structuring complex information, it also has limitations. The identification and categorization of factors rely on subjective judgment, which may introduce bias or inconsistency. Additionally, the framework does not inherently prioritize or quantify the relative importance of different factors, which can make it challenging to directly compare alternatives or support final decision-making without complementary tools. As a result, SWOT analysis is often most effective when used in combination with other analytical methods, such as MCDA, to enhance both structure and rigor. To summarize, an overview of the SWOT analysis framework is shown in **figure XX** below. (Investopedia, 2025)

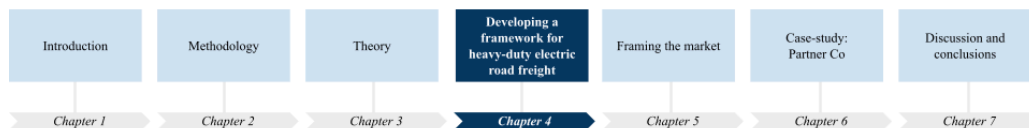


Figure 3.7: Overview of the SWOT analysis framework

Chapter 4

4. Developing a framework for heavy-duty electric road freight

This chapter contains empirical industry-insights from literature review and interviews with network actors. Based on these insights and following the methodological approach outlined in the previous chapter, the theoretically developed market evaluation framework was further developed to the industry.



4.1. Empirical insights

This chapter synthesizes findings from the empirical literature review and external interviews, forming an empirical foundation for the development of the industry-specific framework. The purpose is twofold: first, to establish an understanding of important factors characterizing market attractiveness and feasibility in the electrification of road freight based on existing research, and second, to contextualize and nuance this understanding through insights from interviews with network actors. Together, these sources serve as a preliminary hypothesis guiding the subsequent Partner Co case study provided in chapter 6.

The literature review is based on two comprehensive systematic literature reviews and complementary studies that also validate each other's findings. The first, "Towards building an understanding of electrification of logistics systems - a literature review and a research agenda" by H. Gillström et al. (2024), analyses 62 academic papers with a focus on electrification from a logistics management perspective. It highlights that the emerging market for heavy-duty electric trucks is not driven only by technological advancements, but is shaped by broader system-level considerations, including logistics operations, economic feasibility, charging infrastructure, and coordination among stakeholders. The literature is characterised by an emphasis on quantitative modelling, particularly in areas as route optimisation under range constraints, charging infrastructure placement, fleet sizing, and TCO. This indicates that electrification is approached as a systems and planning challenge rather than a simple substitution of ICE. Across the reviewed studies, five core areas were identified: transport operations, charging, TCO, actors, and sustainability.

The second study, "Electric mobility toward sustainable cities and road-freight logistics: A systematic review and future research directions" by Alarcón et al. (2023), expands the scope by analysing 237 peer-reviewed articles published between 1975 and 2022. Using bibliometric mapping and content analysis, the

study traces the evolution of electromobility in freight logistics, with particular attention to urban contexts. While the field has experienced rapid growth - especially after 2021 - the review identifies several important research gaps, including multimodal integration, long-haul and heavy-duty applications, emerging markets, business models, social dimensions, and policy frameworks related to fleet transitions and infrastructure development. For the purposes of this study, five primary categories are emphasised as central to further electrification: economic and competitive aspects, city logistics, environmental sustainability, vehicle fleet operations, and infrastructure and technology.

Building on these literature-based insights, empirical data was collected through interviews with industry actors. These interviews aimed to capture practical perspectives, contextual experiences, and industry-specific challenges and enablers that are not fully addressed in the academic literature. In doing so, they added depth and nuance to the conceptual understanding derived from the literature and helped validate, and tailor the standardized framework from before. In particular, it was important to understand challenges and enablers from an actor's perspective, as this reveals what defines market attractiveness and feasibility in practice. This insight formed the foundation for the development of the industry-specific framework, based on the standardized one.

Following the methodological approach outlined in the previous chapter, insights from both the literature and interviews were systematically coded, labelled, and mapped into a set of overarching categories with several factors within. This synthezation is presented and discussed in the sub-chapters below.

4.1.1. Transport operations

The transition to electrified road freight necessitates a fundamental paradigm shift in Transport operations, moving away from a “one-to-one” replacement of ICE vehicles toward a more integrated, data-driven logistic system. Literature

and empirical evidence highlight that electrification reshapes the definition of productivity, creating a tension between the theoretical optimizations proposed in research and the practical constraints faced by operators on the ground.

The primary operational challenge identified in both literature and practice is the inherent reduction in operational flexibility. Gillström et al. (2024) argue that battery limitations - specifically range and charging time - necessitate advanced scheduling to maintain competitive delivery windows. This academic perspective is strongly validated by interviewees, who describe electric trucks as “less flexible” than diesel counterparts. However, while Alarcón et al. (2023) suggest that technical solutions like optimization modeling and the “electric vehicle routing problem” (e-VRP) can mitigate these constraints, 3PLs, carriers, and shippers emphasize that real-world implementation is far more complex. They point out that while models can calculate theoretical routes, actual operations must juggle shifting driver rest regulations and erratic infrastructure availability. Conversely, some actors view this forced complexity as an opportunity, as they argue that centralized, data-driven planning can actually improve efficiency by synchronizing charging with loading and unloading tasks, a synergy that is often overlooked in traditional diesel operations.

Bridging further, to offset the higher purchasing price of electric trucks, maximizing utilization has emerged as a critical factor for a viable TCO. Alarcón et al. (2023) highlight city logistics solutions like off-hour and night-time deliveries as a means to increase efficiency and reduce urban congestion. This perspective is supported by stakeholders who note that the low noise levels of electric trucks make these quiet, multi-shift operations more socially and regulatorily feasible. However, a tension exists between this operational ideal and market reality. While researchers and OEMs advocate for continuous 24/7 vehicle use, carriers and shippers highlight a significant bottleneck: customer willingness to adopt. They argue that high utilization is only achievable if the broader network - including customers - is willing to

adjust delivery windows and receive goods outside standard hours. This suggests that the economic viability of electric freight is not just a fleet management issue, but a systemic coordination challenge on several fronts.

Also the structural differences between electric and diesel drivetrains introduce physical limiting factors that create a direct trade-off between electrification and transport efficiency. Gillström et al. (2024) categorize payload loss due to battery weight as a significant barrier, a view echoed by interviewees and practitioners especially in the heavy-duty segment. While researchers often focus on the “last mile” where weight is less critical, interviewees in heavy-duty segments echo that reduced payload capacity necessitates additional trips, which could perversely increase costs and diminish environmental gains. To counter this, many actors advocate for regulatory adaptations, such as higher gross vehicle weight allowances, to level the playing field with diesel. This practical concern is further compounded by environmental sensitivities; while literature focuses on “productive vs. non-productive time,” interviewees and practitioners highlight that external variables like cold weather, wind, and hilly terrain can drastically reduce driving range, making the execution of planned routes far more unpredictable than theoretical models might suggest.

Ultimately, these interrelated factors shape a clear divergence in operational viability between distribution and long-haul transport. Alarcón et al. (2023) and Gillström et al. (2024) largely agree that urban and regional distribution is the most immediate frontier for electrification, given the predictable and repetitive nature of the routes. This is validated by interviews where actors see “last-mile” electrification as a manageable transition. In contrast, long-haul operations are viewed through a much more cautious lens. While technology proponents point to emerging solutions like the MCS and improved battery energy density as future enablers, 3PLs, carriers, and shippers maintain that the current combination of range limitations and infrastructure gaps makes large-scale long-haul electrification a long-term goal. This creates a perspective gap: where

researchers see a roadmap of technological milestones, operators see a current landscape of operational risk that requires significant infrastructural maturity before it can match the reliability of traditional freight.

In sum, while the logistics industry is increasingly capable of addressing operational hurdles through software and hardware innovation, the inherent physical environment remains an immovable reality for electric freight. To ensure the market evaluation framework is both robust and realistic, it must distinguish between factors that can be “solved” and those that must be “endured.” The rationale for selecting these factors lies in their static and market-specific nature: while technological constraints such as battery capacity or scheduling complexities can be managed, optimized, and eventually overcome through engineering and data-driven planning, the physical landscape of a country is constant. Weather and terrain conditions vary significantly across markets, and because these circumstances cannot be changed or optimized away, they form the critical baseline for market evaluation framework. Hence, as illustrated in *table 4.1*, these factors are isolated as the core of the Transport operations category, enabling a more authentic evaluation of market attractiveness and feasibility by acknowledging that while technology is flexible, geography and climate determine a BET’s true range and reliability.

Table 4.1: Factors included in “Transport operations”

Category	Factors
Transport operations	Weather conditions Terrain conditions

4.1.2. Charging infrastructure

Charging infrastructure serves as the fundamental backbone of the transition to electric road freight, acting simultaneously as a key enabler and a primary operational barrier (Gillström et al., 2024). The literature emphasizes that

strategic decisions regarding infrastructure are no longer merely technical inputs but core determinants of business viability (Alarcón et al., 2023). These decisions revolve around a complex interplay between charging locations - ranging from private depots to public en-route stations - and power levels, including the emergence of megawatt-scale systems. The integration of these elements directly dictates vehicle utilization, scheduling flexibility, and the overall feasibility of electric logistics flows (Gillström, et al. 2024).

A clear hierarchy of charging solutions has emerged from actor interviews and academic research, with depot charging forming the economic foundation of the industry. For 3PLs, carriers, and shippers, charging at company-controlled locations or customer sites represents the most cost-efficient strategy, allowing for “home charging” that avoids the high premiums associated with public infrastructure. (Gillström et al., 2024) While public charging is recognized as a necessary tool for extending operational range and enabling long-haul transport, it is currently viewed as a secondary support system rather than a routine solution. To bridge this gap, actors are increasingly exploring contractual agreements to lower public charging costs and integrating high-power MCS to minimize downtime and maintain productivity levels comparable to traditional diesel operations. (Alarcón et al., 2023)

However, the scaling of this infrastructure is severely challenged by systemic constraints, most notably grid capacity. The availability of electrical power - rather than the physical installation of chargers - often sets a “hard limit” on electrification at terminals and industrial sites. Current grid connection processes are frequently described as slow and inflexible by interviewees, posing a significant hurdle for smaller actors. In response, some industry actors are shifting toward energy system integration, utilizing on-site solar production and battery storage to bypass grid limitations. (Gillström et al., 2024)

This interdependence between charging infrastructure and the broader energy system underscores that electrification is not only a matter of establishing physical grid connections, but also of securing access to a sustainable energy mix in order to meet decarbonization targets. Accordingly, the environmental benefits of electrification are closely linked to the composition of the electricity supply, with emissions reductions depending significantly on how and where the energy is generated - thereby complicating the assessment of overall sustainability outcomes. (Gillström et al., 2024) This perspective is further supported by the interviews, where respondents generally describe the Swedish energy system as relatively transparent and reliable in terms of its green credentials. At the same time, several interviewees note that electricity in other European countries is often perceived as less sustainable, with a reputation for being associated with more carbon-intensive energy sources. Additionally, a further challenge concerns the substantial environmental footprint associated with battery manufacturing, alongside the growing need to implement circular economy practices, such as effective battery reuse and lifecycle management. (Alarcón et al., 2023) This issue is also consistently emphasized by interview participants, who frame it both as a sustainability concern and as a source of uncertainty within the transition.

In sum, the factors selected for the market evaluation framework are shown in **table 4.2** and represent the critical enablers that indicated market attractiveness and feasibility for electric road freight. Public charging availability is included as it defines the operational boundaries of a fleet, determining whether electric trucks can transition from short-haul loops to flexible, long-distance routes. Further, grid connection is selected as the primary structural bottleneck; it serves as a proxy for the scalability of an operator's headquarters or terminal, where limited capacity can halt growth regardless of truck availability. Finally, grid mix is incorporated to address the environmental value proposition of the infrastructure, ensuring that the transition results in carbon reduction and aligns with the requirements increasingly demanded by shippers and regulators.

Table 4.2: Factors included in “Charging infrastructure”

Category	Factors
Charging infrastructure	Public charging availability Grid connection Grid mix

4.1.3. Regulations

Regulations play a central role in shaping the adoption and operational strategies of electric freight, influencing everything from vehicle design and route planning to charging infrastructure and TCO. Across the external interviews, all emphasize that predictable and coherent rules are critical for scaling electrification effectively.

Taxes are seen as drivers for adoption, according to several 3PLs, carriers, and shippers. Carbon pricing and the relative cost of fossil fuels create direct economic incentives for electrification. Many carriers and shippers note that low diesel prices today reduce the financial attractiveness of electric vehicles, while higher carbon costs would make electric vehicles more competitive. Tax exemptions, carbon taxes, and EU initiatives such as ETS2 are also recognized as important levers to shift operating economics in favor of low-emission transport. However, inconsistent application of these measures between regions, and uncertainty about future pricing, limits their effectiveness.

Financial incentives remain critical to bridge the investment gap between electric and diesel vehicles. Programs like Sweden’s *Klimatpremier* provide support for electric truck purchases, covering part of the cost difference in relation to traditional trucks, but actors highlight administrative complexity and long processing times as major barriers. Effective incentives, they stress, must be simple to apply for and predictable over time. Public procurement is another

mechanism, allowing shippers and institutional customers to require low-emission transport even when private customers are unwilling to pay a premium. Similarly, frameworks like the SBTi and sustainability reporting requirements provide indirect regulatory pressure, pushing companies to reduce emissions and thereby, creating increased market demand for electrified trucks.

Operational and technical regulations are also factors in the practical use of electric trucks. Maximum weight allowances and the possibility of weight compensation for battery-heavy trucks are vital to avoid operational inefficiencies. Driving and rest time regulations interact with charging needs, making synchronized charging during natural breaks essential to avoid unproductive downtime. Low- and zero-emission zones, as well as restrictions on night-time deliveries in certain cities, further constrain route planning and scheduling, highlighting the need for regulatory adaptation to support usage.

Further, actors mention that regulations act as a market pull mechanism. Well-designed rules create demand that would not emerge spontaneously, particularly for longer or heavier transport flows. Public procurement requirements provide structured incentives for carriers to adopt electric vehicles, effectively reducing market risk and accelerating adoption. Harmonized rules across borders and sectors can further increase predictability, enabling coordinated investment in the network.

Finally, policy predictability is mentioned as a recurrent concerning factor amongst. Particularly among 3PLs, carriers, and shippers, uncertainty about rules governing fiscal measures, incentives, and carbon pricing limits long-term investment. Delays, abrupt changes, or lack of clarity in subsidy programs or climate policies create risk that many actors are unwilling or unable to shoulder, particularly smaller carriers with limited capital. Stable, long-term regulatory frameworks are seen as important to encourage broader fleet electrification.

In sum, the empirical insights suggest that a combination of fiscal measures (primarily taxation), financial incentives, operational and technical regulations, public procurement, and policy predictability collectively act as a market pull mechanism and create market attractiveness and feasibility. Accordingly, these are included in the market evaluation framework as illustrated in *table 4.3*.

Table 4.3: Factors included in “Regulations”

Category	Factors
Regulations	Taxes Financial incentives Operational and technical regulations Public procurement Policy predictability

4.1.4. Actors

The electrification of road freight is a multi-actor challenge, and successful implementation increasingly depends on robust collaboration across the value chain, including carriers, shippers, OEMs, energy providers, and financial stakeholders. (Gillström et al., 2024; Alarcón et al., 2023)

Interviewed carriers emphasize the role of large, committed customers in the electric transition. For instance, real-world cases mentioned in the interviews have enabled pilot deployments of electric trucks, with transport operations adapted without significant cost increases for the customer. Similarly, 3PLs collaboration has helped share financial burden associated with electrification, demonstrating how relationships can align operational and economic motives.

Shippers also play an important role, both as demand drivers and as partners in risk sharing and allocation. As an example, they can coordinate closely with carriers to enable practical deployment of electric trucks, including

considerations such as night-time deliveries, route optimization, and charging access. The high operational and financial risks associated with new technology have led shippers to seek deeper partnerships rather than traditional transactional relationships. Institutional customers with strict sustainability goals often act as catalysts for electrification, but their limited willingness to absorb higher costs means shared-risk structures or extended contracts are essential. Coordination with property owners and facility managers is another necessary component, as infrastructure access and operational flexibility, such as nighttime loading, are critical for electric vehicle efficiency.

Furthermore, OEMs are no longer simply suppliers of vehicles. Their role has expanded to include advisory functions, technical support, and multi-party collaboration. Effective electrification is supported by joint planning among OEMs, carriers, shippers, and energy infrastructure providers. OEMs e.g., provide guidance on route planning, battery management, and charging strategies, and they help bridge knowledge gaps for smaller carriers who may lack the resources to manage complex technology transitions. Transparency in design, such as clear information on battery materials, is also increasingly important to support sustainable decision-making across the logistics chain.

Energy providers and grid operators are also necessary partners in enabling operational feasibility. 3PLs, carriers, and shippers highlight the need for proactive engagement from grid operators to ensure sufficient capacity, green energy supply, and reliable access to charging infrastructure. A 3PL interviewed, demonstrate the two-way nature of collaboration, sharing operational data with OEMs to improve trucks and in exchange for access to try their new features.

Finally, financial institutions and governments are also mentioned to shape the electrification network by reducing investment risk through long-term financing, subsidies, and predictable regulations. Public actors influence outcomes via e.g., procurement, support schemes, and legal frameworks.

Despite the inherent complexity and importance of the actor network revealed through the external interviews, research indicates a significant gap in the inclusion of these stakeholder perspectives within existing literature. While logistics companies, hauliers, manufacturers, governments, and local authorities are frequently mentioned in literature, few studies examine how incentives, risks, coordination challenges, and decision processes differ across stakeholders. The dominance of mathematical modelling over qualitative methods in literature indicates that institutional barriers, behavioural responses, and practical implementation challenges remain underexplored - despite being critical for real market uptake. (Gillström, et al. 2024)

In summary, the empirical insights reveal different actor types, all induced in the market evaluation framework as outlined in *table 4.4*. In addition to traditional road freight industry actors, grid and energy providers emerge as critical actors in assessing market attractiveness in the context of electrification.

Table 4.4: Factors included in “Actors”

Category	Factors
Actors	Logistics companies and hauliers Shippers OEMs Energy providers and grid operators Governments and local authorities

4.1.5. TCO

The economic perspective is a central theme across both the literature review and the external interviews, framed as a critical factor in the feasibility of the transition to electric trucks where the economic calculus serves as a primary determinant of a market’s overall attractiveness. Rather than focusing solely on

purchase price as a comparison, TCO provides a holistic view of the financial impact throughout the vehicle's lifecycle, accounting for various long-term expenses including vehicle purchase cost, fueling, maintenance, infrastructure investments, and residual value.

Gillström et al. (2024) highlights a trade-off between high upfront investments and potentially lower operating expenses for electric vehicles. Electric trucks require significant capital outlays for vehicles, grid upgrades, and charging infrastructure, while benefiting from lower energy costs, reduced maintenance, and lower emissions. However, electricity prices vary substantially by location and contract structure, adding uncertainty to TCO calculations, reinforcing the importance of regulatory context and energy market conditions in shaping market feasibility.

This is further supported by Alarcón et al. (2023), where economic and competitive aspects focus on the financial viability and market competitiveness of electric vehicles compared to ICE vehicles. In this context, TCO is the most prominent valuation method, integrating factors like high upfront purchase prices against lower operating and maintenance costs. While EV are becoming cost-competitive, Alarcón et al. (2023) suggests that HDTs often require subsidies, tax incentives, and a long-term perspective of over ten years to bridge the financial gap, while barriers such as electricity price instability and the “break-even” distance remain critical hurdles for logistics companies. Similar discussions are driven by interviewed actors. A frequent factor related to TCO identified by these actors is the significantly higher upfront cost of electric trucks, as electric trucks currently cost two to three times more than its diesel counterpart. These actors also highlight the long-term financial implications, including extended contract durations and amortization periods, which are often necessary to distribute costs effectively. OEMs acknowledge this challenge, emphasizing the need for innovative financial solutions, such as VaaS-models or longer leasing contracts, to mitigate the risk of tying capital to rapidly

evolving technology. At the same time, rapid technological advancements challenge contract structures and the associated risk allocation within them.

Furthermore, the interviews highlight the importance of effectivizing operations to reach TCO parity with diesel. Energy costs and charging infrastructure also play a vital role in TCO calculations. While depot-based charging offers lower unit costs, reliance on public charging remains expensive despite potential contractual agreements for lower rates, particularly for high-power or long-haul operations.

Interviewed carriers and 3PLs note that infrastructure investments, including MCS charging, cabling, and grid access, are substantial and create additional financial burdens. At the same time, strategic investments in depot infrastructure, solar integration, or energy management can improve operational efficiency and reduce long-term costs, highlighting the importance of aligning charging strategies with operational flows. Furthermore, 3PLs, carriers, and shippers, highlight that fluctuations in electricity prices create significant uncertainty, while the relative cost of electricity compared to fossil fuels strongly influences strategic decisions.

