Thesis Proposals
Autumn 2021
Operations Management

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Management Science - DTU Management
Writing your thesis within Operations Management

Welcome to the presentation of thesis proposals offered within the Section of Operations Management group at DTU Management! 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.

We encourage you to browse the topics presented for each thesis family and subsequently contact us. Please respect that contacting several potential supervisors at the same time may result in a lot of extra work for us, therefore please let us know if you already in contact with other supervisors at the time you contact us.

For some projects, the thesis may be carried out in collaboration with an external company, in this case please consider that the supervisor needs to be included in the discussion with the company from the very start of the scoping/planning process.

The following list of faculty members are potential supervisors:

- Michael Bruhn Barfod, Associate Professor (mbba@dtu.dk)
- Lars Hvam, Professor (lahv@dtu.dk)
- Martin Kidd, Assistant Professor (mpki@dtu.dk)
- Melanie Kreye, Associate Professor (mkreye@dtu.dk)
- Allan Larsen, Professor MSO (alar@dtu.dk)
- George Panagakos, Senior Researcher (geopan@dtu.dk)
- Thalis Zis, Senior Researcher (tzis@dtu.dk)

Please note that it is indeed also possible to write your thesis in collaboration with other research groups within the Management Science division as well as across the department.

We wish you good luck in pursuing an interesting and ambitious thesis project!

Best regards,

The Section of Operations Management
Michael Bruhn Barfod

Position:

Associate Professor, Operations Management

Research Area:

Assessment methodologies used in 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 teach the following courses:

- 42580 Engineering Work 1 (5 ECTS) (BSc, Autumn)
- 42583 Engineering Work 2 (5 ECTS) (BSc, Spring)
- 42584 Project work (10 ECTS) (BSc, Spring)
- 42879 Decision Support and Strategic Assessment (5 ECTS) (MSc, Autumn)
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)
Martin Kidd

**Position:**
Assistant Professor, Supply Chain Management and Logistics

**Research Area:**

I am interested in supply chain management, more specifically supply chain analytics and supply chain collaboration.

Supply chain analytics involves utilizing tools from

- mathematical/stochastic modelling
- optimization
- machine learning
- game theory

to gain insights from data and enhance decision making within the supply chain contexts such as

- forecasting
- production/distribution planning
- network design
- coordination and collaboration

ultimately to assist in the improved design and management of supply chains.

When it comes to collaboration, the main research questions concern in what ways companies can collaborate within a supply chain and how to incentivize collaboration. In my research I combine both, using techniques from analytics, especially cooperative game theory, to answer questions about collaboration.

**Teaching:**

I am teaching the following courses:

- 42380 Supply Chain Analytics (5 ECTS) (MSc, Spring – from 2020)
- 42382 Industry 4.0 in Operations Management (5 ECTS) (MSc, will be offered from autumn 2021)
Melanie Kreye

Position:
Associate Professor, Operations Management

Research Area:
My research focuses on service operations within the manufacturing industry (engineering services). Specific research areas include:

- Service relationships (provider-customer triads, supplier relationships, contract management etc.)
- Innovation of service offerings (development of combined product-service offerings, drivers for innovation)
- Global operations in manufacturing and services
- Employee behavior and management
- Management of change in service-driven manufacturing

Teaching:
I teach the following courses:

- 42402 Sustainable Operations and Supply Chain Management (MSc, will be offered from autumn 2021)
- 42B85 Servitization (MBA, Spring)
Allan Larsen

Position:
Professor MSO, Operations Management

Research Area:
Digitalization and automation opens up new complex planning problems calling for advanced quantitative analytical methods within domains such as transport, logistics, supply chain management and healthcare.

My research is focused on applying cutting-edge operations research based methodologies such as mathematical optimisation, metaheuristics and simulation tools to planning and management problems within transport, logistics, supply chain management and healthcare.

Specific interests include;

- Urban freight transport (city logistics)
- Electro-mobility for freight transport
- Demand-responsive transport systems (autonomous vehicles and fleet management)
- Improvements of efficiency in logistics, supply chains, warehousing, manufacturing through the use of simulation methodology
- Supply Chains in healthcare
- Healthcare Operations Management

Teaching:
I teach the following courses:

- 42587 Introduction to Operations and Supply Chain Management (BSc, Autumn)
- 42417 Simulation in Operations Management (MSc, June)
Thalis Zis

Position:
Senior Researcher, Maritime Logistics

Research Area:

- Port Operations
- Maritime Logistics
- Green Ports
- Sustainable Transport
- Transport Policy

My main research interests lie on identifying solutions that can transform the maritime transportation sector and minimize its environmental impact without experiencing negative economic impacts. Research projects I am currently involved with deal with weather routing for ships, the use of game theory in increasing compliance of ship operators to the sulphur limits, and on the decarbonisation of maritime transport ahead of the commitment of the IMO to reduce GHG emissions by 40% by 2020 and 70% by 2050 compared to 2008 levels. There are several “low-hanging fruits” in the maritime sector that could form interesting MSc theses. These will require the use of quantitative methods in analyzing, managing, and improving the efficiency of transport systems.

