Integrated Planning and Forecasting Systems in Distribution Networks: Collaboration, Sustainability, and Digitalization

Summary

The goal of this doctoral project is to develop and evaluate integrated planning and forecasting systems for distribution networks, with a particular focus on collaborative models that improve both sustainability and operational efficiency. The research will explore key questions such as: 1. What are the main limitations in existing logistics planning and forecasting systems? 2. How can combining demand forecasting with tactical planning improve logistics performance and reduce environmental impact? 3. What helps or hinders the use of collaborative distribution models in both urban and rural settings? 4. Which models are most relevant to the Estonian and Baltic logistics markets?

Research field:	Production and materials engineering, robotics, transport and logistics
Supervisor:	Dr. Kati Kõrbe Kaare
Availability:	This position is available.
Offered by:	School of Engineering Department of Mechanical and Industrial Engineering
Application deadline:	Applications are accepted between June 01, 2025 00:00 and June 30, 2025 23:59 (Europe/Zurich)

Description

The research

Global logistics is facing increasing pressure due to the rise of e-commerce, fragmented supply chains, labor shortages, and stricter environmental standards. Managing parcel and food delivery effectively now demands practical, data-driven tools that balance cost, adaptability, and environmental impact.

Although many planning tools are available, most do not combine critical features such as real-time demand forecasting and tactical routing into a single, coherent system. Likewise, collaborative logistics networks that could lower vehicle numbers and emissions through shared resources are still underused. The integration of forecasting and planning remains relatively unexplored and underutilized in practice.

This PhD project aims to design and test both conceptual and applied tools for integrated planning and forecasting in parcel delivery networks. It will focus on how collaborative models can boost sustainability and efficiency.

Responsibilities and (foreseen) tasks

- Develop a framework for integrated planning and forecasting in distribution logistics
- Identify and evaluate existing digital tools for demand forecasting and routing
- Build and test simulation models to assess collaborative logistics networks and their impact
- Conduct interviews with logistics professionals (e.g., service providers, policymakers)
- Work with anonymized logistics data from Estonia and other countries for model validation
- Run case studies in urban (e.g., Tallinn) and rural areas to evaluate model adaptability
- Provide recommendations to logistics firms and policymakers on sustainable planning methods
- Support the coordination and presentation of project findings at stakeholder events

Applicants should fulfil the following requirements:

- A master’s degree in logistics, industrial engineering, operations research, supply chain management, or a similar field
- A genuine interest in digital logistics, sustainable supply chains, and planning technologies
- Solid analytical skills and experience with modeling or simulation
- Strong command of English, both written and spoken
- Ability to work independently and collaboratively in a research team
- Motivation to contribute to research that has real-world relevance

- Willingness to take part in project-related events and coordination tasks

(The following experience is beneficial:)

- Familiarity with logistics simulation or optimization tools (e.g., AnyLogic, FlexSim)
- Python programming, especially with libraries such as OR-Tools, Pandas, or NumPy
- Experience with data visualization tools like Power BI or Tableau
- Knowledge of forecasting techniques, including time series and machine learning models
- Understanding of collaborative logistics and urban freight systems
- Previous experience with interviews or stakeholder engagement
- Working with large logistics or transportation datasets

The candidate should submit a research plan related to the topic, outlining proposed research questions, data collection strategy, and possible theoretical approaches. The candidate can expand on the listed research questions and tasks and propose theoretical lenses to be used.

We offer:

- A fully funded 4-year PhD position at Department of Mechanical and Industrial Engineering, which works closely with industry on applied research in logistics, manufacturing, and digital technologies
- A chance to contribute to practical research in digital logistics, sustainability, and systems optimization
- Access to advanced simulation tools, modern labs, and real-world datasets
- A supportive and collaborative research environment with a diverse, multidisciplinary team
- Opportunities to attend international conferences, visit partner universities, and work with industry experts across Europe
- A valuable learning experience that prepares you for careers in both academia and industry

About the department

The Department of Mechanical and Industrial Engineering at Tallinn University of Technology (TalTech) combines engineering research and education with real-world applications. The department focuses on developing efficient, smart, and sustainable systems for manufacturing, logistics, energy, and industry.

Key research and teaching areas include:

- Manufacturing technologies and systems
- Robotics, automation, and mechatronics
- Materials engineering
- Energy systems and HVAC
- Product design and digital prototyping (CAD/CAM/CAE)
- Industrial and systems engineering
- Logistics and operations management
- Engineering education and digital learning

The department is highly engaged in applied research and collaborates with industry, especially in Estonia and the Nordic region. It participates in major national and European projects, including Horizon Europe and EIT Manufacturing. Graduates are well prepared for careers in fields like mechanical design, logistics, automation, and energy systems.

(Additional information)

For more information, contact Assoc. Prof. Kati Kõrbe Kaare (kati.korbe@taltech.ee) or Sr. Lecturer Jelizaveta Janno (jelizaveta.janno@taltech.ee), or visit https://taltech.ee/en/department-mechanical-and-industrial-engineering

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