Market and customer dynamics further shape these TCO considerations. Interviewed 3PLs and carriers mention that cost-sensitive customers often resist paying premiums for electrified transport, while large clients may accept higher costs due to reasons ranging from internal reporting targets to portation and image. As a result, risk-sharing mechanisms - such as jointly investing in vehicles or infrastructure - emerge as strategies for managing financial risks. 3PLs and shippers also emphasize the need for flexible pricing models and indexation of transport costs to account for fluctuations in electricity prices and energy availability, ensuring that electrification does not compromise competitiveness and profitability.

Finally, interviewed actors recognize that the economics are context-dependent. Distribution operations with predictable, short routes already approach TCO parity with diesel, particularly when high truck utilization and depot charging are achievable. In contrast, long-haul operations remain financially challenging, largely due to infrastructure gaps, limited high-power charging, and the need for precise operational coordination. Thus, OEMs predict broader TCO parity for long-haul electric freight, likely around 2028 in Europe, as battery technology, charging networks, and regulatory frameworks mature. However, this goal has been delayed since the previous reporting period, underscoring the risk of further postponements of TCO parity.

Ultimately, TCO serves as the key synthesis of market attractiveness, as most critical factors - including charging infrastructure, operational complexity, and regulatory developments - ultimately feed into the TCO calculation, making it a central metric for evaluating the transition. To enable a clearer structure of the framework, factors that are not purely cost-based have been allocated to other corresponding categories, such as charging and regulations. This leaves two primary TCO variables: the price differential for fuel (electricity versus diesel) and the up front vehicle purchasing price (see *table 4.5*).

Table 4.5: Factors included in “TCO”

Category	Factors
TCO	Fuel price delta Vehicle purchasing price

4.2. Framework synthesization

Building on the theoretically developed framework from chapter 3. *Theory* and its subsequent empirical development through literature and interview insights, this chapter 4.2. *Empirical insights - Framework synthesization* synthesizes the insights into a consolidated, industry-specific market evaluation framework for

heavy-duty electric road freight. This is presented in *table 4.6*. The original theoretical framework has been developed based on empirical insights, resulting in a structure that preserves its conceptual logic while reflecting the industry.

Table 4.6: Empirical market evaluation framework

Categories	Factors
Aggregate market factors	Total transport market size Total transport market growth Electrification adoption Freight clusters
Transport operations	Weather conditions Terrain conditions
Charging infrastructure	Public charging availability Grid connection Grid mix
Regulations	Taxes Financial incentives Operational and technical regulations Public procurement Policy predictability
Actors	Logistics companies and hauliers Shippers OEMs Energy providers and grid operators Governments and local authorities
TCO	Fuel price delta Vehicle purchasing price

The aggregate market factors remain the overarching analytical layer but have been substantially reinterpreted to reflect electrification-specific market dynamics. Rather than relying solely on general indicators such as total market size and growth, the framework distinguishes these from the specific trajectory

of electrification adoption. This distinction captures the dual-layered nature of the transition, where overall freight demand evolves independently of electrification uptake. In addition, freight clusters are introduced to reflect geographical and structural concentrations of transport demand, which are critical for identifying viable electrification pathways. Operational conditions - such as transport operations, weather conditions, and terrain conditions - further contextualize feasibility, highlighting that electrification performance is strongly dependent on real-world operating environments. Charging infrastructure is explicitly incorporated as a core enabling factor, differentiated into public charging availability, grid connection capacity, and grid mix, collectively determining the scalability of electrified freight systems.

The actor dimension consolidates the multi-stakeholder ecosystem shaping electrification outcomes. It explicitly includes logistics companies and hauliers, shippers, OEMs, energy providers and grid operators, and governments and local authorities. Empirical findings emphasize that electrification is not driven by isolated firm-level decisions but by interdependent value chain coordination, where vehicle availability, infrastructure access, and operational readiness must align across actors.

The regulatory dimension has been refined to reflect its multi-layered influence on electrification. Rather than broad political or regulatory groupings, the framework differentiates between taxes, financial incentives, operational and technical regulations, public procurement, and policy predictability. Empirical insights particularly underline the importance of regulatory stability, where uncertainty in long-term policy direction can significantly delay investment decisions, even in otherwise economically viable cases.

Finally, TCO is identified as a central decision-making variable, shaped primarily by fuel price delta and vehicle purchase subsidies. These economic

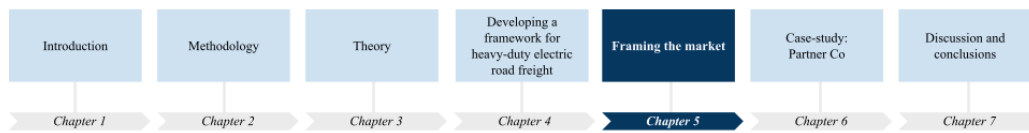
levers are consistently highlighted in both literature and interviews as critical determinants of adoption timing and scale for heavy-duty BETs.

Overall, the synthesized framework bridges theoretical constructs with empirical observations, developing general market and industry theory into a structured, industry-specific framework. It captures not only traditional market dynamics but also the infrastructural, operational, and systemic interdependencies that define the transition toward electric road freight.

Chapter 5

5. Framing the market

This chapter contextualises the theoretically and empirically developed framework within the European road freight industry, based on desk research. However, some data are limited to the European Union due to availability constraints.



5.1. Aggregate market factors

Understanding the broader market context is essential for assessing the transition toward electrification in Europe's heavy-duty road freight industry. Accordingly, this chapter provides an overview of the European transport market by examining its current size and growth trajectory, as well as the pace of electrification adoption. In addition, it introduces the concept of freight clusters to highlight how geographical and structural concentrations of transport demand influence the feasibility and attractiveness of electrification.

5.1.1. Total transport market size

The market size of the EU road freight industry can be measured in either financial value or in terms of volume, specifically in tonne-km. Financially, the transport system plays a vital role in the European economy. The system contributes approximately 5% to the GDP in the EU and provides jobs for over 10 million people across the continent. It is important to note, however, that these figures encompass all modes of transportation combined. (European Commission, 2025)

Focusing specifically on the logistics sector, the European road freight transportation market was estimated at USD 814.14 billion in 2025 (Market Data Forecast, 2026). To put this financial market size into perspective, road freight accounts for approximately 25% of all freight transport based on tonne-kilometers. Most notably, this represents 75% of all inland freight activity across Europe, underscoring the vital role of road networks in the region's internal logistics. (Eurostat, 2025)

5.1.2. Total transport market growth

Following a valuation of USD 814.41 billion in 2025, as mentioned in *5.1.1. Total transport market size*, the European road freight transportation sector is

projected to reach USD 869.95 billion by 2026. This upward trend is expected to continue through 2034, with the market reaching an estimated USD 1.47 trillion. This represents a steady compound annual growth rate CAGR of 6.82% over the eight-year forecast period from 2026 to 2034. (Market Data Forecast, 2026)

Looking more closely at truck sales, the overall truck sales in Europe declined by 6% in 2025. However, the sales of electric HDTs in the EU increased by over 70% year-over-year, and reached almost 13,000 trucks. (CLECAT, 2026)

5.1.3. Electrification adoption

The road transport system, both globally and within Europe, remains dominated by a long-established, diesel-reliant regime. Having governed the road transport system for over a century, this system is highly stable and creates lock-in mechanisms that challenge the transition to electric freight. This stability is clearly reflected in the current composition of the European fleet. As of 2024, a staggering 96.3% of all trucks in the EU still operate on diesel, while battery-electric trucks represent a marginal share of 0.3% (ACEA, 2026d).

Looking at the market share of new registrations in the heavier segment for trucks over 16 tonnes, the electric share reached 3% in 2025. This indicates that while the existing fleet is still dominated by internal combustion engines, new truck sales are beginning to shift toward zero-emission alternatives, with forecasts suggesting this market share will exceed 5% by 2026. (CLECAT, 2026)

5.1.4. Freight clusters

Freight clusters - often referred to as logistics clusters or hubs - are geographic concentrations of companies and institutions involved in the transportation, storage, and distribution of goods. (Sheffi, 2013) In the European market, these

are central to the regional economy, acting as nodes that facilitate intermodal transport and cross-border logistics as they encompass a wide array of actors, including 3PL providers, carriers, and the internal logistics divisions of manufacturers and retailers. (Rivera et al., 2016)

The formation and growth of freight clusters in Europe are driven by “positive feedback” loops where the co-location of diverse firms leads to shared resources, improved human networks, and significant productivity gains (Sheffi, 2012). Consequently, these clusters provide several competitive advantages such as operational efficiency, knowledge transfer, as well as economic spillover implications. More details are provided in *table 5.1* below.

Table 5.1: Effects of freight clusters

Competitive advantage	Description
Operational efficiency	Proximity allows for cargo consolidation and increased capacity utilization, reducing total inventory requirements (Blancas et al., 2022)
Knowledge transfer	Geographical clustering fosters knowledge sharing and the rapid adoption of new technologies, such as digital supply chain tools and data analytics (Liu et al., 2022)
Economic spillovers	Clusters attract a specialized labor pool and specialized service providers (e.g., truck maintenance and IT support), diversifying the local economic base and creating varied employment opportunities (Sheffi, 2012; Rivera et al., 2016)

The European road freight industry is characterized by a high concentration of these hubs, particularly in countries with developed industrial bases. According to Europlatforms data, there are over 240 major logistics centers across the EU, with nearly half located in Germany, Spain, France, and Italy. These hubs, such as the German Freight Villages in Leipzig and Bremen, are often strategically linked to rail, road, and inland waterway networks (Biblioteka Nauki, 2018).

In the European context, freight clusters function as the primary catalysts for systemic change. Research from Chalmers University of Technology through the REEL initiative demonstrates that freight does not move through isolated routes, but rather through interdependent networks where clusters act as high-density nodes. Hence, these clusters as strategic priority zones for the deployment of e.g., high-power charging. By concentrating infrastructure at these hubs, the return on investment is maximized, as the shared use of charging points across multiple logistics providers at a single cluster reduces the TCO for the entire network. (Chalmers University, 2026)

5.2. Transport operations

Weather and terrain conditions come with operational challenges for electric trucks, influencing the energy efficiency and driving range. As these conditions vary across Europe and throughout the different seasons, its effects introduce local and temporal variability in truck performance. This necessitates that operators account for these varying factors in e.g., route and energy planning.

5.2.1. Weather conditions

Temperature remains the most critical factor. As temperatures drop, energy consumption rises to accommodate cabin heating, battery thermal management, and increased fluid density in mechanical components. Research indicates that the most volatile rate of change occurs in the critical transition range between -5°C and 7°C, where even minor temperature fluctuations can lead to substantial shifts in predicted driving range. In addition, humidity's impact is tied to temperature. In cold environments, high humidity drives up consumption through more effective heat transfer and ice formation, whereas its effect becomes negligible in warmer conditions. Furthermore, snow cover consistently leads to higher predicted energy needs. (Umeå University, 2024)

Aerodynamics is another important factor to consider, as energy consumption increases exponentially with wind speeds between 5 km/h and 35 km/h before stabilising at higher velocities. The impact of precipitation is non-linear: while low levels (below 6 mm/h) may result in slightly lower consumption due to cautious driving behaviors, exceeding this threshold causes a spike in energy needs due to increased rolling resistance and air drag. (Umeå University, 2024)

5.2.2. Terrain conditions

Europe's landscape is a mix of geological features that create different "operational zones" for road freight. While flat terrain allows for more predictable range estimation, challenging topographies can present unexpected efficiency advantages for electric trucks compared to diesel counterparts, given that energy recovery through regenerative braking is effectively managed.

Europe's topographical landscape is categorized into four main landforms and zones according to *figure 5.1*. The Northern Lowlands, stretching from the Pyrenees through the Benelux, Germany, and Poland into Russia. Their flat terrain is ideal for electric trucks, allowing for high-speed transport with the most predictable battery range. The Alpine Region, encompassing the Alps, Carpathians, and Pyrenees, presents a high-power challenge due to steep gradients, yet it remains surprisingly favorable for electric trucks that can recover energy through regenerative braking during long descents. The Western Highlands, including the Scandinavian Peninsula, Scottish Highlands, and parts of the Iberian Peninsula, offer rugged and often colder environments where rolling terrain and elevation changes require more complex energy management. Finally, the Central Uplands consist of hilly, fragmented landscapes that create elevation changes. (LOUIS: The Louisiana Library Network, No date)

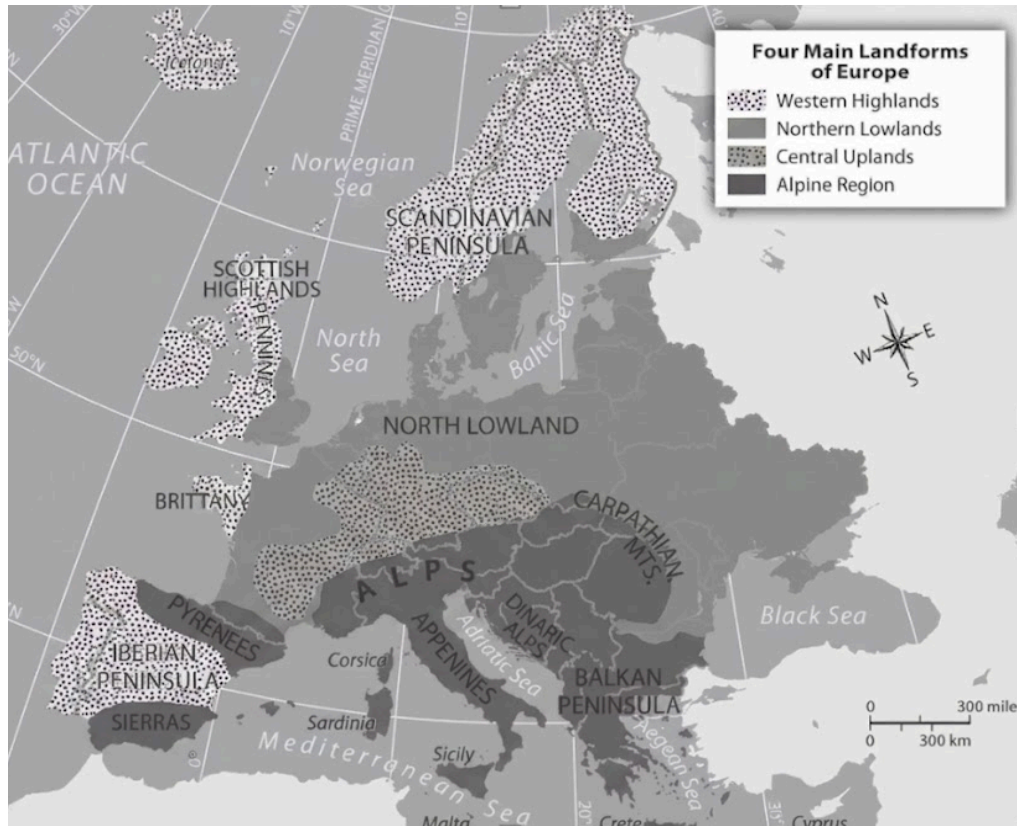


Figure 5.1: The four main landforms of Europe

5.3 Charging infrastructure

The availability of charging infrastructure is fundamental to the operation of BETs. In the EU, Regulation (EU) 2023/1804 on the deployment of alternative fuels infrastructure (AFIR) serves as a driver for establishing such required infrastructure. The directive has specific targets to ensure a minimum level of infrastructure to support the uptake of alternative fuels (including electricity), guarantee full interoperability, and provide comprehensive user information along with adequate payment options. (European Commission, 2024)

5.3.1. Charging availability

According to the latest EU figures, there are 1512 public HDV charging stations, of which 1369 are located at mixed-use sites (also for LDV) and 143 are exclusively dedicated to HDVs. This data indicates that the majority of public charging stations are located in mixed-use environments. Private depot or fleet-only sites are excluded. The distribution of these stations across the EU is illustrated in **figure 5.2**. As shown, the Member States with the highest number of charging stations are Germany (479), Sweden (278), the Netherlands (246), Denmark (158), and France (101). (EAFO, 2025)

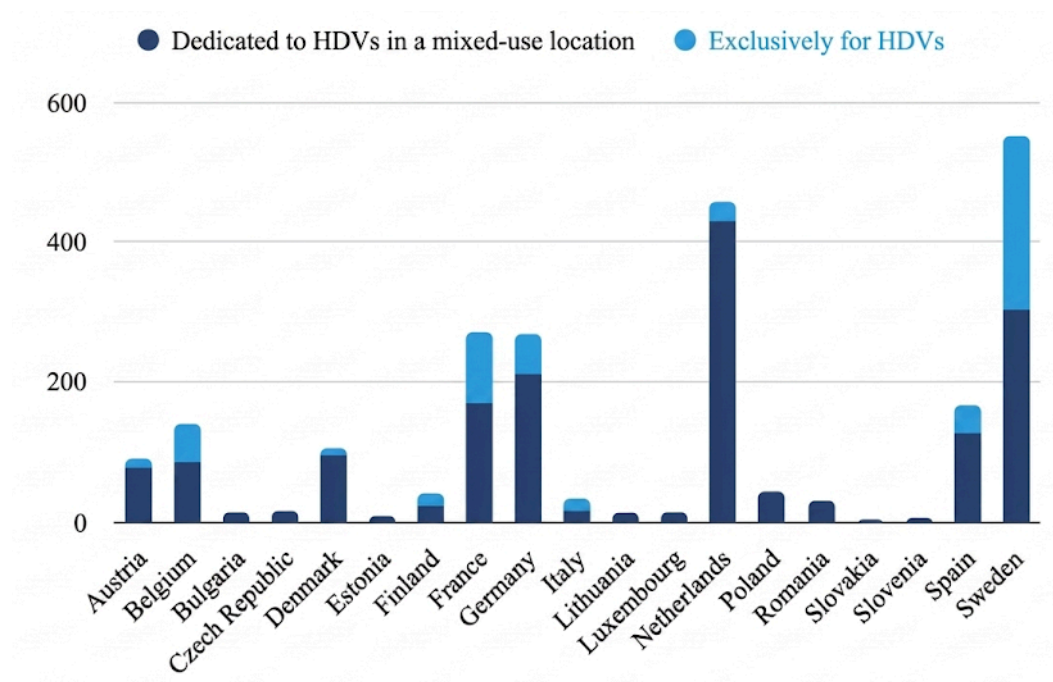


Figure 5.2: Public HDV recharging points across the EU

Further, charging power levels influence the time required to charge electric vehicles and battery performance and degradation over time. They also impact overall cost dynamics: from hardware to installation and grid connection costs.

