

Danilo Zatta

Revenue Management in Manufacturing

State of the Art, Application and Profit
Impact in the Process Industry

 Springer

Revenue Management in Manufacturing

Danilo Zatta

Revenue Management in Manufacturing

State of the Art, Application and Profit
Impact in the Process Industry

 Springer

Danilo Zatta
Munich, Germany

ISBN 978-3-319-30239-3 ISBN 978-3-319-30240-9 (eBook)
DOI 10.1007/978-3-319-30240-9

Library of Congress Control Number: 2016940968

© Springer International Publishing Switzerland 2016

This work is subject to copyright. All rights are reserved by the Publisher, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilms or in any other physical way, and transmission or information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed.

The use of general descriptive names, registered names, trademarks, service marks, etc. in this publication does not imply, even in the absence of a specific statement, that such names are exempt from the relevant protective laws and regulations and therefore free for general use.

The publisher, the authors and the editors are safe to assume that the advice and information in this book are believed to be true and accurate at the date of publication. Neither the publisher nor the authors or the editors give a warranty, express or implied, with respect to the material contained herein or for any errors or omissions that may have been made.

Printed on acid-free paper

This Springer imprint is published by Springer Nature
The registered company is Springer International Publishing AG Switzerland

*To Babette, Natalie, Sebastian, and Marilena
for their love and support*

Foreword

How much time does the typical manager of a manufacturing company dedicate to price and capacity optimization? Probably not enough. However, each manager should be aware that many companies in the service industry would be unprofitable without price and capacity management. They apply a method which is known as revenue management.

This book represents a new landmark and is a pioneering work. It sheds light on the application of revenue management in the manufacturing industry, revealing contents and profit potentials that every manufacturing manager should be aware of. Revenue management is applicable in many manufacturing industries and its profit contribution can be highly significant. Therefore, it should not be ignored.

One of the distinguishing characteristics of revenue management is its use of analytical techniques derived from management science. The use of these techniques to set prices in a dynamic and complex environment is relatively new. The first applications of revenue management were introduced by passenger airlines in the late 1970s. Since then, the availability of customer data, e.g., via customer relationship management systems and the rapid development of information technology solutions as well as e-commerce has led to the adoption of revenue management in numerous other service industries such as car rentals, hotels, cruise lines, railways, gastronomy, and so on. Today, a number of software vendors provide “revenue management” or “demand management” solutions focused on one or more industries. Pricing and revenue optimization has thus become a core competency for many service providers.

However, revenue management has been discovered by manufacturing companies only recently. Quite a few manufacturing companies fulfill the prerequisites to successfully apply revenue management. This is especially true for process industries.

In spite of these first positive experiences, the implementation and the profit potentials of revenue management in the manufacturing sector are still in an early stage. The manufacturing industry is lagging behind the service sector when it comes to dynamic pricing and capacity control.

Danilo Zatta's work illustrates the application of revenue management in the manufacturing sector. The book provides remarkable insights and recommendations. I hope that it will foster the further adoption of revenue management in manufacturing. The book will inspire manufacturing managers and companies to rethink their approach to the control of demand and price patterns.

This book has the potential to become a standard of reference for revenue management and pricing in the manufacturing industry.

President of The Professional Pricing Society
Atlanta, USA

Kevin Mitchell

Preface

Once a hidden weapon in the hands of a restricted selection of incumbent carriers in the North American post-deregulation period of the 1970s, revenue management (RM) developed to a mainstream business practice throughout the service industry.

Companies like Starwood Hotels, Royal Caribbean, Lufthansa, Emirates, Walt Disney Resorts, Avis Rent-a-Car, Maersk, or Thomas Cook attribute strong increases on both the revenue and profit side to RM. Service companies like all major airline operators, hotel chains, railway companies, or car rental companies employ a high number of managers and analysts working on RM. A number of management consulting companies and software developers also have large teams of RM experts. Research on the concepts and applications of RM in the service industry has also been strongly brought forward by both university research and activities of practitioners. In the world's leading business schools, like INSEAD in Europe or Harvard in the USA, one can study both RM and pricing case studies or attend entire courses on this topic.

RM has a similar revenue and profit potential also for manufacturing companies. Despite first applications of RM in manufacturing companies, no book has dealt with the application of RM beyond the service industry. There is also no large-scale quantitative cross-industry, international study of the efficacy of RM in manufacturing and on the profit expectation of companies introducing RM vis-à-vis the realized profit impact after its introduction: This gap is closed by this book.

The target audience for the underlying book are both practitioners and researchers. For practitioners, this book serves as a reference and inspiration for extending and adapting existing RM practices to the manufacturing industry. To illustrate the way RM is implemented and it accelerates revenues and profits, the process industry, as relevant application subset of the manufacturing industry, was chosen. For researchers, the book shall demystify limiting the application to the services industry and trigger new research, approaches, and thoughts on how to further develop RM beyond the services industry.

The intention of this volume is not to develop or propose a standard RM solution or approach that should represent the holy grail of how to succeed in the

manufacturing sector. The ambition is rather to trigger with an assessment of how RM is currently applied beyond the service industries new ideas in the readers to find the best solution for the manufacturing case they are dealing with or will be dealing with in the future.

Munich, Germany

Danilo Zatta

Acknowledgments

Completing an editorial project such as a book on Revenue Management is never solely the result of hard work but the sum of collective efforts of a number of important and valued people who have directly or indirectly assisted and supported me during this project. I owe my gratitude and thanks to all the people who contributed to the completion of this editorial project.

First of all, I would like to thank my advisor and mentor, Prof. Dr. Rainer Kolisch of the TUM School of Management, for allowing me to dive deeper into revenue management. I truly valued his coaching and facilitating my thought development, his wisdom and caring, and the many ideas and advice he gave to me during our collaboration on this topic.

I would also like to express my sincere gratitude to Prof. Dr. Florian von Wangenheim of the Swiss Federal Institute of Technology in Zurich, for having provided very useful directions for my work.

I would like to thank Kevin Mitchell, President of the Professional Pricing Society, for his support and contributions and my Partners at The Boston Consulting Group for encouraging my writing and for challenging me to strive for excellence. The same is true for my direct colleagues of the Marketing & Sales Practice at BCG, with whom I have been working all over the world in several of our 85 offices on engagements related to revenue management and pricing: These experiences helped to combine academic elements with practical applications, thus ensuring that concepts generate value for our clients.

I am indebted to Prof. Dr. Franco Fontana from the Luiss Business School of Rome, Italy, for providing valuable advice during my studies and beyond and supporting me with and also contributing to the publication of my first Revenue Management book.

I express my sincere gratitude to Prof. Dr. Ioana Popescu from INSEAD of Fontainebleau in France, for providing inspiration throughout my MBA, as well as encouragement for my research on the application of revenue management in manufacturing.

I would like to thank my friend Dr. Marcus Zimmer of the Swiss Federal Institute of Technology in Zurich, for providing pertinent and valuable advice and sparring.

For the realization of this work, several people from various companies in different countries were involved at different stages with different intensity discussing revenue management-related challenges in numerous countries. I am sincerely grateful for their interest, availability, and input.

Finally, I would like to thank my family, especially my wife Babette and my parents, for their constant support during the research for this editorial project over the last few years.

Contents

| | | |
|----------|---|----|
| 1 | Introduction | 1 |
| 1.1 | Importance of RM | 1 |
| 1.2 | Motivation and Background | 2 |
| 1.3 | Objectives of the Book | 4 |
| 1.4 | Structure | 5 |
| 1.4.1 | Chapter 2: Concepts and Application | 5 |
| 1.4.2 | Chapter 3: State of the Art and Perspectives of RM in the PI | 6 |
| 1.4.3 | Chapter 4: Application of RM in Europe and North America | 6 |
| 1.4.4 | Chapter 5: Profit Impact of RM in the PI | 7 |
| 2 | Concepts and Application | 9 |
| 2.1 | The Concepts of RM and PI | 9 |
| 2.1.1 | Definition of RM | 9 |
| 2.1.2 | Definition of PI | 10 |
| 2.2 | Demand-Management Decisions | 10 |
| 2.3 | The Innovative Elements of Revenue Management | 11 |
| 2.4 | Origins of RM | 13 |
| 2.4.1 | Airline Industry in the 1970s | 14 |
| 2.4.2 | Innovations Introduced by American Airlines | 15 |
| 2.4.3 | Implications of the Airline Heritage | 16 |
| 2.4.4 | Extension to Other Service Industries | 17 |
| 2.5 | RM in the Manufacturing Industry | 18 |
| 2.5.1 | Planning Approaches | 19 |
| 2.5.2 | Empirical Studies | 19 |
| 2.5.3 | Manufacturing Alternatives: MTS vs. MTO | 19 |
| 2.6 | Prerequisites for the Application of RM in the Service vs. PI | 20 |
| 2.6.1 | Heterogeneous Demand and Customer Segmentation | 20 |
| 2.6.2 | Stochastic Demand | 21 |

| | | |
|----------|---|-----------|
| 2.6.3 | Capacity Expiration | 21 |
| 2.6.4 | Fixed Capacity and Dynamic Demand | 22 |
| 2.6.5 | High Fixed Costs and Low Marginal Costs | 22 |
| 2.6.6 | Pre-booking Option | 22 |
| 2.6.7 | Economic Freedom to Act | 23 |
| 2.6.8 | Data Availability and Information Systems | 23 |
| 2.6.9 | Corporate Culture and Management Support | 23 |
| 2.7 | Price and Capacity Management | 24 |
| 2.8 | Profit Impact of RM | 24 |
| 2.9 | Fairness Within RM | 25 |
| 2.9.1 | Key Elements of Fairness | 26 |
| 2.9.2 | Fairness Within the Service Industry | 26 |
| 2.9.3 | Fairness Within the Process Industry | 27 |
| 2.9.4 | Price Increase Strategies | 27 |
| 3 | State of the Art and Perspectives of Revenue Management in the Process Industry | 29 |
| 3.1 | Background of the First Empirical Study | 29 |
| 3.2 | Explorative Research and Hypothesis Derivation | 29 |
| 3.3 | Quantitative Study: Data Collection | 31 |
| 3.4 | Results: State of the Art of RM in the PI | 33 |
| 3.4.1 | Focus, Implementation and Introduction | 33 |
| 3.4.2 | Importance of RM | 34 |
| 3.4.3 | Type of RM System | 35 |
| 3.4.4 | RM as a Lever Contributing to Profit Growth | 35 |
| 3.4.5 | Future Use of RM | 36 |
| 3.5 | Trends and Perspectives | 37 |
| 3.5.1 | Barriers to the Introduction of RM | 37 |
| 3.5.2 | Benefits and Risks of RM | 37 |
| 3.5.3 | Alternatives to RM | 38 |
| 3.5.4 | Statements on RM | 39 |
| 3.6 | Conclusions | 40 |
| 3.6.1 | Results | 40 |
| 3.6.2 | Limitations and Outlook | 40 |
| 4 | Implementation of Revenue Management in the Process Industry in North America and Europe | 43 |
| 4.1 | Background of the Second Empirical Study | 43 |
| 4.2 | Explorative Research and Hypothesis Derivation | 43 |
| 4.3 | Quantitative Study: Data Collection | 45 |
| 4.4 | Results: RM in Practice | 46 |
| 4.4.1 | Importance of RM | 46 |
| 4.4.2 | Focus, Implementation and Period of Use of RM | 47 |
| 4.4.3 | Current Use of RM | 49 |
| 4.4.4 | Future Use of RM | 51 |

| | | |
|----------|---|------------|
| 4.5 | Trends | 52 |
| 4.5.1 | Barriers to the Introduction of RM | 52 |
| 4.5.2 | Alternatives to RM | 54 |
| 4.5.3 | Statements on RM | 55 |
| 4.6 | Conclusions | 56 |
| 4.6.1 | Results | 56 |
| 4.6.2 | Limitations and Outlook | 57 |
| 5 | Use and Profit Impact of Revenue Management in the Process Industry | 59 |
| 5.1 | Background of the Third Empirical Study | 59 |
| 5.2 | Exploratory Research | 60 |
| 5.3 | Quantitative Study: Data Collection | 62 |
| 5.4 | Results: RM in Practice | 64 |
| 5.4.1 | RM Profit Impact Evaluation and RM Years of Utilization | 64 |
| 5.4.2 | RM Introduction and Use | 65 |
| 5.4.3 | Impact of RM Utilisation on Profits | 66 |
| 5.4.4 | A Priori and a Posteriori Estimation of Profit Improvement Due to RM | 68 |
| 5.4.5 | Barriers that Hinder RM Implementation | 69 |
| 5.4.6 | Reasons for Not Implementing RM | 71 |
| 5.5 | Conclusions | 72 |
| 5.5.1 | Results | 72 |
| 5.5.2 | Limitations and Outlook | 73 |
| 6 | Conclusions | 75 |
| 6.1 | Summary and Results | 75 |
| 6.2 | Final Remarks and Future Research Directions | 76 |
| | Appendix A: Questionnaires | 79 |
| A.1 | Questionnaire for the First Empirical Study | 79 |
| A.2 | Questionnaire for the Second Empirical Study | 84 |
| A.3 | Questionnaire for the Third Empirical Study | 90 |
| | Appendix B: Correlation Matrixes | 99 |
| B.1 | Impact of the Barriers' Evaluations on Real Decision to Introduce RM | 99 |
| B.2 | Spearman Correlation Matrix of the Metric Variables | 100 |
| | Appendix C: State of the Art and Implementation of Revenue Management in Germany | 103 |
| | About the Author | 123 |
| | References | 125 |

List of Figures

- Fig. 3.1 Companies surveyed per industry 32
- Fig. 3.2 Annual turnover of companies surveyed 32
- Fig. 3.3 RM focus, implementation and introduction 34
- Fig. 3.4 Importance of RM and company size 34
- Fig. 3.5 Importance of RM in relation to the period of use and the
management concept 35
- Fig. 3.6 Type of RM-system depending on the duration of use 36
- Fig. 3.7 Importance of RM in relation to implementation 36
- Fig. 3.8 Barriers to the introduction of RM 37
- Fig. 3.9 Degree of agreement with statements on RM 38

- Fig. 4.1 Distribution of the interview partners per country 45
- Fig. 4.2 Distribution of the interview partners per turnover 46
- Fig. 4.3 Distribution of the interview partners per industry 46
- Fig. 4.4 Focus, implementation and period of use 47
- Fig. 4.5 Focus, implementation and period of use in North America 48
- Fig. 4.6 Focus, implementation and period of use in Europe 48
- Fig. 4.7 Period of use in North America and Europe 49
- Fig. 4.8 Importance of RM in relation to company size (turnover) 50
- Fig. 4.9 Perceived importance of RM concepts in relation to
period of use 50
- Fig. 4.10 Importance of RM in relation to its implementation 51
- Fig. 4.11 Future use of RM in different industries in Europe and North
America 51
- Fig. 4.12 Barriers to the introduction of RM 52
- Fig. 4.13 Benefits named by North American versus European
companies 53
- Fig. 4.14 Risks named by North American versus European companies 54
- Fig. 4.15 Statements on RM 55

Fig. 5.1 The structure of this study 60

Fig. 5.2 Distribution of interview partners per country 63

Fig. 5.3 Distribution of interview partners per turnover 63

Fig. 5.4 Distribution of interview partners per industry 63

Fig. 5.5 Number of years of RM use and evaluation of RM ability
to increase profit in North America and Europe 65

Fig. 5.6 Distribution of revenue for companies that introduced RM (*left*)
versus companies that did not (*right*) 66

Fig. 5.7 Distribution of the number of markets for companies that
introduced RM (*left*) versus companies that did not (*right*) 66

Fig. 5.8 RM success in increasing profit with respect to duration
of use in North America and Europe 67

Fig. 5.9 A priori estimation of profit improvement due to RM and
a posteriori realized profit improvement due to RM in North
America and Europe 68

Fig. 5.10 Average importance of barriers to the introduction of RM 69

Fig. 5.11 Average importance of reasons for not introducing RM 72

List of Tables

| | | |
|-----------|--|----|
| Table 2.1 | Comparison of conditions for applying RM to the service and process industries | 21 |
| Table 3.1 | Benefits and risks with respect to the introduction of RM | 39 |
| Table 4.1 | Perceived benefits and risks of RM, ranked by frequency of nominations | 53 |

Acronyms and Symbols

| | |
|--------|--|
| \$ | US Dollar |
| % | Percentage |
| € | Euro |
| AV | Average value |
| BRIC | Brazil, Russia, India, China |
| CAB | Civil Aeronautics Board |
| CEO | Chief executive officer |
| CRM | Customer relationship management |
| CRS | Computerized reservation system |
| DF | Degree of freedom |
| DINAMO | Dynamic Inventory Allocation and Maintenance Optimizer |
| DM | Demand management |
| e.g. | Example given |
| ERP | Enterprise resource planning |
| GDS | Global distribution system |
| GE | General Electric |
| GNP | Gross national product |
| H | Hypothesis |
| IT | Information technology |
| MTO | Make-to-order |
| MTS | Make-to-stock |
| OR | Operations research |
| P | Probability |
| p | Significance level |
| PI | Process industry |
| POS | Point-of-sale |
| RM | Revenue management |
| RMS | Revenue management system |
| ROS | Return on sales |

| | |
|-------|---------------------------|
| SCM | Supply chain management |
| SKU | Stock keeping unit |
| t | Observed t value |
| VP | Vice president |
| WTP | Willingness to pay |
| X^2 | Observed chi-square value |
| YM | Yield management |

Chapter 1

Introduction

1.1 Importance of RM

Everyone who sells either products or services or both faces a number of fundamental decisions.¹ A child selling sweets outside her house has to decide how much to ask for each sweet, which day to have her sale, and when to drop the price, if necessary, as the day rolls on. An apartment owner renting an apartment must decide when to list it, what the selling price should be, which offer to accept, and when to lower the listing price—and by how much—if no offers come in. A mathematics teacher offering private mathematics lessons needs to set the price per lesson, decide which in days to offer her service and at which price, how to adapt the price in case of limited demand, and so on.