Selected projects:

- AEGIS, “Advanced, efficient, and Green Intermodal Systems (AEGIS)” Horizon2020 project (2021-2023)

Teaching:

Guest Lecturing in: 42381 Sustainable Freight and Transport Logistics (from Spring 2021)
Guest Lecturing on Ports and Maritime Transport (Imperial College London, Sapienza University of Rome, University of Memphis)
THESIS
FAMILIES
Advised by
Assoc. Prof.
Michael Bruhn Barfod
Reducing emissions in the maritime sector (MSc)

PROJECT SUPERVISOR: Associate professor Michael Bruhn Barfod (mbba@dtu.dk), Senior researcher George Panagakos (geopan@dtu.dk), PhD student Amandine Godet (amcgo@dtu.dk)

BACKGROUND: In April 2018 the International Maritime Organisation (IMO) adopted its initial strategy on reduction of GHG emissions from ships. Aiming at phasing out GHG emissions as soon as possible in this century, IMO set the targets of:

- strengthening the energy efficiency design requirements for new ships;
- reducing CO₂ emissions per transport work, as an average across international shipping, by at least 40% by 2030, pursuing efforts towards 70% by 2050, compared to 2008; and
- reducing the total annual GHG emissions by at least 50% by 2050 compared to 2008.

More recently, the 4th Greenhouse Gas Study of IMO highlighted that the shipping industry has continued its trend of decoupling emissions from the global growth of seaborne trade (although there was a 40% increase in seaborne trade between 2008 and 2018, CO₂ emissions from shipping fell by 10% over the same period). Nevertheless, measures are needed in the short-, mid- and long-run to achieve the IMO targets and the Paris Agreement ambition. These would involve both improvements in the energy efficiency of new and existing vessels and the development of zero-emission technologies mainly through alternative fuels.

PURPOSE AND DESCRIPTION: Students will be working with different approaches to meet the overall goal of reducing emissions in the maritime sector. This can e.g. include:

- Examine the implications of using alternative indicators in potential measures designed for meeting the target on carbon emissions from ships
- Use available data from leading Danish companies to develop an emission reporting mechanism that combines technical and operational aspects
- From a policy perspective draw recommendations for a more appropriate use of indicators to monitor and benchmark ship efficiency
- Examine the impact of different technologies on board (e.g. waste heat recovery system)
- Examine the potential for alternative fuels as both short- and long-term measures
- Design decision support systems to assist the maritime industry in meeting the reduction targets in the most cost-effective way

PREREQUISITES:
- Good knowledge of statistics
- 42879 Decision support & strategic assessment
THESIS

FAMILIES

Advised by

Assist. Prof.

Martin Kidd
Proactive disruption management in supply chains

PROJECT SUPERVISOR: Assistant Professor Martin Philip Kidd (mpki@dtu.dk)

BACKGROUND: Murphy's law states that if anything can go wrong, it will. Although tongue-in-cheek, it emphasizes an important point, especially for supply chains. In supply chains many things can go wrong, from machine breakdowns to global pandemics, causing disruptions in supply. If we do not plan proactively for potential disruptions and focus too much on "lean" principles, the effects of disruptions will be severe and might propagate throughout the supply chain. On the other hand, adding some flexibility to our plans and schedules will allow room for us to move things around when disruptions happen, and to effectively get back on our feet before things get worse. Digitalization also provides opportunities to enhance flexibility, since real-time monitoring together with machine learning can be used to signal disruptions before they happen. But flexibility usually comes at a cost, and it might be difficult to find the right balance. In this thesis family the objective is to study mathematical models for robust planning and scheduling in supply chains, where the usual objective of minimizing cost is juxtaposed with maximizing the "recoverability" of plans and schedules, given (possibly real-time) predictions of disruptions.

POTENTIAL RESEARCH DIRECTIONS: Different planning contexts can be studied, e.g. robust machine scheduling, robust network design, etc. Different approaches to finding robust solutions can be studied, e.g. adding robustness measures to an optimization problem, following a scenario-based approach to optimization (where constraints are added for different possible disruption scenarios), or to use simulation to study the effects of disruptions.

