Thesis Proposals
Operations Management

OCTOBER 27TH 2017

Management Science
DTU Management Engineering
Writing your thesis within Operations Management

Welcome to the presentation of thesis proposals offered within the Operations Management group at the department of Management Engineering! With this booklet we hope to inspire you to select an intriguing topic for your coming thesis work.

Although the booklet is primarily directed towards MSc students, a large part of the topics presented will also be able to be scoped to match the academic level and aims of a BSc or BEng thesis project. The booklet could therefore also serve as inspiration to BSc and BEng students.

Some thesis projects are carried out internally here at DTU whereas others are performed in close collaboration with external organisations. In addition to the proposals listed in this booklet, you are welcome to suggest your own ideas for a project topic. If you do so, you need to consult a supervisor in order to scope the project so that it is academically sound, relevant and ambitious but also realistic to achieve within the project period. You should check with the potential supervisor whether you have the relevant prerequisites for carrying the specific thesis topic.

We look forward to meeting you as a thesis student in Operations Management!

The following list of faculty members are potential supervisors:

- Michael Bruhn Barfod, Associate Professor (mbba@dtu.dk)
- Steven Harrod, Associate Professor (stehar@dtu.dk)
- Zaza Nadja Lee Herbert-Hansen, Assistant Professor (znlh@dtu.dk)
- Lars Hvam, Professor (lahv@dtu.dk)
- Peter Jacobsen, Associate Professor (peja@dtu.dk)
- Martin Kidd, Assistant Professor (mpki@dtu.dk)
- Allan Larsen, Professor (alar@dtu.dk)
- Harilaos Psaraftis, Professor (hnpsar@dtu.dk)
Michael Bruhn Barfod

**Position:**

Associate professor, Operations Management

**Research Area:**

Assessment methodologies used in transport planning. Specific areas of interest:

- Applied decision analysis, sustainability assessments and customized decision support systems
- Problem structuring and stakeholder involvement in decision support processes
- Model building from initiation to implementation of various methodological approaches and data treatment

The research in particular applies theory in practice, and has often been carried out using real case data in various projects. These projects have besides articles (national as well as international) lead to the research results being applied both in industry and in the education provided at DTU.

**Teaching:**

I am teaching the following courses:

- 42879 Decision Support and Risk Analysis (MSc, Autumn)
- 42995 Intelligente Transportsystemer (ITS) og projektvurdering (BEng, Spring+June)
- 42997 Sustainable Transport (BEng, Autumn)
Steven Harrod

Position:
Associate Professor, Operations Management

Research Area:
Applied mathematics and analytics in industrial engineering contexts
- Operations management in railway
- Railway traffic engineering and management

Teaching:
I teach the following courses:
- 42878 Future Trains: Railway Fleet Acquisition and Management (MSc, June)
- 42880 Railway Operations and Management (MSc, Autumn)
- 42976 Rail Traffic Engineering (BEng, Spring)
Zaza Nadja Lee Herbert-Hansen

Position:
Assistant Professor, Supply Chain Management

Research Area:
Production techniques in a global setting. Specific areas of interest:

- Supply chain management, including the digital supply chain
- Location decision, including decision making, planning and human resources
- Production optimisation

The research is practice-focused and is carried out with Danish and global companies, mainly using qualitative methods.

Teaching:
I teach the following courses:

- 42582 Production and Planning (5 ECTS) (BSc, Autumn)
- 41713 Manufacturing Technology and Operations Management (10 ECTS) (BSc, Jan+Spring) (parts of)
- 42459 Planning and Scheduling in Manufacturing and Services (5 ECTS) (MSc, Spring)
Lars Hvam

Position:
Professor, Operations Management

Research Area:
- Mass customization
- Complexity Management
- Configuration Management
- Production systems

Teaching:
I am teaching the following courses:
- 42406 Introduction to Production (5 ECTS) (BSc, Autumn)
- 42451 Mass customization – application of product configuration (10 ECTS) (MSc, Autumn)
- 42452 Complexity Management (5 ECTS) (MSc, January)
Peter Jacobsen

Position:
Associate Professor, Operations Management

Research Area:
Develop and apply methods within:

- Production systems - design, planning and optimization
- Logistics - planning and optimization of networks and supply chains
- Optimization of the complexity in production and logistics/SC systems
- Simulation - validation, verification and optimization
- Performance measurement/management
- Digitalization, big data and industry 4.0
- Industrial/healthcare area

Teaching:
I am teaching the following courses:

- 42371 Design of Lean Production and Service Systems (10 ECTS) (MSc, Spring)
- 42376 Operations Management in Health Care and Service Systems (5 ECTS) (MSc, Autumn)
Martin Kidd

Position:
Assistant Professor, Supply Chain Management and Logistics

Research Area:
Interested in integer programming (IP), multi-objective optimisation and machine learning techniques, both from a theoretical point of view (development of new methodologies) as well as applications in supply chains and logistics, especially related to integrated planning and decision making.

Specific topics include:

- Integrated optimisation (production, inventory, routing, etc.) in multi-echelon supply networks
- Computing discrete representations of the nondominated set for multi-objective IP
- Development of general single- and multi-objective integer programming heuristics

Teaching:
I am teaching the following courses:

- 42457 Supply Chain Management (5 ECTS) (MSc, Autumn)
- 42401 Introduction to Management Science (5 ECTS) (MSc, Autumn)
Allan Larsen

**Position:**

Professor MSO, Operations Management

**Research Area:**

Applications of operations research based methodology such as mathematical optimisation, metaheuristics and discrete event-based simulation to planning and management problems within freight transport and logistics.

Specific interests include;

- Distribution planning, city logistics, collaborative logistics, electro-mobility for freight transport
- Transport terminal management
- Optimisation and resource scheduling within public transport

Furthermore, strong interests in the digitalization and automation of the transport and logistics domains within the context of Industry 4.0.

**Teaching:**

My teaching activities are centered on the following courses:

- 42875/42992 Transport logistics and transport optimization (BSc+BEng, Autumn)
- 42417 Simulation in Operations Management (MSc, June 2018 and onwards)
- 42995 Intelligente Transportsystemer (ITS) og projektvurdering (BEng, Spring+June) (parts of)
Harilaos N. Psaraftis

Position:

Professor, Transport optimisation

Research Area:

- Transport Logistics
- Specific areas of interest
- Maritime transport
- Green transport
- Vehicle routing & distribution
- Transport policy

Use of quantitative methods in planning and management of transport systems.

Selected projects:

- SuperGreen, EU FP7 project- overall consortium manager, DG-MOVE (2010-2013).
- TENTAcle, INTERREG VI project, Region Blekinge (Sweden) leader (2016-2019).
- Scandria2Act, INTERREG VI project, Region Berlin-Brandenburg (Germany) leader (2016-2019).
- BlueSiros, funded by the European Space Agency, DTU Space leader (2016-2017).
- SMART MARITIME, DTU scientific advisor, Marintek (Norway) leader, Norwegian Research Council (2016-2019).

Teaching:

- 42884/42871 Green Transport Logistics (course responsible)
- 42885 Maritime Logistics (parts of)
Bed logistics at a hospital (MSc)

PROJECT SUPERVISOR: Associate professor Peter Jacobsen (peja@dtu.dk)

BACKGROUND: For many hospitals it is a problem to identify where, the beds are at a certain time. It is essential for the hospital to have beds available at the emergency department and not be in a situation where they are running out of clean beads. In addition, the planning of bed cleaning will be easier if the location and identification of the beds are available.