Anyone who was ever confronted with such decisions knows the uncertainty involved. Your objective is to sell at a time when market conditions are most favorable, but who knows what the future might hold? You want the price to be right, i.e. not too high that you put off potential buyers and not so low that you lose out on potential profits. You would like to know the willingness to pay of buyers, i.e. how much they value your product, but more often than not you must just guess at this number.

In fact, it is not easy to find anyone who is entirely happy with their selling and pricing decisions. Even when you succeed in making a sales, you regularly wonder whether you should have waited for a better offer or whether you accepted a price that was too low.

In the business world selling decisions are even more complex. Here is an example: how can a company segment buyers by providing different conditions and trade terms that profitably exploit their different willingness to pay or buying behavior? Once a firm segments customers, what prices should it charge each

¹ This chapter has been integrated with inputs adapted from Talluri and van Ryzin (2004) with the kind permission of Springer.

segment? How can a company design products to prevent cannibalization across sales channels and segments? If the company sells in different channels, should it use the same price in each channel? In which way should prices be adjusted over time based on seasonal factors and the observed demand to date for each product? How should a company handle the pricing and allocation for products that are substitutes, e.g. different car categories for rentals, or complements, e.g. seats on two connecting airline flights? If a product or service is short in supply, to which channels and segments should a firm allocate the products or services?

RM deals with such demand-management (DM) decisions² and the methodology, systems and processes required to make them. This implies managing the company's "interface to the market" as it were, with the objective of increasing revenues. RM can be regarded as the complement of supply chain management (SCM), which addresses the supply decisions and processes of a firm, typically with the objective of lowering the cost of production and delivery. It is today one of the most successful application areas of operations research (OR).

Over the last decades roughly synonymous names have been given to the practice—*yield management* (the traditional airline term), *pricing and revenue management*, *pricing and revenue optimization*, *demand management*, *demand chain management* (favored by those who intend to create a practice parallel to supply chain management)—each with its own nuances of meaning and positioning. Here we use the more standard term revenue management to refer to the wide range of techniques, decisions, methods, processes, and technologies involved in demand management.

1.2 Motivation and Background

The motivation to conduct this research on the employment of RM³ in the process industry (PI)⁴ comes from a series of interactions with top executives of several corporations in different locations in my professional activity as management

²These can be referred to as either sales decisions, i.e. we are making decisions on where and when to sell and to whom and at what price, or demand-management decisions, i.e. we are estimating demand and its characteristics and using price and capacity control to "manage" demand.

³The notion of RM, also called yield management, revenue optimization and demand management (Talluri and van Ryzin 2004), encompasses the strategies, tactics and tools aiming at the maximization of revenues by allocating a company's capacity to different customers at different price levels. It's success determined a widespread application of RM. However, with strong origins in the airline industry, this industry and the service industries in general, are nowadays the main field of its application. RM covers the systematic use of tactical and operational instruments to maximize revenue for capacities that are fixed in the medium term, for stochastic demand and for cases where no make-to-stock (MTS) production option is available.

⁴The process industry comprises businesses that add value to materials by mixing, separating, forming, or generating chemical reactions. Processes may be either continuous or batch and generally require rigid process control and high capital investment (Wallace 1984). Examples of

consultant. What emerges is that several manufacturing companies are seeking new and sustainable levers to improve profitability.

In the discussions we had, executives indicated two major sources of profitability of the past: Product innovations and cost cutting initiatives. Clearly, both of these sources will remain profit drivers at any company, but both also have clear limitations (Simon et al. 2006).

In fact a product, service or process innovation can boost in a sustainable way both revenues and profits. The issue is however that innovation pipelines typically require several years and substantial investments before they generate returns. A large breakthrough or a new blockbuster that leads to pioneer profits represents the exception rather than the rule. It is therefore not a short-term, nor typically a medium- or long-term profit lever.

Also the profit potential on the cost side is often limited: Many companies interviewed in the exploratory research for this work state that they have already made very substantial gains from cost reductions. In addition, the economic crisis of 2008 forced corporations to reduce the cost basis considerably (Simon et al. 2013).

Managers need therefore to find new approaches to improve profitability, and a key area to work on has been found on the market side, more specifically on the revenue optimization and pricing side (Tacke et al. 2012). Even companies known to be best in class in many areas, like General Electric (GE),⁵ a leading U.S.-based manufacturing company, state that while on the cost side they are very accurate and have invested a lot to make sure that they optimize the cost lever, on the pricing side there is significant room for improvement. Jeffrey Immelt, CEO of GE, stated in this regard: “Not long ago, a guy here named Dave McCalpin did an analysis of our pricing [. . .] and found out that about \$5 billion of it is discretionary. [. . .] It was the most astounding number I’d ever heard [. . .]. We would never allow something like that on the cost side. When it comes to the prices we pay, we study them, we map them, we work them. But with the prices we charge, we’re too sloppy” (Immelt and Stewart 2006).

The CEO of a European lubricants company summarized this challenge: “In the last five years, we have been working on increasing profits by reducing costs through a global SCM excellence program. I do not expect significant additional benefits from this initiative. Pricing and RM are concepts that have only recently been discovered by us and in the manufacturing industry in general. Even if there is no industry-wide RM approach, we need to find a way to embed RM in the organization”.⁶ The sales and marketing VP of a corporation active in the metal industry made a similar statement: “We successfully reduced costs with a dedicated

process industries include food, beverages, chemicals, pharmaceuticals, petroleum, ceramics, base metals, coal, plastics, rubber, textiles, tobacco, wood and wood products, paper and paper products, etc. (IIE 2013). The process industry accounts for more than 50% of the industrial sector’s GNP of several western countries, e.g. 58% in Germany (Destatis 2013).

⁵ GE is regarded as best in class or among the top companies on a global basis in the application of the Six Sigma approach (Eckes 2001) or for its innovation capabilities (Magee 2009).

⁶ Source: Interview conducted during the exploratory research.

internal task force. However our attention to the market side was never as systematic and structured as on the cost side. We clearly need to catch up if we want to further improve our profitability. We have put RM and pricing excellence on our agenda”.⁷

Employing RM and thus optimizing pricing in the manufacturing environment, and more specifically in the process industry, is considered by many corporations⁸ as one of the key topics for the coming years. A confirmation of the fact that the employment of RM in the manufacturing industry is seen as an important topic is evidenced by the fact that, since we started exploring this subject, we have received attention from academic journals (Kolisch and Zatta 2009, 2012, 2014), magazines for practitioners,⁹ newspapers (Noack 2005) other academic researchers from prestigious universities quoting our work (e.g. Buhl et al. 2011; Huefner and Largay 2013; Kocabiyyikoglu et al. 2010, 2013; Mohaupt and Hilbert 2014) and publishers (Zatta 2007) was constantly high.

1.3 Objectives of the Book

To the best of our knowledge, there is no large-scale quantitative cross industry, international study of the efficacy of RM in the PI and on the profit expectation of companies introducing RM vis-à-vis the realized profit impact after its introduction: this gap will be closed by this research.

The objectives of this research are therefore threefold: First, to explore the implementation of RM in the PI starting with one of the largest European economies, namely Germany, to assess since when, how and with which approach RM is applied in the PI, while also evaluating barriers as well as chances, risks and perspectives of the companies. Second, this research extends this assessment geographically to Europe and North America and compares similarities and differences between the two regions. Third, we verify the benefits of RM in terms of profit improvement, assessing e.g. the *a priori* estimation of profit improvement and

⁷ Source: Interview conducted during the exploratory research.

⁸ This was reported to me personally by more than 100 top executives of corporations of different industries and sizes that we met during my last 10 years of project work both in Europe and North America as well as during the exploratory research that will be presented in the next sections.

⁹ E.g.: See Kolisch, R. and Zatta, D. in **I.** (2006). Revenue-Management in der Sachgüterproduktion. *Marketing Journal*, 12: 38–41. **II.** (2006). Revenue Management: Kapazität und Preis richtig managen. *Produktion*. 36: 15. **III.** (2011). Implementation of revenue management in the process industry of North America and Europe. *Journal of Pricing*, 4: 12–21. **IV.** (2013a). Spatz oder Taube. *Absatzwirtschaft*, 4: 40–41. **V.** (2013). Revenue Management: Die Große Chance. *Verkaufen*, 6: 8–11. **VI.** Revenue management in der Industrie. *Bilanz*. Online publication 19 May 2014: <http://www.bilanz-magazin.de/aktuelles/revenue-management-der-industrie/>. **VII.** (2014). Revenue management nel settore industriale. *L'Impresa*. Online publication 8 May 2014: <http://limesonline.net/articolo.php?id=20744&t=Revenue%20Management%20nel%20settore%20industriale&a=Rainer%20Kolisch>.

the *a posteriori* realized profit improvement and examine the reasons why the companies which are not employing RM decided not to use it.

To achieve these objectives, three separate exploratory studies, followed by a quantitative empirical research, were conducted sequentially. All three studies have previously been published in academic journals and will be presented in the next chapters. The first study appeared in the *Zeitschrift für Planung & Unternehmenssteuerung* (Kolisch and Zatta 2009). The second and third studies were published in the *Journal of Revenue and Pricing Management* (Kolisch and Zatta 2012, 2014).

The intention of the underlying book is also to trigger further thoughts around implementing RM in manufacturing and stimulate further implementations beyond the services industry, by highlighting the potential of RM and indicating what worked vis-à-vis what hinders a successful RM introduction.

1.4 Structure

An introduction to the background, motivation and objectives of the book can be found in this chapter. Chapter 2 contains a review of key concepts both applications prerequisites and impacts of RM introduction. More specifically the following aspects are explored: the concepts of RM and PI; the origins of RM; its application in the manufacturing industry; similarities and differences between RM prerequisites in the service and process industries; price and capacity management; profit impact of RM and finally the notion of fairness in RM. Chapter 3 presents the outcomes of the first study conducted in Germany to verify the state of the art and perspectives of RM in the PI. In Chap. 4 the geographic scope of the first study is extended to Europe and North America, assessing the state of the art and perspectives of RM in the PI. Chapter 5 discusses the third study, exploring the profit impact of RM on the PI. The research ends with Chap. 6 providing conclusions and an outlook for possible directions for future research.

In what follows we give a more detailed summary of the three core chapters of this research, highlighting some of the key outcomes.

1.4.1 Chapter 2: Concepts and Application

Chapter 2 contains a series of key elements, starting with the definitions of RM and PI. It then sheds light on demand-management decision and on the innovative elements of RM. The origins of RM in the service industry are then presented, followed by a review of its application in the manufacturing industry.

A review of nine application prerequisites is discussed, assessing both the validity for the service and manufacturing industry. Price and capacity management

concepts are illustrated and the profit impact of RM is discussed. Finally the concept of fairness in RM is reviewed.

1.4.2 Chapter 3: State of the Art and Perspectives of RM in the PI

While traditional RM literature discusses its application in the service industries, RM in manufacturing has received less academic attention (Chiang et al. 2007). Chapter 3 contributes to closing this gap. It summarizes several aspects related to use, focus, introduction, characteristics as well as point of views from the players of the PI interviewed about their perspectives on RM.

An exploratory qualitative study with 15 companies is summarized in the second part of the chapter and leads to formulations of hypotheses. These hypotheses are verified in an empirical quantitative research among 124 firms. The research, described in the third section, involved companies of the PI based in Germany and was conducted between July 2004 and February 2005. Further data were then collected between November 2007 and May 2008.

The results of the empirical quantitative research are presented in the fourth section of the chapter, where topics like focus, implementation, introduction, importance, types, use of RMS are discussed. Then trends and perspectives with regard to barriers, benefits, risks or alternatives are presented in the fifth section. Chapter 3 concludes with an illustration of the principal results and a discussion of limitations and outlook. This chapter is based on Kolisch and Zatta (2009).

1.4.3 Chapter 4: Application of RM in Europe and North America

The research discussed in Chap. 3 contributed to further closing the gap between the extensive available research on the application of RM in the service industry versus the manufacturing industry. However, it had a number of limitations, like the fact that it involved only companies based in Germany (Kolisch and Zatta 2009).

To overcome this geographic limitation, as indicated in the first section of Chap. 4, a new study was conducted in Europe and North America and the results are presented in Chap. 4. As in the first study here, too, aspects related to use, focus, introduction, characteristics as well as points of view of the players of the PI interviewed about their perspectives on RM are assessed. However the scope is extended to twelve countries, namely Canada, France, Germany, Holland, Ireland, Italy, Norway, Spain, Sweden, Switzerland, United Kingdom and the United States.

An exploratory qualitative study with 22 companies is summarized in the second part of the chapter and leads to the formulation of hypotheses, which are verified in

an empirical quantitative research of 479 firms. The research, described in the third section, involved companies of the PI based in these countries and was conducted between June 2008 and July 2009.

The results of the empirical quantitative research are presented in the fourth section of the chapter, where topics like focus, implementation, introduction, importance, types, use of RMS are discussed and comparisons between the two regions are made. Then trends and perspectives on barriers, benefits, risks or alternatives are presented in the fifth section. Chapter 4 concludes with an illustration of the principal results and a discussion of limitations and outlook. This chapter is based on Kolisch and Zatta (2012).

1.4.4 Chapter 5: Profit Impact of RM in the PI

A step towards extending and further completing the research on the application of RM in the PI, as illustrated in Chap. 4 is the research discussed in the next chapter. One of the limitations of previous research is namely the lack of an *a priori* profit estimation of profit improvement and the *a posteriori* evaluation of realized profit through RM, comparing performances of companies in different countries and regions.

To close this gap, as indicated in the first section of Chap. 5, a new study was conducted in Europe and North America and the results are illustrated in Chap. 5. Aspects related to profit impact evaluation, years of utilization, introduction, use, *a priori* and *a posteriori* profit improvement assessment are discussed.

An exploratory qualitative study with 38 companies is summarized in the second part of the chapter and leads to the formulation of a research concept. Empirical quantitative research of 603 firms is then conducted. The research, described in the third section, involved companies of the PI based in 16 countries, 2 in the North American cluster and 14 in the European cluster, and was conducted between July 2012 and May 2013.

The results of the empirical quantitative research are presented in the fourth section of the chapter, where topics like *a priori* and *a posteriori* profit impact, influence of time or reasons for not implementing RMS are discussed and comparisons between the two regions are made. Chapter 5 concludes with an illustration of the principal results and a discussion of limitations and outlook. This chapter is based on Kolisch and Zatta (2014).

Chapter 2

Concepts and Application

2.1 The Concepts of RM and PI

When offering a product or a service the seller faces a number of complex decisions.¹ For example, which is the price that shall be asked? How shall prices be adjusted over time? How shall buyers be segmented by e.g. providing different conditions? Who should prices be varied across segments? If a product is short in supply, to which segment or channel should the products be allocated? These are only some of the questions that arise in the selling process. RM can provide answers to these questions.

2.1.1 Definition of RM

The notion of RM encompasses the strategies, tactics and tools aiming at the maximization of revenues by allocating a company's capacity to different customers at different price levels. Its success has led to widespread application of RM. However, with strong origins in the airline industry, this industry and the service industries in general are nowadays its main field of application.

RM² covers the systematic use of tactical and operational instruments to maximize revenue for capacities that are fixed in the medium term, for stochastic demand and for cases where there is no make-to-stock (MTS) production option available and is employed in the services industries and more recently also in the manufacturing industries. In the latter, it is used e.g. in a make-to-order (MTO)

¹ This chapter has been integrated with inputs adapted from Talluri and van Ryzin (2004) with the kind permission of Springer.

² Alternative names for RM are the English terms yield management, revenue optimization and demand management (Talluri and van Ryzin 2004).

production environment, where customers specify their order previous to the production process and suppliers unable to satisfy the incoming demand from stock (Müller-Bungart 2006). The use of RM in MTO production processes has received consideration by different authors, e.g. Defregger and Kuhn (2007), Hintsches et al. (2009), Quante et al. (2009), Spengler and Rehkopf (2005), and Spengler et al. (2008).

2.1.2 Definition of PI

The PI contains businesses that add value to materials by mixing, separating, forming, or chemical reactions. Processes may be either continuous or batch and generally require rigid process control and high capital investment (Wallace 1984).

Examples of PI include food, beverages, chemicals, pharmaceuticals, petroleum, ceramics, base metals, coal, plastics, rubber, textiles, tobacco, wood and wood products, paper and paper products, etc. (IIE 2013). The process industry accounts for more than 50 % of the industrial sector's GNP in several western countries, e.g. 58 % in Germany (Destatis 2013). Given its weight, the PI was chose a focus industry for the manufacturing sector.

2.2 Demand-Management Decisions

There are three basic demand-management decisions that RM addresses:

- (1) Structural decisions: which segmentation or differentiation mechanisms to use, if any; which selling format to use, such as posted prices, auctions or negotiations; which trade terms to offer (including volume discounts and cancellation or refund options); how to bundle products; and so on.
- (2) Pricing decisions: how to set posted prices, individual-offer prices, and reserve prices (in auctions); how to price across product categories; how to price over time; how to markdown (discount) over the product life cycle; and so on.
- (3) Quantity decisions: whether to accept or reject an offer to buy; how to allocate output or capacity to different segments, products or channels; when to withhold a product from the market and sale at later point in time; and so on.