Electric vehicle charging relies on two types of current: alternating current (AC) and direct current (DC). Both are supported by the standard CCS2 (Combined Charging System Type 2). While electricity from the grid is supplied as AC, vehicle batteries can only store DC power. Hence, the distinction between AC and DC charging lies in where this conversion takes place. In AC charging, the conversion occurs inside the vehicle via an onboard charger, which typically results in slower charging speeds. In contrast, DC charging performs the conversion externally within the charging station, allowing electricity to be delivered directly to the battery and enabling charging at a higher speed. In other words, AC charging delivers a constant power level, whereas DC charging follows a tapering curve, with high initial power that decreases as the battery approaches full capacity. **Figure 5.3** illustrates these differences. (go-e, 2025)

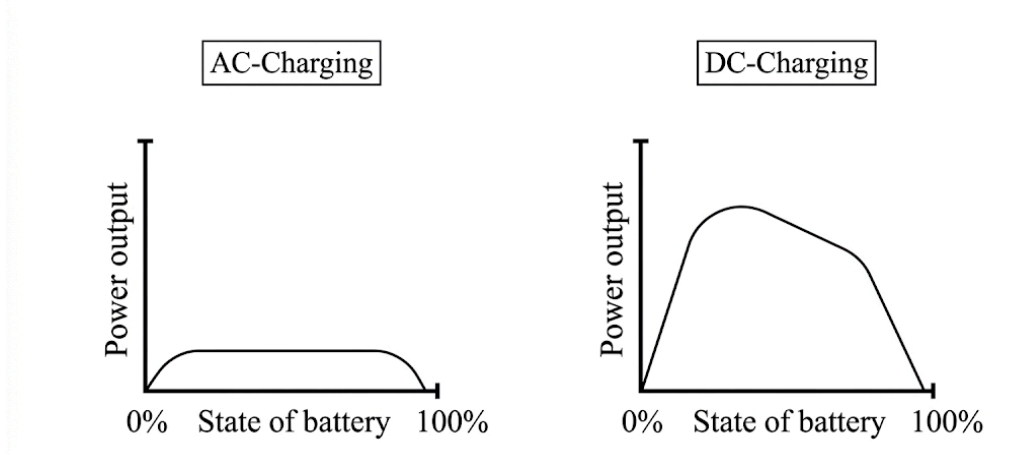


Figure 5.3: Power output from AC versus DC charger

For home charging, AC chargers are generally the most practical option. Although installing a DC charger at home is technically possible, it is rarely justified due to higher costs, larger space requirements, and greater technical complexity, including cooling systems and the need for a high-capacity grid connection. In addition, frequent use of DC charging is not typically recommended. The frequent use of high-power DC fast charging can accelerate battery degradation due to increased thermal load and electrical stress. In contrast, AC charging is generally better for battery health because it delivers lower, more stable power, reducing heat generation and stress on the battery over time. As a result, DC chargers are primarily deployed in public settings, such as along highways, to support fast charging during long haul operations, while AC chargers are better suited for residential use. (go-e, 2025)

Furthermore, when focusing on heavy-duty BETs, DC charging becomes the only practical solution due to their large battery capacities and operational requirements. Within this context, the emerging MCSs represent a significant technological advancement. While current standards such as CCS2 typically deliver up to 350-400 kW, MCS is designed to provide charging power of up to several megawatts, enabling substantially faster charging. This allows trucks to recharge from approximately 20% to 80% within a typical 45-minute driver rest period, thereby integrating charging into existing operational schedules. In addition to reducing downtime, MCS enables the use of smaller battery packs, which can improve payload capacity and overall transport efficiency. While CCS2 remains suitable for depot and overnight charging, MCS is expected to play a critical role in enabling long-distance, high-utilisation for heavy-duty electric freight. (Scania, 2026) However, a key challenge is that not all sites are suitable for this technology, as infrastructure upgrades - such as transformers and substations - can be complex and costly. In addition, requirements for enhanced grid connections (*see more in Chapter 5.3.2. Grid connection*), increased spatial capacity, and advanced cooling systems may further extend installation timelines. (Sarmmah, 2025)

5.3.2. Grid connection

Grid connection refers to the physical - including transformers, substations, and power lines - and administrative process through which electricity producers (e.g., renewable energy installations) and consumers (such as industry, households, or electric vehicle charging infrastructure) are connected to the electricity network. Therefore, this interconnected system must remain resilient to ensure a reliable flow of electricity from producers to consumers without disruptions. It also allows excess self-generated electricity to flow back into the grid. (Eurelectric, 2026)

The EU operates an extensive and resilient electricity system, comprising over 11 million kilometres of interconnected grids. This system enables both cross-border electricity flows and supports the functioning of the internal energy market. However, with increasing electrification and the rapid expansion of renewable energy, demand for grid connections is rising significantly on both the supply and demand sides. Based on the Grid Action Plan (2023) - a part of the European Green Deal -, electricity consumption in the EU is projected to increase by around 60% by 2030, requiring substantial expansion, digitalisation, and reinforcement of the grid infrastructure. (European Commission, 2026b)

Consequently, the EUs grids face growing challenges. These include insufficient capacity to accommodate new connection requests, lengthy permitting procedures, ageing infrastructure - approximately 40% of distribution grids are over 40 years old -, and emerging security risks. Delays in grid expansion and connection queues have also become a bottleneck for renewable energy deployment and electrification efforts, including charging infrastructure for electric vehicles. In response, the European Commission has introduced initiatives such as the Grid Action Plan (2023) and the European Grids Package (2025) - and in particular, the Guidance on efficient grid

connections -, which aim to accelerate infrastructure development, improve cross-border coordination, streamline permitting processes, and mobilise an estimated €584 billion in investments needed by 2030. Nevertheless, ensuring timely grid expansion and efficient connection processes remains a challenge for achieving energy transition targets. (European Commission, 2026b)

5.3.3. Grid mix

The EU's electricity mix is currently balanced between carbon-free and fossil-based sources. As of early 2024, half of the EU's electricity was generated from renewables like wind and solar, while nuclear power served as a low-carbon contributor at 24%. However, a quarter (26%) of the generation still relied on fossil fuels such as coal and gas, which the EU aims to displace through decarbonization targets. (Eurelectric, 2026)

Historically, the grid mix was managed through a uni-directional flow consisting of large, centralized power plants (often fossil or nuclear) sending electricity through high-voltage transmission lines to passive consumers. Today, this is being replaced by a decentralized model and bi-directional flow. In this new system, small-scale generation assets like solar and wind farms are connected directly to the distribution grid - i.e., closer to where the energy is consumed - for capacity and customer proximity reasons. (Eurelectric, 2026)

By 2030, it is projected that 70% of renewable capacity will be connected directly to distribution grids. This transition to a renewable-heavy energy mix introduces technical complexities. One challenge is the emergence of bi-directional flows, as rooftop solar systems both consume and feed electricity back into the grid, requiring more complex system management. In addition, the variable and intermittent nature of wind and solar generation necessitates greater grid flexibility, supported by solutions such as energy storage, heat pumps, and electric vehicles to balance supply and demand. Furthermore,

increased investment is required to avoid capacity constraints that could limit the integration of new renewable sources, with estimates suggesting that distribution grid investment must double to approximately €67 billion annually through 2050. (Eurelectric, 2026)

5.4. Regulations

This chapter highlights regulatory pillars that characterizes and influences the current and future outlook of the heavy-duty road freight industry in Europe.

5.4.1. Taxes

The taxation environment for road freight is shifting from simple infrastructure cost recovery to an active tool for decarbonization. The central mechanism for this shift is the revision of the Eurovignette Directive (Directive 1999/62/EC), which mandates that Member States vary road charges based on the CO₂ emissions of HDVs. The amendment introduced by Directive (EU) 2022/362 requires Member States to implement CO₂-differentiated tolls for trucks over 3.5 tonnes. This framework categorizes vehicles into five CO₂ classes (***table 5.2***), based on their emissions as calculated by the VECTO. Class 1 includes vehicles with the highest emissions, while Class 5 is reserved for zero-emission vehicles. (Dalerstedt, 2024; European Commission, 2026c)

Table 5.2: CO₂ classes for HDTs and toll impacts

Class	Description	Truck examples	Toll impact
Class 1	Do not fall into any of the other CO ₂ classes	Older (by default before 2019)	Subject to highest CO ₂ surcharges
Class 2	More than 5% below the reference value	Fuel-efficient	Significant discount to Class 1
Class 3	More than 8% below the reference value	Advanced ICE	Higher discount than Class 2
Class 4	More than 50% below the reference value	Hybride	Minimal surcharges
Class 5	Zero-emission	Battery-electric	Near-full exemption from surcharges

Germany was the first to implement this system in December 2023, followed by Austria and the Czech Republic in 2024. By 2025, other countries, including Denmark and Slovakia, joined the framework. (DKV Mobility, 2026) The economic implications are profound. To exemplify, in the Austrian “GO-Maut” system for 2025, a standard 2-axle configuration BET paid approximately €0.0577/km, while a Euro VI diesel truck in Class 1 paid €0.2566/km. (ASFINAG, 2026)

Further, year 2026 has already introduced, and will continue to bring, toll rate adjustments, expansion of toll classes, and the gradual replacement of the traditional time-based Eurovignette with distance-based kilometer toll charging. These developments will affect both traditional road toll countries and those introducing new systems or responding to the Eurovignette Directive. For example, in Poland, the toll adjustment in early 2026 represents one of the most significant regional increases, with rates for HDVs increasing by over 40% to encourage more environmentally friendly transport alternatives. Conversely, the Dutch system is designed to provide maximum predictability, with zero-emission 32-tonne vehicles paying roughly 19% of the toll charged to their

Euro 6 diesel counterparts. **Table 5.3** lists toll implementation and tax details for selected European countries for 2025 and 2026 (trans.iNFO, 2025).

Table 5.3: Toll implementations for selected countries

Member State	Implementation	Tax detail
Denmark	January 1, 2025	Launching CO ₂ -differentiated distance tolls
Czech Republic	January 1, 2026	New road toll price list with higher CO ₂ rates
Poland	February 1, 2026	Increasing CO ₂ rates by 40-42% for high emitters
Netherlands	July 1, 2026	Abandoning Eurovignette for km-based tolling

As a future outlook, a development for the road freight industry is the upcoming EU Emissions Trading System for road transport and buildings (ETS2), which is scheduled to go live in January 2028, after being negotiated and postponed by the European Council and European Parliament. Unlike the original ETS which covers industrial sites, ETS2 will place an emission cap on fuel suppliers, effectively introducing a carbon tax at the pump. The revenue generated from ETS2 is earmarked for the Social Climate Fund (SCF), which will become operational in 2026. This fund is designed to support the transition by providing financial aid to vulnerable households and micro-enterprises, including small transport operators, to invest in zero-emission mobility and infrastructure. However, industry associations like ACEA have expressed concerns regarding “double taxation”, where operators could be charged for CO₂ emissions both through road tolls and through the carbon price embedded in fuel costs. However, regulatory efforts are ongoing to ensure these two mechanisms are complementary. To summarize, if the system is introduced and managed successfully, it can support the European transition of road freight by reducing emissions, improving air quality, and enhancing energy security. (EEA, 2025)

5.4.2. Financial incentives

The high upfront cost of BET - typically two to three times that of their ICE counterparts - remains a barrier to adoption. To address this, both the EU and national governments have introduced targeted financial incentives, primarily to support vehicle acquisition and the deployment of charging infrastructure.

Individual Member States continue to offer purchase incentives, although some programs have begun to tighten their eligibility criteria in 2024 and 2025. To exemplify, in the Netherlands, the Aanschafsubsidie Zero-Emissie Trucks (AanZET) is a purchase subsidy that supports companies in acquiring new zero-emission trucks by reimbursing a share of the vehicle's cost. It applies to vehicles exceeding 3.5 tonnes, with higher subsidy rates available for smaller enterprises. Eligible trucks must be new, fully zero-emission, and not previously registered. By reducing the cost gap between ICE and zero-emission trucks, the scheme facilitates fleet electrification and supports compliance with emerging regulations such as zero-emission zones. (EAFO, 2026)

Beyond purchasing incentives, the Alternative Fuels Infrastructure Facility (AFIF), under the Connecting Europe Facility (CEF), is the primary funding vehicle for large-scale infrastructure projects. In late 2025, the European Commission approved over €600 million for 70 projects across 24 countries to electrify the TEN-T. A map of the transport network is provided in *figure 5.4*.

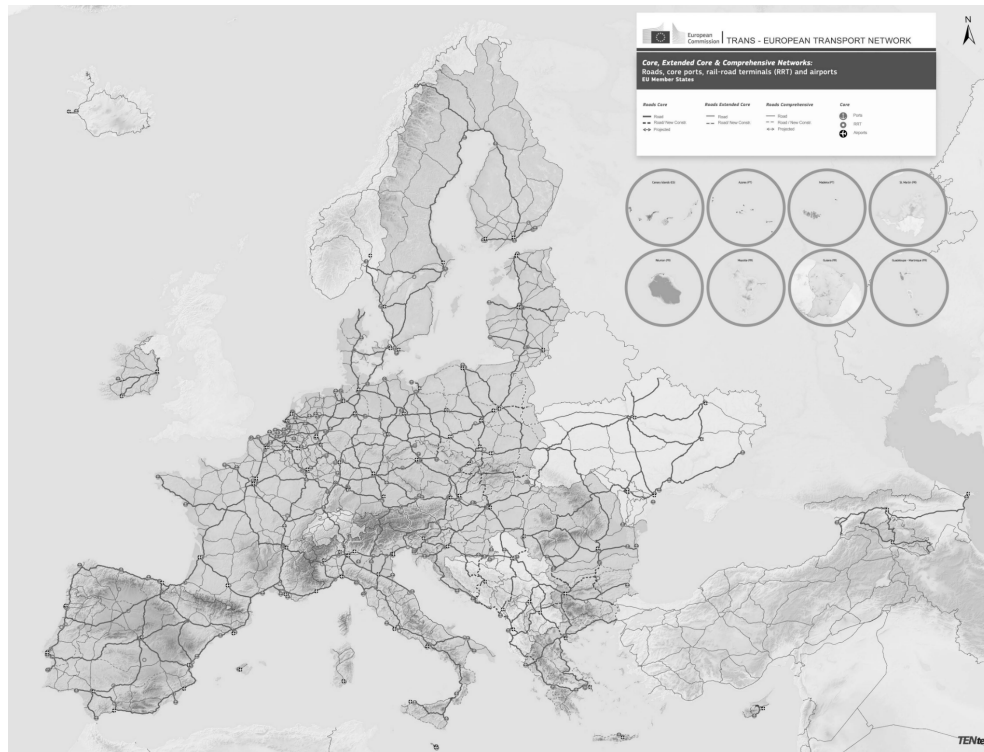


Figure 5.4: Road map overview of TEN-T

This includes investments across road, maritime, aviation, urban mobility, and logistics systems. However, road freight receives the largest share of AFIF support leading to several key outcomes including more than 3000 high-power recharging points for both light-duty and heavy-duty vehicles. In addition, progress has been made in rolling out MCS sites across countries such as Germany, Austria, Finland, the Netherlands, Sweden, and Spain. Cross-border corridors for HDVs are also being established, connecting major TEN-T axes. Furthermore, large-scale pan-European charging networks - such as those developed by Milence - are expanding rapidly. Representative projects for these outcomes are shown in **table 5.4**: (IEA, 2025a; CINEA, 2025)

Table 5.4: Representative projects under the AFIF support

Project	Countries included	Description
VARO HERCULES	NL, DE	548 HDV recharging points across 76 sites
Milence Infrastructure	AT, BE, DE, ES, FR, NL, SE	100 MCS + 64 CCS points across 25 sites
Engine Drive	FR, DE, ES, BE	135 HDV recharging points
OMV Pan-EU HDV network	AT, LT	242 HDV recharging points
Plugit Finland MCS network	FI	16 MCS chargers with battery storage

5.4.3. Operational and technical regulations

The shift to electrification is related to a transformation in the operational and technical regulations that govern how road freight is moved across Europe. These are designed to harmonize working conditions while removing the traditional physical and temporal barriers that have historically favored ICEs.

The EU's Mobility Package I and Regulation No 561/2006 represents a reform of legislation for road freight, aimed to avoid distortion of competition between countries, improve road safety, and ensure driver welfare. Provisions regulate driving and rest times, including a standard daily driving limit of 9 hours, extendable to 10 hours twice per week, and a maximum of 56 hours per week and 90 hours over a two-week period. Drivers must take a break of at least 45 minutes after a maximum of 4.5 hours of driving, which may be split into 15 and 30 minutes. Daily rest requirements are set at a minimum of 11 hours, with limited reductions permitted, while regular weekly rest periods must be at least 45 hours and cannot be taken in the truck cabin. In addition, reduced weekly

rest periods are subject to compensation, and employers are required to provide suitable accommodation for regular weekly rest. The rules also introduce flexibility in exceptional circumstances, allowing limited extensions of driving time to reach a place of residence or operational center. To ensure compliance, trucks are equipped with second-generation smart tachographs (G2V2). Furthermore, transport undertakings must organize operations so that drivers can return home or to their operational base at least once every four weeks. (European Commission, 2026a)

Further, electrification is unlocking new driving windows for freight through the inherent silence of zero-emission drivetrains. Several European jurisdictions are now leveraging this technical advantage to allow electric trucks to operate during night hours when diesel vehicles remain barred. Sweden recently (Autumn 2025) amended its regulations to allow municipalities to exempt zero-emission HDTs from night driving bans, aimed at alleviating daytime congestion, improving fleet utilization, and supporting the overall rollout of zero-emission logistics. (trans.iNFO, 2025; Electrive, 2025) Similarly, electric trucks are already permitted to cross the Brenner Pass between Austria and Italy at night, a critical corridor where diesel models are subject to strict bans. (MAN, 2025) Supporting these operational shifts is the PIEK-Keur noise standard, originated in the Netherlands in 2004, which provides a certification for trucks that emit less than 60-65 dB(A) in urban areas during the night, though the “quiet truck” standard allows up to 72 dB(A) for certain operations. This certification is increasingly becoming a prerequisite for night-time delivery status, allowing operators to conduct silent loading and unloading without disturbing residents. Electric trucks are inherently suited to this standard compared to its fossil fuel counterparts. (UNECE, 2018; Kotte A. et al., 2024)

However, payload limitations present a challenge to the operational utilization of electric trucks, primarily due to the substantial weight of the batteries required for their operation. To mitigate the “payload penalty” associated with

heavy battery packs, the EU is finalizing a revision of the original Weights and Dimensions Directive (96/53/EC). (European Commission, 2026e) The latest legislative approach increases the maximum permissible mass for zero-emission vehicles (such as trucks, buses, coaches and articulated vehicles) by up to 4 tonnes, effectively raising the limit for international transport to 44 tonnes. This allowance is specifically tied to configuration, with up to 4 tonnes granted for 6-axle combinations and 2 tonnes for other configurations. Additionally, articulated zero-emission trucks may be up to 0.90 meters longer to accommodate the necessary technology without sacrificing internal cargo volume. While the European Commission initially proposed increasing the drive-axle weight limit from 11.5 to 12.5 tonnes, this was rejected by Member States in late 2025 due to concerns about the impact on road and bridge infrastructure. (Council of the European Union, 2025) For operators, these compensations ensure that a typical long-haul electric truck can maintain near-parity in payload capacity with its diesel counterparts, particularly in sectors where volume, rather than weight, is the primary constraint. (European Commission, 2026e)

Consistent with the increased payload allowances, the implementation of ZEZs and LEZs across European cities is acting as a demand-side driver for electrification. In the Netherlands, 18 cities have already committed to introducing ZEZs for urban logistics by 2025 and 2026, where only commercial vehicles with zero tailpipe emissions will be permitted access to city centers. (Op weg naar ZES, No date) In France, the Greater Paris zone is tightening its restrictions while a grace period for Crit’Air 3 vehicles exists until the end of 2026, heavy-duty diesel vehicles must meet at least Euro 6 standards to enter during peak hours. (European Consumer Centre France, 2026) Nordic cities are also setting the pace for the strictest mandates: Stockholm’s central zone (Class 3) already bans all diesel vehicles regardless of their Euro class, allowing only electric or fuel cell vehicles. (Stockholms Stad, 2024) Likewise, Oslo is moving toward full ZEZs for commercial trucks, having received government

permission in March 2025 to implement these zones by 2026-2027. (Taylor, G., 2025)

5.4.4. Public procurement

“Public procurement is about public authorities buying goods, works (such as construction) or services from private companies”, according to the European Commission (n.d.b) definition. Relating public procurement to the road freight industry, the revised Clean Mobility Directive (Directive (EU) 2019/1161) is at its core. Since 2 August 2021, this has been required to be transposed into national law. The directive applies to different types of public procurement, including purchase, lease, rent and relevant services contracts, with the aim to increase the demand of low- and zero-emission vehicles - i.e., “clean vehicles”. According to the directive, a “clean heavy-duty vehicle” is defined accordingly:

“Any truck or bus using one of the following alternative fuels: hydrogen, battery electric (including plug-in hybrids), natural gas (both CNG and LNG, including biomethane), liquid biofuels, synthetic and paraffinic fuels, LPG.”

The directive has also a separate definition for “zero-emission heavy-duty vehicle”: “[...] the definition includes all vehicles running on any of the alternative fuels listed in the Alternative Fuels Infrastructure Directive (Directive 2014/95); in order to reflect their performance in terms of air quality and decarbonisation, zero-emission heavy-duty vehicles are given a separate definition”. (European Commission, n.d.a)

Furthermore, the Member States have individual targets for public procurement. These will next be reviewed in 2027. The targets are defined as a minimum percentage of clean vehicles in the aggregated public procurement across a Member State. Aggregated public procurement includes purchase, lease, rental, or hire-purchase contracts *subject to EU public procurement rules*, notably

Directives 2014/24/EU and 2014/25/EU. It also covers *public service contracts* for the provision of passenger road transport services under Regulation 1370/2007, as well as *service contracts for public road transport*, special-purpose passenger transport, non-scheduled passenger transport, refuse collection, and mail and parcel delivery services. Within the directive scope, the Member States have flexibility on distribution of public procurement on different contracting authorities and entities. However, once a contracting authority or entity falls within the scope of the directive, compliance is monitored and reported through the Tenders Electronic Daily (TED) database, ensuring that procurement activities are accounted for in relation to the Member States minimum percentage targets. (European Commission, n.d.a)

5.4.5. Policy predictability

Policy predictability is critical for enabling long-term investments aimed at reducing CO₂ emissions in the road freight industry. However, current EU frameworks reveal a gap between regulatory targets and market realities. Uncertainty remains particularly regarding the phase-out of ICE, as political discussions have shifted from a full ban toward potential partial allowances. This debate gained renewed attention as late as December 2025, with considerations around lifting the 2022 EU decision to ban the sale of new petrol and diesel cars from 2035. (O’Carroll, L., 2025) As a result, while regulation provides strategic direction, it lacks full certainty for industry operators to act.

