Fürderer
Option and Component Bundling under Demand Risk

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Ralph Fürderer

Option and Component Bundling under Demand Risk

Mass Customization Strategies in the Automobile Industry

With a Foreword
by Prof. Dr. Arnd Huchzermeier

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Foreword

In today's world, customers, not firms, are the driving force behind product variety and speed of innovation. Increased global competition and the opening of newly developed markets raise the pressure even further. High margins for newly developed products are short-lived and thus these products become quickly commodity items. The cash-flow generated by the new product is required for the financing of the research and the development activities of the next generation of products. Successful firms do take the lead in this vicious cycle and do not release products prematurely; the unsuccessful ones launch products late and, as a result, often do not generate sufficient capital required.

Ralph Fürderer explicitly addresses the cross-functional tradeoff in the implementation of mass customization strategies. In practice the debate looms between Marketing who wants to broaden product variety and Manufacturing who needs to lower overall costs. Alternatively, the practice of product bundling and bundle pricing can be deployed effectively and thus lead to the best of both worlds, i.e., lower costs, higher prices and higher expected sales through increased service levels!

The main managerial insight is that products need to be tailored to the customer's reservation prices or willingness to pay for individual product features and options. Thus, there is no need to fulfill all customer requirements. From a manufacturing point of view, the products need to be tailored, too. Scale effects through modular design of components enhance the ease of assembly and foster the quick response capability for customized or bundled products. For this reason advanced planning of component designs and assembly lines prior to the market launch poses the grea-

test challenge for manufacturing planning. Ralph Fürderer addresses this complex planning problem in this book. However, the potential benefits - as demonstrated in this book - can be rather rewarding.

This book provides an excellent integration of the different aspects of manufacturing and marketing planning. Moreover, the methods have been implemented and the results have been validated at Adam Opel AG. My colleague, Professor Linus E. Schrage, from the Graduate School of Business of the University of Chicago, and I consider this work an outstanding contribution to the theory and practice of world class manufacturing management. The concepts described in this book have been integrated already in the curricula of leading Business Schools throughout the world.

Prof. Dr. Arnd Huchzermeier

Preface

In times of quickly growing technical complexity, heterogeneous needs in competitive sales markets, and substantial demand uncertainty due to lead times in Planning, the task of increasing the profitability of a car manufacturer's product line requires powerful decision support systems.

The work presents an integrative framework of the Product Engineering and Manufacturing side in terms of product costs and variant driven complexity costs, as well as the sales revenues on the Marketing side, determined by the stochastic structure of demand and competition. The proposed mathematical optimization models for the system component design and the stochastic price bundling are of large scale in practice, and some can not be solved by traditional local search approaches. We have therefore developed and analyzed new solution algorithms which account for the inherent data complexity and non-concavity.

Moreover, the work reports of the implementation of the presented methods at a world-class car producer using efficient data collection methods for empirical validation on real car concept problems. Due to the versatility of the approach, its application is not limited to production industries.

Many people have played important roles in the development of this book. As a non-economist, my views on Operations Research were greatly influenced by the excellent teachers I have had. Professor Arnd Huchzermeier accompanied me during the entire project providing "engines, brakes and safety belts" in many difficult situations. I have benefited a great deal from his ideas and the ideal way of supervi-

sion. To Professor Linus E. Schrage and Professor R. Kipp Martin at the University of Chicago, I not only owe a lot of good suggestions and thorough paper revisions, but also the invaluable disclosure of many exciting facets of OR beyond the scope of this book.

As a non-engineer, at the Adam Opel AG I learned what it takes to build a car and to sell it. In particular, I would like to thank Hans-Joachim Gora, Dr. Eckhard Dornauf and Heinrich Zapf for their support during my time at the Vehicle Computation Department.

Many thanks also go to Dr. Andreas Herrmann for his valuable comments and for always having an open door.

Last not least, I want to thank Petra for her love and patience. During many months, she frequently had to put up with a boarder who ignored laundry, communication, and sunny Sunday afternoons for the sake of getting this work accomplished.

Ralph Fürderer

Contents

List of Figures