Which of these decisions is most relevant in any given business depends on the context. The timescale of the decisions also varies. Structural decisions about which mechanism to use for selling and how to segment and bundle products are normally strategic decisions taken relatively infrequently. Companies may also have to commit to certain price or quantity decisions, for example, by advertising prices in advance or developing capacity in advance, which can limit their ability to adjust quantities or prices on a tactical level. The ability to adjust quantities may also be a function of the technology of production—the flexibility of the supply process and

the cost of reallocating both capacity and inventory. The use of capacity controls for example as a tactic in airlines stems largely from the fact that the different “products” an airline sells (different ticket types sold at different times and under different terms) are all supplied using the same, homogeneous seat capacity. This gives airlines tremendous quantity flexibility, so quantity control is a natural tactic in this industry. On the other side retailers often commit to quantities, e.g. initial stocking decisions, but have more flexibility to adjust prices over time. However, the ability to price in a tactical manner depends on how costly price changes are, which can vary depending on the channel of distribution such as online versus catalog.

Whether a company uses price- or quantity-based RM controls varies even across companies within a given industry. For example, while most airlines commit to fixed prices and tactically allocate capacity, low-cost carriers tend to use price as the primary tactical variable.

Companies can also find innovative ways to increase their ability to make price or quantity resource decisions. For instance, retailers may hold back some stock in a centralized warehouse and then make a mid-season replenishment decision rather than precommit all their stock to stores upfront. Some major airlines have experimented with movable partitions that allow them to reallocate seats from coach to business cabins on a short-term basis. And other major airlines have experimented with a practice called demand-driven dispatch (D^3), in which aircrafts of different sizes are dynamically assigned to each flight departure in response to fluctuations in demand, and are not precommitted to flights. Car rental companies also may reallocate their fleet from one city to another. When it comes to pricing, using online channels or advertising products without price (“call for our low price”) provides companies with more price flexibility. All these innovations increase the opportunity for quantity and price-based RM.

Broadly speaking, RM addresses all three categories of demand-management decisions—structural, pricing, and quantity decisions. We qualify RM as being either quantity-based RM or price-based RM if it uses (inventory- or) capacity-allocation decisions or prices as the primary tactical tool respectively for managing demand. Both the theory and practice of RM differ based on which control variable is used.

2.3 The Innovative Elements of Revenue Management

RM can be seen as a very old idea. Every seller in human history has taken RM-type decisions after having been confronted with a set of similar questions. What price shall be asked? Which offers shall be accepted? When shall the price be reduced? And when to simply “pack up one’s tent” and leave the market as it were and try selling at a later point in time or in a different market. In terms of business practices, the problems of RM are as old as business itself.

In terms of theory, at a broad level the problems of RM are not new either. In fact, the forces of supply and demand and the resulting process of price information—the “invisible hand” of Adam Smith—lie at the heart of our current understanding of market economics. They are embodied in the concept of the “rational”, i.e. profit-maximizing, company, and define the mechanisms by which market equilibria are reached. Modern economic theory addresses many advances and subtle demand-management decisions, such as nonlinear pricing, bundling, segmentation, and optimizing in the presence of asymmetric information between buyers and sellers.

The new element about RM is not the demand-management decisions themselves but rather *how* these decisions are made. The true innovation of RM lies in the method of decision making a technologically sophisticated, detailed, and intensively operational approach to making demand-management decisions.

This new approach is driven by two complementary forces. First, scientific advances in economics, statistics, and operations research now make it possible to model economic conditions and demand, quantify the uncertainties faced by decision makers, estimate and forecast market response, and compute optimal solutions to complex decision problems. Second, advances in information technology provide the capability to automate transactions, capture and store vast amounts of data, quickly execute complex algorithms, and then implement and manage highly detailed demand-management decisions. This combination of science and technology applied to age-old demand management is the hallmark of modern RM.

And both the science and technology used in RM are quite new. Much of the science used in RM today (e.g. forecasting methods, demand models, optimization algorithms) is less than 60 years old. Most of the information technology (e.g. Internet, personal computers, large databases) is less than 30 years old, and most of the software technology (e.g. object-oriented programming, Java, etc.) is less than 5 years old. Prior to these scientific developments, it would have been unthinkable to accurately model real world phenomena and demand-management decisions. Without the information technology, it would be impossible to operationalize this science. These two capabilities combined make possible an entirely new approach to decision making—one that has profound consequences and benefits for demand management.

The first consequence is that science and technology now make it possible to manage demand on a scale and complexity that would be unthinkable through manual means, or would require a veritable army of analysts to be completed. A large airlines, for example, can have thousands of flights per day, providing service between hundreds of thousands of origin-destination pairs, each of which is sold at dozens of prices—and this entire problem is replicated for hundreds of days into the future! A similar complexity is typically found at large retail chains, which have tens of thousand of SKUs³ sold in several hundreds of stores and over the Web with

³ A SKU, i.e. stock keeping unit, is the lowest level at which we identify inventory—such as men’s Arrow blue Oxford shirts, long sleeves, size medium.

prices monitored and updated on a daily basis. The sheer scale and complexity of the decisions-making task in these cases is beyond the ability of human decision makers. If not automated, the task has to be so highly aggregated and simplified that significant opportunities for incremental gains—on particular products, at particular locations, at specific points in time, are simply lost.

The second consequence is that today it is possible to improve the *quality* of demand management decisions, which also leads to significant revenue increases. Complex assessments of demand development, willingness to pay, price thresholds, price setting, capacity constraints, volume vs. profit tradeoffs and so on are tasks most humans, even with many years of experience, are simply not good at. Systems and tools are better at assessing, optimizing and generating consistent decisions. This is especially true for routine RM decisions that are automated through the systems. However, human analysis is required: these decisions need to be overseen and human intervention is required e.g. when flags or alerts indicate extraordinary situations. Tools and algorithms can only detect what is contained in the data—they are not able to reason or anticipate e.g. a sudden price move of a competing company, a demand shock, an unforeseen change in customer preferences and so on. The best of both machine and human decision-making is a man-tool interaction that provides the advantages of the automated analyses combined with the monitoring of the analysts⁴ within a company.

Modern RM can be defined as the management of demand decisions with the support of science and technology, which is implemented with a structured process and supporting tools and overseen by analysts. It can be summarized as the *industrialization* of the entire demand-management process.

2.4 Origins of RM

The history and origins of RM are strictly connected to a single industry, namely the U.S. airline industry in the 1970s (Belobaba 1989; Lindenmeier and Tscheulin 2003; Littlewood 1972; Rothstein 1971; Smith et al. 1992; Weatherford and Bodily 1992). Business practices whose origins are so intimately tightly linked to a single industry like in the case of RM are rare. A short overview of the history of airline RM and its implications follows below.

⁴These analysts are also indicated in the organigrams of companies Revenue Manager, Yield Manager, Pricing Manager or Demand Manager.

2.4.1 Airline Industry in the 1970s

The trigger for the development of RM was the airline fare deregulation. The Civil Aeronautics Board (CAB) regulated the U.S. airline industry until 1978, strictly controlling e.g. airline fares, entry of airlines into and offerings related to different destinations. With the Airline Deregulation Act of 1978, the U.S. Civil Aviation Board phased out state control of airline fares, allowing airlines to freely set prices, schedules and services (Bailey et al. 1985; Morrison and Winston 1995).

The deregulation of the airline industry opened up the market to low cost carriers, which started competing on price with major airlines. This new situation forced major airlines to quickly develop RM approaches to respond to the offerings of the new competitors (Talluri and van Ryzin 2004): they were now free to change prices, schedules, and service without CAB approval. Established carriers thus invested in fast developments of computerized reservation systems (CRSs) and global distribution systems (GDSs), and the GDS business became profitable in its own right. Another development initiated by large airlines were hub-and-spoke networks, which allowed them to offer service in many more markets than was possible with point-to-point service but also made pricing and operations more complex to manage.

New low-cost and charter carriers stepped into the market and were able to profitably price much lower than established airlines, because of their lower labor costs, simpler point-to-point operations and no-frills offering. These new players unlocked an entirely new and vast demand for discretionary travel, e.g. families on a holiday, couples getting away for the weekend or college students visiting home, many of whom might otherwise have driven their cars, taken a bus or not travelled at all. One of the main findings—quite surprisingly to some at the time—was that air travel was quite price elastic: with prices sufficiently low, people switched from driving to flying, and demand from this segment surged. People Express can be taken as a good example of one of these successful and strongly growing players, which started in 1981 with fares 50–70 % lower than established carriers and cost-efficient operations. Only after 3 years, in 1984, its revenues were around \$1 billion, with a profit of \$60 million (Cross 1997).

The consequence of the new low-cost offerings was a visible shift of price-sensitive discretionary travelers to the new budget airlines. However, established carriers still had strengths, that these new entrants lacked: they offered e.g. more frequent schedules, service to more city pairs and established brand names and reputation. For several business travelers, schedule convenience and service was and still is more relevant than price. The threat represented by budget airlines was therefore less acute in the business-traveler segment of the market. Still, the cumulative losses in revenue from the migration in traffic were heavily damaging the profits of large airlines.

Thus, incumbents needed to recapture the leisure passengers. However, for the majors, a head-to-head price war against the upstarts would have been suicidal: with significantly lower costs, airlines like People-Express could still earn a profit at

the new low prices, while most established airlines would lose money at a staggering rate.

2.4.2 Innovations Introduced by American Airlines

One of the key incumbents, namely American Airlines, adopted a price differentiation approach to offer discounts with purchase restrictions. With this new mechanism, American Airlines successfully responded to the challengers with a new offering for price sensitive leisure travelers without putting at stake revenues generated by inelastic business travelers. Robert Crandall, vice president of marketing at American Airlines at that time, is widely credited with the breakthrough in solving this problem. He understood that his airline was already producing seats at a marginal cost near to zero because most of the costs of a flight, i.e. capital costs, wages and fuel, are fixed. Therefore, American Airlines could in fact afford to compete on cost with the upstarts using its surplus seats.

Despite having laid the foundation to find a solution to the competitive moves of budget airlines, Crandall needed to solve to issues before being able to execute a new strategy. First, American Airlines had to find a way of identifying the surplus seats on each flight. If a sale of a low-priced seat would displace a high-paying business customer, this scheme would clearly reduce overall profits. Second, it needs to be ensured, that business customers do not switch and buy the new low-cost products that are meant to discretionary, leisure customers.

American Airlines found a solution to the two issues above using a combination of purchase restrictions and capacity-controlled fares. Discounted fares had significant restrictions for purchase: they were nonrefundable, required a 7 day minimum stay and had to be purchased 30 days in advance of departure. With such restrictions, American Airlines prevented most business travelers from utilizing the new low fares. In parallel to this, they limited the number of discount seats sold on each flight: American Airlines capacity-controlled the fares. With these two elements American Airlines had the means to compete on price with the budget carriers without damaging their core business-traveler revenues. This new pricing scheme was launched 1978 and called American Super-Saver Fare. They were quite effective at stemming the tide of defections of discretionary travelers to the budget carriers.

After the initial success of the new strategy, the roll-out of it to the whole product offering experienced significant issues. The capacity controls of American Airlines were namely based on setting aside a fixed portion of seats on each flight for the new low-fare products. However, as American Airlines cumulated experience with its Super-Saver fares, it also discovered that not all the flights were the same. Flights at different times of a day or on different days had different patterns of demand. Some had many excess seats and could profitably support a higher allocation of discount seats; others had sufficient demand for regular-priced seats and warranted very little if any allocation to the new, discounted products.

Robert Crandall realized thus, that he needed a more intelligent approach to realize the full potential of capacity-controlled discounts. The development of what became known as the Dynamic Inventory Allocation and Maintenance Optimizer system (DINAMO) was initiated. DINAMO represents the first large-scale RM system in the airline industry: it was large and complex and took several years to develop and refine.

The full implementation of DINAMO was reached in January 1985 along with a new fare program called Ultimate Super-Saver Fares, which matched or even undercut the lowest discount fares available in every market in which American Airlines operated. DINAMO enabled American Airlines to beat competition. In fact, American Airlines became much more aggressive on price. It was able to offer fares that spanned a large swath of individual flights, confident in its capability to accurately capacity-control the discounts on each individual departure. In addition, competitors could not observe American Airlines' capacity controls unlike prices themselves, which, thanks to GDSs, instantly became public information. This peculiarity of pricing aggressively and competitively at an aggregate, market level, while controlling capacity at a tactical, individual-departure level still characterizes the practice of RM in the airline industry today.

The new competitive power the American Airlines gained from the RM-weapon DINAMO was dramatic. People-Express was especially hard hit as American Airlines repeatedly matched or beat their prices in every market it served: its annual profit fell from an all-time high of \$60 million in 1984, i.e. the year before the implementation of DINAMO, to a loss of \$160 million by 1986, i.e. 1 year after DINAMO was launched. The mounting losses led to the bankruptcy of People-Express and in 1986 the company was sold to Continental Airlines.

Nowadays RM is widespread in the airline industry and reached a high maturity level, with RM being considered as critical to running a modern airline profitably. American Airlines, for instance, indicates that its RM practices generated \$1.4 billion in additional incremental revenue over a 3-year period starting around 1988 (Smith et al. 1992). Several other airlines all over the world similarly attribute a significant share of both revenues and profits to their RM approaches.

2.4.3 Implications of the Airline Heritage

The intimate heritage of RM from the airline industry can be regarded both as a blessing and curse for the field of RM. The blessing is that RM can present a major success case in an industry in which the practice of RM is heavily contributing to revenue and profit gains, is highly sophisticated and pervasive on a global scale. Without RM a high number of established carriers would not be able to operate in a profitable way.⁵ The complexity and scale of RM at large carriers is

⁵ See Sect. 2.8 "Profit Impact of RM".

truly mind-blocking. Thus the airline success story validates both the feasibility of executing RM reliably in a complex business environment and the economic impact of RM.

The curse of the strong heritage of RM from the airline industry is that it has created some kind of myopia inside its application field. A number of researches and practitioners regard RM as solely airline-specific. This lead to the creation of biases that have hampered both implementation efforts and research in other industries. An additional issue is that this airline-specific association of RM tends to have a bad reputation among consumers. On one hand customers appreciate the very low fares that RM made possible but on the other the fares are perceived as complex, sometimes so dynamic that good prices go away from minute to the other and discriminating when consumers realize that two persons sitting side by side on a flight are paying drastically different prices. This lead to hostility towards RM in other industries and reluctance to try its practices.

In reality, when moving from the airline industry to other industries, applying RM means disclosing untapped revenue potentials and increasing significant profit margins. Applying RM typically does not involve radically changing the structure of pricing and sales practices. It rather is a matter of making more intelligent decisions.

2.4.4 Extension to Other Service Industries

Starting with Littlewood's research (1972), there is an immense amount of work on RM planning approaches for the service industry, especially for the airline industry. An overview can be found, for example, in Talluri and van Ryzin (2004). Likewise, there are a range of empirical studies on RM in the service industry. In this sector, Kimes (1994), Kimes and Wirtz (2003a, b) and Wirtz and Kimes (2007) examine the extent to which customers perceive RM to be fair. Wangenheim and Bayón (2006, 2007) analyze the impact of an airline's RM measures on customer satisfaction and Crystal (2007) examine the success factors for RM in the hotel industry.

As the production-inflexibility peculiarities of airlines are shared by many other service industries, RM is strongly associated with the service industry in general. In addition to the airline industry, RM has also been used in many other service industries, such as car rental, hotels, apartment renting, casinos, saunas, golf, cruise lines, entertainment events, conferences, sport events, railways, gastronomy, health, Internet, broadcasting, media, TV services, cellular network services, cargo and logistics (Chiang et al. 2007; Defregger and Kuhn 2007; Klein and Steinhardt 2008; Kuhn and Defregger 2005a, b; Talluri and van Ryzin 2004).

An adopter of RM has also been the energy sector, principally in the area of managing the sales of pipeline capacity for gas transportation. Also in the energy sector demands are volatile and uncertain, and the technology for generating and transmitting electricity and gas can be inflexible. In addition, the deregulation of

this industry led to a lot of experimentation and innovation in the pricing practices of energy, gas and transmission markets.

The adoption of RM has also been reported in the retail industry. Especially fashion apparel, toy and consumer electronics sectors were the early adopters of RM within the retail players. The reason for this is that retail demand is highly volatile and uncertain, supply is quite inflexible, consumers' valuations change rapidly over time, and short selling seasons are combined with long production and distribution lead times. The introduction of bar and QR codes as well as the point-of-sale (POS) technology has made it possible to achieve a high degree of automation of sales transactions for most major retailers.

In terms of future application of RM one could argue, that many industries are potential candidates for RM. Almost all companies must deal with demand variability, uncertainty, and customer heterogeneity. Most are subject to some sort of supply or production inflexibility. The progress made on enterprise software and e-commerce innovations enabled many companies to automate their business processes. All these elements bode well for the future widespread of RM.

However, as with any technological and business-practice innovation, the case for RM ultimately boils down to a cost-benefit analysis for each individual firm. For some firms, the potential benefit will simply never justify the costs of implementing RM systems and business processes. Nevertheless, it is likely that for the majority of firms, RM will eventually be justified once the technology and methodology in their industry matures. In fact, the history of RM in industries such as airlines, hotels, and retail suggests that once the technology gains a foothold in an industry, it spreads quite rapidly. Therefore it would not be a surprise, if we will see RM systems or systems performing RM functions under a different denomination become as ubiquitous as ERP, SCM, and CRM systems are today.

2.5 RM in the Manufacturing Industry

While research in the service industries has been concerned with the optimal usage of limited capacity resources since the end of the 1970s, research in manufacturing is a relatively young scientific discipline compared to the former (Chiang et al. 2007). Recently, research on RM has been extended to its application in the manufacturing industry (Barut and Sridharan 2005; Watanapa and Techanitasawad 2005a; Defregger and Kuhn 2007; Spengler et al. 2007).

