Introduction to Computational Optimization Models for Production Planning in a Supply Chain

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With 28 Figures and 24 Tables

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Preface

"For almost any program, there exists a champion who can make it work – at least for a while." Hopp and Spearman (2000)

Managers and information technology professionals need to have an understanding of computational optimization models for production planning in a supply chain. This book provides an accessible introduction to the subject. We develop the terminology and concepts needed to understand the important issues.

We are not trying to be all things to all people. In particular, we are not trying to describe algorithms used by commercial software firms, but rather provide models that could be used by do-it-yourselfers and also can be used to provide understanding of the background issues so that one can do a better job of working with the (proprietary) algorithms of the software vendors.

In this book we strive to provide models that capture many of the details faced by firms operating in a modern supply chain, but we stop short of proposing models for economic analysis of the entire multi-player chain. In other words, we produce models that are useful for planning within a supply chain rather than models for planning the supply chain. The usefulness of the models is enhanced greatly by the fact that they have been implemented using computer modeling languages. Implementations are shown in Chapter 7, which allows solutions to be found using a computer.

A reasonable question is: why write the book now? It is a combination of opportunities that have recently become available. The availability of modeling languages and computers that provides the opportunity to make practical use of the models that we develop. Meanwhile, software companies are providing software for optimized production planning in a supply chain. The opportunity to make use of such software gives rise to a need to understand some of the issues in computational models for optimized planning. This is best done by considering simple models and examples.

This book pursues a number of goals. Some of them are addressed directly such as the goal of developing useful models for production and distribution planning. Others accrue more as side-effects such as an understanding of the leverage that can be gained from abstract optimization models. We describe usable models that can be fed to fairly low cost, readily available software. However, many readers will be interested in these models not for direct im-

plementation but as a means of understanding some of the issues in supply chain optimization for the purpose of using or assessing sophisticated, special purpose supply chain management software. We can also view the book either as a vehicle for understanding production planning within a supply chain via optimization modeling or for understanding optimization modeling by using production planning as an example. Both views are important.

These are things that need to be understood by managers and planners. This level of planning constitutes the interface between strategy and tactics. It is critical. However, it is often left to operational personnel or software vendors. This book aims to change that.

The book is also appropriate for a business school or industrial engineering course. Earlier drafts were used for a course in the Working Professional MBA program at the University of California at Davis, a business information systems course at the University of Technology in Braunschweig and the Karl Franzens University in Graz. Overall, the student population varied greatly from undergraduate business and engineering majors through professional managers from a wide range of backgrounds. The feedback from the students was a great help in preparing the final version of the book and we are grateful for it.

We would like to acknowledge the assistance of student Janin Oer who helped implementing the AMPL models shown in Chapter 7, Michael R. Bussieck of the GAMS development corporation who implemented the GAMS version of the models, Bjarni Kristjansson of Maximal Software who implemented the MPL versions, Greg Glockner and Veronique Blanchard of ILOG who implemented the OPL versions, and Susanne Heipcke of Dash Optimization who implemented the Xpress-Mosel models and students at the UC Davis Graduate School of Management as well as the staff at the University of Technology Braunschweig for proofreading.

Stefan Voß
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