PROJECT DESCRIPTION: The project will look at the status for the hospitals and a literature research both domestic and international. The whole logistics from a patient is hospitalized and requires a bed, moved in the bed to different examinations at different departments, released from the hospital. The bed is then transported to the bed cleaning department and returned to the emergency department ready for a new patient.

PROJECT PURPOSE: The purpose of this project is to identify different technological solutions. Design of different scenarios measuring sensitivity if more beds are necessary or if newer patient treatments require other types of patient transportation. Make a cost benefit analysis and an implementation plan.

PREREQUISITES:

NUMBER OF STUDENTS: 1-2 MSc students (2 projects of 30-35 ECTS Credits).
Distribution of pharmaceuticals at a hospital (MSc)

PROJECT SUPERVISOR: Associate professor Peter Jacobsen (peja@dtu.dk)

BACKGROUND: Hospitalized patients require both customized/individual together with general pharmaceuticals products. The individual products needs to be available when needed. It is time consuming for the employees to keep track of the different types of products at the medicine room, ordering new and return old pharmaceuticals. Besides, they are forced to keep track of the products and an account as soon as the products enter the hospital.

PROJECT DESCRIPTION: The project will look at the status for the hospitals and a literature research both domestic and international and suggest solutions that are more efficient

PROJECT PURPOSE: The purpose of this project is to identify different supply chain possibilities for supplying pharmaceuticals from a supplier to the individual patients at a hospital.

PREREQUISITES:

NUMBER OF STUDENTS: 1-2 MSc students (2 projects of 30-35 ECTS Credits).
Performance of a supply chain (MSc)

PROJECT SUPERVISOR: Associate professor Peter Jacobsen (peja@dtu.dk)

BACKGROUND: Industry 4.0 is a new production philosophy. In some areas, they are also talking about a supply chain 4.0. Industry 4.0 contains new technological possibilities for companies to produce their products. In order to gain the full benefits the complete logistic chain needs to be considered.

PROJECT DESCRIPTION: The project will look at the status for Industry 4.0, possibilities for automation and how the performance of the logistic chain can be enhanced by applying industry 4.0 tools.

PROJECT PURPOSE: The purpose of this project is to identify possibilities for enhancing the performance of the logistics by using the industry 4.0 tools.

PREREQUISITES:

NUMBER OF STUDENTS: 1-2 MSc students (2 projects of 30-35 ECTS Credits).
Cyber resilient supply chains

PROJECT SUPERVISOR: Assistant Professor Zaza Nadja Lee Herbert-Hansen (znlh@dtu.dk)

BACKGROUND: The modern supply chain is becoming increasingly digital. This means new risks and therefore a new approach to supply chain risk assessment. This project focuses on this aspect of supply chain management.

PREREQUISITES: 42582 Production and planning (or similar courses), 42457 Supply chain management. Insight into IT security would be an advantage but not a must.
Supply Chain 4.0

PROJECT SUPERVISOR: Assistant Professor Zaza Nadja Lee Herbert-Hansen (znlh@dtu.dk)

BACKGROUND: Supply chains are becoming more global, digital and larger. What impact does this complexity have on competitiveness? What is the future of supply chains and does it differ from industry to industry? Is the supply chain becoming more agile and better able to meet challenges and changes or is it the opposite?

PREREQUISITES: 42582 Production and planning (or similar courses). Insight into simulation and linear programming could be useful but is not needed
Food production in the new millennia

PROJECT SUPERVISOR: Assistant Professor Zaza Nadja Lee Herbert-Hansen (znlh@dtu.dk)

BACKGROUND: The population is increasing. How do we produce food to feed a growing population? What techniques and technologies should we employ? What challenges do we face?

PREREQUISITES: 42582 Production and planning (or similar). Insight into simulation and linear programming could be useful but is not needed.
Corporate Social Responsibility: A corporate advantage or a sales trick?

PROJECT SUPERVISOR: Assistant Professor Zaza Nadja Lee Herbert-Hansen (znlh@dtu.dk)

BACKGROUND: In an increasing global world what is corporate social responsibility? Is it a corporate advantage? A disadvantage? How, when, where and why is it needed - if it is needed? Is it equally needed for all industries? What drives this trend and where is this trend going?

PREREQUISITES: 42582 Production and planning (or similar).
Humanitarian Logistics – the Quest for doing better when the Catastrophe Strikes

PROJECT SUPERVISOR: Professor Allan Larsen (alar@transport.dtu.dk)

PROJECT CO-ADVISOR: PostDoc Diana Cordes Feibert (dife@dtu.dk)

BACKGROUND: Humanitarian logistics can be described as the organization of delivery and warehousing of essential goods (foods, medical supplies, materials, etc.) for relief to people living/staying in an area exposed to a natural disaster such as an earthquake, a tsunami or a famine. Timely and efficient logistics operations is considered to be one of the most important tools when recovering from a natural disaster.

PROJECT DESCRIPTION: The thesis topic can be approached in either a qualitative manner or a quantitative manner. Qualitatively oriented projects should carefully study current practices within humanitarian logistics based on the international scientific literature and data from relevant international organizations to map and analyze processes and provide recommendations that improve process/supply chain performance. Quantitatively oriented projects could either take a simulation or an optimization based approach to building a model framework capable of studying specific the efficiency of a number of semi-realistic scenarios emulating a natural disaster. The project may – if possible – involve discussions and possible collaboration with external organizations and companies. The project could also combine a qualitative and quantitative approach.

PROJECT PURPOSE: The thesis work should build on the newest knowledge from both practice and scientific literature and seek to suggest how processes and planning can be improved to respond in a more efficient manner to natural disasters. The thesis should propose new planning or design concepts and/or deliver a simulation framework to test various distribution scenarios.

PREREQUISITES: The need for prerequisites depends on the approach chosen in the thesis. Independent of the approach, the student(s) must possess a good knowledge of and a strong interest in supply chain management. In case a conceptual qualitative approach is chosen, the student(s) should be familiar with the ideas of process optimization, lean concepts, performance measurement and business process management (BPM) through courses such as 42371 Design of Lean Production and Service Systems or 42376 Operations Management in Health Care and Service Systems. Alternatively, if a more quantitative oriented approach is chosen, the student(s) should have experience with simulation models obtained through for instance courses such as 42413 Simulation in Production and Services or 42882 Simulation in Transport and Logistics.

NUMBER OF STUDENTS: 1-2 MSc students (30-35 ECTS). The project topic may also be scoped to the requirements of a BSc thesis.
Data Driven Supply Chain integration: lane characterization and packaging equipment optimization

PROJECT SUPERVISOR: Professor Allan Larsen (alar@transport.dtu.dk)

PROJECT ADVISORS: Transport Validation Expert Kim B. Salling (kslg@novonordisk.com)

BACKGROUND: Shipping of Novo Nordisk’s products is carried out via a vast amount and often varying transport corridors by a limited number of carefully selected and approved transport companies/forwarders. As quality performance are crucial for any pharmaceutical company authorities and regulators keeps a close surveillance of all shipments sent by Novo Nordisk. Stemming from the large portfolio of pharmaceuticals, needles, pens, etc. in Novo Nordisk A/S each type is configured and hence shipped accordingly, in terms of different packaging equipment, vehicle and mode.