5.5 Actors

The European road freight industry is characterised by interdependence among actors, a dynamic that is further intensified by the transition to electrification, which introduces new dimensions for coordination and collaboration. This chapter outlines central actors and their positions in the evolving electrification.

5.5.1. Logistics companies and hauliers

Logistics companies and hauliers are central operators in the road freight industry, providing transport services as well as, in the case of logistics companies, additional functions such as inventory management, order fulfilment, and warehousing. (DHL, 2026) As central industry actors, they play a critical role in driving the adoption of zero-emission technologies, including electrification. This transition is increasingly becoming a competitive necessity, driven by rising diesel costs, regulatory pressure, and growing customer demand for low-emission logistics. Consequently, early adopters may gain reputational advantages and secure access to limited charging infrastructure, while laggards risk reduced competitiveness. (Consultancy.eu, 2024)

At the same time, operators face significant barriers, including: high upfront costs of electric trucks and uncertain TCO, dependence on charging infrastructure availability (especially for long-haul operations), need to adapt logistics planning and depot charging strategies, and more. Despite these challenges, large-scale implementation is underway, with the sector shifting from pilot projects to broader electrification strategies. (Consultancy.eu, 2024)

5.5.2. Shippers

Shippers - such as retailers, manufacturers, and FMCG companies - play a crucial demand-side role by procuring transport services and increasingly requiring low-emission logistics solutions. Dynamics include increasing pressure from public commitments and reporting requirements, such as the CSRD. In response, shippers can leverage their procurement power to require zero-emission transport solutions from logistics providers, while also supporting, investing, and participating in collaborative initiatives such as green freight corridors. Hence, shippers can increase the demand for electric trucks. (Electrification Coalition, 2024)

5.5.3. OEMs

A truck OEM produces trucks or key components and is currently at the forefront of the transition to zero-emission road freight. These manufacturers are investing in battery-electric and hydrogen technologies to comply with the EU's mandate to reduce truck CO₂. While manufacturers like Scania and Volvo have rapidly expanded their zero-emission portfolios to cover nearly all weight segments, they emphasize that vehicle availability alone cannot drive the transition. (ACEA, 2026a) Consequently, OEMs are “technology enablers” whose success further depends on e.g., synchronized industry regulations and policy. For example, while electric trucks are becoming competitive, their mass adoption is tethered to the availability of charging infrastructure. (Rodriguez, F., et al., 2022) Likewise, to the European Automobile Manufacturers' Association, Europe requires approximately 50,000 public charging points - including 35,000 MCS chargers - for heavy-duty BETs by 2030 to meet demand and climate targets, yet current infrastructure lags significantly behind vehicle readiness. (ACEA, 2025) As a future outlook, without implementation of the Alternative Fuels Infrastructure Regulation (AFIR) and sustained financial incentives to offset high upfront costs, the pace of electrification will likely remain below the trajectory required to meet the EU's 2050 sustainability neutrality targets. (Transport & Environment, 2025)

However, in Europe, the HDT OEM leaders include Daimler Truck AG, Volvo Group, Traton Group, DAF Trucks MV, and Iveco Group NV. Hence, this is a rather consolidated market dominated by a few major players. (Mordor Intelligence, 2026a) Focusing on electrification, the market is generally more fragmented. However, the heavy-duty segment remains relatively consolidated, led by established OEMs such as Daimler Truck AG, Volvo Group, and Scania. These players have been the most successful in advancing electrification, capturing a significant share of BET sales in Europe. Their progress is largely

supported by strong dealer networks, established customer bases, and integrated financing capabilities. (Mordor Intelligence, 2026a)

5.5.4. Energy providers and grid operators

Energy providers and grid operators serve as the “system enablers” in the electrification of heavy-duty BETs, as they are responsible for the physical delivery of power to the, above all, increasingly demanding charging infrastructure networks. Their responsibilities have also expanded from simple utility provision to active infrastructure management, including the deployment of MCS to support long-haul trucking. (Scania, 2026) Additional solutions, provided tailored to the electrification of trucks, include the deployment of smart charging and V2G solutions. Through these, such actors support grid balancing by enabling electric fleets to function as flexible assets that can store excess renewable energy and contribute to network stability during periods of peak demand. (Eurelectric, 2026)

5.5.5. Governments and local authorities

Governments and authorities at EU, national, and local levels act as “market shapers,” utilising a mix of strategies and tools to steer the road freight industry towards reduced GHG emissions. These include taxes, financial incentives, operational and technical standards, and public procurement. However, policy predictability varies across EU, national, and local levels, creating differing dynamics and perceptions regarding the attractiveness and feasibility of the transition to electrification. This is more discussed in chapter 5.5. *Regulations*.

5.6. TCO

The transition to zero-emission road freight is closely linked to the “fuel price delta”, defined as the cost gap between fossil fuel and electricity. Although

electric trucks currently have higher upfront costs, their operational cost-effectiveness relies on a favorable gap between fossil fuel and electricity prices.

5.6.1. Fuel price delta

Average diesel price across the 27 EU member states is approximately €1.96 per liter as of mid-March 2026. Prices vary significantly by country, ranging from liter prices around €1.21 in Malta to over €2.47 in the Netherlands. Major, high-cost nations like Belgium, Germany, France, and Denmark are currently exceeding €2 per liter. **Figure 5.5** illustrates the differences across all Europe. This is consistent with historical trends, whereby Eastern Europe has generally experienced lower average prices, linked to comparatively lower tax rates. (European Commission, 2026d) Other factors driving price differences include government interventions, supply chains and infrastructure, and market competition (Miller, J., 2018). Recent and ongoing geopolitical conflicts in and around Europe have also influenced diesel pricing dynamics. In particular, disruptions to supply chains from the Russia-Ukraine conflict have constrained the supply of diesel - a fuel on which Europe was previously highly dependent on Russian imports - resulting in regional shortages and pressure on prices, especially in countries with strong reliance on these supplies. Furthermore, the European Union's ban on Russian oil imports has necessitated a shift toward alternative suppliers, further tightening diesel availability across the region. (Statista, 2025) After almost one month of the US-Israel war against Iran, the oil-question is at the centre. The closure of the Strait of Hormuz has disrupted the flow of nearly one-fifth of the world's oil supply, a critical chokepoint for international energy trade. While fuel prices have already increased, a prolonged disruption could lead to significantly more severe impacts, further constraining supply and amplifying price volatility across the world. (Stackpole T, 2026)

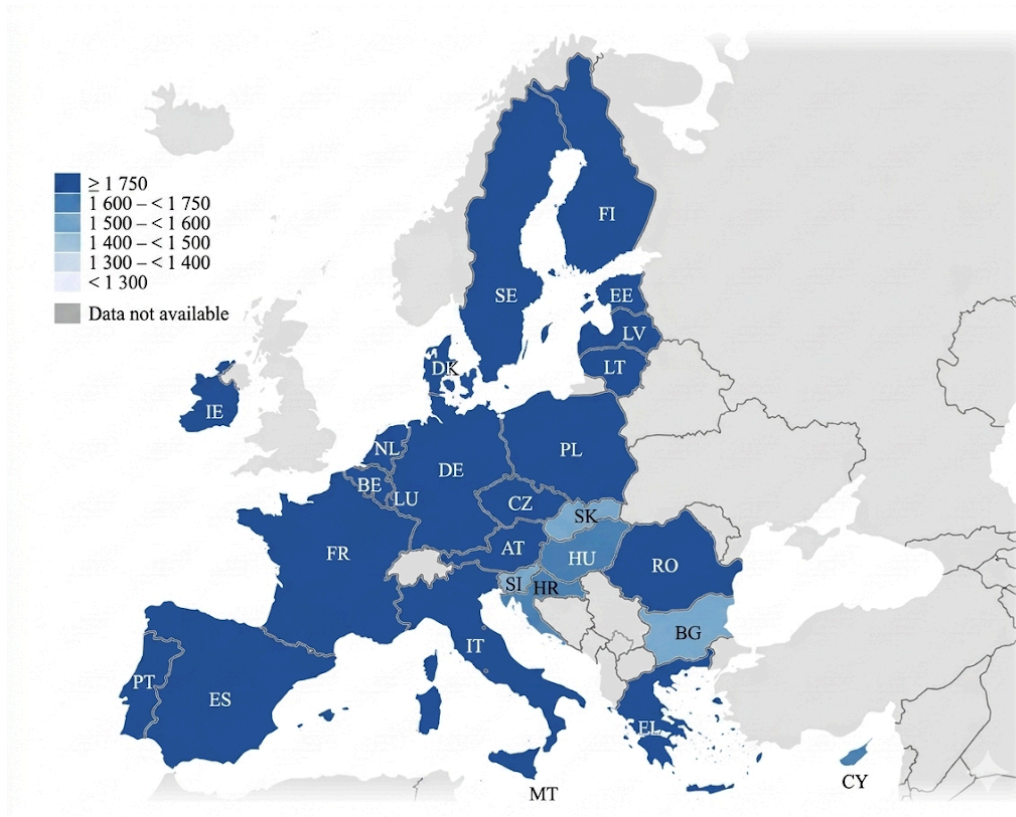


Figure 5.5: Diesel EUR price per 1000 liter (March 2026)

Likewise, the cost of electricity is not a single figure but a hierarchy of pricing. The European electricity market operates on a marginal pricing principle, known as the “merit order”, where the overall market price for any given hour is set by the production cost of the most expensive plant required to meet demand. Historically, gas-fired power plants have occupied this marginal position, meaning that even as more low-cost renewable energy enters the grid, wholesale spot prices remain highly sensitive to fluctuations in the global natural gas market. (Gasparella A, et al., 2023)

By 2025, however, record growth in solar and wind generation has begun to significantly decouple power prices from gas. This transition has fundamentally altered the volatility of the European spot market. In many parts of Europe, wholesale prices now fall to zero or even enter negative territory during periods of high renewable output and low demand, particularly in midday summer hours. Conversely, price spikes remain common during “gas-heavy” morning and evening hours when renewables are less available and demand peaks. For road freight operators, this creates an economic landscape where “spot-aware” charging can capture green energy at near-zero costs, whereas unmanaged charging during demand peaks can result in energy expenses that rival traditional diesel. However, despite the integration of European power markets, wholesale price differences remain between Member States, primarily driven by differences in national energy mixes and cross-border interconnectivity. The Nordics consistently maintain the lowest wholesale prices in Europe, thanks to a high concentration of hydropower and wind. In contrast, markets with a reliance on imported fossil fuels or those facing specific bottlenecks regularly see wholesale prices two to three times than the Nordics. (Hostert, D. et al., 2025)

5.6.2. Vehicle purchasing price

While operational costs for electric trucks are becoming increasingly competitive, the initial investment remains one of the most significant barriers for many hauliers to the large-scale adoption of electrified road freight. Currently, the purchase price of a heavy-duty BET is typically two to three times higher than its diesel counterpart. (IEA, 2025c) For a standard 40-tonne truck, this translates to a price range of approximately €250,000 to €350,000, compared to roughly €100,000 to €120,000 for a conventional Euro VI diesel truck. This premium is primarily driven by the high cost of large-scale battery packs required for heavy-duty operations. Although unit prices for batteries fell

by 27% from 2023 to 2025, the vast total capacity required for long-haul transport keeps the final vehicle price high. (Luman, 2026a)

Despite these high costs, the offering of heavy duty electric trucks itself is relatively consistent across the European market. The market shifted toward series production in 2025, with Volvo and Renault securing an early lead and accounted for nearly half of all deliveries in Europe in early 2025. Competition has intensified as Mercedes-Benz, MAN, DAF, and Scania scale operations. (Luman, 2026a) Although some manufacturers were only beginning to see the benefits of series production in late 2025, they are expected to catch up as production volumes increase. The European market is also facing the entry of Chinese brands such as BYD, Yutong, and FAW. These new entrants are leveraging lower entry barriers and extensive experience with electric motors and scaled battery supply chains to challenge established European players. While these brands are expected to focus initially on light trucks, their presence is already being felt across the industry. (Luman, 2026b)

To speed up the adoption of electric trucks and bridge this price gap, several European countries have implemented different subsidy programs for purchasing electric trucks, though the availability and structure of these incentives vary significantly between countries. Some nations cover a percentage of the price difference between electric and diesel models, while others provide fixed-sum grants based on the vehicle's weight class. However, one-third of EU member states still offer no direct incentives for the acquisition of electric trucks. This creates an uneven market where the feasibility is highly dependent on local politics rather than just technological maturity. (ACEA, 2026e)

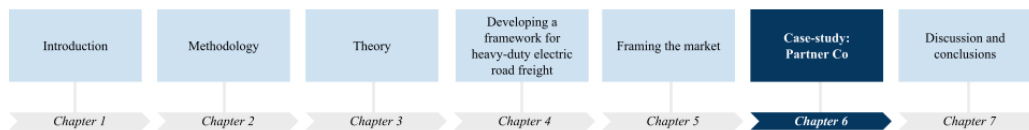
Beyond geographic disparities, these programs are often short-lived, creating uncertainty and potential for drastic shifts in TCO calculations that may impact the willingness to invest. According to the Public Funding and Policy Manager

at Partner Co, many initiatives also operate with fixed budget caps, meaning funds may run out before buyers can secure them. (Internal Interviews, 2026-04-29) Furthermore, there is an economic divide in how these benefits are accessed, as many programs predominantly target large-scale fleet operators. This creates an unequal burden for independent owners, who may not be able to fully capitalize on such financial incentives. (Danielis and Niazi, 2025)

Chapter 6

6. Case study: Partner Co

This chapter introduces Partner Co by outlining its core activities, business model, and strategic position within the road freight industry. It further examines the company's perspective on the market evaluation framework developed through theory and empirical insights. It then details the application of the framework in a real-world commercial context - first across countries using MCDA, followed by a qualitative illustration in one selected country.



6.1. Company description

The chapter introduces Partner Co's role within the evolving industry of electric heavy-duty road freight by outlining its origins, strategic positioning, and business model. In doing so, it highlights how the company combines electrification and digitalisation to deliver low-emission road freight solutions.

6.1.1. Introduction to Partner Co

Founded in 2016, Partner Co was born from the conviction that the traditional logistics and road freight industry was ripe for a digital and ecological overhaul. Hence, the company serves as a bridge between the fossil-fuel-dependent past and an electrified, autonomous future. This mission has rapidly evolved from a concept into a series of milestones. By collaborating with different industries, Partner Co has validated its model across diverse actors and sectors ranging from retail to manufacturing. These partnerships feed into a revenue structure characterized by high-margin subscriptions and long-term service contracts. By relentlessly pursuing the trifecta of electrification, automation, and digitization, Partner Co has transitioned from a Swedish startup into a global actor, currently scaling its operations in Europe, America, and the UAE, as it also prepares for its rumored public debut on the New York Stock Exchange. (Partner Co, n.d.)

6.1.2. Business model

Partner Co operates on a Freight Capacity as a Service business model, moving away from traditional vehicle sales to provide a complete, end-to-end transport solution. Hence, Partner Co creates and captures value by positioning itself as a “transformation partner” rather than a mere carrier or OEM, addressing the urgent global need for decarbonization. At the core of their business model is the software platform, a freight operating system that connects all the vehicles, charging infrastructure, and data to manage and optimize freight operations, also at scale. Amongst, Partner Co's hardware portfolio includes *Connected*

Electric Transport - a fleet of heavy-duty electric trucks - and *Autonomous Electric Transport*, exemplified by the autonomous electric cab-less truck named *Ebot*. Also, to ensure seamless operational scalability, Partner Co provides *the Partner Co Grid*, a charging infrastructure network that facilitates the management of electric freight. By unifying advanced software, specialized electric vehicles, and foundational infrastructure, the Partner Co enables the transition to sustainable logistics while eliminating the operational complexity of managing fragmented hardware and software. (Partner Co, n.d.)

Further, Partner Co's value proposition, *Intelligent Movement*, focuses on reducing the customer's TCO over time through the fusion of digital, electric, and autonomous technology to create more efficient and sustainable freight operations. Their approach also introduces pioneering roles, such as *Remote Operators* who remotely monitor and control the Ebots from away, and *Solution developers* who tailor electrification plans to customer needs. (Partner Co, n.d.)

6.2. Problem description

As a scaling company, Partner Co needs to systematically assess which markets are most ready for the electrification of heavy-duty road freight. This requires an understanding of both attractiveness and feasibility at the country level. The challenge lies in determining the relative importance of these underlying factors to understand markets. This is further complicated by varying levels of data availability and market maturity, introducing decision-making complexity. However, Partner Co's primary interest was to compare countries quantitatively.

6.3. Partner Co framework development

Through an iterative process involving internal interviews with Partner Co employees across different organisational units and levels of seniority, the framework - based on theory and empirical insights - was further developed to align with Partner Co's role and business model in the road freight industry.

This development incorporated Partner Co insights to ensure the framework was suited to a real-world commercial setting and ready for application. This development process resulted in two frameworks: a narrower and broader one.

6.3.1. Partner Co insights

A primary outcome of Partner Co insights was the decision to maintain two frameworks. As the primary interest of Partner Co was a quantitative comparison of countries market attractiveness and feasibility, the goal was to develop a framework suitable for such application. This framework is hereby mentioned as a *narrower* framework, whereas the, in contrast, so-called *broader* framework incorporates more factors. However, the narrow framework focuses on a reduced set of the most critical factors identified by Partner Co. It is primarily with the objective of enabling more structured and objective one-to-one comparisons between countries. The selection of factors in this version was guided not only by strategic relevance, but also by practical considerations such as quantification possibility - if not of quantitative nature -, data accessibility, and the need to ensure a scalable and low-maintenance model over time. Secondly, and in contrast, the broader framework includes additional factors to what's in the narrower one, i.e., a comprehensive set of both quantitative and qualitative factors. This is designed to support the purpose of capturing contextual dynamics of individual markets, enabling a more detailed understanding beyond what is possible through a quantitative ranking alone.

Further, when walking through the theoretical and empirical framework category by category, starting with aggregate market factors, Partner Co agreed on the inclusion of this category and its associated factors, as illustrated in **table 6.1**. Total transport market size was identified as a key indicator of long-term electrification potential, while electrification adoption was highlighted as a signal of current market momentum and overall market electrification maturity.

Table 6.1: “Aggregate market factors” based on Partner Co

Aggregate market factors	
Theoretical and empirical framework	Partner Co framework
Total transport market size	Total transport market size
Total transport market growth	Total transport market growth
Electrification adoption	Electrification adoption
Freight clusters	Freight clusters

Regarding transport operations, while Partner Co agreed these factors are relevant they were viewed as less important from their strategic perspective. These factors are considered manageable constraints rather than “deal breakers” for market entry. Further, Partner Co could not find any additional factors here. Hence, according to **table 6.2**, weather and terrain conditions remained central.

Table 6.2: “Transport operations” based on Partner Co

Transport operations	
Theoretical and empirical framework	Partner Co framework
Weather conditions	Weather conditions
Terrain conditions	Terrain conditions

Charging infrastructure was considered a highly important category, as it is - according to Partner Co and in line with empirical findings - viewed as an enabler for large-scale electrification. Within this category, all predefined factors were deemed relevant, and no additional factors were required at this stage (see **table 6.3**). However, while public charging availability was considered the most obvious to include, there was broader discussion around its data availability up to data. Additionally, grid connection attracted discussions.

Grid connection is currently difficult to assess quantitatively due to the lack of

standardised measurement methods and was therefore not considered suitable for quantitative application at this stage. However, it was emphasised as an important factor to assess qualitatively, as it can indicate whether charging infrastructure has the potential to scale efficiently - for example, in terms of location suitability, available power capacity, and appropriate time horizons for development. Amongst, grid mix was also identified as an interesting factor, as it provides an indication of sustainability performance of charging, particularly in relation to Scope 2 and 3 emissions of electrification. However, it was revealed as not being a direct constraint for Partner Co's market entry decisions, even though Partner Co places importance on the use of green energy. Hence, even though it is not viewed as a "hard barrier", it should be given a weight.

Table 6.3: "Charging infrastructure" based on Partner Co

Charging infrastructure	
Theoretical and empirical framework	Partner Co framework
Public charging availability Grid connection Grid mix	Public charging availability Grid connection Grid mix

Partner Co emphasised that regulations related to electrification can differ significantly from country to country and are therefore generally difficult to quantify in a way that enables one-to-one comparison. Due to this variation in practice, it can also be challenging to compare countries qualitatively, as regulations may differ in form while pursuing similar objectives and outcomes.

However, road tolls - particularly distance-based systems - were identified as both quantifiable and highly important for market attractiveness and feasibility, as they directly influence and can reduce TCO. The remaining regulatory factors derived from theory and empirical insights were slightly adjusted (see **table 6.4**) to be expressed more broadly (e.g., "other regulations") in order to

better capture country-specific differences and inform the framework user. Policy predictability was also highlighted as an important factor to consider - as it e.g., reduces risks for those investing in the electric transformation - although it remains difficult to measure consistently both between and within countries.