METHODOLOGIES: Robust optimization, simulation, machine learning

PREREQUISITES: Decent programming skills, e.g. in Python, Java, C++. Experience with formulating and solving MIPs in e.g. Julia or Python. Also useful but not strictly necessary would be knowledge of basic theory on simulation and experience with using machine learning packages, e.g. in Python.
Configuring collaborative planning in supply chains

PROJECT SUPERVISOR: Assistant Professor Martin Philip Kidd (mpki@dtu.dk)

BACKGROUND: Considerable value can be generated through collaboration in supply chains. This is especially true when it comes to planning, where different decision makers across a supply chain are responsible for planning production, distribution and inventory. The ideal would be full collaboration, where the optimization problems concerning production, distribution and inventory are solved collaboratively as a single, integrated optimization problem - as opposed to each decision maker solving its own local optimization problem. However, collaboration often requires investments of time and money and can increase the complexity of the planning process, as more entities need to communicate with each other across the supply chain. In this thesis family the objective is to study the value of collaboration in supply chain planning as we move from no collaboration to full collaboration. In particular, the following questions will be addressed: How can we effectively solve integrated supply chain optimization problems? How many supply chain members in a given supply chain need to collaborate to get close to the value of full collaboration? How can we identify the optimal collaborative relationships for a given supply chain? How can we ensure that all collaborators get their fair share of collaborative gains?

POTENTIAL RESEARCH DIRECTIONS: Formulating and solving different integrated optimization problems in supply chains. Formulating and solving "coalition formation" problems that tries to find the optimal coalitions in a given supply chain - this can be formulated as a set partitioning problem that contains subproblems for each potential coalition’s integrated optimization problem. Using simulation to study the value generated by different collaborative structures. Developing fair benefit sharing mechanisms for different collaborative supply chain planning settings.

METHODOLOGIES: Optimization, simulation, cooperative game theory

PREREQUISITES: Decent programming skills, e.g. in Python, Java, C++. Experience with formulating and solving MIPs in e.g. Julia or Python. Also useful but not strictly necessary would be knowledge of basic theory on simulation and cooperative game theory.
THESIS
FAMILIES
Advised by
Professor
Lars Hvam
Manufacturing footprint/ production architecture in the supply chain

Supervisor: Professor Lars Hvam (lahv@dtu.dk)

Background: The constantly changing external requirements on new products, markets, and customers as well as legal requirements and regulations require the production architecture and manufacturing footprint to be currently updated and adjusted. Having the right manufacturing footprint for the actual requirements can lead to significant improvements in the production e.g. 50 % reduction of production costs, improvement of delivery performance, reduction of time to market for new products etc. And, on the other hand, having an outdated production architecture and manufacturing footprint may lead to significant loss of competitive power as well as higher exposure to political risks such as BREXIT, trade wars etc.

Project description: A master project on production architecture cover one or more of these areas:

- Analyzing the manufacturing task – the requirements for production
- Modeling the existing production architecture for the supply chain related to market requirements and the product architecture
- Develop scenarios for the future production architecture in the supply chain
- Quantification of expected impact of selected scenarios incl. expected flexibility and scalability
Product configuration

**Supervisor:** Professor Lars Hvam (lahv@dtu.dk)

**Background:** Product configurators are increasingly being used to support sales and engineering for making specifications like quotations, and other product and production specifications. Configurators are a means to control the product assortment and increase efficiency in sales, engineering and production.

**Project description:** A master project on product configuration may cover one or more of these areas:

- Defining scope and business cases for product configurators
- Modelling products for a product configurator
- Making a prototype product configurator
- Modelling and developing sales and engineering processes
- Analyzing impact from using product configurators
Complexity management

Supervisor: Professor Lars Hvam (lahv@dtu.dk)

Background: Industry and service companies experience increasing complexity in their products and operations. There is a strong management on reducing complexity and the potential benefits for the companies are significant.