PROJECT DESCRIPTION: Current efforts within supply and distribution of products (herein both associated with finished products, intermediates, API (active pharmaceutical ingredients), raw material, etc.). Importantly, as the majority is shipped in cold chain – all shipments are required to be mapped in terms of temperature monitors (loggers). This, render a huge amount of data – which needs to be assessed and analyzed for each shipment corridor/lane. Additionally, each shipments as pertaining to the stability and hence product quality, needs different types of packaging equipment, as some products can tolerate a relative high temperature variance whereas other products do not tolerate any temperature variance at all. Thus, this is typically divided between what we call active and passive shipper modules. Importantly, as the two data sources are divided into two separate systems, a need for supply chain integration is crucial.

PROJECT PURPOSE: The overall purpose is to secure compliance and cost effectiveness with current authorities in respect to present and hence validate current transport lanes and corridors (Lane Mapping). The project (depending on scope and frame) necessitates a benchmark of current best-practice within the organisation of Novo Nordisk, specifically within the Division of Product Supply. Herein, extensive data material, interviews with key stakeholders, and strong analytical skills are necessary. Concurrently, the project may vary in content and approach depending on the candidate(s) and their ideas/wishes.

PREREQUISITES: Statistics and probability theory, Data Mining and Machine Learning, Operations management

NUMBER OF STUDENTS: 1-2 BSc students (15-20 ECTS)

NB! The project will be completed in collaboration with Novo Nordisk A/S whereof strict confidentiality agreements exists.
Supply and cold chain management: analysis and performance measures for temperature monitoring in Novo Nordisk

PROJECT SUPERVISOR: Associate professor Stefan Mabit (smab@dtu.dk) and Professor Allan Larsen (alar@dtu.dk)

PROJECT ADVISORS: Transport Validation Expert Kim B. Salling (kslg@novonordisk.com)

BACKGROUND: Shipping of Novo Nordisk’s products is carried out by a limited number of carefully selected and approved transport companies. The quality performance of the transport companies is ensured by the initial selection procedure, regular audits and the Quality System Agreements. Additionally, almost all freight and goods movement from the large port-folio of pharmaceuticals, needles, pens, etc. in Novo Nordisk A/S are undergoing substantial regulation and demands for various indicators. The latter ensures the quality of the batch under shipment where one of the key indicators for any shipment is the so-called temperature tracers (monitors). These Temp Tracers monitor the temperature for every shipping unit (whether this is a pallet or shipperbox) throughout the shipment, either with 10 or 28 minute intervals from point of departure to final destination. The Temp Tracer system is a validated temperature monitor system, which is recorded for each individual shipping unit – evaluated at receipt (signed for and downloaded) by a trained personnel who decides on product release. Thus, current requirements used for transport of Novo Nordisk products according to authorities (e.g. EU GDP – Good Distribution Practice) are set within the interval of (+2 to +8 degree Celsius).

PROJECT DESCRIPTION: As part of the above – each Temp Tracer comprises a read out at destination where the data is compiled and assess depicting the temperature variation throughout the transport. Evidently, for shipments with temperature variations not within the allowed interval of regulation- the shipment either goes into quarantine or in worst instances destroyed. However, for shipments within the threshold boundary the raw-data is stored in a massive database – where deviations, routes, trans-shipments, etc. can be assessed.

PROJECT PURPOSE: The purposes of this suggested projects is divided into various sub-tasks. 1. Can the derived data from the database of temp tracer monitoring be classified and assigned the typical route of shipment 2. For each type/classification of goods map out the allowed deviations from the allowed temperature and combine these with real-life data from the temp tracers 3. Where in the given shipment are the main hazards and risks for the goods. Finally, as much of the data currently has been un-treated it is expected that a lot of the initial time spent will be to clean and assess the data.

PREREQUISITES: Interest in Statistics and Stochastic simulation/Processes, machine learning, Operations research and operations management

NUMBER OF STUDENTS: 1-2 MSc students (30-35 ECTS Credits).

NB! The project will be completed in collaboration with Novo Nordisk A/S whereof strict confidentiality agreements exists.
Optimization of Inter-Site Transportation in Novo Nordisk

PROJECT SUPERVISOR: Professor Allan Larsen (alar@transport.dtu.dk)

PROJECT ADVISORS: Transport Validation Expert Kim B. Salling (kslg@novonordisk.com) and Project Manager Michael B. Poulsen (mpus@novonordisk.com)

BACKGROUND: Authorities are pushing the limit for compliance by increasing the level of regulatory requirements; especially temperature compliance within the distribution processes of pharmaceuticals are in focus by authorities. This necessitates a new agenda for the pharmaceutical companies, thus Novo Nordisk. Novo Nordisk is required to demonstrate ‘Transport Control’, for which reason insight and knowledge on product type and lane specific level is a necessity.

PROJECT DESCRIPTION: Current efforts within supply and distribution of products (herein both associated with finished products, intermediates, API (active pharmaceutical ingredients), raw material, etc.) have only been focused upon international transports. However, as part of a re-organisation – inter-site transportation have become of huge interest. The following project – hence – looks into the current inter-site transportation in terms of an optimisation, operations management and evaluation perspective. Depending on initial discussions – the project can and will be scoped accordingly – however with the main focus to optimise inter-site transportation costs.

PROJECT PURPOSE: The overall purpose is to secure compliance and cost effectiveness with current authorities in respect to present and hence validate current transport lanes and corridors (Lane Mapping). Evidently, the project necessitates a benchmark of current best-practice within the organisation of Novo Nordisk, specifically within the Division of Product Supply. Herein, extensive data material, interviews with key stakeholders, and strong analytical skills are necessary. Concurrently, the project may vary in content and approach depending on the candidate(s) and their ideas/wishes.

PREREQUISITES: Statistics and probability theory, Data Mining and Machine Learning, Operations management and Operation Research

NUMBER OF STUDENTS: 1-2 MSc Students (30-35 ECTS)

NB! The project will be completed in collaboration with Novo Nordisk A/S whereof strict confidentiality agreements exists.
Open Problems in Dynamic Vehicle Routing (MSc)

SUPERVISOR: Professor Harilaos N. Psaraftis (hnpsar@dtu.dk)

BACKGROUND: Dynamic vehicle routing problems (DVPRs) are defined as vehicle routing problems in which problem inputs are received and updated concurrently with the execution of the route. Such problems find applications in many transport contexts, such as city logistics, dial-a-ride systems, courier services and others. DVRPs may or may not involve stochasticity in the input data. Research in this area has grown strongly over the years and many methods and techniques have been developed. A recent survey paper has surveyed more than 100 papers and developed a taxonomy for this class of problems according to 11 criteria. Numerous open problems that merit investigation have been identified.

PROJECT PURPOSE: The purpose of this project is to advance the state of the art in DVRP methodology.

PROJECT DESCRIPTION: A thesis in this area will investigate one or more of the open problems in this area. These include further analyzing the “Dynamic Travelling Salesman Problem”, analyzing of the worst case or average performance of heuristic algorithms, including vehicle speed as a decision variable, looking at environmental criteria, exploring alternative objective functions, better exploiting ICT technologies and modifying known approaches so as to obtain better solutions, or exploiting any other idea related to DVRPs.