Table 6.4: “Regulations” based on Partner Co

Regulations	
Theoretical and empirical framework	Partner Co framework
Taxes	Road tolls
Financial incentives	Operational and technical regulations
Operational and technical regulations	Policy predictability
Public procurement	Other regulations
Policy predictability	

Regarding actors, Partner Co agreed that they are central to both the expansion of existing operations within a country and entry into new markets, including more regional contexts. However, Partner Co preferred to define the key actors as customers, shippers, carriers, and competitors, which led to an adjustment of factors as outlined in *table 6.5*. At the same time, Partner Co strongly emphasised the importance of relationships and dynamics between these actors in enabling an interesting commercial case. However, such relationships and interactions are inherently difficult to quantify in a way that allows for meaningful one-to-one comparison between countries. Discussions also touched upon potential indicators such as carrier fragmentation, but due to high levels of uncertainty and limited data reliability, these were not considered suitable for quantitative application. Nevertheless, the role of actors remains important and should be considered within a qualitative framework application.

Table 6.5: “Actors” based on Partner Co

Actors	
Theoretical and empirical framework	Partner Co framework
Logistics companies and hauliers Shippers OEMs Energy providers and grid operators Governments and local authorities	Customers Shippers Carriers Competitors

Finally, Partner Co - consistent with empirical insights - identified TCO as the overarching category in the electrification of road freight, shaping both current decision-making and the future trajectory of the transport sector. However, Partner Co’s insights further specify that, despite high upfront vehicle costs remaining a key barrier, the financial viability of electric heavy-duty road freight is primarily driven by two direct cost variables: vehicle purchase subsidies and the fuel price delta. While vehicle purchasing prices are relatively similar across European markets, subsidies play a more significant role in the one-to-one country comparison linked to TCO affected by upfront investment.

By changing focus to these factors (see **table 6.6**), the framework TCO category distinguishes between CAPEX and OPEX. Given that vehicle purchase prices and model availability are largely consistent across European countries, the most relevant CAPEX differentiator becomes the level of government subsidies. On the OPEX side, the fuel price delta - representing the cost difference between electricity and fossil diesel - emerges critical for cross-country comparison. A favourable fuel price differential is essential to offset the higher initial investment and support TCO calculations over time. However, Partner Co highlighted that other framework categories - such as charging infrastructure - also have an impact on TCO, but can be treated as separate categories within the framework. This discussion further reinforces the empirical insights and perspectives that electrification is fundamentally driven by TCO considerations.

Table 6.6: “TCO” based on Partner Co

TCO	
Theoretical and empirical framework	Partner Co framework
Fuel price delta Vehicle purchasing price	Fuel price delta Vehicle purchase subsidy

6.3.2. Framework synthetization

Based on Partner Co insights, the framework has been synthesised into two versions to support different application and analytical purposes. **Table 6.7** provides the narrower version, focusing on the factors considered most important to Partner Co. These are primarily quantitative in nature, enabling more structured comparison and prioritisation across markets. In contrast, **table 6.8** illustrates the broader framework, which includes additional factors. These are either considered less critical to Partner Co - such as weather and terrain - but still relevant for more detailed market assessment, including within-country (region-to-region) comparisons, or they are more qualitative in nature and therefore require a case-by-case analysis rather than a quantitative application.

Table 6.7: “Narrower” Partner Co framework

Categories	Factors
Aggregate market factors	Total transport market size Electrification adoption
Charging infrastructure	Public charging availability Grid mix
Regulations	Road tolls
TCO	Fuel price delta Vehicle purchase subsidy

Table 6.8: "Broader" Partner Co framework

Categories	Factors
Aggregate market factors	Total transport market size Total transport market growth Electrification adoption Freight clusters
Transport operations	Weather conditions Terrain conditions
Charging infrastructure	Public charging availability Grid connection Grid mix
Regulations	Road tolls Operational and technical regulations Policy predictability Other regulations
Actors	Customers Suppliers Carriers Competitors
TCO	Fuel price delta Vehicle purchase subsidy

6.4. Partner Co framework application

The application of the Partner Co framework consisted of two complementary parts: firstly, a cross-country comparison of approximately 15 selected European countries - based on Partner Co's interests- of a more quantitative nature leveraging MCDA, and secondly, an illustration of one country - France in this case - of a more qualitative nature to provide a deeper understanding.

The quantitative, MCDA-guided application was identified by Partner Co as the primary point of interest and therefore constituted the first phase. This phase supported the identification of “focus markets” with the highest market attractiveness and feasibility for electrification. Once these priority markets were identified, a second, more qualitative application was introduced to provide deeper insights into additional framework factors and to better understand underlying market dynamics. Accordingly, this phase was based on the broader framework, incorporating factors not fully captured in the quantitative analysis. In this case, the French market was used as an example to test this qualitative application and to demonstrate how the broader framework can be applied to gain a more nuanced understanding of market-specific dynamics beyond the initial cross-country ranking guided by the MCDA model.

6.4.1. Cross country comparison

To ensure output with commercial relevance for Partner Co, an iterative process was conducted involving internal interviews with Partner Co employees. These discussions focused on how the factors within the narrow framework could be operationalised and quantified. This included establishing clear measurement methods with defined metrics, units, and ranges for each factor to ensure consistency and comparability across countries. In cases where defined and developed framework factors were either too broad or considered to capture multiple distinct dynamics, they were further decomposed into more granular sub-factors to improve precision and analytical depth (see illustration in **figure 6.1**). In addition, relevant data sources were identified and validated across approximately 15 selected European countries, for cross-market comparability.

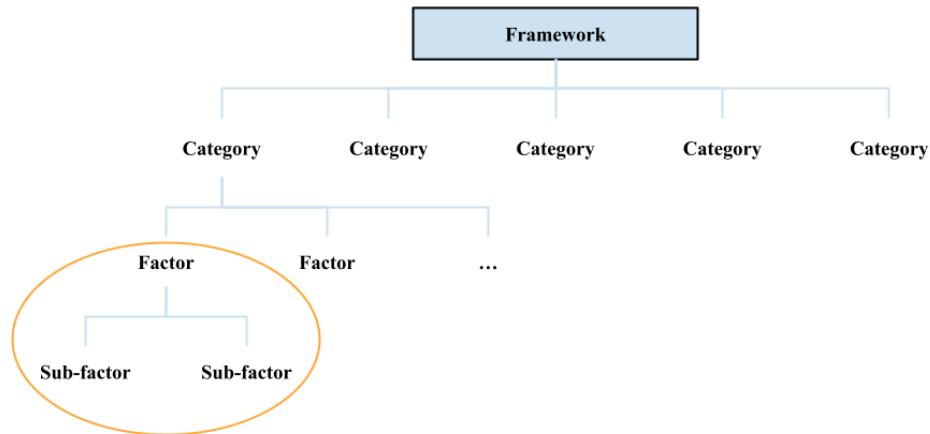


Figure 6.1: Illustration of factor and sub-factors

The quantitative application was carried out using an MCDA framework, enabling the integration of multiple factors into a single comparable score. Within this, relative weights were assigned at factor level in line with Partner Co's strategic priorities and perceived importance of the factors relative to each other, while sub-factors - where applicable - were assigned internal weights to reflect their contribution to the broader framework factor. However, to ensure comparability, all factors and sub-factors were normalized before aggregation on category or factor level. See **figure 6.2** for an overview of the application.

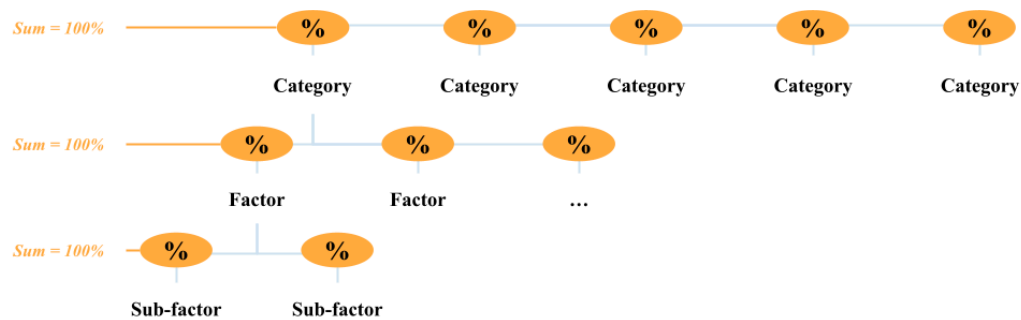


Figure 6.2: Overview of the MCDA application

The final result produced a relative, score-based ranking of the selected countries, where each market was evaluated based on its aggregated performance across the defined factors. While the specific country scores and rankings remain confidential, the outcome can be illustrated as a distribution of normalized scores, highlighting variations in overall market attractiveness and feasibility across the countries. As illustrated in *figure 6.3*, a limited number of markets emerged with comparatively higher scores, forming a preliminary group of “focus markets,” while others demonstrated moderate to lower attractiveness based on the framework factors. This representation demonstrates the differences between markets while anonymizing the underlying data.

Weight	[XX%]	[XX%]	[XX%]	[XX%]	[XX%]	[XX%]	[XX%]	
Category	Aggregate market factors	Aggregate market factors	Charging infrastructure	Charging infrastructure	Regulations	TCO	TCO	
Country / Factor	Total market size	Electrification adoption	Public charging availability	Grid mix	Road tolls	Fuel price delta	Vehicle purchase subsidy	Final output Score
Country A	4	18	85	72	0	63	35	42
Country B	4	18	48	100	19	100	97	62
Country C	0	17	22	64	6	12	8	14
Country D	76	50	9	33	0	44	100	47
Country E	100	84	91	37	33	10	0	43
Country F	13	39	40	34	15	33	5	26
Country G	3	27	8	74	37	12	0	17
Country H	10	15	10	14	15	40	0	17
Country I	63	36	27	14	0	59	53	40
Country J	86	5	1	13	0	0	41	17
Country K	12	8	0	0	3	1	29	9
Country L	62	20	24	43	0	30	53	32
Country M	2	25	14	44	100	41	0	30

Final ranking:		
1	Country B	62
2	Country D	47
3	Country E	43
4	Country A	42
5	Country I	40
6	Country L	32
7	Country M	30
8	Country F	26
9	Country H	17
10	Country G	17
11	Country J	17
12	Country C	14
13	Country K	9

Figure 6.3: Illustration of results of MCDA

Following the initial output, the rankings were subject to validation. Internal Partner Co employees reviewed the rankings to assess their alignment with real-world market conditions and Partner Co’s experience. During this iteration, factors were also reweighted, and sensitivity testing was conducted to evaluate how changes in factor weights and measurement methods influenced the final

ranking. In addition, the exercise enabled a more detailed discussion of whether, for example, certain factors served as strong or weak indicators of market attractiveness and feasibility, and whether they were suited for quantification. This was more difficult in the initial phase, but as the framework was developed and initial data applied, it provided a stronger foundation for discussion. Overall, this strengthened the robustness of the quantitative framework application and helped identify the most influential factors to retain for subsequent iterations. However, these discussions and iterations also highlighted the importance of a qualitative application. For example, the role of actors was frequently mentioned as crucial to map in order to understand market dynamics and whether they represented strengths or weaknesses for Partner Co.

Due to the real-world commercial case study and the competitive nature of the industry, detailed information - including final rankings, weighting schemes, sub-factors, underlying data, and full discussions and associated insights - remains proprietary to Partner Co and is therefore not disclosed in this report.

6.4.2. Illustration on one selected country

The qualitative application was conducted through a case study of the French market, identified as *Country I* in figure 6.3 above, representing one of the “focus countries”. The focus was on understanding overall country performance - and where applicable, intra-country variation between regions - by adding further contextual insights and depth to the preceding quantitative application.

6.4.2.1. The French market

The French market was selected for a qualitative application of the framework. France represents a strategically relevant case due to, among other factors, its market size and early developments in the electrification of road freight. Hence, it was of interest to gain a deeper understanding of its underlying dynamics in order for Partner Co to assess its commercial relevance linked to its business.

6.4.2.1.1. Aggregate market factors

The French road freight transport market remains one of the largest in Europe, valued at approximately \$70 billion at the beginning of 2026 and projected to reach \$83 billion by 2030, reflecting a CAGR of about 3.30%. (Mordor Intelligence, 2026b) However, recent figures signal that France experienced a decline of 1.4% of new truck registrations compared to Q1 2025. (ACEA, 2026c)

However, the previous and projected growth is largely supported by a resilient e-commerce industry and a continued increase in demand for logistics and road transport services. Structurally, the market is characterized by a strong dominance of traditional, high-volume logistics segments, while several smaller segments are expected to drive future growth. In 2025, wholesale and retail trade accounted for over one-third of the market, making it both the largest and fastest-growing end-user segment. Domestic transport dominated overall activity, although international freight is projected to expand at a slightly higher rate in the coming years. Operationally, the market is largely defined by full-truckload, non-containerized, and non-temperature-controlled transport, reflecting standardized and cost-efficient logistics structures. In addition, long-haul transport and solid goods account for the majority of freight activity, highlighting the importance of large-scale, interregional distribution. At the same time, segments such as less-than-truckload, containerized freight, temperature-controlled logistics, and fluid goods are expected to grow steadily, indicating gradual diversification of the market. (Mordor Intelligence, 2026b)

Among fuel types, diesel still represents the dominant share at 88.7% in France and 92.44% in Europe. However, the electrification of BETs is currently gaining momentum. As of the first quarter of 2026, France - together with Germany - led the expansion of newly registered electric, chargeable trucks, with growth reaching 66.3%, compared to the EU average of 40.1%. (ACEAb, 2026)

Furthermore, in France, the logistics activity is largely concentrated in specific “freight clusters”, notably Île-de-France (Paris), Auvergne-Rhône-Alpes (Lyon), and Hauts-de-France. These clusters function as central hubs for distribution, benefiting from well-developed infrastructure, high population density, and proximity to major consumption and industrial areas. At the same time, they are closely linked to the geographical distribution and characteristics of French production, with different regions specializing in distinct industrial and agricultural activities that shape freight flows and transport demand. This interconnection between production patterns and logistics structures influences both the volume and direction of road freight. In *figure 6.4*, key French production regions and selected road freight implications are further illustrated.

Also, these regions serve as testing grounds for the development of electric freight corridors. For instance, the Paris-Lyon axis has emerged as one of the first “electric truck corridors” in France, supported by the deployment of high-capacity charging infrastructure along key routes. (Engie Vianeo, No date) This corridor reflects both strong freight demand and favorable conditions for early electrification. Hence, these logistics clusters are important as they enable the implementation of “milkrun” logistics - short, repetitive distribution routes, typically between 180 km and 450 km. As a result, such regions provide a practical environment for scaling electric freight solutions while minimizing operational risk and infrastructure constraints. (France Supply Chain, 2026)

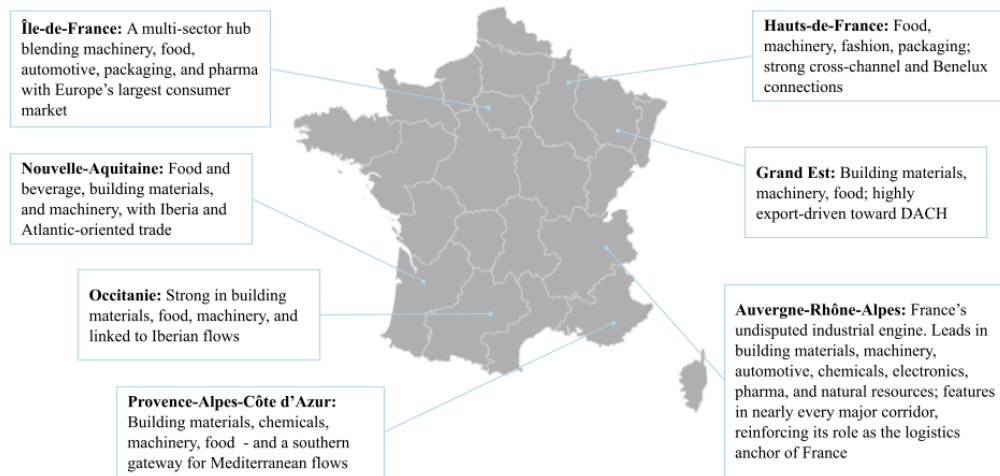


Figure 6.4: French production regions

Further, this intra-country dynamics links to the French export market, which is defined by its role as Europe's central logistics "turntable", where specific production regions feed into a network of international corridors. The most vital of these is the Iberia corridor, which serves as France's strongest road freight link. This route is primarily fueled by the industrial outputs of the Nouvelle-Aquitaine and Occitanie regions, which specialize in food and beverage, building materials, and heavy machinery. As of 2026, this corridor remains a critical artery for seasonal produce and automotive components, maintaining high volume despite broader economic fluctuations in Southern Europe. Similarly, the DACH corridor connecting France to Germany, Austria, and Switzerland - stands as the most strategic industrial link. This path is anchored by the Auvergne-Rhône-Alpes region, France's undisputed industrial engine, which channels high-value electronics, chemicals, and pharmaceuticals into Central Europe. The Grand Est region further bolsters this flow, particularly through export-driven machinery and building material industries that rely on the proximity to German markets. (xMap, 2025; Geobirds, No date)

In the north, the Hauts-de-France region acts as the gateway to the Benelux and Scandinavian markets, focusing on short-haul logistics for food, fashion, and packaging. As mentioned before, this region has become a primary hub for the adoption of electric HDTs due to the high density of logistics clusters and the prevalence of predictable milkrun routes. Meanwhile, the Italian corridor remains a destination for fashion and building materials originating from the Provence-Alpes-Côte d’Azur and Auvergne-Rhône-Alpes. (xMap, 2025; Geobirds, No date)

6.4.2.1.2. Transport operations

France presents a diverse set of operating conditions for electric road freight, influenced by both climate and geography. In colder northern and high-altitude regions, low temperatures can reduce battery efficiency and increase energy demand for heating. In contrast, higher temperatures and heatwaves in southern regions may lead to increased energy use for cooling systems. (Campus France, No date)

In terms of terrain, France features a diverse topography, with low-lying plains in the north and west and high mountain ranges in the east and south. While much of the country is relatively flat, mountainous regions such as the Alps and Pyrenees can affect vehicle performance and energy consumption. (NASA Earth Observatory, 2003)

6.4.2.1.3. Public charging infrastructure

Currently, there is no available standardized data on public charging infrastructure for heavy-duty BETs across Europe, according to ACEA mapping (ACEA, 2026b). However, a survey provided from the same source gives an overview of the current view of this technology, as shown in **figure 6.5** below. This shows that France is not at the top, but not at the bottom either, with a

market estimated to consist of approximately 53 charging points for heavy-duty electric trucks today, and with 79 additional units planned to be built by 2030.

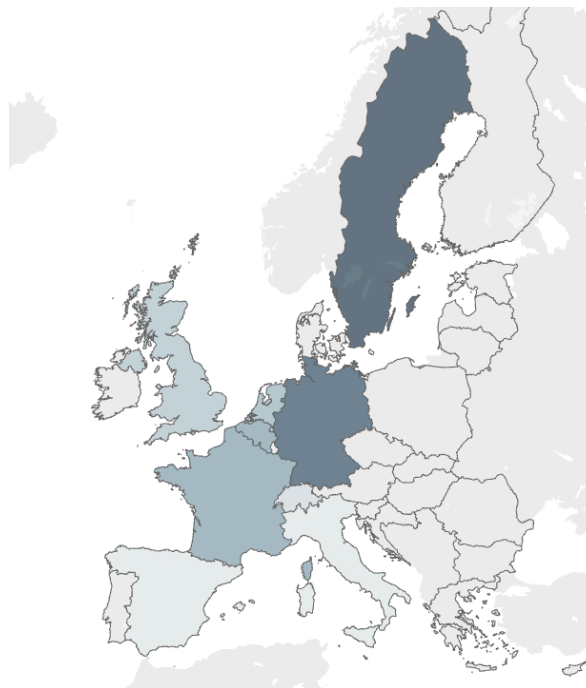


Figure 6.5: Distribution of charging for heavy-duty BETs

However, on the charging infrastructure side for electric vehicles overall, ENGIE Vianeo is the largest supplier across France. This supplier also delivers charging that is suitable for heavy-duty BETs, and currently has seven stations up and running. These are concentrated around the Paris-Lyon axis, as shown in **figure 6.6**. This was the result of ENGIE Vianeo’s partnership with APRR (France’s second-largest motorway network) in 2024, marking a milestone in the decarbonization of the French logistics “turntable.” The project led to the deployment of five very high-power charging stations dedicated to HDVs and long-distance transport along the Paris-Lyon axis. Furthermore, in more detail,

the infrastructure is designed to accommodate the current technical limitations of the market while anticipating future growth. Each station is equipped with 400 to 500 kW ultra-fast charging points, allowing two trucks to charge simultaneously, with an additional back-up point to ensure service continuity. These hubs are strategically spaced approximately every 150 km - specifically at Melun, Auxerre, and Beaune - to provide a safety net for electric trucks that currently average a 300 km range. This dedicated network creates a predictable “electric corridor” that enables transport companies to transition from diesel to electric operations. (ENGIE Vianeo, 2026)



Figure 6.6: ENGIE Vianeo charging for heavy-duty BETs

On a similar note, based on a non-exhaustive overview of the infrastructure distribution for heavy-duty BETs provided by eTrucker, figure 6.7 illustrates the distribution of charging infrastructure across several suppliers. This overview also indicates a higher concentration around Paris and along the Paris-Lyon axis, as well as in northern France, particularly in regions connected to neighbouring countries such as Belgium, Germany, and Switzerland. (eTrucker, 2025) Hence, these regions appear to have the highest concentration of charging infrastructure for heavy-duty BETs, which can be linked to their traditionally

critical transport flows and the strategic prioritization of early investments by providers, with this concentration also being reinforced by network effects.