The first studies investigated the applicability of RM concepts to the manufacturing industry, concluding that RM can be applied in many manufacturing industries such as paper, steel and aluminium (Blumenthal et al. 2008), iron and steel (Spengler et al. 2007), automotive (Blumenthal et al. 2008; Voigt et al. 2008) or assemble-to-order (Harris and Pinder 1995).

2.5.1 Planning Approaches

Planning approaches for the use of RM in the manufacturing industry have only appeared comparatively recently. The works differ with regard to the control parameters of approaches to deciding on the acceptance of orders for requests with a fixed price and date (Defregger and Kuhn 2007; Elimam and Dodin 2001; Kimms and Müller-Bungart 2003; Kniker and Burman 2001; Spengler and Rehkopf 2005; Spengler et al. 2007), approaches to defining delivery dates for orders with a fixed price (Keskinocak et al. 2001) and approaches to defining offer prices and delivery dates for order requests (Charnsirisakskul et al. 2006; Watanapa and Techanitasawad 2005a, b). However, these works are of a conceptual and normative nature and, with the exception of a number of case studies, fail to address the state of revenue management in the manufacturing industry.

So far little empirical research is available on the use of RM in general (see Weatherford (2009) for survey results on the deployment of RM software in the airline industry) and on the use of RM in the manufacturing industry in particular.

2.5.2 Empirical Studies

To the best of our knowledge, the only empirical study on the use of RM in the manufacturing industry besides our research (Kolisch and Zatta 2009, 2012, 2014) was conducted by Kuhn and Defregger (2005a, b).

Based on 107 companies from the paper, steel and aluminium industries, this study examines the extent to which the conditions are in place in the aforementioned industries for the use of RM and the extent to which RM is currently applied. Based on this sample, it is estimated that approximately 60 % of companies in the aforementioned industries meet the conditions to apply revenue management, but that RM is not yet being used extensively. Prerequisites, importance, period of use and type of application (capacity versus price-based RM) have been assessed (Kolisch and Zatta 2009; Kuhn and Defregger 2005a, b; Talluri and van Ryzin 2004).

2.5.3 Manufacturing Alternatives: MTS vs. MTO

When applying RM to manufacturing companies, a distinction between make-to-stock (MTS) and make-to-order (MTO) scenarios needs to be made.

Typically MTS manufacturers, like consumer goods producers, produce large quantities of a relatively standardized product, based on forecast of future demand. The trade-off that companies face in this case is between the fulfilment of stochastic and uncertain demand patterns and both production and inventory costs.

While dynamic pricing tends to be the exception, most MTS manufacturers price based on aggregate decisions, however allowing end-of-life-cycle discounts or trade promotions (Coy 2000).

MTO manufacturers are typically characterized by smaller volumes produced, usually generated by business-to-business orders. Pricing of continuous streams of bids and requests for quotes are distinctive pricing elements, and pricing decisions are influenced by factors as estimated costs like materials, machine time and labour rates as well as strategic customer-life-cycle analyses. Activity-based pricing approaches are considered efficient RM tools in this context (Daly 2002).

After acceptance, orders are scheduled into the manufacturer's production planning and supply chain management system, where current and new orders are optimally coordinated. While it is the guiding principle to meet delivery due-dates at the lowest cost, neither pricing considerations as a regulatory mechanism for incoming orders nor price incentives to reduce production-peaks represent common practices (Talluri and van Ryzin 2004).

Production planning models for production capacity optimization in a combined MTS and MTO production environment have recently been proposed by researchers, opening up new opportunities to apply RM in the manufacturing arena (Tsubone and Kobayashi 2002).

2.6 Prerequisites for the Application of RM in the Service vs. PI

A range of conditions for the successful use of RM are stipulated in the available literature (Kimms and Klein 2005; Klein and Steinhardt 2008; Kuhn and Defregger 2005a, b; Netessine and Shumsky 2002; Talluri and van Ryzin 2004). Several works (Harris and Pinder 1995; Kimms and Müller-Bungart 2003; Kuhn and Defregger 2005a, b) examine the conditions for application of revenue management with respect to the MTO manufacturing of tangible goods and come to the conclusion that these conditions can essentially be deemed to have been met (Table 2.1).

In Table 2.1 the column "process industry" only displays the differences to the service industry. Blank spaces in this column indicate that the same condition also applies to the PI.

2.6.1 Heterogeneous Demand and Customer Segmentation

Demand heterogeneity is expressed by the fact that customers display variations in willingness to pay (WTP), in preference for different products, and in purchase behaviour over time. The more articulated the heterogeneity in customer needs, the

Table 2.1 Comparison of conditions for applying RM to the service and process industries (see also Talluri and van Ryzin 2004, pp. 13–16, 574–576; Watanapa 2004)

| Service industry | Process industry |
|---|--|
| 1. Heterogeneous demand and opportunity for customer segmentation. | |
| 2. Stochastic demand. | |
| 3. Capacity is available in discrete periods and expires at the beginning of a period. Orders are assigned precisely to individual periods. As a result, sequencing is not necessary. | Capacity is constantly available and constantly expires. The delivery of the order takes place at a certain point in time. Sequencing of orders is necessary. |
| 4. Largely fixed capacity and dynamic demand. | Largely fixed capacity and dynamic demand which is determined by the delivery dates requested by the customer, the state of resources and the result of scheduling. Changes in availability are possible within certain limits by adjusting the intensity. |
| 5. High fixed costs and low marginal costs. | |
| 6. Pre-booking option. | |
| 7. Economic freedom to act. | |
| 8. Data availability and information systems. | |
| 9. Corporate culture and management support. | |

more opportunities arise to use revenue management to strategically and tactically maximize revenues within different market segments.

Heterogeneous demand and the possibility to segment customers based on their WTP certainly characterizes both the services and manufacturing industries. They both have different patterns of usage and behaviour in terms of when they purchase and how flexible their demand is, and they place very different valuations on the need to purchase services.

2.6.2 *Stochastic Demand*

Demand varies according to season, week, day, and time of day. The more uncertain demand is, the harder it becomes to take future demand-management decisions. Forecasting time-related demand to effectively take pricing and allocation decisions thus becomes a critical success factor both in services and manufacturing industries.

2.6.3 *Capacity Expiration*

In the service industry capacity is available in discrete periods and expires at the beginning of a period. Orders are assigned precisely to individual periods. As a result, sequencing is not necessary. In the PI capacity is constantly available and

constantly expires. The delivery of the order takes place at a certain point in time. Sequencing of orders is necessary.

Since RM is typically used in a context where services are extremely perishable or cannot be stored at all there is limited or no arbitrage opportunity for the services. The same concept applies to manufacturing firms, because manufacturing capacity is as perishable as an airline seat or an advertising slot: if it is not used when it is available, that opportunity to use capacity is gone forever.

2.6.4 Fixed Capacity and Dynamic Demand

In the short run capacity is considered as fixed, even though companies can adapt their capacity by adjusting available units, e.g. by changing the aircraft use to a larger or smaller one. However, with an increasing degree of production inflexibility, the more production delays, economies of scale, switch-over costs and fixed capacity constraints exist, the more cost-intensive it becomes to match demand with supply variations. Thus, the higher fixed capacity is, the more strategically relevant revenue management becomes.

In the service industry capacity is largely fixed and demand is dynamic. In the process industry capacity is also largely fixed. Demand is also dynamic and it is determined by the delivery dates requested by the customer, the state of resources and the result of scheduling. Changes in availability are possible within certain limits by adjusting the intensity.

2.6.5 High Fixed Costs and Low Marginal Costs

The application of RM is characteristic of industry structures with a fixed cost component which is significantly larger compared to the variable cost component. Once, as an example, a restaurant has facilities and staff in place, the marginal cost of an additional client is relatively low when expressed in terms of food and drinks served as well as laundry and dishwashing. Therefore the revenue generated must cover variable costs and offset at least part of the fixed costs. This is true for both the services and manufacturing industries.

2.6.6 Pre-booking Option

The service is usually booked or purchased in advance of consumption, e.g. in the car rental industry. The same applies to manufacturing capacities, e.g. in the pharmaceutical industry.

2.6.7 Economic Freedom to Act

In the airline industry, for example, companies can withhold seats from current economy customers in order to make them available to future, more profitable business customers without being morally irresponsible or acting illegally. The same applies to manufacturing companies and their economic freedom to act.

However, such practices are not admissible in emergency wards or when allocating organs for transplantation.

2.6.8 Data Availability and Information Systems

To model demand, data and supporting systems are required. The data gathering and elaboration of the systems represent the starting point to implement and monitor the resulting real-time decisions. In this case information technology enables companies to operationalize RM science.

The services industry, and more specifically the airline industry, is an excellent case on data management and information technology and system support. The pricing and distribution processes of this industry were widely automated with the implementation of GDSs starting from the 1960's. Therefore it is one of the earliest industries to move almost entirely to electronic selling and distribution already decades before the advent of e-commerce. Also the manufacturing industry has today the same potential to leverage data availability and information systems, even if those can differ in terms of use and level of maturity between companies.

2.6.9 Corporate Culture and Management Support

Last but not least a “soft” prerequisite linked to corporate culture and more broadly to change management aspects and the management support linked to it is considered an important aspect by researchers. RM demands a management approach that is receptive to science and technology. The culture of the industry or of a specific company positively conditions the implementation success of RM, especially when inclined to accept innovations and deterministic decision mechanisms.

If the implementation of RM is additionally supported by top-level sponsorship, success probability increases even further. This holds for any kind of company.

Firms that exhibit all or most of the above characteristics can expect significant gains deriving from the application of RM practices.

2.7 Price and Capacity Management

Of the various RM instruments available (for an overview see Klein and Steinhardt 2008; Talluri and van Ryzin 2004), we only wish to consider the price and quantity management that is generally suitable for the manufacturing industry and specifically suitable for the order-based process industry (Klein 2001).

Price and quantity management is divided into revenue-based and quantity-based management (Klein and Steinhardt 2008). With respect to quantity-based management, total capacity is divided into partial capacity with different prices. In the airline industry, the partial capacities correspond to the quotas for individual booking classes, while in MTO manufacturing, these partial capacities are reserved for specific order types, such as large-volume orders with a later delivery date. A range of partial industry-specific planning approaches are stipulated for the distribution of capacities in the literature available (see for example Talluri and van Ryzin 2004). Demand will be assumed if the explicitly or implicitly demanded partial capacity is still available in sufficient quantities.

With respect to revenue-based management, the price offered by the demanding party is compared with an internal reference price determined on the basis of opportunity cost. If the price offered exceeds the reference price then the demand is accepted, otherwise it is rejected. Revenue-based management enables a negotiation process with the customer in which different (reference) prices are determined subject to different delivery dates (see for example Keskinocak and Tayur 2004).

Quantity-based management is also referred to in this paper as capacity management and/or capacity control, and revenue-based management is also referred to as price management and/or price control.⁶

Price and capacity management is deemed to be in place if both control elements are used parallel to each other, as partial capacities are reserved for specific order types and decisions are made on the basis of reference prices regarding the acceptance of orders, for example.

2.8 Profit Impact of RM

Since its introduction, RM has been used throughout the airline industry and has made a substantial contribution to airlines' profit. By most estimates, the revenues gains from the implementation of RM are roughly comparable to many airlines' total profitability in a good year, i.e. about 4–6 % of revenues.⁷

⁶ The term “pricing” is also used at times in the preliminary study interviews presented in Sect. 2.4. However a distinction must be made between the latter and the concept of “dynamic pricing” (see for example Klein and Steinhardt 2008).

⁷ Sceptic voices point to Southwest Airlines as a counterexample. However, Southwest Airlines does use RM systems. Because its tariff structure is less complex than most other airlines the use of RM is less obvious to consumers and casual observers.

The increase of revenue and earnings, credited to RM by US Airways and Delta Airlines, was \$500 and \$300 million respectively (Boyd 1998). American Airlines indicated increased revenues of approximately \$1.4 billion over a 3-year period deriving from effective employment of a RMS (Smith et al. 1992). RM also helped Marriott Hotels gain \$100 million additional annual revenues (Cross 1997). RM can also contribute substantially to cost savings and revenue maximisation in the airline industry while helping maintain quality (Elliott 2003). Success cases of RM application in service industries have been reported in Europe as well: As a result of using RM, Lufthansa was able to generate additional profits of 105 million euros in 2005 (see Klophaus and Pölt 2007).

The successful application in terms of revenue and profit impact of RM in the manufacturing industry has been assessed in Smith et al. (1992), Welch (2003) and AMR Research (2010). However, since research in the manufacturing industries is still in its infancy (Chiang et al. 2007), very few companies experiencing RM successes have been explicitly quoted in the literature. We are aware of only two. One is ThyssenKrupp VDM, a leading global producer of high-performance nickel and cobalt alloys as well as special stainless steels. The employment of RM generated gains in contribution margin and quantity of up to 13 and 8%, respectively (Hintsches et al. 2009). The second is Ford Motor Company in the automotive sector: Ford developed an RM system (RMS) in 1995 and in 1998 it was in use in 5 out of 18 U.S. sales regions. While those regions using RM exceeded their profits by \$1 billion, the other 13 regions were short of their target by \$250 million (Blumenthal et al. 2008).

2.9 Fairness Within RM

One of the key elements in the successful application of RM is dynamic pricing. The perception of trust as well as fairness and its effect on variable pricing decisions, however, is an undervalued and under-researched field (McMahon-Beattie et al. 2002).

Customers paying more for a product or service that is similar or perceived as equal may consider the company selling the same product or providing the same service at a lower price at a different time or to a different group of customers as unfair.

When solely focusing on short term benefits RM runs the risk of alienating customers regarding RM as an unfair practice and thus puts the long-term profit maximization at stake. Managing the perceived fairness of RM is therefore a key to its implementation success.

2.9.1 Key Elements of Fairness

When discussing fairness, researchers use the concept of “reference transaction”, thus referring to how customers think a transaction should be conducted and to how much a given product or service should cost in the customers’ opinion. In order to identify the price that is perceived as fair customers use “reference prices” that reflect e.g. market or posted prices or past experience with the company (Kahneman et al. 1986).

According to researchers, customers believe that the value to the firm should equal the value to the customer. If that relationship becomes unbalanced by increasing the value to the firm or decreasing the value to the customer, the customer may view subsequent transactions as unfair. In this context the principle of “dual entitlement” holds that most customers believe that they are entitled to a reasonable price and that firms are entitled to a reasonable profit (Kahneman et al. 1986).

From the above principle of “dual entitlement” three hypotheses emerge: (1) Customers believe that raising the price to maintain profits is fair. If costs increase, customers consider it reasonable for the price of the product or service to increase; (2) customers feel that raising the price to increase profits is unfair; and (3) If costs decrease, customers believe that it is reasonable for the company to maintain the same price, e.g. because the customers are paying what they think they should, or because they believe management should reap the rewards of its cost-cutting efforts (Kimes 1994).

2.9.2 Fairness Within the Service Industry

The application of RM in the service industry has a long track record and customers have accepted to pay different prices for the same service, even accepting restrictions for specific fares e.g. when flying. As RM is gaining in popularity in several service industries, the question of how customers react to RM remains relatively unexplored, apart from the airline and hotel industries, where RM can increase revenue without affecting customer satisfaction (Kimes 1994).

In fact, recent studies in the hotel industry have shown that variable pricing practices do not result in lower perception of fairness among customers. Moreover, in the cases in which information on the room pricing practices of the hotel was offered to customers at the same time of reservation, unconstrained acceptance of RM was registered (Choi and Mattila 2004).

Perceived fairness in the leisure industry, e.g. in the golf industry, represents another area of research that has provided valuable insights. The study results show that golfers perceive arrival duration control practices in the form of reservation fees or no-show fees as fair. Additionally, it has been found that golfers perceive demand-based pricing in the form of coupons (two for the price of one), time-of-day

and reduced tee time intervals as fair. Conversely, time-of-booking prices are rated as unfair (Kimes and Wirtz 2003a, b).

2.9.3 Fairness Within the Process Industry

In the process industry customers may pay different prices depending on different criteria like the set due date and processing time. However, empirical studies on perceived fairness related to RM practices in the process industry are extremely rare.

2.9.4 Price Increase Strategies

Researchers draw conclusions from the perception of fairness in relation to RM. Generally customers view justified price differences as fair, but unjustified price increases as unfair. If a customer thinks that the transaction is only different from the reference transaction in price, she may believe that the firm is receiving more than its reference profit and is thus behaving unfairly (Kimes 1994).

Either of the following four options can be chosen to handle price increases without hurting customers' perceived price fairness: (1) Increasing the reference price by e.g. the full-fare rate: most customers receive some discount, and if informed of the discount, may consider themselves lucky; (2) Attaching additional services or products to the service sold at an increased price, thus increasing the perceived value to the customer; (3) Bundling the product or service in order to obscure the price; (4) Attaching restrictions to discounted prices so that higher prices with fewer restrictions seem fair by comparison (Kimes 1994).

Chapter 3

State of the Art and Perspectives of Revenue Management in the Process Industry

3.1 Background of the First Empirical Study

RM is recognized as the source of success of many players in the service industry and is becoming an increasingly discussed topic in the PI. However, while a large amount of academic research is available on the service industry, the manufacturing industry and the PI in particular has received limited attention (Chiang et al. 2007). In the first step of the book, the objective is therefore to assess the state of the art and the perspective of RM in the PI in one significant European country, namely Germany.

The outcome of this first quantitative research for the book was published in an academic journal (Kolisch and Zatta 2009) and will be summarized in this chapter. This chapter of the book is structured as follows: First, the results from the exploratory study are presented in Sect. 3.2 and then hypotheses are derived on the basis of the inputs received from practitioners in the PI. In Sect. 3.3 an overview on the collected data is presented. Sect. 3.4 contains the results of the quantitative empirical study. Trends and perspectives on the introduction and application of RM are examined in Sect. 3.5. This chapter concludes with an illustration of the principal results and a discussion of the various limitations in Sect. 3.6.