PREREQUISITES: Knowledge of a programming language (C++, Java, or other). 42887 Vehicle routing and distribution planning.

NUMBER OF STUDENTS: 1-2 MSc students (30 ECTS Credits).
Decarbonization pathways for international shipping (MSc)

PROJECT SUPERVISOR: Professor Harilaos N. Psaraftis (hnpsar@dtu.dk)

BACKGROUND: International shipping accounts for 2.2% of anthropogenic CO₂ emissions, and produces some 796 million metric tons of CO₂ per year (2012 fleet data). Much regulatory activity is tasked to find ways to significantly reduce CO₂ and other greenhouse gas (GHG) emissions. Shipping is not yet included in the Kyoto protocol, that being the mandate of the International Maritime Organization (IMO). The IMO, on its part, has adopted in 2011 the only mandatory GHG reduction scheme to date, in the form of the Energy Efficiency Design Index (EEDI). At the same time, the EEDI is plagued with various problems, which will substantially limit its effectiveness for reducing GHG emissions from ships in the future. Several other measures have been proposed, but none is expected to guarantee GHG reductions in the years ahead. In that sense, significant GHG reduction for shipping is only a wish at this point in time.

PROJECT PURPOSE: The purpose of the project is to identify viable pathways to reduce GHG emissions from ships and place them in context vis-à-vis current regulatory activity at the IMO, the EU and other bodies.

PROJECT DESCRIPTION: This project will review technical, logistics-based and market based measures that can potentially achieve significant GHG reductions for the world fleet. Obstacles for implementing such measures will be identified and the analysis will be made on selected ship and fleet scenarios. Interaction with new project ShipClean is foreseen.

PREREQUISITES: A minimum knowledge of maritime transport. Optionally: 42884 Green Transport Logistics

NUMBER OF STUDENTS: 1-2 MSc students (30 ECTS Credits).
Monitoring, reporting and verification (MRV) of CO$_2$ maritime emissions and emissions allocation (MSc)

PROJECT SUPERVISOR: Professor Harilaos N. Psaraftis (hnpsar@dtu.dk)

BACKGROUND: The purpose of MRV is to monitor the energy efficiency and CO$_2$ emissions of the world merchant fleet. In order to document and track global energy efficiency gains, data from ships must be collected and a robust data collection and reporting system must be established. There are currently two MRV systems at play. The EU has adopted Regulation 2015/757, the implementation of which is currently under way. The Regulation applies to vessels above 5,000 gross registered tons (GRT) of all flags conducting voyages into, out of and between EU ports and will require annual reporting of their CO$_2$ emissions in line with an approved monitoring plan. The IMO MRV track has some key differences with the EU scheme, mainly on cargo reporting which is considered mandatory in the EU scheme whereas this is not the case at the IMO level. The EU MRV Regulation has a clause that it may revert to the IMO scheme in case the latter is deemed satisfactory, but at this point in time the two regimes are different and it is not clear if or when they will be harmonized.

PROJECT PURPOSE: The purpose of this project is to assess the status and prospects of MRV in maritime transport and analyze some scenarios as regards its implementation.

PROJECT DESCRIPTION: The project will review the two MRV systems that are currently at play (IMO and EU) and will assess key differences and implementation difficulties. Alternatives for a harmonized regime will be examined. The issue of emissions allocation, that is, how emissions generated by the ship are allocated among cargo, passengers and possibly other accounts associated with the ship will be examined. Links to possible Market Based Measures (MBMs) will be explored. Analysis will involve several ship scenarios.

PREREQUISITES: A minimum knowledge of maritime transport. Optionally: 42884 Green Transport Logistics

NUMBER OF STUDENTS: 1-2 MSc students (30 ECTS Credits).
Impact of sulphur regulations on short-sea shipping in Northern Europe (MSc)

ADVISORS: Professor Harilaos N. Psaraftis (hnpsar@dtu.dk), Postdoc George Panagakos (geopan@dtu.dk)

BACKGROUND: As of 1/1/2015, IMO’s MARPOL Annex VI and EU Directive 2012/33/EU stipulate, among other things, a 0.1% limit in the sulphur content of marine fuels, or equivalent measures limiting the percent of SOx emissions to the same amount. As low-sulphur fuel (Marine Gas Oil-MGO or Marine Diesel Oil-MDO) is substantially more expensive than Heavy Fuel Oil (HFO), the introduction of the stricter limits was expected to lead to significant price increases. Unlike its deep-sea counterpart, in short-sea shipping such a freight rate increase can induce shippers to use land-based alternatives (mainly road). However, the substantial drop in fuel prices of the last two years has mitigated the negative repercussions.

PROJECT PURPOSE: The purpose of this project is to investigate potential market shifts in relation to the Ro-Ro connections along the Scandria®Corridor, extending from Germany to Finland through Denmark and Sweden.

PROJECT DESCRIPTION: The project will look into the Ro-Ro offers in the region and examine their stability in view of the more stringent regulations with regard to the sulphur content of marine fuels enforced on 01/01/2015. More specifically, the project will:

- identify all Ro-Ro connections along the corridor,
- select 4-5 of typical ones,
- estimate their market shares against land-based alternatives,
- investigate market shares sensitivity in relation to fuel prices and speed, and
- assess the competitiveness and long-term stability of the existing offers.

PREREQUISITES: Permission of supervisor, or 42884 Green transport logistics.

NUMBER OF STUDENTS: 1-2 MSc students (30 ECTS Credits).
Dynamic maritime weather routing under uncertainty (MSc)

SUPERVISOR: Professor Harilaos N. Psaraftis (hnpsar@dtu.dk)

BACKGROUND: Dynamic maritime weather routing under uncertainty involves the development of algorithms that optimize a ship's path through the ocean under time varying and stochastic weather conditions. Objectives to be optimized include time, cost, emissions, or other. Decision variables include ship speed and route. Constraints may include time windows. The problem is very important for shipping companies.

PROJECT PURPOSE: The purpose of this project is to advance the state of the art in maritime weather routing.

PROJECT DESCRIPTION: A thesis in this area will develop algorithms for optimizing ship routes and speeds under dynamic and stochastic scenarios and apply these algorithms on various scenarios as regards, ship type, route and environment data. A related DTU project is SIMOS (2017-2020), led by DTU Space and funded by Innovation Fund Denmark.

PREREQUISITES: Knowledge of a programming language (C++, Java, or other). Knowledge of basic shortest path and optimization algorithms. Knowledge of basic maritime technology and/or ship propulsion and/or hydrodynamics.

NUMBER OF STUDENTS: 1-2 MSc students (30 ECTS Credits).
A cost benefit analysis of green ports agendas (MSc)

PROJECT SUPERVISORS: Professor Harilaos N. Psaraftis (hnpsar@dtu.dk); Postdoc Thalis Zis (tzis@dtu.dk)

BACKGROUND: Regulatory bodies and port authorities have been developing green agendas that seek to reduce shipping emissions in areas near ports. This can be achieved through the use of clean fuel and technologies, as well as through changing the operating patterns of the vessels near the port and specifically reducing sailing speed. While emissions per vessel call are reduced through compliance to such programs, there may be time penalties and increased operating costs for ships.