Figure 6.7: eTrucker view of charging for heavy-duty BETs

Further, grid connection access in France is currently a bottleneck for high-power applications, both in terms of cost and timing. Amongst, costs can be substantial, typically ranging from tens of thousands to several hundreds of thousands of euros for high-capacity installations. Although public support mechanisms, such as the *Advenir Program* and tariff reductions, can cover some of these costs, the remaining share still constitutes a significant financial burden for private operators. In addition, connection timelines remain a constraint. While the initial administrative phase - such as receiving a technical proposal - generally takes around 3 to 6 months, the implementation phase can extend total

lead times to 12 to 24 months. This challenge is further compounded by emerging capacity constraints in high-demand regions, where the main distribution network operator, Enedis, faces difficulties in deploying grid infrastructure within required timeframes. (Fulli, 2024)

However, France's electricity grid represents a strategic asset for the decarbonisation of heavy-duty road freight, with a low carbon intensity and a largely carbon-free electricity supply. The energy mix is primarily based on nuclear power, complemented by a contribution from renewable sources - around 35% - such as hydro and solar. (Electricity Maps, 2026) For the heavy-duty road freight industry, this is not only an incremental improvement but a reduction in environmental impact, with the potential to lower operational CO₂ emissions compared to diesel. In addition, reliance on domestic nuclear and renewable energy reduces exposure to volatility in fossil fuel markets. This contributes to greater predictability in long-term TCO estimates, strengthening the economic case for electrification of road freight in France.

6.4.2.1.4. Regulations

France operates a distance-based road tolling system where heavy truck operators typically pay between €0.20 and €0.40 per kilometer depending on the vehicle's weight and emission class. (Alonso-Villar & Basma, 2026) This network is managed via a concession model where the state delegates construction, financing, and maintenance to private companies in exchange for toll collection rights. (ASECAP, n.d.) Because these private operators bear all financial risks and rely on tolls to service massive debts, rates are locked into contracts, and fee reductions require renegotiation of these five-year state contracts. (ASECAP, n.d.) This is one reason why France has not implemented the Eurovignette Directive, which mandates a CO₂-based toll variation, as seen in Germany. (Alonso-Villar, 2026) Despite these barriers, the incentive for reform is compelling. A 100% road-toll exemption for long-haul electric trucks

could reduce their TCO enough to make them 4.9% cheaper to operate than diesel models this year. (Alonso-Villar & Basma, 2026)

The implementation of electric HDVs in France is also influenced by operational regulations. France's Low Emission Mobility Zones (ZFE-m) exempts electric trucks from the increasingly stringent traffic bans targeting diesel and petrol trucks in major cities like Paris, Lyon, and Marseille. In many ZFEs, heavy goods vehicles are subject to restrictions every weekday from 8am to 8pm, creating a competitive advantage for electric HDVs that maintain access to these urban hubs. (Atout France, 2025) However, the regulatory pressure is uneven. Approximately 40 cities are classified as "Territoires de Vigilance" due to improved air quality, meaning they are not legally mandated to implement the strictest diesel bans, which may slow electrification outside the largest hubs. (Service-Public.fr, 2024)

Regarding market entry specifically, the regulatory landscape presents additional administrative and capital barriers to operational activity. To operate HDV permanently in France, carriers must obtain a national license by satisfying four requirements established by French authorities. First, the establishment requirement mandates a physical headquarters in France to serve as the central hub for administrative records, operational management, and fleet maintenance. Second, the business owners and the transport manager must have a clean legal record, specifically free from serious criminal convictions. Third, the company must demonstrate financial capacity by maintaining at least €9,000 in capital for the first vehicle and €5,000 for each subsequent one. Finally, the designated transport manager must hold a *Certificate of Professional Competence* for heavy transport, which requires passing a national exam. (Ministère de la Transition écologique et de la Cohésion des territoires, 2024)

Finally, in early 2026, France introduced a *Draft Transport Framework Bill (Projet de loi cadre relatif au développement des transports)* to accelerate the

adoption of zero-emission vehicles by shifting decarbonization responsibility to large transport buyers. Article 18 of the bill mandates that companies with over €50 million in turnover and 250+ employees procure a minimum share of zero-emission road freight. This trajectory begins at 0.5% in 2027 and rises to 30% by 2036. By requiring transport buyers to account for these costs, the bill seeks to provide the financial certainty needed for logistics firms to invest in fleet electrification and overcome traditional price-centric contracting barriers. (Preston, 2026; Assemblée nationale, 2026) If implemented, this would act as an enabler for the electric transition.

6.4.2.1.5. Actor network

Within the heavy road freight network, shippers function as the primary order-givers, exerting significant influence over the speed of fleet electrification. Currently, the wholesale and retail trade constitutes the largest segment of the French market with a 36.5% share. This sector is projected to be the fastest adopter of electric freight due to the operational suitability of milk run distributions and the necessity of navigating urban LEZ. (Mordor Intelligence, 2026b)

Despite this potential, widespread adoption faces concerns where feasibility and operational competitiveness remain major hurdles. Like in many other countries, French shippers remain unwilling to pay the green premium for electric transport. To break this deadlock, the French government proposed a draft transport bill in early 2026 as mentioned in chapter 6.4.2.1.4. *Regulations*. If implemented, this legislation would create a “sanctuarized market” for zero-emission freight by shifting the decarbonization burden away from carriers and onto the country’s largest freight buyers. (Pölös, 2026)

While shippers dictate the demand for change, carriers are responsible for the actual execution of transport. In line with the EU in general, the French carrier

landscape is highly fragmented, with a majority of companies in the road freight sector being small-to-medium enterprises operating fewer than ten vehicles (Eurostat, 2024). This, combined with the fact that the industry is facing severe financial strain, creates a significant barrier to electrification. Despite showing unexpected resilience amidst a broader economic crisis, the French road haulage sector continues to struggle with thin profit margins around 2-3% (Auris Finance, 2026; Kulikowska-Wielgus, 2026). This financial fragility and lack of capital make it difficult for carriers to justify the high upfront costs of electric vehicles and charging infrastructure, potentially delaying the industry's transition to electric.

In contrast to the fragmented carrier market, the French heavy duty OEM landscape is significantly more concentrated. The sector is dominated by a few European manufacturers, led by Renault Trucks that as of early 2026 holds nearly a 30% market share in the heavy-duty segment. While it is a subsidiary of Volvo Group, the brand retains its headquarters and primary production facilities within France, providing it with a distinct domestic strategic advantage.

The long-standing dominance of European incumbents is currently being challenged by more affordable and technologically agile entrants. Chinese manufacturers, including brands like BYD, Farizon, and Sany, are preparing a European entry to offer electric HDVs with purchase prices up to 30% lower than domestic alternatives. (Mobility Portal, 2026) However, these challengers are facing concerns regarding lack of local after-sales support and the perceived lower resale value of these vehicles compared to traditional European brands. (Transport Operator, 2026) Although this competition poses a direct threat to the market share and industrial sovereignty of European manufacturers, the resulting price competition and increased vehicle availability are expected to accelerate the overall adoption of electrified road freight across the continent. (Mobility Portal, 2026)

6.4.2.1.6. TCO

France currently provides an operational advantage for electric HDVs when evaluated through the price differential between diesel and electricity. As of February 2026, the median fast-charging price in France stands at €0.52/kWh, ranking 12th out of 29 European nations. (Elport, 2026) However, these benchmarks primarily represent a public-charging baseline - incorporating both ad-hoc and membership rates - and may not fully capture the optimized operational costs for commercial HDV fleets. Furthermore, the lower end of the French market is arguably the most competitive in Europe for operators capable of flexible energy procurement. Specifically, by utilizing “spot-aware” charging, operators can leverage the merit order principle to capture green energy at near-zero costs during renewable surpluses, significantly accelerating the path to TCO parity. (Elport, 2026)

While market diesel prices reached €2.16 per liter in April 2026 - placing France as the fifth most expensive market in Europe - the fuel cost-per-kilometer remains lower for electric HDVs. (European Commission, 2026d) In 2026, geopolitical unrest in Iran and the Strait of Hormuz blockade sparked global supply constraints, driving extreme volatility in diesel prices. To mitigate volatility, price caps implemented by TotalEnergies (France’s major fuel retailer) across its 3,300 stations currently limit diesel prices to a maximum of €2.25/L. These measures can potentially act as a headwind for electric adoption, as they artificially dampen the price signals that could potentially accelerate the transition to electric fleets if diesel prices keep rising. (IRU, 2026)

Beyond operational fuel costs, the French government has significantly strengthened the financial feasibility of fleet electrification through the 2026 update of its ecological bonus and electric conversion subsidies. Under this

revised scheme, HDTs are eligible for direct subsidies of up to €100,000. While these incentives act as a critical enabler by drastically reducing the high initial CAPEX that typically hinders TCO parity, eligibility for the programs remains specific. The subsidies are primarily targeted at small and medium-sized enterprises and are often contingent upon the scrappage of older vehicles. (Fleet Intel, 2026) Consequently, while these subsidies offer significant financial incentives on paper, they may be difficult to capture in practice.

6.4.3. Summary: Understanding overall country performance France

The focus of this qualitative deep dive was to develop a deeper understanding of France's overall performance regarding the electrification of heavy-duty road freight. Based on this evaluation, France emerges as a promising frontier for the electrification of heavy-duty road freight, although some pain points remain.

As of 2026, the total French road freight market is valued at approximately \$70 billion, supported by a resilient e-commerce industry and a well-developed network of freight and industrial clusters. In addition, France's geographic position makes it Europe's central logistics turntable, strengthening the resilience of demand for its freight capacity. Further, one of the country's primary strengths is its low-carbon electricity mix, largely based on nuclear and renewable energy production, which creates environmental, commercial, and economic advantages for electrification while reducing reliance on external fuel supply, and thereby lowering exposure to supply-side risks. Additionally, through the use of spot-aware charging strategies, operators may benefit from periods of near-zero electricity prices during energy surpluses, strengthening the long-term TCO relative to the volatility of diesel prices.

Within France, the currently strongest opportunities for electrification appear to be concentrated in industrial and logistics-intensive regions such as Île-de-France and Auvergne-Rhône-Alpes. These regions support high-density

freight flows and milkrun logistics operations characterized by predictable and repetitive transport routes between approximately 180 and 450 kilometers, aligning well with current BET technical specifications and capabilities. Moreover, most charging infrastructure developments and major pilot projects for heavy-duty truck electrification are currently being implemented within these regions, along the Paris-Lyon axis. At the same time, evolving regulation is increasingly supporting the transition. In particular, the 2026 *Draft Transport Framework Bill* shifts a greater share of decarbonization responsibility toward large transport buyers rather than small carriers. Combined with exemptions and advantages linked to ZEZ in major road freight cities - including hubs such as Paris and Lyon - this creates a growing competitive advantage for BETs.

Despite these favorable conditions, several structural barriers continue to constrain market adoption. Grid connection access remains a bottleneck, as administrative and technical lead times for high-power charging infrastructure may extend up to 24 months, while investment costs can amount to several hundred thousand euros. In addition, the French carrier market is highly fragmented and dominated by SMEs operating with narrow profit margins, often estimated at 2-3%, limiting their ability to absorb the high upfront capital expenditure associated with BETs. Furthermore, unlike several neighboring European markets, France's distance-based tolling system currently lacks CO₂-differentiated pricing mechanisms, thereby reducing an important financial incentive that could otherwise accelerate TCO parity and electrification uptake.

6.4.4. Application synthesization

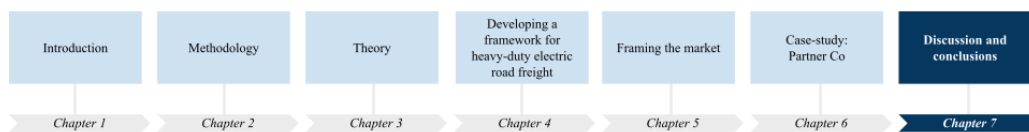
This chapter has demonstrated how MCDA can be leveraged to identify and prioritise “focus markets”, followed by a more qualitative deep dive into a selected country - France - to better understand regional market dynamics. This combination allows for a structured top-down evaluation, complemented by contextual insights that explain how a certain market functions in practice.

As a further step, a SWOT analysis can be applied to assess Partner Co's position in relation to the selected market. In this context, this study primarily contributes the external dimensions - Opportunities (O) and Threats (T) - based on the analysed market environment. The internal dimensions - Strengths (S) and Weaknesses (W) - are more company-specific and therefore need to be evaluated in greater detail by Partner Co itself to ensure a more complete and complementary contribution to a market entry discussion and GTM strategy.

Chapter 7

7. Discussion and conclusions

This chapter discusses and concludes findings regarding the framework, as well as its development and application with Partner Co, in relation to the background, purpose, and research questions. It also suggests future research.



7.1. Discussion of the results

The following chapter discusses the framework's final structure, its development process, and its application, as well as the insights gained along the process.

7.1.1. Discussion of framework

The primary empirical contribution of this study is the qualitative market evaluation framework tailored specifically for the electrification of heavy-duty road freight. As outlined in the introduction, this framework represents the resulting output designed to address our second research question (*RQ2: How can this framework be tailored for heavy-duty electric road freight?*) by moving from general academic constructs to an industry-specific application. As first presented in 4.2 *Framework synthesization*, the framework restructures the traditional macro-environmental layers into six categories: *aggregate market factors*, *transport operations*, *charging infrastructure*, *regulations*, *actors*, and *TCO*, see table 7.1 (first presented in table 4.6).

Table 7.1: Empirical market evaluation framework

Categories	Factors
Aggregate market factors	Total transport market size Total transport market growth Electrification adoption Freight clusters
Transport operations	Weather conditions Terrain conditions
Charging infrastructure	Public charging availability Grid connection Grid mix
Regulations	Taxes Financial incentives

	Operational and technical regulations Public procurement Policy predictability
Actors	Logistics companies and hauliers Shippers OEMs Energy providers and grid operators Governments and local authorities
TCO	Fuel price delta Vehicle purchasing price

While traditional frameworks like Lehmann and Winer’s Industry Analysis are designed to broadly fit any industry, our framework tailors these factors to the distinct characteristics of electric road freight. For example, under *Aggregate market factors*, general factors like sales cyclicality and seasonality were removed because heavy-duty road freight operations are less sensitive to these short-term, intra-year demand variations. Instead, greater emphasis was placed on *Total transport market size* and *Market growth* to capture long-term commercial potential. Similarly, the classical factor *Technology adoption rate* was replaced by *Electrification adoption* to serve as an industry-specific metric.

The final framework consists of 20 specific factors across the six categories. A central consideration during the analysis was whether this level of granularity was sufficient for comprehensive industry coverage without causing excessive analytical complexity or leading to correlation and overlap between factors. The application phase demonstrated that the selected categories and factors provide an adequate and balanced representation of the market structure. At the same time, the analysis revealed the existence of systemic interdependencies across categories. For instance, clear linkages emerged between *Freight clusters* and the organizational entities within the *Actors* category, particularly shippers and carriers, highlighting how operational structures and market participants are

interconnected. These interdependencies indicate that the framework captures the multidimensional nature of the industry without over-fragmenting the analysis. Consequently, the six-category structure can be considered sufficient to support meaningful analysis, while remaining manageable and analytically coherent.

7.1.2. Discussion of framework development

The framework development demonstrates that high-technology, infrastructure-dependent industries cannot be fully assessed using simplified or static analytical frameworks. The inclusion of actors as a core category reflects that electrification is not driven by isolated firm-level decisions, but by interactions - more or less intentionally coordinated - across a network of actors, where coordinated actions can help reduce risk. This is consistent with both socio-technical perspectives and diffusion theory, which emphasize that adoption depends not only on the innovation itself, but also on the surrounding system that enables or constrains its use.

Furthermore in this context, the developed framework captures elements related to the *Diffusion of Innovations*, where adoption is influenced by factors such as perceived risk, compatibility with existing operations, and observability of benefits. The empirical insights suggest that electrification in heavy-duty road freight remains in an early phase of diffusion, where uncertainty and system dependencies slow down uptake. According to Moore, bridging this “chasm” requires more than just a functional truck, it requires a “Whole Product” - a comprehensive solution where the core technology is supported by professional services, installation, and regulatory compliance. In this study, the “Whole Product” is represented by the synergy between charging availability, regulatory support, and grid readiness. Currently, heavy-duty road freight remains in an early phase of diffusion, where the absence of this complete ecosystem slows down widespread uptake.

Moreover, the framework development insights reflect the challenge of introducing “new rules” to the market, particularly through regulatory mechanisms and infrastructure requirements. Electrification alters established industry logics - e.g., by shifting cost structures, operational planning, and network actor roles - which can create resistance unless supported by e.g., clear and consistent regulatory conditions or contractual collaborations. So, by incorporating factors such as subsidies, incentives, and policy predictability, the framework captures how governmental actors shape the feasibility of this transition. At the same time, the interdependencies between categories highlight the inherent complexity of factor delineation, reinforcing that market dynamics are systemic rather than modular, since individual market factors cannot be cleanly separated without losing important relational effects between them.

7.1.3. Discussion of framework application

An insight from the application of the framework through a case study with Partner Co is the distinction between factors suitable for quantitative application versus those requiring deeper qualitative application and interpretation. This distinction is critical for understanding both the strengths and limitations of the framework when used for market evaluation and as a decision-support tool.

On the one hand, several factors lend themselves well to quantitative analysis. Variables such as total transport market size, fuel price differentials, and road toll levels are relatively measurable and comparable across European markets, as they are quantitative in nature. Hence, these can be effectively integrated into an MCDA approach, enabling structured scoring and ranking of markets. This supports a high degree of consistency in factor comparison - while keeping application effort and time consumption manageable - and provides the clarity and efficiency needed for initial strategic screening and market prioritisation.

On the other hand, a significant share of the framework consists of qualitative factors that are inherently more complex to operationalise and measure quantitatively. Factors such as policy predictability and actors cannot - at least not at this stage of industry maturity or discovered throughout this study - be meaningfully reduced to single quantitative proxies without risking loss of important contextual nuance. As illustrated in the case analysis of the French market, these factors require in-depth qualitative evaluation to uncover barriers or opportunities. For example, while France may rank high quantitatively in the MCDA application due to its big road freight market and energy mix, qualitative insights reveal that the grid connection access and private concession model for road tolls delays and complicates the immediate implementation of the financial exemptions necessary to achieve TCO parity.

This dual analysis introduces a comparability challenge. While quantitative application enables cross-country ranking, it risks oversimplifying underlying market dynamics. Conversely, qualitative analysis provides essential contextual understanding by capturing e.g., enabling conditions, friction points, and systemic barriers, but is more difficult to standardise and compare across countries. As a result, purely quantitative comparisons may fail to reflect meaningful differences in real-world market attractiveness and feasibility, while purely qualitative comparisons may be hard to make consistent across countries.

Overall, the framework application suggests a combined application approach. Quantitative analysis is most effective for identifying where to focus, whereas qualitative analysis is necessary to understand and validate the quantitative ranking results in depth. Relying exclusively on either approach would therefore be limiting - either by reducing strategic nuance or by introducing excessive complexity and non-comparable insights. The combined use of both perspectives is thus essential for robust results from the framework application.

7.2. Reflection on the methodology

The abductive research approach proved effective for this study, as it enabled iterative movement between academic theory and emerging empirical insights within the rapidly changing context of electrification in the European road freight industry. The application of thematic analysis provided a guiding foundation for systematically organizing both textual and verbal data into meaningful categories and factors, while also supporting effective collaboration and knowledge sharing between the authors. Furthermore, triangulation across literature, external industry actors, and internal Partner Co employees strengthened the robustness of the insights by adding depth, different perspectives, and nuance, while also mitigating potential professional biases.