Project description: A master project on complexity management may cover one or more of these areas:

- ABC analysis of products and customers
- Identification and quantification of the most significant complexity cost drivers and allocation of complexity costs to products
- Quantification of other impact than costs e.g. impact from complexity on delivery performance or quality
- Identification of initiatives for reducing complexity in products and/or processes
- Quantifying expected and cost benefits from each suggested initiative and plan for implementation
THESIS
FAMILIES
Advised by
Associate Professor
Melanie Kreye
Thesis family: Services in manufacturing (MSc)

PROJECT SUPERVISOR: Associate professor Melanie Kreye (mkreye@dtu.dk),

BACKGROUND:
Services have become an increasingly important source of business revenue and competitiveness for most manufacturing companies. However, the settings of services within a product-dominated manufacturing business frequently create tensions and challenges for operations. In addition, service require strong dependencies beyond the manufacturer to manage, for example, regular customer inputs, supplier relationships and changes in regulatory frameworks.

PURPOSE AND DESCRIPTION: Projects within this family of MSc theses focus on specific challenges related to services in manufacturing, including but not limited to the following:

- Market trends for services in specific industry sectors and how to translate them into commercial offerings
- Service sourcing and service supply chains;
- The role of services to facilitate reverse manufacturing and circular economy;
- Compliance with regulatory frameworks of, for example product functioning;
- Delivering value to customers: value proposition/ROI tool for service agreements;
- Internal integration of service department with other operations, including product innovation and sales.

Students will be working closely with at least one project company. Potential company contacts are available for some of these project topics. Own company contacts can be used.

PREREQUISITES:
- Good knowledge of qualitative research, including interviews, qualitative coding
- Management of industry collaboration
Thesis family: Global operations (MSc)

PROJECT SUPERVISOR: Associate professor Melanie Kreye (mkreye@dtu.dk),

BACKGROUND:
Services have become an increasingly important source of business revenue and competitiveness for most manufacturing companies. However, the settings of services within a product-dominated manufacturing business frequently create tensions and challenges for operations.

PURPOSE AND DESCRIPTION: Projects within this family of MSc theses focus on specific challenges related to services in manufacturing, including but not limited to the following:
- Differences between national cultures in terms of performance perceptions and assessments;
- Perceptions of ownership in global operations from local subsidiaries;
- Network integration within the global business, including supply purchasing, customer management and logistics networks.
- Network coordination and knowledge sharing in global service networks

Students will be working closely with at least one project company. Potential company contacts are available for some of these project topics. Own company contacts can be used.

PREREQUISITES:
- Good knowledge of qualitative research, including interviews, qualitative coding
- Management of industry collaboration
Thesis family: Digitalisation enabling knowledge sharing in large-scale companies (MSc)

PROJECT SUPERVISOR: Associate professor Melanie Kreye (mkreye@dtu.dk),

BACKGROUND: As many engineering companies continue to implement digital technologies within their organizations, questions arise around changes in their operations and internal functioning. Digital technologies offer the potential to utilize engineering knowledge more effectively. For example, project knowledge and modular product designs may be easier stored and reused, reducing the cost of offering products and services.

PURPOSE AND DESCRIPTION: Project can focus on the internal sharing of knowledge based on implemented digital technologies, including, but not limited to, the following focus areas:

- Industry benchmarks / sustainability & digitalisation ratings
- How digitalization of various tools affects operations and internal collaboration activities, in, for example, new development projects.
- Analyse information reuse through digital technology, for example through re-use of project- information and ability to modularize product designs;
- Ability for risk reduction in engineering firms through information reuse and digitalization.

Students will be working closely with at least one project company. Potential company contacts are available for some of these project topics. Own company contacts can be used.

PREREQUISITES:

- Good knowledge of qualitative research, including interviews, qualitative coding
- Management of industry collaboration
THESIS

FAMILIES

Advised by

Professor MSO

Allan Larsen
Simulation in Operations & SCM

**BACKGROUND:** Operations and supply chain management are home to a wide range of complex planning problems. Simulation modelling is often a well-suited methodology for studying and analyzing the behavior of such problems. In this thesis family, students work on specific topics within logistics, freight transport, supply chain management as well as production planning. The starting point of the theses are discrete-event based modelling but also agent-based modelling and even in some cases system dynamics may be chosen as the method employed.

**RESEARCH TOPICS:** Potential thesis topics include (but are not limited to):

- Analysis of alternative last-mile delivery concepts within sustainable eCommerce logistics
- Simulation of reverse logistics systems for efficient handling of waste, food, etc.
- Analysis of potentials of electric vehicles in short and medium haul freight transport
- Simulation of distribution networks within the pharmaceutical industry

**PREREQUISITES:** 42417 Simulation in Operations Management and preferably 42587 Introduction to Operations & Supply Chain Management or 42401 Introduction to Management Science (or similar).