PROJECT DESCRIPTION: This project considers the emissions reduction potential of various policies deployed in green agendas of port authorities. The implications of a complying decision to the ship costs need to be identified (e.g. costs due to delays, technological investments, increased fuel consumption) and compared with the emissions reduced at the port. The option of a convincing monetary incentive provided by the port authority to the ship operator will be considered. It is expected that the value of the incentive will influence the ship operator’s decision to participate or not in the proposed emissions reduction measure.

PROJECT PURPOSE: The purpose of this project are to enhance an existing model that predicts emissions savings from port authority programs with a cost benefit analysis that minimizes the cost per abated ton of pollutant emissions near the port. The decision variables in the proposed optimization problem will depend on the examined policies during the project.

PREREQUISITES: At least one of the following: 42885 Maritime logistics, 42884 Green transport logistics.
Programming experience in C#, VBA or similar language.

NUMBER OF STUDENTS: 1-2 MSc students (30 ECTS Credits).
MSc Project at ROCKWOOL International A/S

Maintenance optimization for curing oven process

In a tight capacity situation, ROCKWOOL is currently searching for every ton of wool they can produce on their production lines to meet the high demand for stone wool products. A recent analysis showed that one opportunity to gain capacity is by managing the regular maintenance stop at the end of a production period (i.e. campaign). The maintenance stop is typically performed every 2-3 weeks after a campaign and involves cleaning of all critical machinery, including the curing oven. When producing ROCKWOOL, the curing oven heats to temperatures over 200 degrees C to cure the binder that holds the wool fibres together. During this process, incidents with fires can occur where residue from binder, oil and dust sets in the oven over time. The number of fires normally increases over time until a point where residue in the curing oven changes due to long term subjection to high temperature, making the residue more combustible causing more fires.

Length of the campaign period differs from factory to factory, but what is puzzling is that factories having the same campaign period show very different frequency of fires. This is a safety concern for ROCKWOOL. Factories with very short campaign periods and more frequent maintenance stops have very few fires. However, shorter campaign periods create more stops, which means lost production of material that the customer is ready to buy, therefore it is lost money to the company. A further complexity is that different products have different composition which might influence the number of fires and when in the campaign period fires occur, but this is not yet known.

Your primary task in this project is identifying relationships between product composition, campaign period and fires investigated with the aim to determine the optimal campaign period which creates as few fires as possible while maximizing production capacity. This will involve working with our Safety and Operations team in Hedehusene to investigate the curing oven cleaning process and analysing historical production and maintenance data. The project may also include research on predictive maintenance and machine learning techniques to see how ROCKWOOL can foresee a coming fire. The results of the project will have a direct impact on the capacity of the ROCKWOOL facilities and the safety of production. This project will be for a group of 2 MSc students and will require students to be 3-4 days per week at the company.

If you are interested in the project, please send a short email explaining your motivation along with your CV and grade transcripts to Alexandria alexandria.trattner@rockwool.com by November 1, 2017.
Product configuration assignment at MAN Diesel & Turbo

**Background:** MAN Diesel & Turbo Copenhagen designs customer specific two-stroke diesel engines. Two engines are rarely completely alike, but a massive part of the product documentation can be reused across different engine variants. In order to facilitate such a reuse, the company has developed a modularised product architecture. And the specification of specific engine variants is supported by product configuration systems containing models of the product architecture. The department for Engineering Process Development is involved in multiple product configuration projects. The focus is to develop configuration systems that support users in specifying products and controlling all constraints related to how the products can be configured.

**Assignment:** The current configuration process is that the engine design is specified and ordered via a tool called DSO (Design Specification Order), which is based on a product configurator that is developed in-house. As stated above, the design of an engine is heavily modularised and a large part of the engine design is reused. For identifying reusable parts, a second product configurator is used, called MVC (Module Variant Center). This product configurator is also developed in-house and is based on a system of Excel sheets and macros.

In February 2018 the department for Engineering Process Development will start an investigation of the applicability of alternative tools for product configuration. One of these tools is released in December 2017 by the PLM-software provider ARAS. MAN Diesel & Turbo is already using ARAS as PLM-system. Another tool is provided by the configuration software provider Configit.

We are looking for two MSc-students that can help us do the following:

1. Get an overview of the current product configuration process from order to design alongside creating a requirement specification for product configuration at MAN Diesel & Turbo.
2. Study the new tools and experiment by building some basic product configuration examples.
3. Create working prototypes in ARAS and Configit containing subsets of the order configuration process (as in the DSO) integrated with the sub seeding design configuration process (as in the MVC).
4. Continually evaluate the functionality provided by the two tools with regards to the requirement specification.

You will have a contact person in the department who will guide you through the assignment.

**Who are you?**

You communicate well and you can work independently. You have a systematic approach and you enjoy working with IT tools. If you are interested please contact Dept. manager Bjarne Rosford Nørgaard, Bjarne.noergaard@man.eu

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Thesis proposals in Operations Management Spring 2018
MSc thesis projects in Mass customization and complexity management, 2017

PROJECT SUPERVISOR: Professor Lars Hvam (lahv@dtu.dk)

Identification and quantification of Complexity cost at ETO company

The Case company produce highly complex and customized printing solutions for the B2B market. They are working with Product Modularity and are able to customize a high degree of each project (ETO product) with standard modules. But to support their customer’s needs, almost all projects have a non-standard customization need.

The purpose of this project would be to identify and quantify the complexity drivers related to these non-standard customizations, to calculate the true performance of ETO projects (including complexity cost) and based on these learnings define a complexity categorization/index of non-standard customizations that can be the basis for improved cost estimation for these. As well as identify the need for data collection, so the company will be able to follow up on complexity cost in the future.

Contact Sara Helene Markworth Johnsen at shmj@dtu.dk for more information regarding the project.

Prototyping a Sales Configuration System at ETO company

The Case company produce highly complex and customized printing solutions for the B2B market. They are working with Product Modularity and are in the process of defining a new product platform. Currently their Order specification process is based on cost estimations in excel sheets and manual product configuration, and they see a need for a configuration system.

The purpose of this project would be to develop and test a Sales configuration system prototype to improve the cost estimation in the sales phase as well as the configuration process of ETO projects.

This would require mapping the Product Family Master Plan for the new product platform. Identifying configuration rules and creating a configuration system prototype in a configuration software.

Contact Sara Helene Markworth Johnsen at shmj@dtu.dk for more information regarding the project.
Which variety is "free"?

Understanding and quantifying the variety in the product assortment has proven to be a great challenge for the modern company. Manufacturers today facing increasing customer requirements and competitive business environments often broaden their product assortments without determining which products can be added in a cost effective way and which will disturb production performance. Being able to determine which product features and product variants can be added without affecting the performance of production is the key to optimizing the profitability of the production system. This is a particular challenge for companies that have long operated with a mass production operations strategies, such as process industries companies which make steel, chemicals, and bulk goods.

The research question for this product is: how does the product complexity (i.e. architecture) impact production performance in the process industry? The same question, asked from a cost perspective, reads: which variety is “free”? This project will focus on quantifying how different levels of the product structure impact various stages of a continuous production system. The work will be performed in close cooperation with a case company ROCKWOOL International A/S, a world-wide producer of stonewool materials whose aim is to “unleash the natural power of stone to enrich modern living.” The work done in the project will feed directly into the complexity management program within the ROCKWOOL Group and allow exposure to various supply chain activities at the company. Expected methods for analysis include statistics, regression, and value stream mapping along with qualitative methods such as interviews. This will be the perfect chance to apply analytical problem solving skills while gaining experience working in highly collaborative industry work environment.