Amongst, the continuous documentation of methodological choices, analytical steps, and iterative adjustments throughout the research process contributed to transparency and enabled the reader to follow the development of the study from the initial theoretical framework to the final framework application. Although the findings are context-dependent and grounded in the electrification of heavy-duty road freight, the transparent and systematic methodological approach supports transferability to other industries. By clearly documenting the research purpose, sampling strategy, data collection procedures, interview structures, and thematic analysis process, the study provides a replicable methodological foundation that can be adapted to other industrial contexts. Consequently, while the specific framework categories and factors may differ depending on the industry studied and over time, the overall methodology can be replicated to support the development of market evaluation frameworks for other industries.

At the same time, several methodological challenges and trade-offs should be acknowledged. In the thematic analysis, one difficulty was the process of defining and refining the factors included in the framework. Given the breadth

and sometimes complexity of the empirical insights, the coding, labeling, and categorization process involved a sometimes significant degree of interpretation and problem solving. To mitigate the risk of misinterpretation and subjective opinions, while increasing validity, fact-checking was introduced during the thematic analysis to strengthen objectivity. This included individual fact-checking by the two authors prior to discussions in pairs. In cases of inconsistency, desk research, follow-up discussions with the interviewed actor in question, and supervisor or employee input from Partner Co were used. Altogether, the collaboration between the two authors and the external contributions through triangulation strengthened the objectivity of the analysis.

Another complexity followed the internal interviews with Partner Co employees. While these interviews provided valuable practical insights, they also introduced perspectives shaped by the organizational context and employee roles and seniority, at times, implicit strategic or political considerations. This required careful information handling to ensure that such inputs were balanced against each other as well as external sources, and did not disproportionately influence the framework, particularly during its quantitative application. As a result, considerable attention and time were given to considering different perspectives and maintaining a critical stance when synthesizing the insights. Practically, this was done by adhering to an iterative process, moving back and forth between sources of information while continuously reassessing interpretations and acknowledging alternative perspectives during the analysis.

Finally, and with a forward-looking perspective, particularly in relation to Partner Co and the framework application, the study involved trade-offs between qualitative depth and quantitative rigor. While a more quantified and standardized set of factors could have enabled clearer comparisons across markets, the availability of reliable and comparable data remains limited. Consequently, the suggested market evaluation prioritizes analytical flexibility and contextual understanding over strict quantification. Although this may

reduce direct quantitative comparability between regions, it strengthens the framework's relevance for real-world strategic decision-making, where qualitative factors may carry greater weight than quantitative data in practice.

7.3. Final conclusions

The purpose of this study was to develop a qualitative market evaluation framework to evaluate market attractiveness and feasibility in the electrification of heavy-duty road freight. By integrating academic theory with empirical industry insights and a case study, the following conclusions address the three guiding research questions.

7.3.1. Conclusions of framework development (RQ1 and RQ2)

This study concludes that a standardized market evaluation framework must be tailored when applied to industries undergoing a socio-technical transition. While traditional frameworks, like PESTEL and Porter's Five Forces, provide foundational input, they must be adapted to capture the interdependent nature of modern socio-technological transitions as well as the industry in question. This study shows that a market evaluation framework for electric heavy-duty road freight can be sorted into six categories: aggregate market factors, transport operations, charging infrastructure, regulations, actors, and TCO.

The research identifies that while all these categories influence the market attractiveness and feasibility, the primary dimension dictating the pace of the transition is economic parity with diesel, i.e., the current regime. The TCO remains the ultimate synthesis of market attractiveness, especially in a fragmented industry characterized by low margins. However, TCO is currently a factor difficult to determine as it serves as a convergence point for several other factors, including charging infrastructure and regulations. Currently, TCO is a policy-driven metric rather than a purely market-driven one, as it remains heavily reliant on the fuel price delta and road toll exemptions.

Beyond TCO, the study concludes that in interconnected markets undergoing a socio-technical transition, the actors are critical qualitative determinants. Feasibility is not merely a result of technological maturity and availability, but of the coordination between 3PLs, associated organizations, shippers, carriers, OEMs, and grid operators, to share risk and synchronize operations.

In parallel, public charging infrastructure - as well as grid connection and grid mix - emerges as a critical bottleneck for expansion, often limiting scalability. This highlights interconnectedness of the factors, and the innovation adoption.

Finally, the current available technology acts as a constraint of harder factors that cannot change including the operational factors like weather and terrain.

7.3.2. Conclusions of framework application (RQ3)

The application of the framework through a case study with Partner Co concludes that a dual-layered approach is needed to evaluate markets. A narrower, quantitative MCDA application allows for efficient market screening and prioritization, while a broader, qualitative application is essential to capture the contextual depth and systemic barriers required for a GTM strategy.

Further, because the electric heavy-duty freight market is evolving, the framework should be treated as a dynamic tool. Specific factors that are critical today may shift in importance, requiring regular updates of the framework's structure to ensure it remains aligned with market realities. Despite these necessary adjustments to the inputs, the core logic of the application remains a foundation for long-term strategic evaluation.

7.4. Suggestions for further research

Looking ahead, several paths for future research emerge from both the development and application of the framework. While the current framework provides a foundation for evaluating market attractiveness and feasibility in heavy-duty electric road freight, it should be viewed as a dynamic tool rather than a static one, that will require continuous refinement as e.g., the market matures and new data becomes available. In particular, both the categorization of factors and the relevance of specific factors should be periodically reassessed. As the industry matures, certain factors may diminish in importance, while new factors - such as emerging business models, energy market integration mechanisms, digital coordination platforms, battery circularity or autonomous integration - may need to be added into the current framework.

The application of the framework, particularly the quantitative MCDA, presents significant opportunities for further methodological advancement. A key area for future research is the evolution of criteria weights. As the market matures, the relative importance of factors like vehicle purchase subsidies may decrease while grid mix becomes paramount. Future framework applications should implement sensitivity analysis to test these shifts in prioritization. Furthermore, a promising advancement is the integration of AI to triangulate results and act as a layer of output validation, reducing analysis bias inherent in e.g., scoring.

Beyond the framework itself, operationalizing and productization of the framework over time will also require reassessing measurement methods and data sources. As the market emerges, the units or scales used to quantify current factors may need to change to better capture market dynamics. For example, data sources are likely to become more standardized and accessible as the industry matures, moving away from the currently sometimes fragmented character. Partner Co SMEs could explore automating data collection through

API integrations with logistics hubs, energy providers, and governmental databases, which will likely become more available as the industry matures.

Finally, while this study provided a deep dive into the French market to demonstrate the framework's qualitative application, future work should expand this to include in-depth analyses of all markets of interest. Also this can be done leveraging AI. Expanding the qualitative scope will help identify regional nuances and market-specific characteristics that may not be fully captured through quantitative assessment alone. Differences in infrastructure maturity, regulatory interpretation, and stakeholder dynamics, can vary significantly across regions, influencing both the attractiveness and feasibility of electrification in ways that are difficult to standardize quantitatively. By incorporating deeper, context-specific analyses across multiple markets, the framework can better account for these variations, thereby improving its robustness, adaptability, and practical relevance as a decision-supporting tool.

References

This chapter provides a complete list of the references cited throughout the study, arranged in alphabetical order.

ACEA (2025) *Decarbonising heavy-duty road transport: state of the enabling conditions*. Available at: <https://www.acea.auto/publication/decarbonising-heavy-duty-road-transport-state-of-the-enabling-conditions/> (Accessed 2026-03-31).

ACEA (2026a) *Europe's truck transition needs the right conditions: short-term flexibility welcome, challenges remain*. Available at: <https://www.acea.auto/news/europes-truck-transition-needs-the-right-conditions-short-term-flexibility-welcome-challenges-remain/> (Accessed 2026-05-07).

ACEA (2026b) *Mapping Europe's zero-emission transformation: ACEA zero-emission tracker*. Available at: <https://www.acea.auto/zero-emission-tracker/> (Accessed 2026-05-06).

ACEA (2026c) *New commercial vehicle registrations: vans +2.3%, trucks +10.7%, buses +24.5% in Q1 2026*. Available at: <https://www.acea.auto/cv-registrations/new-commercial-vehicle-registrations-vans-2-3-trucks-10-7-buses-24-5-in-q1-2026/> (Accessed 2026-05-06).

ACEA (2026d) *Report: vehicles on European roads 2026*. Available at: <https://www.acea.auto/publication/report-vehicles-on-european-roads-2026/> (Accessed 2026-05-07).

ACEA (2026e). *Zero-emission commercial vehicles - Tax benefits and incentives 2026*. Available at: <https://www.acea.auto/files/Zero-emission-commercial-vehicles-%E2%80%93-Tax-benefits-and-incentives-2026.pdf> (Accessed 2026-04-08).

ACEA (n.d.) *Fact sheet: CO₂ standards for heavy-duty vehicles*. Available at: [https://www.acea.auto/files/Fact-sheet-CO₂ standards for heavy duty vehicle s.pdf](https://www.acea.auto/files/Fact-sheet-CO2_standards_for_heavy_duty_vehicle_s.pdf) (Accessed 2026-01-27).

Aguilar, F. J. (1967) *Scanning the business environment*. New York: Macmillan.

Alarcón, F. E., Mac Cawley, A., and Sauma, E. (2023) *Electric mobility toward sustainable cities and road-freight logistics: a systematic review and future research directions*. Journal of Cleaner Production, 430, 138959. Available at: <https://doi.org/10.1016/j.jclepro.2023.138959> (Accessed 2026-02-10).

Alonso-Villar, A. (2026) *Fast-tracking the Eurovignette Directive: how road toll exemptions can accelerate zero-emission truck adoption*. International Council on Clean Transportation. Available at: <https://theicct.org/fast-tracking-the-eurovignette-directive-how-road-toll-exemptions-can-accelerate-zero-emission-truck-adoption-apr26/> (Accessed 2026-04-11).

Alonso-Villar, A. & Basma, H. (2026). *Road tolls and CO2 charges: Impact on the total cost of ownership of trucks in Europe*. International Council on Clean Transportation. Available at: <https://theicct.org/road-tolls-and-co2-charges-impact-on-the-total-cost-of-ownership-of-trucks-in-europe-apr26/> (Accessed 2026-05-06).

ASFINAG (2026) *GO-Maut for vehicles over 3.5 tonnes*. Available at: <https://www.asfinag.at/maut-vignette/go-maut/> (Accessed 2026-04-12).

ASECAP (n.d.). *France*. Available at: <https://www.asecap.com/france> (Accessed 2026-05-06).

Assemblée nationale (2026). *Projet de loi cadre relatif au développement des transports*. Available at: https://www.assemblee-nationale.fr/dyn/17/textes/l17b2740_projet-loi.pdf (Accessed 2026-05-06).

Atout France (2025). *Crit’Air anti-pollution vehicle sticker*. Available at: <https://www.france.fr/en/article/crit-air-anti-pollution-vehicle-sticker/> (Accessed 2026-05-06).

Auris Finance (2026). *Transport & Logistics: 2025 M&A Review*. Available at: <https://auris-finance.fr/en/transport-logistics-2025-ma-review/> (Accessed 2026-05-06).

Blancas, L. C., Briceño-Garmendia, C., Roh, H. and Vrenken, H. (2022) *Competing with logistics clusters: vignettes from the international experience*. Washington, DC: World Bank. Available at: <https://documents1.worldbank.org/curated/en/099200003142222613/pdf/P17230501783ad0470bcb501f9d81317eda.pdf> (Accessed 2026-05-07).

Campus France (No date) *The climate and weather in France*. Available at: <https://www.campusfrance.org/en/France-weather-climate> (Accessed 2026-05-07).

Carlsson, R. and Nordgren, E. (2024) *Weather impact on energy consumption for electric trucks: predictive modelling with machine learning*. Master thesis. Umeå University. Available at: <https://www.diva-portal.org/smash/get/diva2:1874010/FULLTEXT01.pdf> (Accessed 2026-04-12).

Chakravorti, B. (2004) ‘The new rules for bringing innovations to market’, *Harvard Business Review*, 82(3), pp. 58–67. Available at: <https://hbr.org/2004/03/the-new-rules-for-bringing-innovations-to-market> (Accessed 2026-02-03).

Chalmers University of Technology (2026) *REEL 2 Wave 1 - System demonstrations of regional electrified logistics*. Available at: <https://research.chalmers.se/en/project/10512> (Accessed 2026-04-12).

CINEA (2025) *EU awards over €600 million to alternative fuel projects to boost zero-emission mobility*. Available at: https://cinea.ec.europa.eu/news-events/news/eu-awards-over-eu600-million-alternative-fuel-projects-boost-zero-emission-mobility-2025-11-17_en (Accessed 2026-04-12).

CLECAT (2026) 'Electric truck sales in the EU jump 70% in 2025, but growth remains highly uneven across Member States', *CLECAT Newsletter 2026/04*, 30 January. Available at: <https://www.clecat.org/news/newsletters/electric-truck-sales-in-the-eu-jump-70-in-2025-but> (Accessed 2026-04-07).

Consultancy.eu (2024) *Electric trucks gain ground in Europe despite adoption challenges*. Available at: <https://www.consultancy.eu/news/13204/electric-trucks-gain-ground-in-europe-despite-adoption-challenges> (Accessed 2026-03-31).

Council of the European Union (2025) *Council sets position on maximum weights and dimensions for road vehicles*. Available at: <https://www.consilium.europa.eu/en/press/press-releases/2025/12/04/council-sets-position-on-maximum-weights-and-dimensions-for-road-vehicles/> (Accessed 2026-03-28).

Dalerstedt, Y. (2024) *How the updated EuroVignette directive will impact truck operating costs*. Available at: <https://www.volvotrucks.com/en-en/news-stories/insights/articles/2024/jan/how>

[-the-updated-eurovignette-directive-will-impact-truck-operating-costs.html](#)
(Accessed 2026-04-12).

Danielis, R. & Niazi, A. (2025). *The economic feasibility of battery electric trucks: A review of the total cost of ownership estimates*. *Energies*, 18(2), 429. Available at: <https://www.mdpi.com/1996-1073/18/2/429> (Accessed 2026-04-06).

Denscombe, M. (2018) *Forskningshandboken: för småskaliga forskningsprojekt inom samhällsvetenskaperna*. 4th edn. Translated by P. Larson. Lund: Studentlitteratur AB.

Denzin, N. K., & Lincoln, Y. S. (Eds.). (2018). *The SAGE Handbook of Qualitative Research* (5th ed.). Los Angeles, CA: Sage.

DHL Freight Connections (2026) *Third-party logistics (3PL)*. Available at: <https://dhl-freight-connections.com/en/logistics-dictionary/third-party-logistics-3pl/> (Accessed 2026-03-31).

DKV Mobility (2026) *Toll & toll billing after CO2 class introduction: how to determine the CO2 class of your vehicle*. Available at: <https://www.dkv-mobility.com/uk/en/toll/toll-services-by-country/co2-toll> (Accessed 2026-04-12).

EAFO (2025) 'New public HDV recharging infrastructure data now live on EAFO', *European Alternative Fuels Observatory*, 20 October. Available at: <https://alternative-fuels-observatory.ec.europa.eu/general-information/news/new-public-hdv-recharging-infrastructure-data-now-live-eafo> (Accessed 2026-04-12).

EAFO (2026) *Dutch subsidies for heavy EV charging, zero-emission trucks and touring coaches: SPULA, AanZET & STour*. Available at: <https://alternative-fuels-observatory.ec.europa.eu/general-information/news/dutch-subsidies-heavy-ev-charging-zero-emission-trucks-and-touring-coaches> (Accessed 2026-04-12).

EEA (2026) *EU new Emissions Trading System (ETS2) and Social Climate Fund: mechanisms, challenges and conditions for a fair decarbonisation in road transport*. Available at: <https://www.eea.europa.eu/en/analysis/publications/emissions-reduction-from-transport-in-europe-how-the-ets2-will-help-this-sector-meet-its-climate-targets> (Accessed 2026-04-12).

Electricity Maps (2026) *Real-time electricity 24/7 grid carbon intensity: France*. Available at: https://app.electricitymaps.com/map/zone/FR/live/fifteen_minutes (Accessed 2026-05-06).

Electrification Coalition (2024) *Electric partnerships: freight electrification recommendations for shippers and carriers*. Available at: <https://electrificationcoalition.org/resource/electric-partnerships-freight-electrification-recommendations-for-shippers-and-carriers/> (Accessed 2026-04-01).

Electrify (2025) *Sweden opens door to night-time operations for electric heavy trucks*. Available at: <https://www.electrify.com/2025/11/27/sweden-opens-door-to-night-time-operations-for-electric-heavy-trucks/> (Accessed 2026-03-28).

Eleport (2026). *Fast Charging Prices across Europe Analyzed: Big 2026 Overview*. Available at: <https://eleport.com/price-report/#France> (Accessed 2026-04-29).

ENGIE Vianeo (2026) *ENGIE Vianeo and APRR: a 100% network dedicated to heavy duty vehicles*. Available at:

<https://www.engie-vianeo.com/en/news/aprr-heavy-duty-vehicles/> (Accessed 2026-05-06).

ENGIE Vianeo (No date) *About us*. Available at:

<https://www.engie-vianeo.com/en/a-propos/> (Accessed 2026-05-06).

eTrucker (2025). *eTrucker* (Version 1.2.0) [Mobile app]. Available at: Google Play Store (Accessed 2026-05-06).

Eurelectric (2026) *What are grid connections and how Europe can fix the queue*. Available at:

<https://www.eurelectric.org/in-detail/what-are-grid-connections-and-how-europe-can-fix-the-queue/> (Accessed 2026-04-01).

European Commission (2024) *Alternative fuels infrastructure*. Available at:

https://transport.ec.europa.eu/transport-themes/clean-transport/alternative-fuels-sustainable-mobility-europe/alternative-fuels-infrastructure_en (Accessed 2026-04-12).

European Commission (2025) *Transport and the Green Deal*. Available at:

https://commission.europa.eu/topics/transport-and-tourism/transport-and-green-deal_en (Accessed 2026-03-29).

European Commission (2026a) *Driving time and rest periods*. Available at:

https://transport.ec.europa.eu/transport-modes/road/social-provisions/driving-time-and-rest-periods_en (Accessed 2026-03-28).

European Commission (2026b) *European grids*. Available at:
https://energy.ec.europa.eu/topics/infrastructure/european-grids_en
(Accessed 2026-04-03).

European Commission (2026c) *Road charging (tolls and vignettes)*.
Available at:
https://transport.ec.europa.eu/transport-modes/road/road-charging_en
(Accessed 2026-03-26).

European Commission (2026d). *Weekly Oil Bulletin*. Available at:
https://energy.ec.europa.eu/data-and-analysis/weekly-oil-bulletin_en (Accessed
2026-05-03).

European Commission (2026e) *Weights and dimensions*. Available at:
https://transport.ec.europa.eu/transport-modes/road/weights-and-dimensions_en
(Accessed 2026-03-28).

European Commission (n.d.a) *Clean Vehicles Directive*. Available at:
https://transport.ec.europa.eu/transport-themes/clean-transport/clean-and-energy-efficient-vehicles/clean-vehicles-directive_en (Accessed 2026-05-07).

European Commission (n.d.b) *Public procurement: trade and economic security*. Available at:
https://policy.trade.ec.europa.eu/help-exporters-and-importers/accessing-markets/public-procurement_en (Accessed 2026-03-29).

European Consumer Centre France (2026) *Environmental zones in Europe*.
Available at:
<https://www.europe-consommateurs.eu/en/topics/vehicles/driving/environmental-zones/> (Accessed 2026-03-29).

Eurostat (2024). *Key indicators on business demography by size class (NACE Rev. 2) [sbs_ovw_act]*. Available at: https://ec.europa.eu/eurostat/databrowser/view/sbs_ovw_act_custom_21017045/default/table (Accessed 2026-05-06).

Eurostat (2025) *Key figures on European transport - 2025 edition*. Luxembourg: Publications Office of the European Union. Available at: <https://ec.europa.eu/eurostat/documents/15216629/22895843/KS-01-25-057-E-N-N.pdf/b93acb00-811a-9b83-310f-69e1b88c5799?version=2.0&t=1768895647974> (Accessed 2026-03-23).

Fleet Intel (2026) *France offers up to €100,000 per electric truck or van for businesses*. Available at: <https://fleetintel.ai/france-electric-truck-van-subsidy-100000-2026> (Accessed: 2026-05-05).

France Supply Chain (2026) *France Supply Chain: the network of supply chain professionals*. Available at: <https://www.francesupplychain.org/en/> (Accessed 2026-05-07).

Fulli (2024) *Electric charging stations in France: what is the goal for 2025?*. Available at: <https://www.fulli.com/en/charging-stations-france-goal-2025> (Accessed: 2026-05-08).