3.2 Explorative Research and Hypothesis Derivation

Having established the fact that the PI is suitable for RM, this suitability raises a number of questions regarding the acceptance, distribution and specific configurations of such systems. With this in mind, 15 preliminary discussions were held with experts from the process industry, in particular from the chemical (4), pharmaceutical (4), metal (3), paper (1), crude oil (2) and glass (1) industries, prior to the qualitative study being carried out. The relevance of RM was generally considered

to be high across all of the industries: “In recent years, the process industry has focused heavily on cost reduction activities. This has been successful in many companies. However the additional potential to reduce costs is low. This means that RM is playing an increasingly important role in helping to increase revenues” (chairman of the board of directors of a metal company). “The use of RM in the process industry is in its early stages. Many companies in our industry are focusing on this, but there is still no standard solution in place; once there will be one, then everyone will take advantage of it” (department head of a pharmaceutical company).

Several managers who were surveyed beforehand noted that the importance of RM is generally high for companies in the process industry, and that it is something that becomes even more important the larger the company is and the longer the period of use. The vice president of sales of a leading crude oil company commented, “For a number of years, we have been working on leveraging revenues by reducing costs and increasing volumes. Still, RM and pricing are concepts that have only recently been discovered, not only by us but also by many of our other competitors as well. What is striking is that the larger the size of the company is, the more professionally RM can be used because of the fact there are larger budgets and more resources available for this purpose than in small businesses.” The period of use also has a positive impact: “The longer RM is in use, the stronger the learning-by-doing effects are, especially in the first few years, and the more successful this tool can be used.”

With respect to the configuration as a price or capacity-based system, there appears to be a development from pure capacity management to combined price and capacity management: “In the first few years that revenue management was in use, this was characterized by pure capacity management. The price components were included from the third year onwards. Now RM is based on a combination of price and capacity management” (member of the management board of an international manufacturer of generic items).

Likewise the respondents drew on their own experiences, highlighting the fact that the positive impact of RM increased thanks to the integration of information technology: “The benefits of revenue management were apparent when we moved from an Excel to a SCM application, which has allowed us, for example, to organize the workload of the machinery in various plants in a more efficient and timely manner and to increase the acceptance of RM within the company” (production director of a chemicals company).

Faced with the question of how the use of RM is expected to develop in future, the experts surveyed expect to see an increased prevalence of RM systems: “There is a clear trend whereby RM issues and pricing issues in particular are being added to the agenda of management. This is expected to increase in the future, simply because of the fact that fewer companies will be able to afford to ignore such sources of profitability. RM and price optimization provide sources that have yet to be sufficiently exploited” (supply chain manager, paper and packaging company).

Given that the main study is essentially of an exploratory nature, it does not focus on verifying (theory-based) hypotheses. Nevertheless, the comments made by

the experts may indeed become of a hypothetical nature and will be reviewed during the study. The following working hypotheses were drawn up based on these preliminary discussions:

Hypothesis 1: The importance of RM is generally high. Furthermore, it becomes higher with increasing revenue and the period of use within the company.

Hypothesis 2: The peculiarities of the RM approach depend on the period of use within the company. Over time, price and capacity-based systems have become more prevalent compared to pure capacity-based systems.

Hypothesis 3: The assessment as to what extent RM contributes to revenue growth depends on how it is implemented.

The research question of this paper is therefore to obtain insight into the assessment and use of RM by those responsible in the process industry, focusing on the working hypotheses derived from the preliminary discussions and reviewed by means of the following quantitative empirical study.

3.3 Quantitative Study: Data Collection

Data was collected in Germany between July 2004 and February 2005. Further data was then collected from a number of selected companies between November 2007 and May 2008. The individuals surveyed were employees responsible for carrying out managerial duties as part of the various RM tasks examined in Sect. 3.4.

The surveys were conducted in personal interviews with the aid of a five-part questionnaire (see Appendix A.1). Parts one and five of the questionnaire contained background information about the study. The three main parts of the questionnaire included the collection of key economic parameters of the company, questions on the use of RM in the company and questions regarding a general assessment of RM (each on a 1–7 Likert scale), along with duplicate questions in order to check consistency.

To begin with, 270 companies in the process industry (pharmaceutical, glass, crude oil, paper, metal and chemical industries) whose headquarters were based in Germany were randomly selected from the Hoppenstedt and Chamber of Industry and Commerce company databases in order to determine who to interview. Relevant respondents from the Management Board, Divisional Management, Production Management and Plant Management, Supply Chain Management, Customer Relationship Management and Strategic Planning departments of each company were chosen by the Press or Communications Department of the respective company, and were then called to see if they would be willing to participate in the study.

A questionnaire and a letter stating the various aims of the study and explaining the main technical terms were sent to all individuals who had confirmed their willingness to participate in the study, and an interview date was then fixed. At the start of the interview, the main technical terms were explained once again and

Fig. 3.1 Companies surveyed per industry

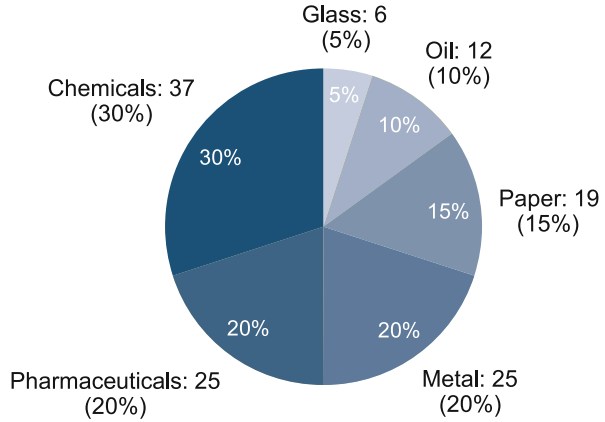
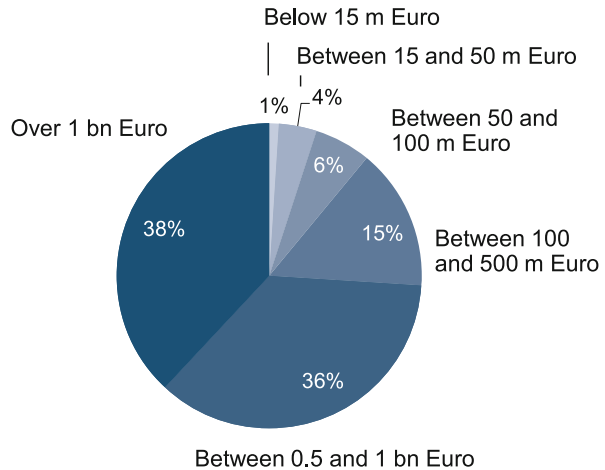


Fig. 3.2 Annual turnover of companies surveyed



checks were made to ensure that the interviewee was indeed able to correctly answer the questions on the basis of his or her education, training and position within the company. By following this approach, the intention was to eliminate the issue of the “wrong key informant”.

Interviews were conducted with a total of 124 individuals (46 % of the companies contacted). The interviews lasted for 90 min on average. Figure 3.1 illustrates the companies involved per branch, and Fig. 3.2 illustrates the distribution of annual turnover of the companies involved in the study.

To ensure the general validity of the results, it is important to assess whether a “non-response bias” can be excluded, i.e. whether such participation in the empirical study on the importance of revenue management took place independently any opinion (Friedrichs 1990). To verify this, all respondents were first asked about the importance they attributed to revenue management within their company. Seven percent of the non-participating respondents and 5 % of participating respondents

attributed low importance to this topic. From this it can be concluded that there was no “non-response bias”. As for the participating respondents, the position held within a company did not have any impact on the perceived importance of revenue management (ANOVA, $F = 0.986$; $p > 0.4$).

Correlation analyses (Pearson’s correlation as metric variables), t-tests and analyses of variance (ANOVA) were used as statistical test methods in order to verify the aforementioned working hypotheses. In the case of heterogeneous variances (Levene’s test where $p < 0.2$), we used the Brown-Forsythe test instead of the F-test as part of the analysis of variance.

The results of the study are illustrated below. First, the results on the state of revenue management is illustrated in Sect. 3.4.2, while the various trends and opinions are illustrated in Sect. 3.4.3.

3.4 Results: State of the Art of RM in the PI

Based on their own statements, approximately 80 % of the companies surveyed use revenue management in some form that is not necessarily system based. These applications will be analyzed in the following.

3.4.1 *Focus, Implementation and Introduction*

With a total of 74 %, the majority of applications are capacity-based, whereas only 15 % are price based and only 5 % are both price and capacity based (see Fig. 3.3).

RM is implemented in the majority of cases (83 %) by way of basic electronic data exchange, e.g. via spreadsheet files. The data is exchanged manually in 9 % of cases. Only 7 % of the companies surveyed use complex and highly automated systems. These systems are integrated within Supply Chain Management or Customer Relationship Management applications.

RM had been introduced within the past 5 years in 86 % of cases; in certain cases this introduction had not yet been fully completed at the time of the interview. Thirty-four percent of the introductions took place within the past 2 years, 52 % took place between 2 and 5 years prior to the data being collected and 4 % took place between 6 and 10 years prior to the data being collected. No such measures were introduced more than 10 years ago. Compared to applications in the services sector, including the airline industry which has been working with revenue management since the 1970s, the PI is still not particularly experienced in RM (Talluri and van Ryzin 2004; Weatherford and Bodily 1992).

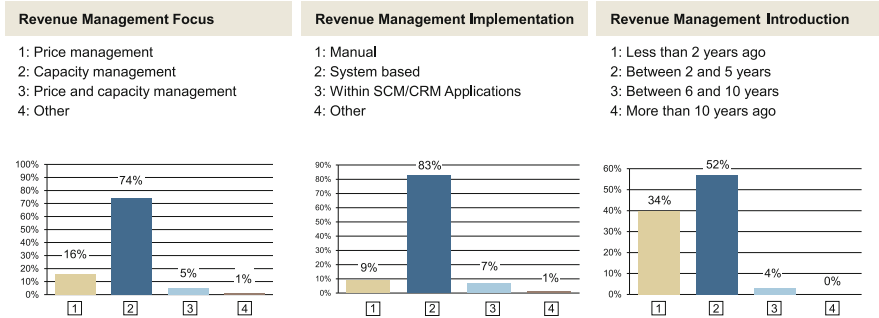


Fig. 3.3 RM focus, implementation and introduction [Questions asked: “Which of the following revenue management approaches are used?” (Revenue Management Focus), “In what form is revenue management used?” (Revenue Management Implementation), “How long has revenue management been used in your company?” (Revenue Management Introduction)]

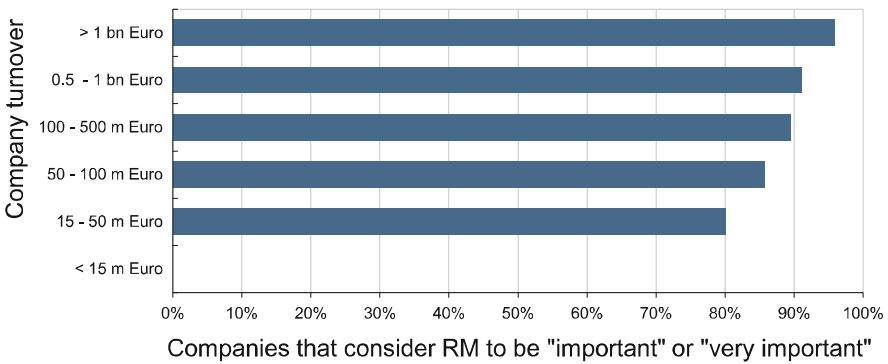


Fig. 3.4 Importance of RM and company size

3.4.2 Importance of RM

Figure 3.4 illustrates the degree to which companies regard RM as “important” or “very important” depending on the companies’ size (measured in turnover). The overall importance of RM is generally high and increases—as indicated already on the basis of the preliminary discussions (H1)—with a higher turnover for the company in question (moderately significant correlation between importance and turnover $r_{\text{pearson}} = 0.224$; $p < 0.05$).

Figure 3.5 illustrates the average importance attributed to RM on a 1–7 Likert scale depending on the management concept (price based, capacity based, price and capacity based) as well as the period of use.

There is generally a positive correlation between the period of use (in years) and the importance ($r_{\text{pearson}} = 0.233$, $p < 0.001$). The reason for this may either be due to an increasing importance of revenue management over time or to the fact that the companies that see revenue management as very important had already implemented such systems early on.

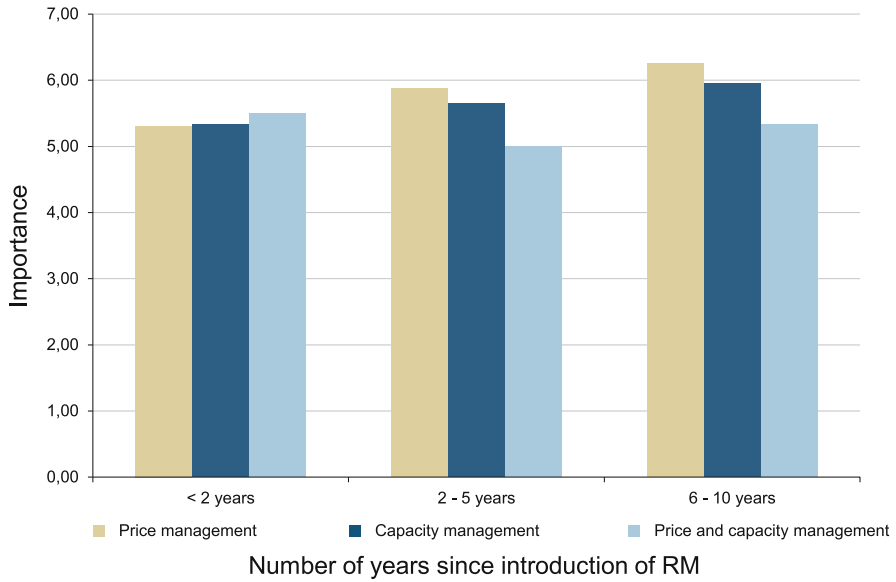


Fig. 3.5 Importance of RM in relation to the period of use and the management concept

3.4.3 Type of RM System

Figure 3.6 shows the form of the RM system (price based, capacity based and price and capacity based) in relation to the usage period of RM within the company.

Hypothesis H2 is curtailed to the extent that the proportion of pure capacity-based or price-based RM systems decreases if the usage period increases, whereas the proportion of capacity and price-based systems increases over the same period.

This fact is also reflected in the significantly different mean periods of use of RM in relation to the form used; the average period of use is 2.52 years for price-based systems, 3.41 years for capacity-based systems and 5.91 years for combined price and capacity-based systems (ANOVA; Brown-Forsythe = 4.858, $df_1 = 2$, $df_2 = 20.6$, $p < 0.01$).

3.4.4 RM as a Lever Contributing to Profit Growth

Figure 3.7 illustrates the importance attributed to revenue management as a measure contributing to revenue growth in relation to the implementation (H3); this is on a 1–7 Likert scale. In the case of manual implementation, there is no systematic IT integration, whereas a system-based revenue management implementation implies some kind of integration within the existing IT systems, typically supported by Office systems.

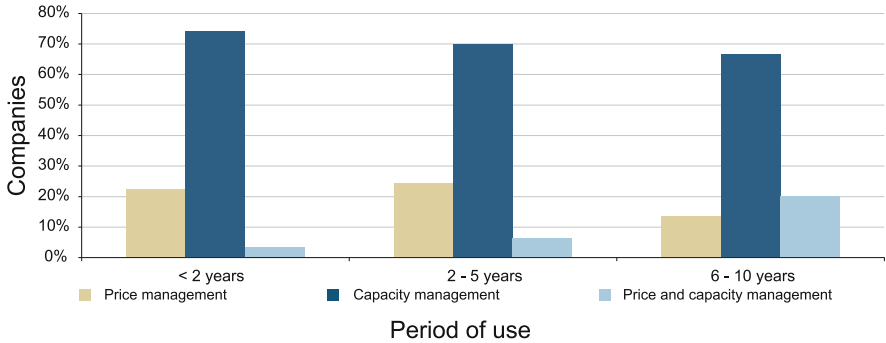


Fig. 3.6 Type of RM-system depending on the duration of use

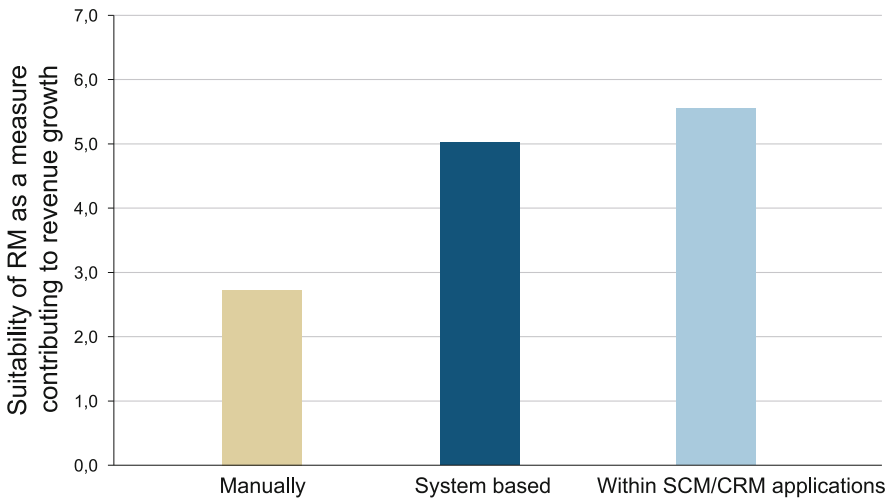


Fig. 3.7 Importance of RM in relation to implementation

An SCM/CRM revenue management implementation implies integration within a Supply Chain Management (SCM) or Customer Relationship Management (CRM) system. On average, the importance of revenue management is deemed to be higher the more extensive the IT implementation is (ANOVA; Brown-Forsythe = 16,965, $df_1 = 2$, $df_2 = 18,352$, $p < 0.000$).