Contact Alexandria Trattner alexandria.trattner@rockwool.com for more information regarding the project. For more information about the company, visit the website: http://www.rockwool.com/.

Besides this, also Grundfos want projects on product configuration, please contact Lars Hansson, lhansson@grundfos.com or you can contact Professor Lars Hvam lahv@dtu.dk.
PROJECTS WITH NCC

Bachelorprojekt - Altaner
Altaner har i dag en betydelig rolle i boligbyggeriet, hvor de bruges som en væsentlig del af det arkitektoniske udtryk og "lækkerhed" af lejligheder. Altanerne herunder altanophængene skal projekteres i forhold til krav til isolering (kuldebroer), statik og arkitektur, dette betyder at projekteringen af altaner udgør en væsentlig del af særligt statikprojekteringen. I NCC ønsker vi at ensrette vores måde at arbejde med altaner på. Bachelorprojektet vil handle om at etablere en produktfamilie for altaner, særligt altanophæng, samt at vurdere mulighederne for at etablere et konfigureringsystem til at støtte projekteringsprocessen. Arbejdet vil foregå under vejledning fra NCC’s afdeling for Innovation og Koncepter og i samarbejde med NCC Konstruktionsprojektering.

Master project – Daylight configurator
NCC has for some time been developing a configuration system for handling of daylight conditions. Daylight is a very important factor of the early design phases of a project. Several master theses have worked on this and have shown good results in relation to the possibility to develop a configuration system that includes parameters such as the window share of the façade, glazing type, room height, room depth, building shape, building height, external shades and more. The daylight requirements in the building code have been updated and therefore the configuration system needs to be updated accordingly and at the same time upgraded with more features, as the current configuration is fairly limited. NCC wants to continue establishing configuration systems in cooperation with DTU students, including the new requirements and calculation methods. The work will be supervised by NCC Engineering based in the sections Innovation and Concepts as well as HVAC design.

Please contact Anders Kudsk aku@ncc.dk at NCC for further details or contact supervisor Professor Lars Hvam lahv@dtu.dk
Auction theory

PROJECT SUPERVISOR: Assistant professor Martin Philip Kidd (mpki@dtu.dk), Professor Jesper Larsen (jesla@dtu.dk)

BACKGROUND: Kopenhagen Fur solely sell furs through auctions. 5 times during the year approx. 30 million skins are sold on auction at Kopenhagen Fur, making KF by far the biggest fur auction house in the work. The mink farmers’ turnover come from these auctions. The selling method is based on very high tacit knowledge among our auctioneers.

PROJECT ASSIGNMENT: Come up with methods to improve the average selling bid. Through video analysis, auction room behaviour, data analysis etc. Develop operational theories that can help KF auctioneers to improve the selling bid.

PREREQUISITES: Game theory would be an advantage, but is not essential

NUMBER OF STUDENTS: 1-2 MSc students (2 projects of 30-35 ECTS Credits).
Machine learning for fur quality detection

PROJECT SUPERVISOR: Assistant professor Martin Philip Kidd (mpki@dtu.dk), Professor Jesper Larsen (jesla@dtu.dk)

BACKGROUND: Kopenhagen fur sort their mink skins by quality manually using a mostly visual process. The project will look into ways to better subdivide the quality and speed up the process for a limited subset of the incoming mink skins. The quality can be subdivided into several manually detectable features.

PROJECT ASSIGNMENT: Setting up a machine learning strategy to improve the classification success rate for one or more manually detectable features. The assignment will consist of:

- Selecting filters and features on images of mink skins
- Analyzing, selecting and implementing an adaptable machine learning strategy like neural network, nearest neighbor, SVM etc.
- Finetuning the image acquisition process to optimize the results

PREREQUISITES: Operations Research, basic knowledge on machine learning. Programming ability is an advantage.

NUMBER OF STUDENTS: 1-2 MSc students (2 projects of 30-35 ECTS Credits).
Creating value for DSB through SAP S/4HANA and redesign of accounting processes aligned with company strategy

PROJECT SUPERVISOR: TBD
CO-ADVISOR: TBD
INFORMATION: Contact Prof. Allan Larsen (alar@dtu.dk).

BACKGROUND:
Can an accounting system based on innovative technology make an organization more competitive and increase efficiency? How is DSB a different organization after the implementation of project FRØ – Fremtidens Regnskab og Økonomi? Replacing a legacy accounting system including related financial/accounting processes was initiated in 2014, however what has been the tangible and intangible effects and results? FRØ is a complex and high-risk project, which affects the core of DSB as an organization and the ability to deliver ‘trains on time’ with a high degree of attention from the board of directors and other important stakeholders. Did the FRØ-project deliver the defined goals and results to DSB as expected?

THE PROJECT:
You will focus on a cost benefits analysis on the FRØ project and its implications and clear value adding benefits. The focus should also be whether the use of new innovative technology aligns with the overall strategy in DSB or not, only supported by a business case. Your focus should be on identifying the tangible and intangible variables of why SAP S/4HANA as a modern accounting system is beneficial and creates competitive advantages for DSB. Applying IT strategy, organizational (e.g. theory of the firm) and corporate managerial economics theory aligned with an economical perspective is recommended. Alternatively, processes and sub deliveries could also be taken into consideration in the analytical process since a redesign of normative structures and habits has been key part of project FRØ. A managerial approach where organizational and managerial theory can be applied is also seen as potential focus. Your focus should be on identifying tangible variables that has contributed to the current state of DSB Finance department, both negative and positive. Using a process perspective could also include e.g. methodology such as SCRUM or PRINCE 2.

Your job will be to include new ideas on what could have been done differently to optimize efficiency and benefits. That being technology, processes or products. And present what you believe should be a recommendation for future initiatives strategic, technology and product wise. Your job will also include a business case presentation of why FRØ has been a success or a failure. What are the generic business case for choosing the platform of SAP S/4HANA for other organizations?

LEVEL: Best suited to a MSc thesis, however can be applied a BSc project as well.

NUMBER OF STUDENTS: 1 preferred, potentially 2 if agreed upon.
Transport Project Evaluation: Decision Support and Multi-Criteria Decision analysis (MSc)

PROJECT SUPERVISOR: Associate professor Michael Bruhn Barfod (mbba@dtu.dk)

BACKGROUND: Recent research has shown that conventional cost-benefit analysis is inadequate as a decision support tool for appraising transport infrastructure projects as it fails to capture criteria of a more strategic and qualitative character. Multi-criteria decision analysis (MCDA) can be applied to the appraisal scheme to deal with this issue.

PROJECT DESCRIPTION: Current research deals with the difficult task of identifying the most suitable decision aids for supplementing the cost-benefit analysis. Several MCDA techniques have been suggested suitable for decision making in the transport sector when dealing with selections among a limited number of alternatives. However, these techniques become inappropriate when dealing with large a number of alternatives and criteria such as in a screening phase.

PROJECT PURPOSE: The purpose of this project is to look into the possibilities of using outranking methods belonging to the so-called constructive MCDA approach. These methods are able to handle a large number of alternatives and criteria simultaneously using a sort of voting mechanism. The different methods can be applied to a suitable case study and the results can be benchmarked against the outcome of a conventional analysis.