Gasparella, A., Koolen, D. and Zucker, A. (2023) *The merit order and price-setting dynamics in European electricity markets: a 2022 and 2030 investigation using METIS*. European Commission, Joint Research Centre (JRC). Available at:

<https://publications.jrc.ec.europa.eu/repository/handle/JRC134300>

(Accessed 2026-04-10).

Geels, F. W. (2002). *Technological transitions as evolutionary reconfiguration processes: a multi-level perspective and a case-study*. Research Policy, 31(8-9), 1257-1274. [https://doi.org/10.1016/s0048-7333\(02\)00062-8](https://doi.org/10.1016/s0048-7333(02)00062-8)

Gillström, H., Jobrant, M., & Sallnäs, U. (2024). Towards building an understanding of electrification of logistics systems - A literature review and a research agenda. *Cleaner Logistics and Supply Chain*, 10, 100134. <https://doi.org/10.1016/j.clscn.2023.100134> (Accessed 2026-02-11).

Geobirds (No date) *Logistics insights from French industry: mapping production and transport at the regional level*. Available at: <https://geobirds.io/blog-posts/logistics-insights-from-french-industry-mapping-production-and-transport-at-the-regional-level> (Accessed 2026-05-06).

go-e (2025) *AC vs DC charging: 7 fundamental differences*. Available at: <https://go-e.com/en/magazine/ac-dc-charging> (Accessed 2026-04-12).

Hagleitner, N. (2025) *How heavy-duty transport can surmount obstacles on their journey to net zero*. World Economic Forum. Available at: https://www.weforum.org/stories/2025/01/how-heavy-duty-transport-can-surmount-obstacles_on-their-journey-to-net-zero/ (Accessed 2026-01-27).

Hostert, D. et al. (2025) *New Energy Outlook 2025 (NEO 2025)*. BloombergNEF. Available at: <https://about.bnef.com/insights/clean-energy/new-energy-report-neo2025/> (Accessed 2026-05-07).

IEA (2025a) *Alternative Fuel Infrastructure Facility (AFIF)*. Available at: <https://www.iea.org/policies/27827-alternative-fuel-infrastructure-facility-afif> (Accessed 2026-04-12).

IEA (2025b) *Global EV Outlook 2025: expanding sales in diverse markets*. Paris: IEA. Available at: <https://www.iea.org/reports/global-ev-outlook-2025> (Accessed 2026-01-27).

IEA (2025c) *Trends in heavy-duty electric vehicles*. In: *Global EV Outlook 2025*. Available at: <https://www.iea.org/reports/global-ev-outlook-2025/trends-in-heavy-duty-electric-vehicles> (Accessed 2026-04-08).

Investopedia (2024) *SWOT analysis: how to use it with examples*. Available at: <https://www.investopedia.com/terms/s/swot.asp> (Accessed 2026-02-17).

IRU (2026) *War at the pump: prices continue to climb*. Available at: <https://www.iru.org/news-resources/newsroom/war-pump-prices-continue-climb> (Accessed 2026-05-06).

Kotler, P. (2024) *Principles of marketing*. 19th edn. Harlow: Pearson.

Kotte, A. and Buck, C. (2024) *The MAN e-Truck: quieter than you've ever heard before*. Available at: <https://www.man.eu/corporate/en/newsroom/stories/quieter-than-youve-ever-heard-before-126656.html> (Accessed 2026-03-28).

Kulikowska-Wielgus, A. (2026) *France's transport crisis has a surprise survivor: road freight*. Trans.info. Available at: <https://trans.info/en/france-s-transport-crisis-has-a-surprise-survivor-road-freight-450277> (Accessed 2026-05-06).

Lehmann, D. R. and Winer, R. S. (1991) *Analysis for marketing planning*. 7th edn. Boston: McGraw-Hill Irwin.

Lipińska-Słota, A. and Mindur, M. (2021) 'The future of the European logistics centres as nodal objects of intermodal transport infrastructure', *Scientific Journal of Logistics*, 17(1), pp. 41-52. Available at: [DOI: 10.26411/83-1734-2015-2-38-5-18](https://doi.org/10.26411/83-1734-2015-2-38-5-18) (Accessed 2026-04-10).

Liu, S., He, N., Cao, X., Li, G. and Jian, M. (2022) 'Logistics cluster and its future development: a comprehensive research review', *Transportation Research Part E: Logistics and Transportation Review*, 168, 102941. Available at: <https://doi.org/10.1016/j.tre.2022.102974> (Accessed 2026-05-07).

LOUIS: The Louisiana Library Network (No date) 'Introducing the realm', in *World Regional Geography*. Pressbooks. Available at: <https://louis.pressbooks.pub/worldregionalgeography/chapter/2-1-introducing-the-realm/> (Accessed 2026-04-10).

Luman, R. (2026a). *Europe's e-truck market speeds up*. ING Think. Available at: <https://think.ing.com/articles/europes-e-truck-market-speeds-up/> (Accessed 2026-04-08).

Luman, R. (2026b). *Tentative signs of recovery for the European truck market*. ING Think. Available at: <https://think.ing.com/articles/european-truck-market-outlook/> (Accessed 2026-04-08).

Market Data Forecast (2026) *Europe road freight transportation market*. Available at:

<https://www.marketdataforecast.com/market-reports/Europe-road-freight-transportation-market> (Accessed 2026-04-04).

Malhotra, N. K. (2019) *Marketing research: an applied orientation*. 7th edn. New York: Pearson.

Milence (2026) *Charging the future of road transport*. Available at: <https://milence.com/> (Accessed 2026-01-27).

Miller, J. (2018) *Why the era of the diesel truck is coming to an end*. BBC News. Available at: <https://www.bbc.com/news/business-44401999> (Accessed 2026-03-28).

Ministère de la Transition écologique et de la Cohésion des territoires (2024). *Accès et exercice de la profession de transporteur de marchandises*. Available at: <https://www.ecologie.gouv.fr/politiques-publiques/acces-exercice-profession-transporteur-marchandises> (Accessed 2026-05-06).

Mobility Portal (2026). *Chinese electric trucks are gaining momentum in Europe with prices up to 30% lower*. Available at: <https://www.mobilityportal.eu/en/notes/camiones-electricos-chinos-pisan-el-acerador-en-europa-con-precios-hasta-30-mas-bajos> (Accessed 2026-05-06).

Moore, G. A. (1991) *Crossing the chasm: marketing and selling disruptive products to mainstream customers*. 1st edn. New York: Harper Business.

Mordor Intelligence (2026a) *Europe heavy-duty truck market size & share analysis - growth trends and forecast (2026 - 2031)*. Available at: <https://www.mordorintelligence.com/industry-reports/europe-heavy-duty-truck-market> (Accessed 2026-04-01).

Mordor Intelligence (2026b). *France Road Freight Transport Market Size & Share Analysis - Growth Trends and Forecast (2026 - 2031)*. Available at: <https://www.mordorintelligence.com/industry-reports/france-road-freight-transport-market> (Accessed 2026-05-06).

NASA Earth Observatory (2003) *The topography of France*. Available at: <https://science.nasa.gov/earth/earth-observatory/the-topography-of-france-3655/> (Accessed 2026-05-06).

O'Carroll, L. (2025) *EU's 2035 petrol and diesel car ban will be watered down, says senior MEP*. The Guardian. Available at: <https://www.theguardian.com/business/2025/dec/12/eu-2035-petrol-diesel-car-ban-mep-green-deal> (Accessed 2026-03-28).

Op weg naar ZES (No date) *Waar komen de zero-emissiezones?*. Available at: <https://www.opwegnaarzes.nl/bedrijven/waar-komen-de-ze-zones> (Accessed 2026-03-28).

Partner Co (n.d.) *Partner Co*. (Accessed 2026-04-31).

Porter, M. E. (1980) *Competitive strategy: techniques for analyzing industries and competitors*. New York: Free Press.

Preston, R. (2026). *French transport bill provides additional infrastructure funding*. Rail Journal. Available at: <https://www.railjournal.com/infrastructure/french-transport-bill-provides-additional-infrastructure-funding/> (Accessed 2026-05-06).

Pölös, Z. (2026). *French bill would push shippers into zero-emission road freight*. Trans.info. Available at: <https://trans.info/en/french-zero-emission-bill-464298> (Accessed 2026-05-06).

Rivera, L., Gligor, D. and Sheffi, Y. (2016) ‘The benefits of logistics clustering’, *International Journal of Physical Distribution & Logistics Management*, 46(3), pp. 242–268. Available at: <https://www.emerald.com/ijpdlm/article/46/3/242/162896/The-benefits-of-logistics-clustering> (Accessed 2026-04-07).

Rodriguez, F., Basma, H., Mulholland, E. and Ragon, P.-L. (2022) *The CO2 standards required for trucks and buses for Europe to meet its climate targets*. International Council on Clean Transportation (ICCT). Available at: <https://theicct.org/publication/hdv-co2standards-recs-mar22/> (Accessed 2026-04-01).

Rogers, E. M. (1962) *Diffusion of innovations*. 1st edn. New York: Free Press.

Sarmmah, S. (2025) ‘DC charging vs AC charging for EVs: what businesses need to know’, *Bolt.Earth*, 6 October. Available at: <https://bolt.earth/blog/dc-charging-vs-ac-charging-for-evs-what-businesses-need-to-know> (Accessed 2026-05-07).

Saunders, M. N. K., Lewis, P. and Thornhill, A. (2023) *Research methods for business students*. 9th edn. Harlow: Pearson.

Scania (2026) *Megawatt charging - all you need to know about MCS*. Available at: <https://www.scania.com/group/en/home/electrification/e-mobility-hub/me>

[gawatt-charging-all-you-need-to-know-about-mcs.html](#) (Accessed 2026-03-31).

ScienceDirect (n.d.) *Multiple criteria decision analysis*. Available at: <https://www.sciencedirect.com/topics/computer-science/multiple-criteria-decision-analysis> (Accessed 2026-05-07).

Service-Public.fr (2024). *2025 Crit'air 3 car restrictions: which agglomerations are affected?*. Available at: <https://www.service-public.gouv.fr/particuliers/actualites/A17253?lang=en> (Accessed 2026-05-06).

Sheffi, Y. (2013) 'Logistics-intensive clusters: global competitiveness and regional growth', in Bookbinder, J. H. (ed.) *Handbook of global logistics: transportation in today's economy*. New York: Springer, pp. 463–500. Available at: https://ideas.repec.org/h/spr/isochp/978-1-4419-6132-7_19.html (Accessed 2026-04-07).

Stackpole, T. (2026) *The oil shock is here — and we're just beginning to feel it*. Harvard Business Review. Available at: <https://hbr.org/2026/03/the-oil-shock-is-here-and-were-just-beginning-to-feel-it> (Accessed 2026-03-28).

Statista (2025) *Volume of fossil fuel exports from Russia from February 2022 to December 2024, by destination region*. Available at: <https://www.statista.com/statistics/1378485/russia-fossil-fuel-export-volume-by-region/> (Accessed 2026-03-28).

Stockholms Stad (2024) *Clean air zone class 3*. Available at: <https://trafik.stockholm/en/trafikregler/clean-air-zones/clean-air-zone-class-3/> (Accessed 2026-05-07).

Suneson, A., Herlt, A. and Hans, M. (2024) *The bumpy road to zero-emission trucks*. McKinsey & Company. Available at: <https://www.mckinsey.com/industries/automotive-and-assembly/our-insights/the-bumpy-road-to-zero-emission-trucks> (Accessed 2026-01-27).

Taylor, G. (2025) *Norway will let cities introduce zero-emission zones*. The Energy Mix. Available at: <https://www.theenergymix.com/norway-will-let-cities-introduce-zero-emission-zones/> (Accessed 2026-03-29).

Trans.INFO (2025) *Higher tolls across Europe: what changes in 2026*. Available at: <https://trans.info/en/higher-tolls-2026-445921> (Accessed 2026-04-12).

Trans.INFO (2025) *Stockholm expands electric night deliveries to reduce daytime congestion*. Available at: <https://trans.info/en/electric-night-deliveries-442204> (Accessed 2026-03-28).

Transport & Environment (2025) *Nearly all truckmakers on track to meet 2025 CO₂ target, ICCT finds*. Available at: <https://www.transportenvironment.org/articles/nearly-all-truckmakers-on-track-to-meet-2025-co2-target-icct-finds> (Accessed 2026-03-31).

Transport in Nood (n.d.). *New French law - weights and dimensions for trucks*. Available at: <https://tin.eu/en/news/nieuwe-franse-wet-gewichten-en-afmetingen-voor-vrachtwagens/> (Accessed 2026-05-06).

Transport Operator (2026). *Six Chinese entrants expected in European truck market in 2026*. Available at:

<https://transportoperator.co.uk/2026/03/27/six-chinese-entrants-expected-in-european-truck-market-in-2026/> (Accessed 2026-05-06).

UNECE (2018) *Night-time delivery: noise emissions of quiet vehicles and quiet equipment*. Economic Commission for Europe, Working Party on Noise (GRB). Available at: <https://unece.org/DAM/trans/doc/2018/wp29grb/GRB-68-10e.pdf> (Accessed 2026-03-28).

Von Hofsten, H., Noreland, D. and Uhrdin, A. (2023) *Elektrifiering av tunga vägtransporter - mycket mer än teknik*. Skogforsk. Available at: <https://www.skogforsk.se/kunskapsbanken/kunskapsartiklar/2023/elektrifiering-av-tunga-vagtransporter/> (Accessed 2026-01-27).

xMap (2025) *Transportation & logistics locations in France*. Available at: <https://www.xmap.ai/location-intelligence-reports/transportation--logistics-locations-in-france> (Accessed 2026-05-06).

Yin, R. K. (2018) *Case study research and applications: design and methods*. 6th edn. Thousand Oaks: SAGE.

Appendices

This chapter contains the appendices referenced throughout the study, including interview guides related to the interviews conducted as part of the research.

Appendix A: Semi-structured interviews with 3PLs

1. Role and Organizational Overview

- Can you describe your role and main responsibilities within the company?
- Can you briefly describe the company and its current operations?

2. Strategy and Current State of Electrification

- What does your current strategy look like regarding electrified trucks?
- How are you managing this transition (e.g., formal strategy, projects, external consultants)?
- What is your current progress (e.g., timeline, share of fleet, and specific routes electrified)?
- What are the main drivers behind your electrification efforts?
- What are your overall goals and targets for the coming years?
- When comparing electric to fossil-based transport, what are the most critical:
 - Challenges?
 - Differences?
 - Opportunities/Enablers?
- Does the impact of electrification differ significantly between your short-haul and long-haul operations?

3. Enabling and Constraining Market Factors

- What external factors are most important for you to continue the transition toward electrification?

4. Customer Needs and Market Demand

- How do you perceive the general maturity of customers regarding electric trucks?
- How has customer demand for electric trucks evolved over time?
- Do you perceive that larger customers drive demand more than smaller ones?
- Are customers willing to pay a premium for electrified transport services?
- Have you noticed changes in which stakeholders are placing demands on you to adopt electric trucks?
- Can you share a typical or unexpected customer case related to the electric transition?

5. Future Outlook

- How do you think the electrification of trucks will develop in the future?
- What will be prioritized and in focus in your daily operations going forward?

Appendix B: Semi-structured interviews with Associated Organizations

1. Role and Organizational Overview

- Can you describe your role and main responsibilities within the organization?
- Can you briefly describe the organization and its primary mission?

2. Strategy and Advocacy for Electrification

- How is the organization working to support the transition to electric transport?
- What is the primary driver for your involvement in this transition?
- In what ways can the organization exert influence on the market or policy?
- What is your current assessment of the transition's progress within your sector?
- When comparing electric to fossil-based transport, what are the most critical aspects noticed by your members:
 - Challenges?
 - Differences?
 - Opportunities/Enablers?

3. Enabling and Constraining Market Factors

- What factors have you identified as the primary drivers and barriers for the market?

4. Member Needs and Market Demand

- How do you perceive the general maturity and attitude among your members regarding electric transport?
- How has the demand for electrified solutions among your members evolved over time?
- Which types of members (e.g., large vs. small) are most active in driving this demand?

5. Future Outlook

- How do you think the electrification of trucks will develop in the future?
- What will be prioritized and in focus in your organization's work going forward?

Appendix C: Semi-structured interviews with OEMs

1. Role and Organizational Overview

- Can you describe your role and main responsibilities within the company?
- Can you briefly describe the company and its current operations?

2. Strategy and Current State of Electrification

- What does the company's current strategy look like regarding electrified trucks?
- How are you managing the transition in terms of production and development?
- What are the main drivers behind your electrification efforts?
- What are your overall goals for the share of electric vehicles in your sales mix?
- When comparing electric to fossil-based transport from a manufacturer's perspective, what are the:
 - Challenges?
 - Differences?
 - Opportunities/Enablers?

3. Enabling and Constraining Market Factors

- How do you approach market evaluation specifically for electric trucks?
- What factors (e.g., infrastructure, subsidies) are most critical when evaluating a potential market?

4. Customer Needs and Market Demand

- How do you perceive the general maturity of customers regarding electric trucks?
- How has the demand for electric trucks evolved over time (trends and volume)?
- Who is driving the demand: the end-customer (shipper) or the carrier/hauler?
- How do customer requirements differ when purchasing an electric truck versus a fossil-fuel one?
- Are customers willing to pay a higher initial investment for electrified vehicles?

5. Future Outlook

- How do you think the electrification of trucks will develop in the future?
- What will be prioritized and in focus in your daily operations going forward?

Appendix D: Semi-structured interviews with Carriers

1. Role and Organizational Overview

- Can you describe your role and main responsibilities within the company?
- Can you briefly describe the company and its current operations?

2. Strategy and Current State of Electrification

- What does your current strategy look like regarding electrified trucks?
- How are you managing this transition (e.g., formal strategy, projects, external consultants)?
- What is your current progress (e.g., timeline, share of fleet, and specific routes electrified)?
- What are the main drivers behind your electrification efforts?
- What are your overall goals and targets for the coming years?
- When comparing electric to fossil-based transport, what are the most critical:
 - Challenges?
 - Differences?
 - Opportunities/Enablers?
- Does the impact of electrification differ significantly between your short-haul and long-haul operations?

3. Enabling and Constraining Market Factors

- What external factors are most important for you to continue the transition toward electrification?

4. Customer Needs and Market Demand

- How do you perceive the general maturity of customers regarding electric trucks?
- How has customer demand for electric trucks evolved over time?
- Do you perceive that larger customers drive demand more than smaller ones?
- Are customers willing to pay a premium for electrified transport services?
- Have you noticed changes in which stakeholders are placing demands on you to adopt electric trucks?
- Can you share a typical or unexpected customer case related to the electric transition?

5. Future Outlook

- How do you think the electrification of trucks will develop in the future?
- What will be prioritized and in focus in your daily operations going forward?

Appendix E: Semi-structured interviews with Shippers

1. Role and Organizational Overview

- Can you describe your role and main responsibilities within the company?
- Can you briefly describe the company and its current transport setup (e.g., own fleet vs. 3PL)?

2. Strategy and Current State of Electrification

- What does your current strategy look like regarding electrified transport?
- What is the current status of electrification within your transport operations?
- How have you approached the electrification of specific flows (e.g., selection of suppliers or lanes)?
- What are the main drivers behind your demand for electrification?
- What are your overall goals and targets for transitioning your freight to electric?
- When comparing electric to fossil-based transport from a buyer's perspective, what are the:
 - Challenges?
 - Differences?
 - Opportunities/Enablers?

3. Enabling and Constraining Market Factors

- What external factors (e.g., price, infrastructure) are most important for you to transition your freight to electric?

4. Customer Needs and Market Demand

- How do you perceive the market's maturity and its ability to meet your needs for electric freight?
- How has your own demand for electric transport evolved over time?
- Are you willing to pay a premium to carriers for electrified transport services?
- How have your requirements for carriers/hauliers changed as a result of electrification?
- Can you share a typical or unexpected case regarding your transition to electric freight?

5. Future Outlook

- How do you think the electrification of trucks will develop in the future?
- What will be prioritized and in focus in your daily operations going forward?

Appendix F: Semi-structured interviews with Partner Co

1. Open Question

- Which factors are the most critical for Partner Co's market expansion?

2. Based on the Developed Framework...

- Are these factors relevant from a Partner Co perspective?
- Should we add or remove any factors to better align with Partner Co perspective?
- Is the categorisation and naming of the factors appropriate according to Partner Co?

3. Data collection

- How could each factor be measured (e.g., through which sub-factors)?
- How could each factor be quantified?
- Which unit of measurement is the most relevant for quantification?
- Suggestions for sources? (e.g., official datasets or internal Partner Co documents)

4. Inputs on weights for the MCDA Application

- How important is each respective factor to Partner Co?
- What is the hypothesis regarding prioritization and weighting?