

TRANSITION TO ZEV'S

SIMULATION AND OPTIMIZATION OF HEAVY VEHICLE FLEETS

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*ITRL – INTEGRATED TRANSPORT
RESEARCH LAB*





Agenda

- Introduction
- Approach of the research
- Hauliers outlook
 - Customer interviews – REEL project
 - Stakeholder interviews – TREE project
- Master thesis project



INTRODUCTION

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Introduction

- What factors influence the operational management of an electric truck fleet for transport missions?
 - How to describe a transport mission and task?

➤ Which are the suitable zero-emission vehicles (ZEVs) for an electrified heavy-duty transport fleet?

➤ What is an optimal electrified fleet yielding the lowest Total Cost of Ownership (TCO) and highest revenue?

➤ What would be the transition roadmap toward fleet electrification of heavy-duty transportation?

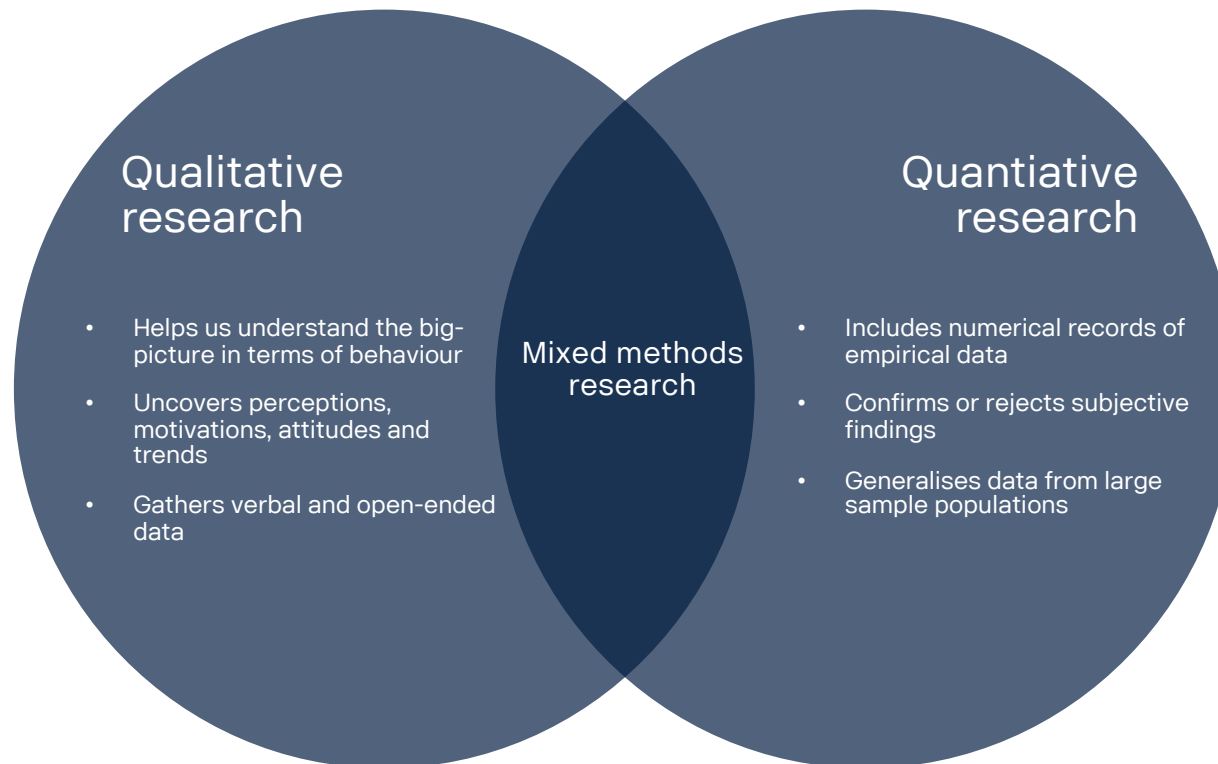


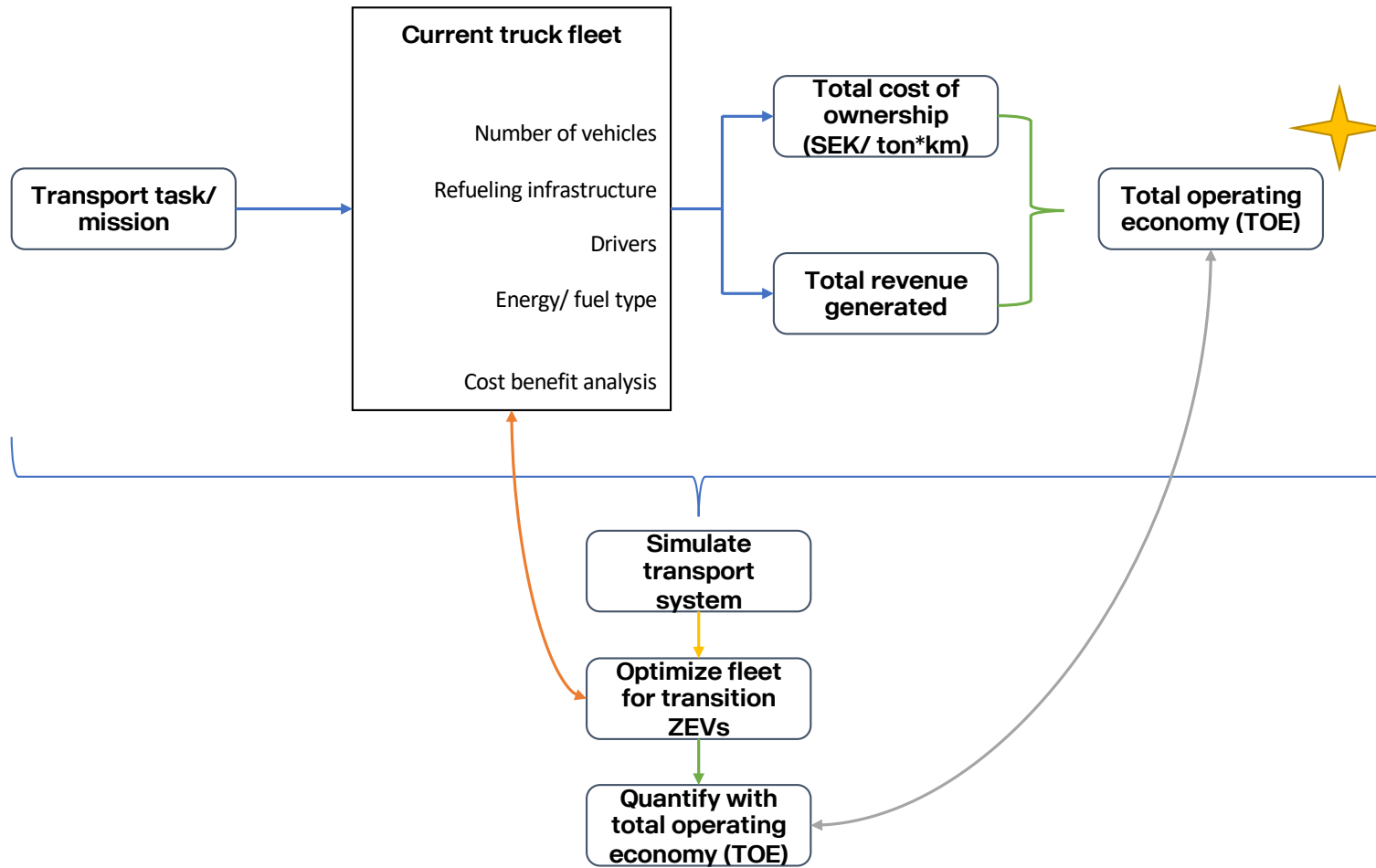
APPROACH OF THE RESEARCH

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Approach of the research





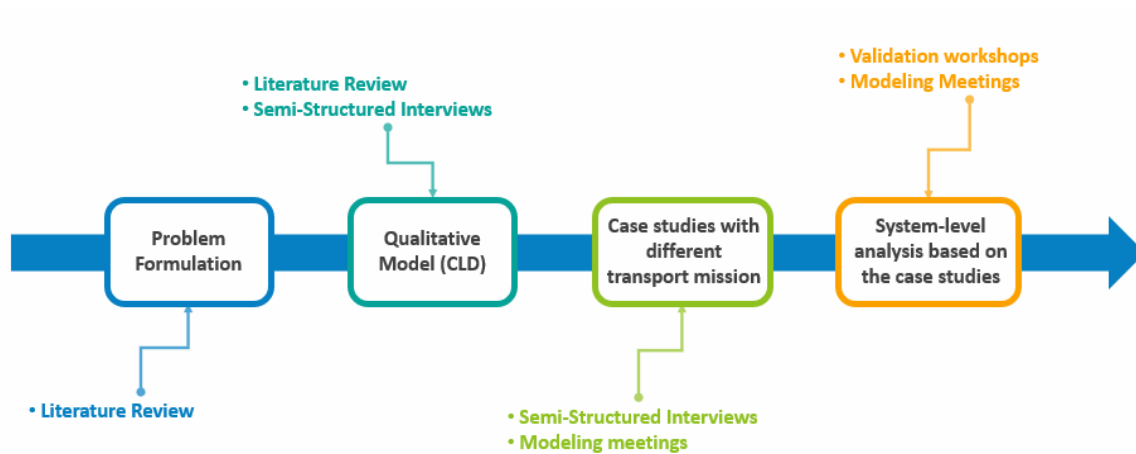


HAULIERS OUTLOOK

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On-going contribution



From vehicle-level simulation to system-level insights: Exploring dynamic interdependencies in freight transport electrification