3.4.5 Future Use of RM

Many respondents expect there to be an increased prevalence of revenue management systems in the process industry (average 5.56; standard deviation 0.97; 1–7 Likert scale). However there are no significant mean differences identified across the industries surveyed (ANOVA; $F = 1.864$; $p > 0.1$).

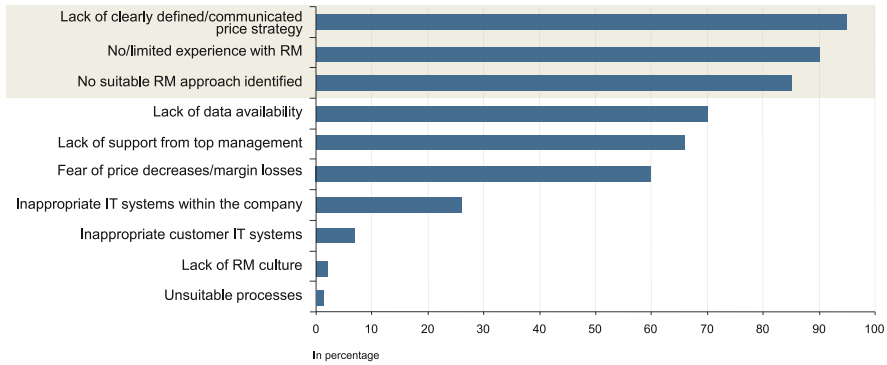


Fig. 3.8 Barriers to the introduction of RM

3.5 Trends and Perspectives

3.5.1 Barriers to the Introduction of RM

The reasons listed in Fig. 3.8 are given as being barriers to the introduction of RM. In descending order of frequency these are cited as: (1) the lack of a clearly defined and/or communicated price strategy, (2) no or limited experience with RM, (3) no suitable RM approach identified, (4) a lack of relevant data, (5) a lack of support from top management, (6) a decline in prices as a result of the industry-wide introduction of RM, and (7) inappropriate or missing IT systems for the support of RM applications.

Inappropriate IT systems on the customer side, the lack of a RM culture within the company or inappropriate or missing processes within the company are not considered to be critical barriers. The lack of acceptance of a RM system on the customer side has not been mentioned. There is no fear in particular that customers will get used to and permanently request low prices.

3.5.2 Benefits and Risks of RM

When confronted with the benefits and risks of using RM, companies see more benefits than risks.¹ These were sorted according to the number of citations (Fig. 3.9). In terms of benefits, the increase of turnover and capacity utilization, cost reductions through the improved use of existing capacities or cutbacks on

¹This question was asked openly by the interviewer, i.e. the respondents were able to freely express their views without specifying possible answers.

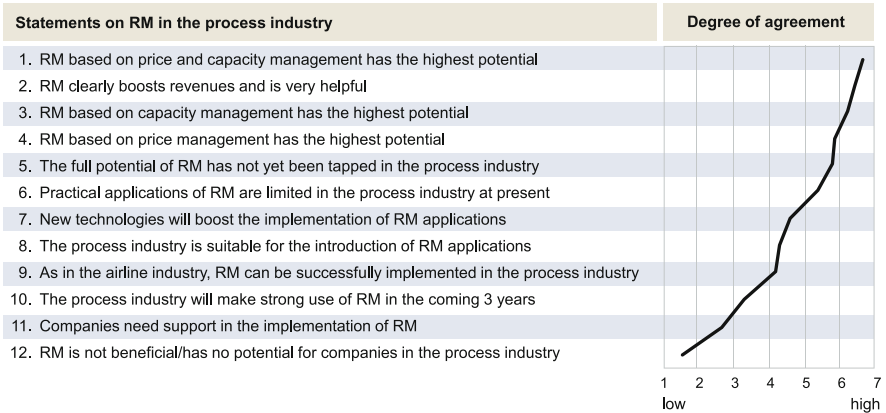


Fig. 3.9 Degree of agreement with statements on RM

(over-)capacities, efficiency gains and access to new customers and markets were all mentioned.

Additional “soft” benefits are seen in the “job enrichment” of posts, such as the post of production manager, the cross-site harmonization of capacity handling strategies, the enhanced control over capacities as well as the introduction of a corporate culture of profit maximization.²

In terms of risks, unrealistic expectations of revenue increases, high investment in IT systems, resistance to RM being introduced in the company, a lack of know-how, higher complexity and lack management focus are all mentioned (Table 3.1).

3.5.3 Alternatives to RM

When asked about alternative approaches to RM, approximately 60% of the respondents mentioned various alternatives to outsource production capacities in order to reduce the fixed cost risk. More specifically, these include: (1) The outsourcing of production capacities to legally and economically independent companies, (2) the relocation of value-added generating production steps to

²Other positive effects include, for example, the cross-site harmonization of capacity handling strategies in companies that have different production sites with different capacity handling concepts. Thanks to the company-wide implementation of a uniform revenue management approach, this helps to prevent any variations in price and capacity management between the various sites and reduce the level of complexity. As a consequence, any additional positive experiences regarding capacity management can be transferred more easily from one site to another. The enhanced monitoring of existing production capacities and their utilization is another benefit that makes it easier to control capacities and their utilization in production plants with different lines or in groups of companies with more than one site.

Table 3.1 Benefits and risks with respect to the introduction of RM

| Benefits | Risks |
|---|---|
| <ul style="list-style-type: none"> • Increases revenue through enhanced pricing and better capacity utilization • Cuts down on costs through better management of existing capacities • Helps to open up new markets or to serve new customers • Extends responsibilities, e.g. within production management, and professional development opportunities • Harmonizes different capacity handling strategies within corporations, for example • Enhances monitoring of existing production capacities and their utilization • Introduces a revenue-maximizing oriented culture | <ul style="list-style-type: none"> • Creates unrealistic expectations of revenue and turnover increase • Demands high investment into new IT systems or upgrades of existing IT systems • Corporate culture may resist the introduction of RM • A lack of RM know-how and employees who can be entrusted to carry out RM tasks • Increases complexity • Averts management focus |

suppliers, (3) cooperation with legally and economically independent companies in production networks and (4) the transfer of production capacities from their own facilities to low-cost locations.

However, approximately 15 % of the companies surveyed do not see any alternatives to revenue management, reporting that there are already numerous RM applications in place, though they are not referred to as such. Instead, they are referred to using other terms, such as EBIT optimization in production, price and RM, price and revenue optimization, revenue and pricing process optimization, and/or management and yield management.

The introduction and use of production planning systems to improve the matching of orders with existing capacities are considered to be additional alternatives (approx. 15 %) to RM.

3.5.4 *Statements on RM*

In the last section of the survey, the respondents were asked to express how much they agree or disagree to a series of statements on RM (Fig. 3.9).

An RM approach focusing on price and capacity management is considered to offer higher potential compared to pure and/or capacity management approaches. In this context, respondents pointed out that in the past capacity management played a major role, whereas price management has gained considerable importance in the past few years.

The second highest level of agreement was obtained for the statement that the use of RM leads to an increase in turnover. The statement that RM does not show any potential within the PI was clearly rejected.

3.6 Conclusions

To the best of our knowledge, this exploratory research contains the first study based on interviews with 124 companies in Germany that provides insights into the state-of-the-art of the implementation of RM in the PI. Main results, limitations and outlook can be summarized as follows.

3.6.1 Results

To the best of our knowledge, this study, based on a survey of more than 120 companies, is the first of its kind to provide descriptive and conclusive statements on the use of RM in the PI. As a result, the following principal results were achieved.

RM concepts are used in a broader sense in the vast majority of the companies we surveyed. Although it has already been noted in a range of studies that the conditions are in place for the use of RM in the make-to-order manufacturing industry, our study shows for the first time that RM is actually being used. The calculated proportion of companies totaling 80% is significantly higher than the 60% proportion estimated by Kuhn and Defregger (2005a, b). However, it is important to note that comparatively rudimentary concepts are being used in the majority of cases when compared to the latest concepts and approaches.

Two points in particular were identified in the closing part of the study. First, the importance attributed to RM increases the larger the company is. Indeed, large companies appear to be (process) innovators with respect to the use of this comparatively new concept. In addition, the importance attributed to RM and the proportion of combined price- and capacity-based concepts increases in relation to the period of use, whereas the increased IT-based implementation of concepts occurring at the same time also has a positive impact on how they are regarded. As a result, the successful use of RMS requires a long-term learning process within which increasingly complex systems are to be used.

The open part of the study shows that the main barriers to the introduction of RM in the PI are the lack of a price strategy, lack of experience and the lack of appropriate concepts. The scientific community should therefore strive to go beyond its contributions to date and adapt the existing approaches to the specific needs of the process industry, linking them with robust price strategies.

3.6.2 Limitations and Outlook

There are, however, a number of limitations to our study. First, this study was conducted as a cross-sectional study over a given period of time, meaning therefore that it does not show how perspectives have changed over time. Studies looking at

other sections and which build on this work could show both how attitudes towards revenue management change over time and how they increase the validity of causal conclusions, especially in areas that have scarcely been explored (Rindfleisch et al. 2008).

Second, the study is geographically restricted to Germany. What would be of particular interest would be to extend this to encompass the European or North American markets to identify any differences and similarities between the economic regions.

Third, a single-source bias cannot be excluded as we only interviewed one person per company. Admittedly, the respondents were identified as being responsible for revenue management, but they belonged to different functional areas within their respective companies (Marketing, Sales, Production, Supply Chain Management, and Strategic Planning). Any future studies should therefore interview several persons from different functions within a company in order to allow for the differentiation of perspectives within specific functions.

Chapter 4

Implementation of Revenue Management in the Process Industry in North America and Europe

4.1 Background of the Second Empirical Study

To the best of our knowledge, when this second study was conducted, there were only two empirical studies on the use of RM in the manufacturing industry. The first, by Kuhn and Defregger (2005a, b), based on a sample of 107 companies in the paper, steel and aluminium industries analyzes whether the prerequisites for RM are met and whether RM is used, concluding that around 60 % of the companies analyzed fulfill the prerequisites but that RM is still not widely spread. The second study by Kolisch and Zatta (2009) investigates the use of RM in the German PI.

Thus, in this research the focus of the first study is extended to Europe and North America to both assess how RM is employed in these regions and to make comparisons between them. As in Kolisch and Zatta (2009), the PI is considered. To this end, the results of an exploratory study are reported and working hypotheses are derived. Thereafter, the results of the quantitative study are reported. This chapter ends with conclusions and a brief outlook for further research.

4.2 Exploratory Research and Hypothesis Derivation

Before starting the quantitative study, an exploratory study was conducted based on 22 interviews with experts from the PI in the chemical (5), pharmaceutical (5), metal (4), paper (3), oil (3) and glass industry (2). From the explorative study, we derived a number of statements on RM.

The relevance of RM was considered as high by all interviewees: ‘Several companies of the PI have focused their attention on cost-cutting activities in the last few years and many of those have succeeded in increasing profits by reducing costs. However, the scope for further cost cutting is limited. Therefore, RM will become increasingly important as a lever to increase profits’ (chairman,

international metal producer). ‘The use of RM in the PI is quite recent. Many companies of our sector intend to make extensive use of it. However, a standard solution does not exist. If there were one, nobody would do without it’ (division director of a pharmaceutical company).

Several interviewees stated that the importance of RM increases as the size of the company increases and the longer RM has been used. The Sales Vice President of a leading oil corporation stated: ‘We have been working on the cost and volume levers for years. RM and pricing have only recently become a top priority for us as well as for our competitors.’

Interestingly, the larger a company is, ‘the higher is the professionalism with which RM is used, as, compared to smaller companies, larger budgets and more resources are available’. According to the respondents, the period of use also has a positive impact: ‘The longer RM is in use, the stronger the learning-by doing effects are, especially in the first years following its introduction, and the higher is the success of this tool’ (Business Unit Manager, specialty chemicals company). In addition, a trend from single capacity-based to price- and capacity-based systems was observed: ‘During the first years of use RM was purely capacity driven. Already from the third year onwards we included a price component. Today, our RM system is based on an integration of price and capacity management’ (member of the board, international generics producer).

Another testimonial described the positive effect of integrating RM within the IT landscape: ‘The advantages of RM became more evident when we shifted from a basic Excel- to a SCM-application. This allowed us to monitor the machine parks of different plants in real time more efficiently and thus to detect and sell available capacities, while also increasing the acceptance of RM within the company’ (head of production, chemical corporation).

When asked about the future of RM in the PI, the experts expected an increasing use of RM applications: ‘There is a clear trend to put RM and pricing on the management agendas. This phenomenon will become more prevalent as fewer companies can afford to neglect sources of profitability. RM and price optimizations offer sources that were not sufficiently exploited in the past’ (supply chain manager, paper- and packaging company).

Differences between and within continents have also been highlighted: ‘The first significant RM applications in the manufacturing sector appeared in North America. Europe followed, with northern Europe being the pioneer, followed later by southern Europe. This was what I noticed both in our company, which has its own premises in all these regions, but also at major competitors’ (head of corporate business development, global oil company).

On the basis of the expert interviews, we formulate the following working hypotheses:

Hypothesis 1: The importance of RM is generally high and becomes higher with increasing turnover and the period of use.

Hypothesis 2: The peculiarities of the RM approach depend on the period of use. Over time, price- and capacity-based systems have been more frequently compared to pure capacity-based systems.

Hypothesis 3: The contribution of RM to revenue growth depends on the implementation.

On the basis of these working hypotheses, we want to obtain insight into the assessment and use of RM in the PI across different geographic regions.

4.3 Quantitative Study: Data Collection

The study was conducted by personal interviews. Four hundred companies in the PI were contacted in North America and 500 in Europe. The companies were randomly selected using a Dun & Bradstreet database (Dun & Bradstreet Sales & Marketing Database 2005).

The data collection that involved 479 participating companies was completed in July 2009. A total of 227 of the participating companies were situated in the regional cluster North America (Canada and the United States), whereas 252 companies were located in the regional cluster Europe (Germany, France, Netherlands, Ireland, Italy, Norway, Spain, Sweden, Switzerland and the United Kingdom), see Figs. 4.1, 4.2 and 4.3.

Respondents were managers responsible for the activities linked to RM. Personal interviews were conducted on the basis of a semi-structured questionnaire (see Appendix A.2). At the beginning of each interview, we provided the definition of RM given by Phillips (2005): ‘Revenue Management refers to the strategy and tactics used by a number of industries . . . to manage the allocation of their capacity to different fare classes over time in order to maximize revenue’. In this way we were assured that there was a clear and consistent understanding of RM among the respondents of the study.

Fig. 4.1 Distribution of the interview partners per country

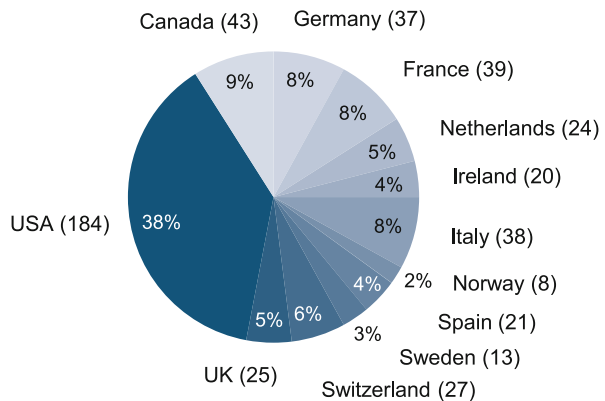


Fig. 4.2 Distribution of the interview partners per turnover

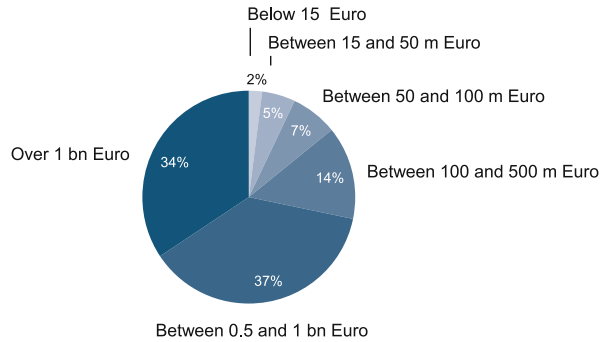
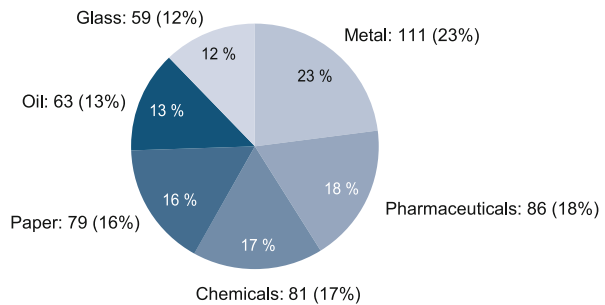


Fig. 4.3 Distribution of the interview partners per industry



For the validity of the results, it is necessary to assess whether managers decided to participate in the study independently of their opinion on the importance of RM (Wolfe 2003). To verify this issue, all targeted interviewees were first asked about the importance they attributed to RM within their company. Three per cent of the non-participating target-interviewees and 2% of the participating interviewees attributed low importance to RM. From this it can be concluded that there was no non-response-bias.