**SUPERVISOR:** Professor MSO Allan Larsen (alar@dtu.dk). Potential involvement of PhD students if relevant.

**EXAMPLES OF PREVIOUS PROJECTS:**

- Exploration of Discrete Event Simulation in Process Manufacturing Industries
- Analysis of supply chain flexibility requirements in Novo Nordisk
- Simulation and optimisation of a free floating car sharing system
- Efficiency improvements of warehousing operations through increased automation - Simulation study for DHL Supply Chain Denmark
- Assessing the sustainability of electro-mobility for the routing of service technicians
Healthcare Operations Management

BACKGROUND: The population growth and the change in demographics we are currently witnessing makes efficient use of resources within healthcare systems even more vital to the modern society. The healthcare domain holds a wide range of complex planning problems which are well-suited to be analysed via advanced simulation modelling. Methodologies such as simulation modelling and process optimization may help decision makers to make better use of resources.

RESEARCH TOPICS: Potential research topics for student theses (MSc as well as BSc level) includes (but are not limited to):

- Analysis of the operational performance of a specific hospital department taking into account fluctuations in demands (patient flows) and resources available (human resources such as doctors and nurses as well as physical resources such as rooms, beds, equipment etc.)
- Efficient management of the flows of goods (medicine, food and other supplies) are vital to large hospitals. The project should build an optimization and/or simulation model capable of analyzing various logistics concepts. Projects within this topic can potentially be based on the notion of Hospital 4.0 extending the Industry 4.0

Theses within this topic may be set under the umbrella of the Copenhagen Health Innovation collaboration (please see https://cobox.dk/#video for more information). The thesis projects may involve a hospital department or a central planning entity of the healthcare system.

PREREQUISITES: 42587 Introduction to Operations & Supply Chain Management or 42401 Introduction to Management Science (or similar). 42417 Simulation in Operations Management (or a similar course).

SUPERVISOR: Professor MSO Allan Larsen (alar@dtu.dk). Potential involvement of PhD students if relevant.

EXAMPLE OF PROJECTS:

- “Simulation of patient flows for the Emergency Department at Hvidovre Hospital”, ongoing MSc thesis project.
THESIS
FAMILIES
Advised by
Senior Researcher
Thalis Zis
Sustainable Maritime Logistics and Port Operations

PROJECT SUPERVISOR: Senior Researcher Thalis Zis (tzis@dtu.dk), PhD student Sotiria Lagouvardou (sotla@dtu.dk), Student Assistant Martina Reche Vilanova (mrevi@dtu.dk)

BACKGROUND: The International Maritime Organization (IMO) has set ambitious targets for the reduction of GHG emissions from international shipping. A broad variety of candidate measures have been proposed, to tackle this challenge. Short-term measures (2018-2023) include speed optimization and speed reduction, various goal-based measures and engine power limitation. Medium-term measures (2023-2030) include Market Based Measures (MBMs). Long-term measures (2030-2020) include low carbon fuels, use of electricity and innovative energy saving devices such as sails, rotors, air bubbles, cold ironing in ports and others. In parallel, the EU is looking at including shipping within its Emissions Trading System (ETS). This project provides a great opportunity to contribute to the IMO and EU debates.

PROJECT PURPOSE: A number of distinct MSc thesis projects can be envisioned towards the goal of decarbonising shipping. The overarching theme of each project will be to quantify the emissions reduction potential of different emissions reduction actions. These can include policies, technologies, operational measures, and optimization problems. Each action will need to be analysed thoroughly, and consider the perspective of each affected stakeholder. Stakeholders can include the shipowners, the ship operators, shippers, port authorities, and the society.

PROJECT DESCRIPTION: This project will examine the potential impacts of the measures under examination for various scenarios in international shipping, including the role of ports and terminals. Interaction with research projects MBM SUSHI (focusing on market-based measures in shipping), AEGIS (autonomous ships and port operations), PortGreen (role of ports in the decarbonisation of shipping) is foreseen. Potential topics include but are not limited to:

- Use AIS data on port calls to quantify emissions reduction potential from port strategies
- The role of MBMs in promoting alternative fuels in maritime shipping
- The impact of major disruptions in maritime supply chains (e.g. COVID19, Suez Canal blockage, global sulphur cap, potential regional ETS)
- Port call optimization in conjunction with Virtual Arrival Schemes
- Optimal pricing for the provision of alternative maritime power in ports.

PREREQUISITES: A minimum knowledge of maritime transport and/or maritime technologies. Optionally: 42892 Shipping and Port Logistics, or 42381 Sustainable Freight and Transport Logistics

NUMBER OF STUDENTS: 4-5 MSc students (30 ECTS Credits).