PREREQUISITES: 42879 Decision support & Risk analysis.

NUMBER OF STUDENTS: 1-2 MSc students (2 projects of 30-35 ECTS Credits).
Transport Planning: Decision Support and Planning workshops (MSc)

PROJECT SUPERVISOR: Associate professor Michael Bruhn Barfod (mbba@dtu.dk)
PROJECT ADVISORS: Professor Steen Leleur (stle@dtu.dk)

BACKGROUND: Tendencies in the transport sector has revealed a growing need for involving stakeholders more in the decision support process in order to capture all aspects of the of very complex decision problems. Planning workshops has been suggested to deal with this issue by gathering relevant stakeholders and decision makers with the purpose of generating a fruitful discussion to improve the final decision making.

PROJECT DESCRIPTION: Planning workshops consist of three main elements: group processes, decision analysis and information technology. The purpose is to link these three elements and use the best from each of them in the decision support process. The composition of such a workshop will, however, depend on the decision context, the participants’ affiliations, the participants’ level of power, and many other issues.

PROJECT PURPOSE: The purpose of this project is to test how the planning workshop concept can be used for real decision support. The implementation of the concept can be tested through a current running decision problem, where workshops e.g. can be held on different levels (citizens, municipality, regional, or organizational) to improve the actual decision support in form of more diverse and detailed information to the final decision makers.

PREREQUISITES: 42879 Decision support & Risk analysis.

NUMBER OF STUDENTS: 1-2 MSc students (2 projects of 30-35 ECTS Credits).

NB! A smaller version of the project can be aligned to suit both BSc and BEng student theses.
Integrating life-cycle assessment into transport cost-benefit analysis (MSc)

PROJECT SUPERVISOR: Associate professor Michael Bruhn Barfod (mbba@dtu.dk)
PROJECT ADVISORS: Post Doc Stefano Manzo (stman@dtu.dk)

BACKGROUND: Traditional transport cost-benefit analysis commonly ignores the indirect environmental impacts of a project deriving from the overall life-cycle of the different project components. Such indirect impacts are instead of key importance in order to assess the long-term sustainability of a transport project. In the present study we suggest to overcome this limit by combining life-cycle assessment approach with standard transport cost-benefit analysis.

PROJECT DESCRIPTION: Based on the outcome from the Brundtland report (UN, 1987), Holden et al. (2013) derived four main dimensions of sustainable development: satisfaction of human needs, intra- and intergenerational equity and longterm ecological sustainability. Having the latter dimension in mind, it can be argued that traditional transport project evaluation frameworks commonly fail to provide decision makers and stakeholders with a complete picture of the full environmental costs deriving from the implementation of transport projects. In fact, while direct environmental costs, such as air pollution from vehicles operation, are normally included in the project evaluations, indirect environmental costs, such as the energy and emissions associated with vehicle manufacturing, are usually not. The indirect environmental costs derive from the entire life-cycle of the project components and are commonly quantified in studies on sustainability through Life-Cycle Assessment (LCA) techniques.

PROJECT PURPOSE: The aim of the present study is to fill this gap by, first, outlining a framework combining LCA and CBA and, second, implementing a case study to compare the results from a standard CBA and the suggested framework. As first step, a tool developed to implement transport projects CBA will be applied and tested. Then, a case study e.g. referring to the planned construction in Frederikssund (Denmark) of a new road bridge across the Roskilde Fjord can be analysed.

The effects of the new infrastructure on the overall Danish transport system are then estimated by using the Danish National Transport Model (NTM), an activity-based model meant to establish a unified reference model for transport policy analyses and project evaluations in Denmark.

PREREQUISITES: 42879 Decision support & Risk analysis

NUMBER OF STUDENTS: 1-2 MSc students (2 projects of 30-35 ECTS Credits).
Supporting Copenhagen Green Mobility initiatives with state-of-the-art decision support tools (MSc)

PROJECT SUPERVISOR: Associate professor Michael Bruhn Barfod (mbba@dtu.dk)

EXTERNAL ADVISOR: Annette Kayser, Project Manager, City of Copenhagen, Technical and Environmental Department

BACKGROUND: Sustainable transport appraisal and planning is a complex socio-technical challenge. Copenhagen’s 2012 “Action Plan for Green Mobility” includes 25 initiatives as part of its green mobility package. The selection and prioritization of these measures was complex and difficult to operationalize in practice. A set of criteria for the selection of the initiatives was defined, including green mobility, environment, safety, city life and health. However the qualitative nature of the judgments and the different priorities between stakeholders made it difficult to provide a fact-based approach with clear results to bring to decision-makers. There is thus a need for revisiting this case by applying a decision-support tools to prioritize the proposed measures and review the plan according to a more systematic and transparent process. Such tools can help highlight differences but also potential overlaps in preferences between stakeholders – and thus provide maneuver for negotiation and improve the decision-making process. Finally, the approach allows for comparing priorities and decisions with a potential sustainability ‘benchmark’: that of future generations.

PROJECT DESCRIPTION: In this project you will review and assess the current initiatives as described in the “Action Plan for Green Mobility”. With input from the Technical and Environmental Department, the criteria for success will be reviewed and defined based on sustainability principles and applicable sustainable mobility goals for the municipality. Using AHP (Analytic hierarchy process, or similar complex decision-support tool), the judgments for the prioritization of the criteria for each type of stakeholders will be collected through various means (past data, survey, interviews etc). The expected performance of each initiative will also be assessed through expert evaluations. Finally, the perspective of future generations as a ‘virtual’ stakeholder may also be defined to provide a stronger sustainability perspective. The project concludes with an improved, systematic and transparent decision-support process and impact assessment for Copenhagen’s “Action Plan for Green Mobility”.

PROJECT PURPOSE: The purpose of this project is to provide the Technical and Environmental Department of Copenhagen Municipality with a state-of-the-art decision-support tool for complex, multi-stakeholder, ‘ex-ante’ assessment of sustainable mobility initiatives.

The project also evaluates the usefulness in creating a ‘future generations’ stakeholder as a potential benchmark for backcasting from a vision of sustainability as part of this process.

PREREQUISITES: 42879 Decision support & Risk analysis

NUMBER OF STUDENTS: 1-2 MSc students (2 projects of 30-35 ECTS Credits).
Sustainable highway rating systems – a comparative analysis (MSc)

PROJECT SUPERVISOR: Associate professor Michael Bruhn Barfod (mbba@dtu.dk)

BACKGROUND: There is increased interest in assessment frameworks and tools that can support an evidence-based transition towards a sustainable transport paradigm. In the US, frameworks such as the Federal Highway Administration Infrastructure Voluntary Evaluation Sustainability Tool (INVEST) or The Sustainable Transportation Analysis and Rating System (STARS) are increasingly being used to assess transportation projects. Although one may challenge the concept of a ‘sustainable highway’, departments of transport (DOTs) in the US have been particularly keen to use such systems for highway and bridge projects. In the UK, the sustainability assessment, rating and awards scheme for civil engineering (CEEQUAL) serves a similar purpose. A previous DTU Transport research project for the EU National Road Administration also proposed a Sustainability Rating System Framework (SUNRA).

The increasing number of such tools raises the question: how do they compare, and how strong is the level of sustainability they are likely to provide?