4.4 Results: RM in Practice

4.4.1 Importance of RM

Respondents were asked to assess the importance of RM in the PI (Likert scale from 1—not important to 7—very important). The overall score was high, but a two-tailed t-test shows a highly significant difference ($P=0.000$, $T=9.881$, $DF=477$) between the average value (AV) in Europe (5.87) compared to North America (6.78).

Participants were also asked to judge the future importance of RM in the PI for different time horizons (short, medium, long term). Two-tailed t-tests show for all time horizons that North American companies generally consider RM as more important than European companies. In the short term (within the next 6 months), the AV is 5.5 for Europe, whereas it is 6.42 for North America ($P = 0.000$, $T = 6.58$, $DF = 477$); in the medium term (in the next 6–18 months), the AV is 5.75 for Europe, whereas it is 6.63 for North America ($P = 0.000$, $T = 7.31$, $DF = 477$); and in the long term (not before the next 18 months), the AV is 6.58 for Europe, whereas it is 6.78 for North America ($P = 0.011$, $T = 2.549$, $DF = 477$). An explanation for this difference could be the fact that North American companies introduced RM earlier than European companies (see the next sub-section); consequently, they judge its application as more valuable—as indicated in the exploratory study and hypothesized (Hypothesis 1). Although in the short and medium term, the difference between the AV of North America and Europe is still high, that is 0.92 and 0.88, respectively, it amounts to only 0.2 in the long term. On the basis of this gap reduction over time, we believe that in the long term RM will become equally important in the two continents.

4.4.2 Focus, Implementation and Period of Use of RM

Figure 4.4 illustrates that 67 % of RM applications are capacity based, whereas only 22 % are based on price management and 11 % rely on price and capacity management. When comparing the two continents, a highly significant difference emerges ($P = 0.000$, $X^2 = 36.619$, $DF = 2$), see Figs. 4.5 and 4.6: Companies in North America use proportionally more price-based approaches, that is 47 % of the North American companies choose price- or price- and capacity-based RM applications, compared to European companies, where this percentage amounts to 21 %.

In contrast, 79 % of European companies indicate that they use RM based on capacity management, whereas in North America this holds true only for 53 %.

RM implementation is carried out by over half of the companies through electronic data interchange (52 %), for example Excel-based tools. In 29 % of the

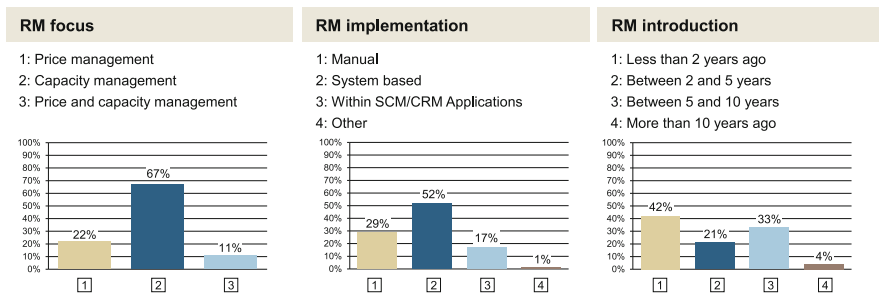


Fig. 4.4 Focus, implementation and period of use

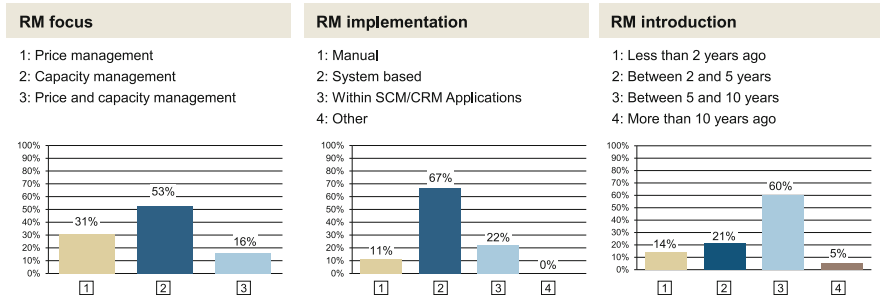


Fig. 4.5 Focus, implementation and period of use in North America

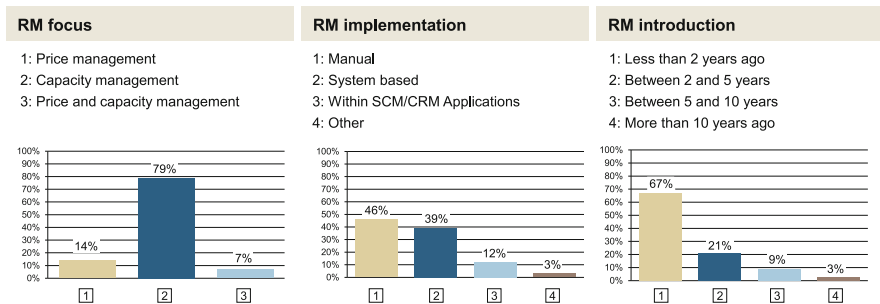


Fig. 4.6 Focus, implementation and period of use in Europe

cases, the data are recorded manually, whereas in 17 % it is processed through automated IT-systems, typically integrated in SCM or CRM applications, as illustrated in Fig. 4.4. In Europe, manual applications prevail with a share of 46 %, followed by system-based applications with 39 % and SCM/CRM applications with 12 % (see Fig. 4.6). In North America, the dissemination of system-based applications is with the highest 67 %, followed by SCM/CRM applications with 22 % and manual applications with 11 % (see Fig. 4.5). This indicates a more sophisticated use of RM in North American companies.

In 63 % of the cases, the period of use of RM is 5 years or less, as illustrated in Fig. 4.4. More specifically, the period of use of 42 % of the respondents is 2 years or less, whereas for 21 % of the respondents the period of use is between 2 and 5 years and 33 % of the respondents report a period of use between 5 and 10 years. The period of use is more than 10 years for only 4 %. In contrast to the service industry, and more specifically to the airline industry, the experience with RM in the PI is thus much more limited. In accordance with the findings of the exploratory study, differences with respect to the period of use of RM can be detected between North America and Europe.

Although European companies had typically introduced RM less than 2 years previously, the majority of North American companies had introduced RM 5–10

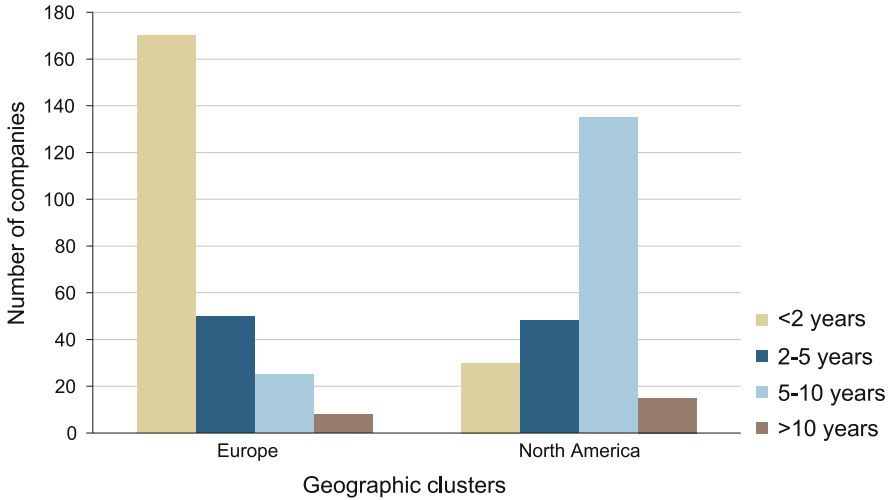


Fig. 4.7 Period of use in North America and Europe

years previously ($P = 0.000$, $X^2 = 175.45$, $DF = 3$, see Figs. 4.5 and 4.6. As illustrated in Fig. 4.7, the cluster of North America clearly shows a longer period of use compared to Europe. Within the European countries, it can be observed that the southern countries Italy and Spain have used RM significantly less than the other European countries ($P = 0.000$, $X^2 = 26.770$, $DF = 3$). Apart from the above stated differences between European countries, no further significant differences could be found.

4.4.3 Current Use of RM

The overall importance of RM is generally high and increases—as indicated in the exploratory study and hypothesized (Hypothesis 1)—with a higher turnover of the responding company. Figure 4.8 illustrates the degree to which companies regard RM as important depending on the companies’ size measured in turnover. Highly significant differences ($P = 0.000$) emerge when the importance of RM is assessed in relation to company size measured in yearly turnover in North America and Europe, both in terms of main effects and in terms of interaction effects. Main effects demonstrate that in both continents the importance of RM increases with company size. Interaction effects show that for companies with a low turnover, North American firms attribute a higher importance to RM than European companies, whereas the difference is less distinct for companies with a high turnover.

There is a positive correlation between the period of use (in years) and the importance of RM ($R_{\text{Spearman}} = 0.293$, $P = 0.000$ one-tailed), which supports

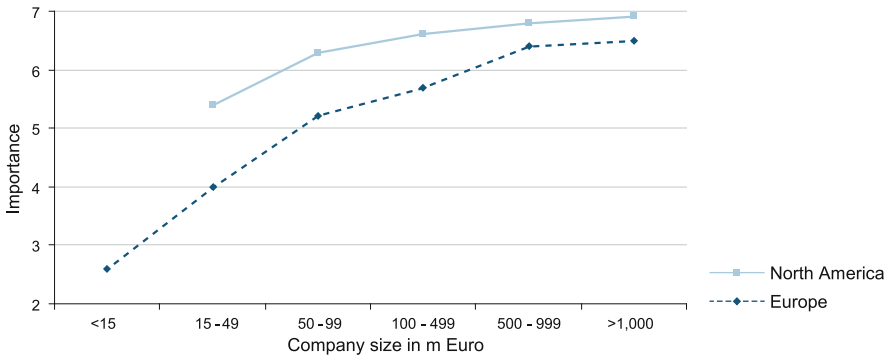


Fig. 4.8 Importance of RM in relation to company size (turnover)

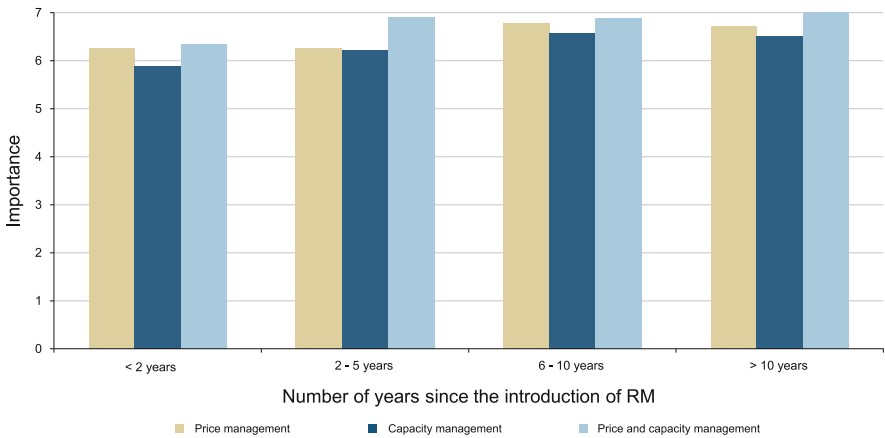


Fig. 4.9 Perceived importance of RM concepts in relation to period of use

Hypothesis 1. A possible explanation for this observation is that companies have to learn about the effective use of RM systems. The comparison of RM importance in relation to the approaches reveals significant differences ($P = 0.000$): Price- and capacity-based approaches are classified as most important, followed by price-based and capacity-based approaches (see Fig. 4.9). Figure 4.10 shows the importance of RM in relation to the type of application (Hypothesis 3). In the case of a manual application, there is no systematic data integration in the IT landscape, whereas a system-based RM application implies some kind of integration within the existing IT-systems, typically supported by Office products such as Excel or Access databases. In the third case, RM is integrated within an SCM, CRM or Enterprise Resource Planning system. ANOVA with post hoc tests (Bonferroni) shows a significant difference in the importance between manual and system-based application (ANOVA, $F = 3.588$; $P = 0.014$; Bonferroni, $P = 0.007$).

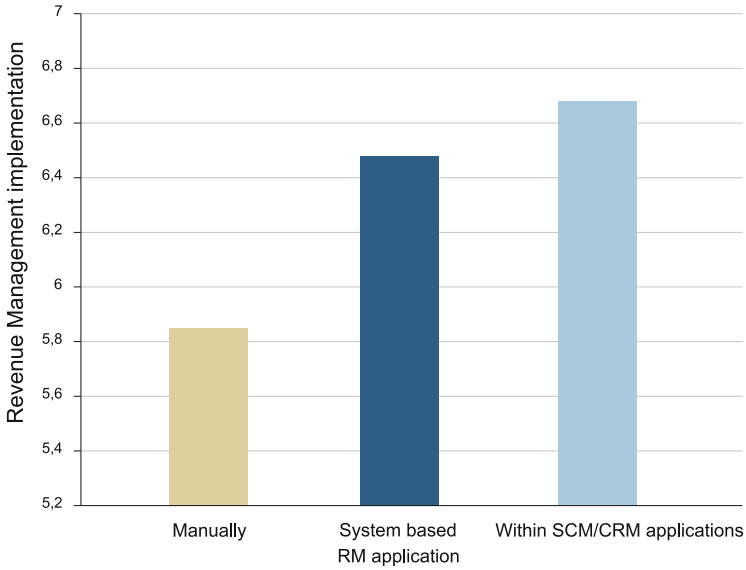


Fig. 4.10 Importance of RM in relation to its implementation

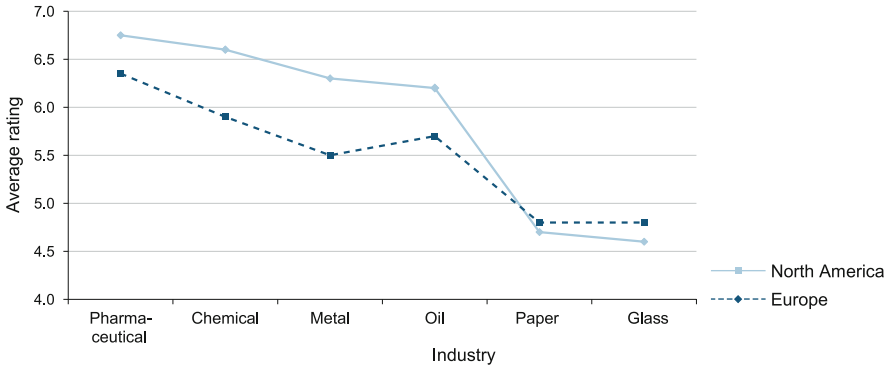


Fig. 4.11 Future use of RM in different industries in Europe and North America

4.4.4 Future Use of RM

The interviewed companies in the PI expect an increase in the use of RM throughout the industry (AV = 5.66; standard deviation 1.61; 1–7 Likert scale), especially in the pharmaceutical (AV = 6.55) and the chemical (AV = 6.26) industry.

North America expects a higher use of RM in all industries except for the paper industry (see Fig. 4.11). The ratings of the respondents vary highly significantly from industry to industry (ANOVA (within subjects): $F = 113.4$; $P = 0.000$).

4.5 Trends

4.5.1 Barriers to the Introduction of RM

The respondents mentioned a number of barriers related to the implementation of RM (Fig. 4.12). In decreasing order of importance, these are: (1) Lack of a clearly defined and/or communicated price strategy, (2) no suitable RM approach identified, (3) fear of price decreases or margin losses, (4) no or limited experience with RM, (5) lack of data availability, (6) inappropriate or lack of IT-systems for the support of RM applications and (7) lack of support from top management.

Several interviewees stated that pragmatic concepts that can be implemented in practice would be helpful in overcoming the inability to identify a suitable RM approach. Even if the literature contains RM concepts for the manufacturing industry, their practicability is regarded as limited. Inappropriate IT-systems on the customer side, the lack of an RM culture within the company or inappropriate supporting processes are not considered critical barriers to the use of RM. The lack of acceptance of an RM system on the client side has not been mentioned. Interviewees do not fear that their clients will get used to and permanently request low prices. When confronted with the benefits and risks of RM, companies assess benefits higher than risks (Table 4.1). In terms of benefits, interviewees mention the increase of turnover and capacity utilization, cost reduction, the use of idle capacities, efficiency gains and access to new clients and markets. Additional ‘soft’ benefits mentioned are career opportunities for production or plant managers, the introduction of a culture of profit maximization, company-wide and cross-production site harmonization of capacity management approaches, as well as the enhanced control of capacities.

Considering risks, interviewees mentioned overdrawn expectations with respect to an increase in profit, high investments in the IT-systems, resistance to the introduction of RM within the company, lack of know-how, complexity increase, as well as the loss of management focus.

