Technische Universität München

TUM School of Management

Group for
Production and Supply Chain
Management

Prof. Dr. Martin Grunow

Arcisstr. 21
80333 Munich
Germany

Tel +49.89.289.24870
Fax +49.89.289.24872

martin.grunow@tum.de
www.scm.wi.tum.de

Technische Universität München
80290 München · Germany

Master's thesis:
A multi-objective approach for reducing nervousness in lot-sizing problems

Topic:

In make-to-stock environments, production planners have to take decisions under demand uncertainty. Lot-sizing is a key step in production planning which aims at satisfying the uncertain demand while balancing setup and inventory costs, and ensuring customer satisfaction. Before the realization of the demand, decisions have to be made both on the period in which to produce and on the size of the lot.

In practice, the demand for future periods is estimated using forecasts over a finite prediction horizon. The problem is solved and implemented in a rolling horizon fashion. Because the forecasts are inherently imperfect, they are periodically updated. The production planning may be frequently readjusted to better reflect the newly available knowledge. However, the changes in subsequent production plans can be detrimental for the firm, especially when low flexibility of the processes do not allow for quick and frequent revisions. The instability in the production plans can propagate through the firm and through the supply chain, participating in the so-called bullwhip effect. It may also lead to confusion and inefficiency on the shop floor. This frequent revisions of production plans is an important aspect of production planning often referred to as system nervousness or planning instability in the literature.

It appears that managers have two objectives which may be conflicting: achieving optimal cost of the production planning in the face of uncertain demand, and at the same time ensuring a certain stability in successive plans. Because the cost of nervousness may

be hard to quantify, formulating a multi-objective optimization problem can be an appropriate approach.
The goal of this Master's thesis is therefore to propose and evaluate solution methods to find a compromise between flexibility and stability when solving the lot-sizing problem.

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Fakultät für Wirtschaftswissenschaften

Lehrstuhl für BWL - Produktion und Supply Chain Management

Tasks:

Your tasks will be to

1. Conduct a literature review on the lot-sizing problem, nervousness in production planning, and multi-objective optimization methods.
2. Propose a multi-objective formulation of the lot-sizing problem with adequate measure(s) for performance and stability. An emphasis will be put on the evaluation of nervousness and how to integrate it into a multi-objective formulation.
3. Investigate exact and/or approximate solution methods.
4. Evaluate the solution methods through numerical simulations.

Prerequisites:

You should have taken the course "Modelling, Optimization and Simulation in Operations Management" or an equivalent course and have an understanding of mathematical modelling and optimization. A first experience with multi-objective optimization is a plus.

Contact

Please send a short mail including CV, and transcript of records to Alexandre Forel (alexandre.forel@tum.de). The project topic and start date can be discussed.