PROJECT DESCRIPTION: You will analyse existing sustainable transport assessment frameworks (minimum 2 of your choice) with regards to their strength and weaknesses. Your analytical framework will cover the conceptualisation, operationalization, and utilization of indicators. How does the framework connect to principles of sustainability? How were these principles translated into indicators? How is this evidence utilized in their context? Depending on the chosen focus between the three themes above, this comparative study will consist of mixed methods (desktop analysis, interviews with practitioners in targeted countries). You will use real cases to illustrate your analysis.

PROJECT PURPOSE: The purpose of this project is to analyse the strengths and weaknesses of existing sustainable transport rating systems with regards to their design and application in real life.

PREREQUISITES: 42879 Decision support & Risk analysis

NUMBER OF STUDENTS: 1-2 MSc students (2 projects of 30-35 ECTS Credits). Due to the comparative nature of the thesis, a team of 2 students is recommended but not required.
Accessibility in rural municipalities (MSc)

PROJECT SUPERVISORS: Associate professor Michael Bruhn Barfod (mbba@dtu.dk)
PROJECT ADVISOR: Associate professor Jacob Kronbak (jakro@dtu.dk)

EXTERNAL ADVISORS: The project requires establishing contact with an interested suburban or rural municipality.

BACKGROUND: While larger cities are seeing dramatic changes towards more sustainable patterns of transportation in recent years, car dependency and its associated environmental costs remain largely unaddressed outside city centres, in suburbs and within rural municipalities. Geographic information systems (GIS) have been used in many settings to more accurately present accessibility measures. These include 30-min isochrones, walkability, bikability, but also housing & transportation affordability depending on location (see for e.g. http://htaindex.cnt.org/).

There is a need for systems of indicators to assess current situations, to guide decision-making, and to monitor progress towards a paradigm of sustainable transportation at rural level in Denmark. As transportation demand is tightly coupled to land-use planning, this project proposes a set of spatially disaggregated indicators of accessibility using (GIS), with a view on enabling a transition towards a sustainable transport paradigm.

PROJECT DESCRIPTION: You will demonstrate the feasibility of producing spatial indicators of accessibility and sustainable transportation at the required scales with data available publicly or at DTU. You will do this by performing a full iteration in the process of defining and selecting indicators, including testing acceptability with a test municipality (at minimum 1). Selected indicators should support existing sustainability goals (at municipal, regional, national or EU level).

PROJECT PURPOSE: To propose GIS-based indicators to represent and communicate accessibility and sustainable transportation for Danish municipalities based on existing goals and data.

PREREQUISITES: 42879 Decision support & Risk analysis, general GIS course.

NUMBER OF STUDENTS: 1-2 MSc students (2 projects of 30-35 ECTS Credits).
Mobility-potential of public transport initiatives (MSc)

PROJECT SUPERVISORS: Associate professor Michael Bruhn Barfod (mbba@dtu.dk)
PROJECT ADVISOR: Associate professor Jacob Kronbak (jakro@dtu.dk)

EXTERNAL ADVISORS: The project requires establishing contact with an interested municipality.

BACKGROUND: Nearly 9 out of 10 people live in cities today where 50 years ago it was only 7 out of 10. During these 50 years, the area of the Danish cities has also tripled. The city zones has been expanded by 10% since 2000 and the population in the cities has increased by 4% in the same period (Ministry of the Environment, 2008). There are both positive and negative aspects of this. The cities are attractive as there are both housing, workplaces, educational facilities, institutions, shops, culture and leisure facilities. The cities are efficient in that sense as there are people, homes and companies enough to ensure sustainable, collective solutions for, among other things, transport, drinking water, waste water, waste and energy.

The cities are also problematic. The division of labor in cities and between cities has caused transport needs to rise, and the largest cities are already heavily congested. Noise, air and soil pollution affect everyday life, and transport and many other activities cause high energy consumption and CO₂ emissions. Thus, the cities and their activities play a major role in the climate change debate. Therefore, urban development and construction must aim at a wide range of solutions that together create the modern, sustainable city.

Central to a sustainable city is a well-functioning public transport system that helps to ensure the mobility of all population groups while counteracting road congestion. There is also a major social gain in terms of better health and cleaner air by moving traffic from cars to other more environmentally friendly modes (CONCITO, 2015).

PROJECT DESCRIPTION: The project should analyse the mobility potential of a public transport initiative such as a light rail project on a strategic level. The first part of the analysis should begin with illustrating the effects of the creation of the initiative itself. In this connection, a model tool should be developed based on a network access that takes into account how distance and time are affected by physical barriers, etc. in the transport network.

The second part of the analysis should illustrate the effect of different ways of utilizing the new infrastructure. This should be addressed by comparing the consequences of accessibility to e.g. stations with mobility for passengers.

PROJECT PURPOSE: To conduct a strategic analysis and propose GIS-based indicators to represent and communicate transport initiatives to increase mobility and sustainable transportation for Danish municipalities.

PREREQUISITES: 42879 Decision support & Risk analysis, general GIS course.

NUMBER OF STUDENTS: 1-2 MSc students (2 projects of 30-35 ECTS Credits).
Inaccuracy in road transport infrastructure projects (MSc)

PROJECT SUPERVISOR: Associate professor Michael Bruhn Barfod (mbba@dtu.dk)
EXTERNAL ADVISOR: Risk Manager Trine Holst Veicherts, (Danish Road Directorate) (thv@vd.dk)

BACKGROUND: Recent research has proven that construction costs are embedded with substantial degrees of uncertainty, which ultimately can lead to wrongful input to decision support models.

PROJECT DESCRIPTION: Currently, the Danish Road Directorate possess information with regard to construction costs within a large database system. This project seeks to investigate and assess the data material within the database in order to benchmark estimated costs against realized costs for road projects.

PROJECT PURPOSE: The purpose of this project is to structure, validate and verify the huge amount of data within the database and hereby to investigate whether there in fact is bias in the estimating of construction cost within road transport projects.

PREREQUISITES: 42879 Decision support & Risk analysis

NUMBER OF STUDENTS: 1-2 MSc students (2 projects of 30-35 ECTS Credits).
Sustainable Decision Support: Sustainable transport and infrastructure planning (MSc)

PROJECT SUPERVISOR: Associate professor Michael Bruhn Barfod (mbba@dtu.dk)
PROJECT ADVISORS: Professor Steen Leleur (stle@dtu.dk)

BACKGROUND: There is a growing focus on sustainable transport planning in order to reduce CO₂ emissions as well as congestion. This is a global focus which has to be dealt with locally, thus implying challenges in defining the main planning objectives.

PROJECT DESCRIPTION: The project can either take its starting point in a specific case of transport or infrastructural planning or in the development and testing of an assessment methodology. It should consider the different structural and sectorial frameworks related to the planning process and thereby approach the problem of defining and assessing sustainability within infrastructural planning, which so far remains unsolved.

PROJECT PURPOSE: The purposes of this (these) suggested project(s) are to clarify potential obstacles for the implementation and realization of a sustainable transport network as well as to present a possible assessment and evaluation method for advancing and encouraging sustainable development within transport and infrastructural planning.

PREREQUISITES: 42879 Decision support & Risk analysis.

NUMBER OF STUDENTS: 1-2 MSc students (2 projects of 30-35 ECTS Credits).

NB! A smaller version of the project can be aligned to suit both BSc and BEng student theses.