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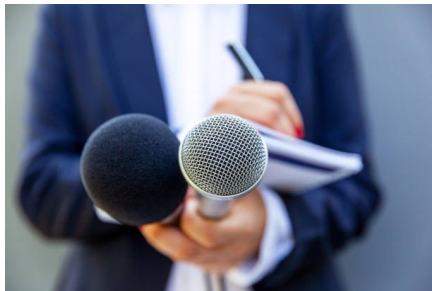
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Executive Summary

Starting from a system-level perspective, we first outline the main dynamics and interconnections between various components of freight transport. Through some case studies, we zoom in on specific components, such as battery size and charging strategies, and with simulations, showcase the dynamic relationships between them. Finally, we zoom back out to discuss the insights gained from this approach, highlighting the broader implications for the system as presented in the article.



Qualitative modelling (CLD)



Stakeholder interviews



Modeling meetings



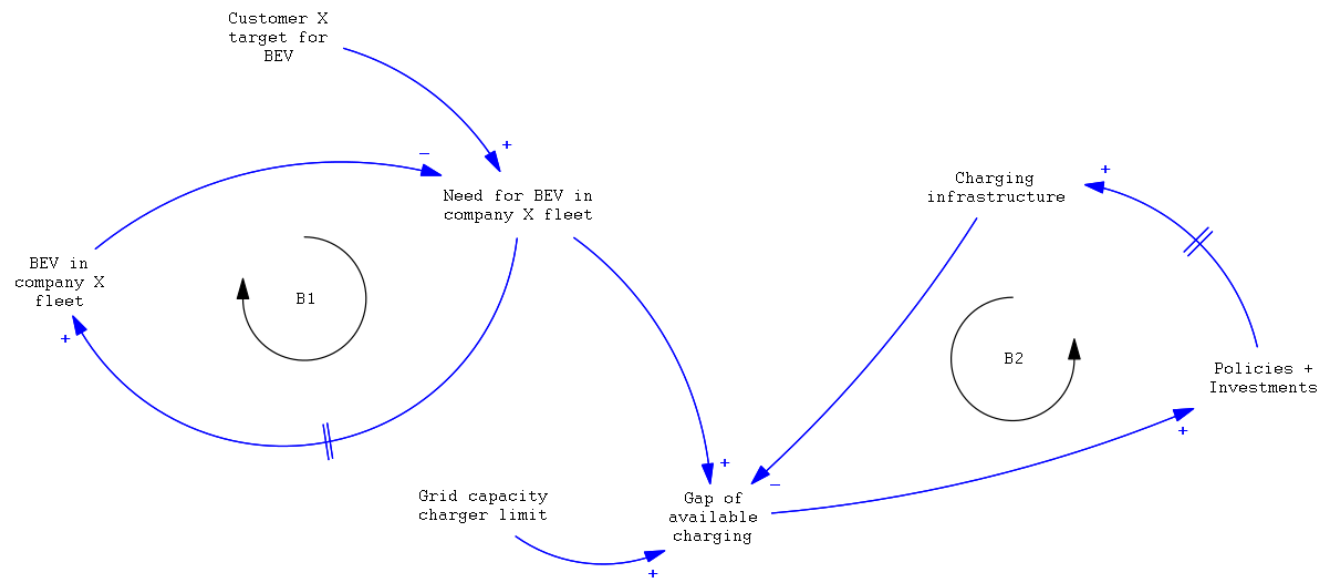
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Qualitative modelling (CLD)



Modeling meetings



Legend:

B1 -> Balancing loop 1

B2 -> Balancing loop 2

|| -> Represents delay in the causal link

+ -> Represents positive causal effect


- -> Represents negative causal effect

System thinking approach



Customer interviews – REEL project

Key highlights:

- Distance driven  by customers ranges from **60 km to 500 km/ task**
- Customers interviewed were from diverse logistic operations like **waste collection, intermodal transportation, B2B deliveries, and mining operations**
- Their fleet has varying numbers of trucks; some have **26 to couple of hundred trucks in operation**
- Key challenges voiced by many towards electrification were the **lack of high-power public charging infra, payload losses/km, the high vehicle cost, and the high cost of charging while loading**

Challenges with electrification (Driver's perspective):

- **More electrical energy consumption** is seen when driving at allowable road speed
- **Lack of charging infrastructure** at all unloading and waiting zones
- **Range anxiety** is sometimes felt when stuck on the highway for some hours



Stakeholder interviews – TREE project

Key highlights:

- Essential factors while understanding this transition are **road conditions, weather, and driver availability**
- The **diesel mindset, transport price, and missing end-of-life analysis of vehicles** hinder the acceptance of new technologies
- The prominent challenges within the forestry sector are **weather, challenges of loading, range anxiety, and under optimized planning system**

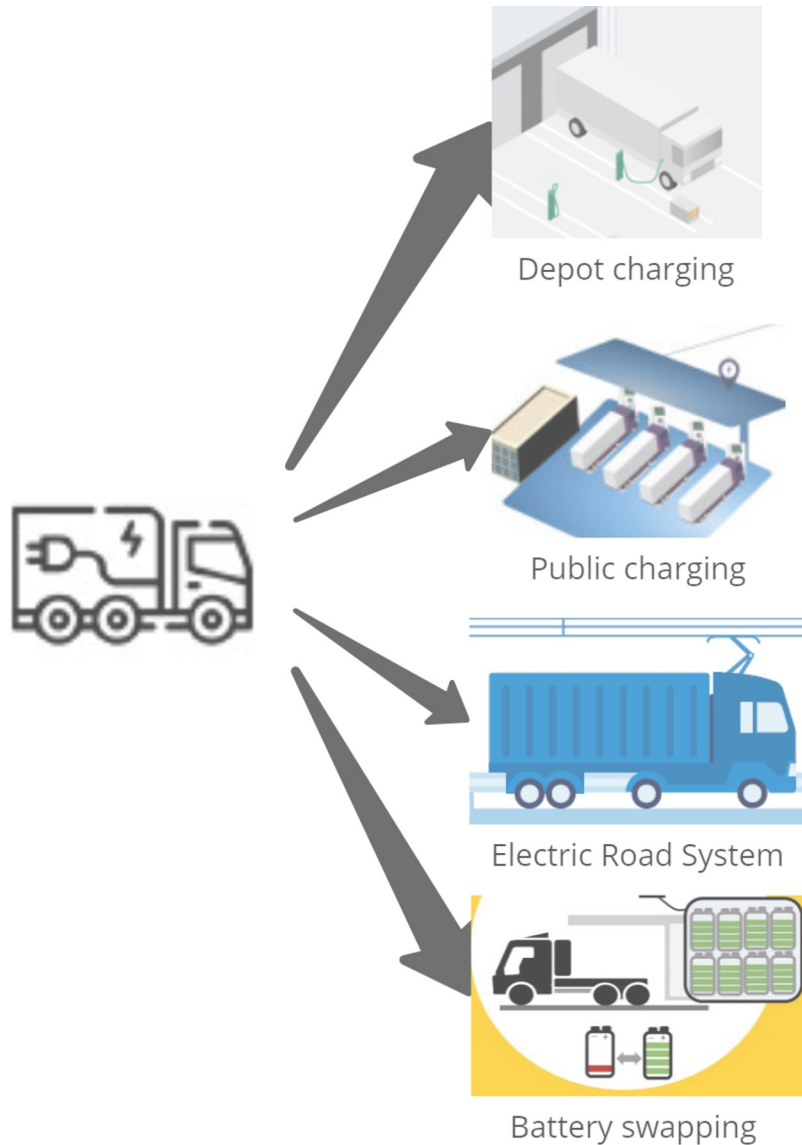
Forestry hauliers (The driver's perspective):

- The Åkeri's need **reliable vehicles, guidance for optimizing transport operation, and a tool to guide towards refueling stations**
- Key aspects that can aid in sustaining this transition start with **longer contract lengths, incentives, and mixed fleet strategy for operation**
- The need is for a reliable prognosis of operation and suggestions for revenue models to keep the business profitable



MASTER THESIS PROJECT

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What aspects are important in choosing a charging alternative?

- Master Thesis of Paolo Pantano
- Freight carrier perspective
- Finding the best charging alternative for different types of freight carriers
- Aspects include for example
 - Investment costs
 - Flexibility
 - Charging plan
- Survey coming soon



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THANK YOU

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