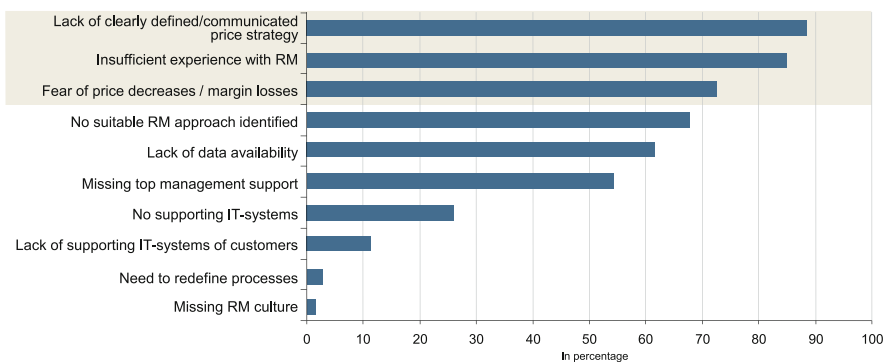


Fig. 4.12 Barriers to the introduction of RM

Table 4.1 Perceived benefits and risks of RM, ranked by frequency of nominations (multiple nominations possible)

| Benefits | Risks |
|---|--|
| <ul style="list-style-type: none"> • Revenue increase through enhanced pricing and better capacity utilization • Realization of cost savings based on maximum use of current machines and over-capacity dismantlement • Efficiency increase • Possibility to serve new clients or new markets via better capacity management • Possibility to obtain new revenue streams due to optimal capacity management • Professional enrichment of production managers becoming revenue managers • Harmonization of different capacity handling strategies in corporations with multiple production sites through a single and consistent RM approach • Enhanced monitoring of existing capacity • Introduction of a revenue-maximizing oriented production management | <ul style="list-style-type: none"> • Creation of excessive expectations of revenue and turnover increase • High investment in new IT-systems or upgrade of existing IT-systems • Corporate culture resistant to the introduction of RM • Lack of experts/knowledge to implement RM in the organization • Increase of complexity • Loss of management focus |

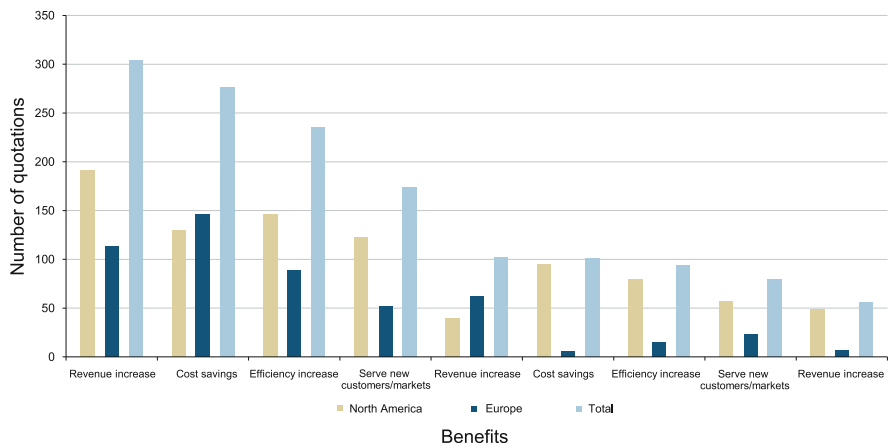


Fig. 4.13 Benefits named by North American versus European companies

When discussing benefits, North American companies mention on average four benefits, whereas European companies mention only two. The chance that North American companies see most frequently is revenue increase through enhanced pricing and improved capacity utilization (mentioned 191 times out of 909 in the North American sample), whereas European respondents name the realization of cost savings based on maximum use of current machines and reduction of over-capacity most often (mentioned 146 times out of 513 in the European sample, see Fig. 4.13).

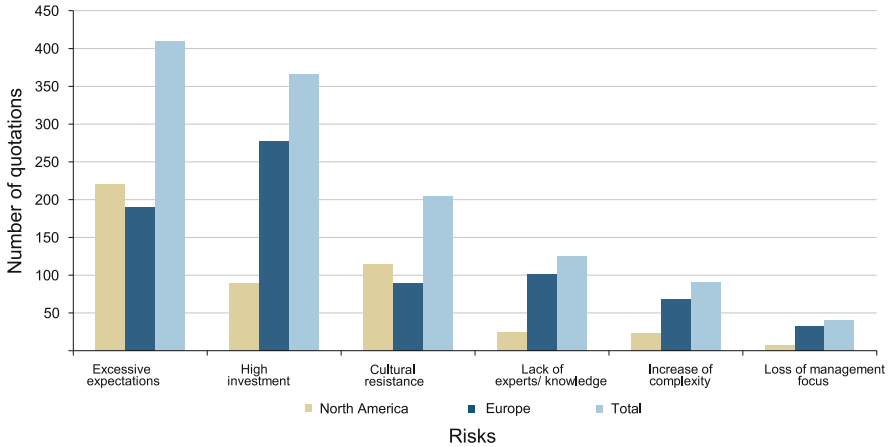


Fig. 4.14 Risks named by North American versus European companies

Comparing risks, European companies mention on average three risks, whereas North American companies mention two risks. The risk that European companies see most often is a high investment in new IT-systems or the upgrade of existing IT-systems (mentioned 277 times out of 759 in the European sample), whereas North American companies name overly high expectations with respect to revenue and turnover increase most often (mentioned 220 times out of 478 in the North American sample, see Fig. 4.14).

Two explanations why European companies name more risks than their North American counterparts are difference in experience and in risk-taking attitude, respectively. Less experience with the use of RM on the part of European companies might lead to the listing of more risks. A more risk-seeking and more innovation-friendly attitude in North America (see, for example, Weber and Hsee 1998; Beckmann et al. 2008; Martin et al. 2009) might lead to a different perception of existing risks.

4.5.2 Alternatives to RM

When asked for alternative approaches to RM, approximately 35 % of the interviewees mentioned various alternatives to introduce flexible production capacities. More specifically, the following alternatives were mentioned: (1) Outsourcing of production capacities to legally and economically independent companies, (2) the relocation of value-added generating production steps to suppliers, (3) cooperation with legally and economically independent companies within production networks and (4) the transfer of production capacity from their own facilities to low-cost locations.

However, 55 % of the interviewed companies do not recognize alternatives to RM. The introduction and use of production planning systems to improve the matching of orders with existing capacities are considered additional alternatives by 10 % of interviewees.

4.5.3 Statements on RM

In the last part of the empirical study, the interviewees were asked to express their degree of agreement or disagreement with a series of statements on RM (see Fig. 4.15).

An RM approach with a focus on price management is thought to offer a higher potential compared to pure capacity management approaches: In this context, it was pointed out that in the past capacity management played a major role in optimizing inventory, whereas price management has gained considerable importance in the past few years. The statement that RM leads to an increase in turnover obtained the second highest agreement, while the statement that RM does not show any potential within the PI was clearly denied.

For all the statements above, North American companies show a significantly higher agreement compared to European companies with the exception of statement 6 (RM applications are limited in the PI), which does not display a significant difference. For statement 12 (RM is not beneficial), we observe a significantly lower consensus from the North American correspondents than from the European ones ($P = 0.000$).

By using a cluster analysis (hierarchical, Ward’s Method) on the 12 statements, it was possible to create two clusters could be built: One less supportive of RM (including Italy, Spain and France) and one more supportive of RM (including United States, United Kingdom, Canada, Switzerland, Germany and Norway).

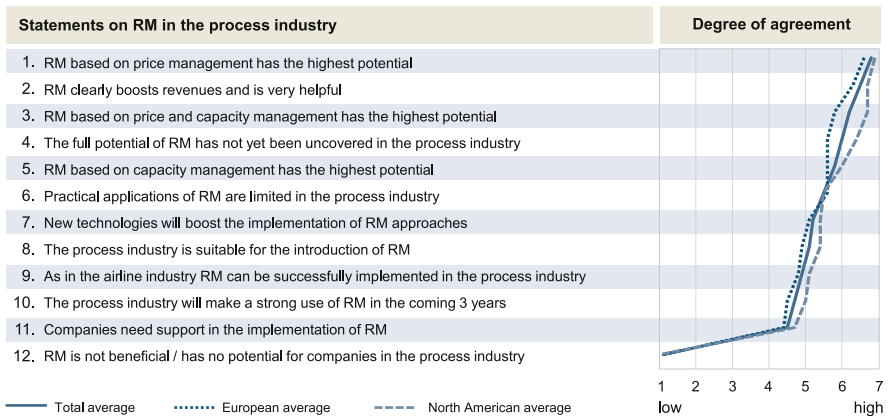


Fig. 4.15 Statements on RM

Apart from the above differences between country clusters, no further significant differences were detected.

4.6 Conclusions

To the best of our knowledge, this exploratory research, based on interviews with 479 companies in North America and Europe, represents the first study that provides comparative insights into the implementation of RM in the PI between these two regional clusters. The primary results, limitations and outlook can be summarized as follows.

4.6.1 Results

In the literature, it has generally been agreed that prerequisites for the application of RM in the manufacturing industry exist. This study confirms this, by showing that, to a large extent, RM is already used in the PI. Eighty-six per cent of the companies in our sample use some kind of RM concept.

The importance of RM is generally regarded as high, but the average importance is higher in North America than in Europe. The importance of RM increases on both continents with company size measured in turnover. However, for companies with a lower turnover, North American firms attribute a higher importance to RM than their European counterparts, whereas differences between companies with a higher turnover are less distinct.

There is also a positive correlation between the period of use and the importance of RM. RM was introduced earlier in North America compared to Europe, and even within Europe there are differences in the period of use: Southern European countries introduced RM later than northern European countries. The first RM applications were mainly capacity based. Now there is a trend towards integrating the price-perspective or to purely price-based RM approaches.

North American companies value RM as more important than European firms. In addition, there are significant differences in the valuation depending on the form of application: Users of system-based RM applications value the appropriateness of RM higher than users of manual applications.

The main barriers to the implementation of RM are the lack of a clearly defined price strategy, no identification of a suitable RM approach and the fear of price decreases or margin losses.

4.6.2 *Limitations and Outlook*

Our study is a cross-country and cross-industry study, which does not take into account changes over time. Hence, a longitudinal research could be undertaken in order to eliminate this issue. Such research would also allow causal conclusions (Rindfleisch et al. 2008).

Within our study, we interviewed only one person per company. Hence, a single-source bias cannot be excluded. In addition, the interviewees identified as responsible for RM often held different functions (marketing, sales, production, SCM, strategic planning).

This research as well as existing academic research yields limited insights into the profit impact of RM: Even if RM is regarded as contributing to revenue and profit improvement it would be interesting to compare the *a priori* estimation of profit improvement to the *a posteriori* realized profit improvement and also compare similarities and differences between the two regions, i.e. Europe and North America. Future studies could also use more interviewees in different functions within a company in order to obtain a differentiated, function-specific perspective.

Chapter 5

Use and Profit Impact of Revenue Management in the Process Industry

5.1 Background of the Third Empirical Study

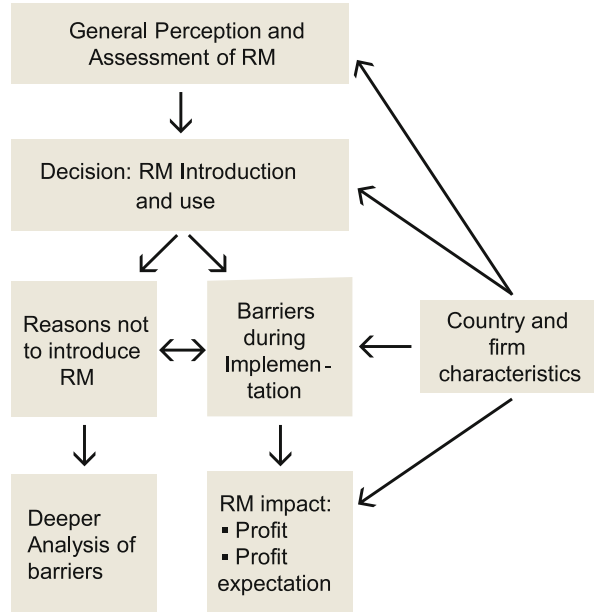
The positive profit impact of RM has contributed to its widespread adoption by many service industries, such as the travel industry, retail and utilities (Talluri and van Ryzin 2004). Differentiated pricing, capable of exploiting the willingness-to-pay of different customers or customer segments, is a key driver of the successful RM application.

In some RM approaches, the different willingness-to-pay is utilized by offering various product variants, tailored to different client segments, such as different fare classes offered by airlines. Other approaches focus on a single product variant but dynamically adapt the price over time: Low-cost airlines or fashion retailers during end-of-season clearance sales follow this approach (Fleischmann et al. 2004; Quante et al. 2009).

This third line of research builds upon the studies of Kolisch and Zatta (2009, 2012). Kolisch and Zatta (2009) analyze the current status and perspectives of RM in the PI in Germany, as one of Europe's key markets. The study involves 124 companies interviewed between June 2004 and February 2005. The main finding of the study is that the interviewees regard the overall importance of RM within the PI as high. Furthermore, the perceived importance positively correlates with company size, time since introduction and IT implementation. The type of RM system employed depends on the duration of its use: RM systems shift from capacity or price control to price and capacity control over time. Barriers to introduction of RM consist of the absence of a clearly defined pricing strategy, lack of experience and lack of adequate approaches.

In Kolisch and Zatta (2012), the application of RM was assessed for Europe and North America, comparing its use across countries. Interviews with 479 companies were carried out between May 2008 and July 2009. Comparisons between North America and Europe indicated differences in the application of RM: In North

Fig. 5.1 The structure of this study. Note: *Arrows* represent relations that have been investigated in detail



America, RM is considered more important, was introduced earlier and is more price based.

As in Kolisch and Zatta (2009, 2012), for this study, the PI is examined. The overall objective of this study is to assess the profit impact of RM in the PI. More specifically, we investigate the following issues (see Fig. 5.1):

- What is the general perception and assessment of RM?
- How high is the profit expectation linked to RM before its introduction?
- How strong is the profit impact after implementation?
- What has hindered the introduction of RM either for the companies that have not introduced it or for firms that have implemented it?

This Section proceeds as follows: First, the exploratory research is presented and then the quantitative study described. The results are reported next and finally the findings are summarized and an outlook offers inputs for further research.

5.2 Exploratory Research

In a first step, we undertook an exploratory study with 38 interviews of experts from the PI in the oil (8), metal (7), chemical (6), pharmaceutical (6), paper (6) and glass industries (5). Half of these companies use or have recently introduced RM, whereas the other half do not employ RM. We use the findings of this explorative study in order to derive a number of positions on RM.

When we consider companies that employ RM, it becomes evident that the relevance of RM is considered high by all interviewees, whether they have used RM for more than a year or they have only recently started applying RM. In addition, the companies of the exploratory study indicate that they introduced RM to improve profitability through optimized prices or better use of idle capacities.

The Sales Director of a North American pharmaceutical company reported: 'The main reason for the introduction of RM is to generate a positive EBIT impact. Each investment made by our company needs to be approved on the basis of a business case. When considering RM the return indicated in the business case is caused by an optimized price and capacity management'. The financial trigger as a prerequisite to an investment in RM was emphasized in several statements such as the following: 'An RM project is a journey that is a long term commitment which requires a significant upfront effort, but we expect an overall positive ROI once it is fully operative. This is the reason why we decided to move ahead on this journey. I am confident that through RM we will increase the use of idle capacities and also serve new customers' (CEO, a European paper company).

The introduction of RM positively impacts firm profitability, according to the companies using it, as in the case of a US-based oil company: 'After implementation, the impact of RM on the return on sales was in the range of 3–5 percentage points, which equals a three-digit million US dollar amount. RM is clearly having a positive impact on our financial results. We will extend its use also to our subsidiaries in the other geographic regions where we are operating' (Sales Vice President, a US-based oil company).

The same applies to the metal industry: 'The landscape of our industry is quite differentiated. In some sub-sectors of the metal industry there are overcapacities, for example in the extrusion sub-sector in Southern Europe, while in other sub-sectors demand peaks are registered. This is the reason why RM is of great value when your company serves different sub-sectors of the metal industry. Since the introduction of RM, our company has increased the EBIT in a range of 3–5 percentage points which has had a significant impact on overall profitability' (CEO, a European metal company).

If we then review the feedback provided by companies that do not apply RM, two elements, both linked to insufficient experience with RM, emerge. First, lack of awareness is responsible for not applying RM: 'I have heard about this concept but I have never seen a standard RM solution or software for the glass industry—or at least I am not aware of it. If RM really helps increase profits there would be some success stories around it that for the moment I cannot think of. Before taking into consideration an implementation of RM, I would like to see some proven case studies in our industry' (General Manager, a European glass company).

Second, lack of management attention prevents RM introduction: 'RM and pricing has not reached the agenda of the CEO yet: I seriously believe that our company should invest in this area, however the top management is currently dealing on the one hand with supply chain optimization and purchase of raw materials, whose price increases are eroding our margins, and, on the other hand, with an internal reorganization. I believe that once the restructuring project has

been completed, RM will be the next topic on the agenda' (Global Marketing Director, a North American chemical company).

Low management attention to RM can be found in companies where other projects or activities have higher priority. Rather than failing to recognize the benefits or potential of RM in such cases, RM is put on hold due to other projects and thus awareness throughout the company is low: 'I recognize the value and potential of RM. However, we are currently rolling out a new global ERP-system. Once this is up and running, we will have a solid IT infrastructure that will represent a good basis also for a future RM introduction' (Vice President Transformation and Strategy, a US-based pharmaceutical company).

The CFO of a European chemicals company responded in this respect: 'The reason that no RM system is currently in place is not due to the fact that our company does not recognize the benefits of it: We have just taken over a smaller company and we are busy integrating it. After the post-merger reorganization we are going to review in detail the potential margin improvement that we could realize through RM and decide how to move ahead'.

5.3 Quantitative Study: Data Collection

Based on the exploratory research, we developed a semi-structured questionnaire (see Appendix A). The study was conducted through personal interviews. Six hundred companies in the PI were contacted in North America and 600 in Europe. The companies were randomly selected using the Dun & Bradstreet database (Dun & Bradstreet Sales & Marketing Database 2012).

The data collection, which involved 603 participating companies, was completed between July 2012 and May 2013. Of the participating companies, 259 of 2 countries were located in the regional cluster North America (Canada and USA), whereas 344 companies of 14 countries were located in the regional cluster Europe (Austria, Denmark, France, Germany, Ireland, Italy, Netherlands, Norway, Poland, Portugal, Spain, Sweden, Switzerland and the UK).

Figures 5.2, 5.3, and 5.4 show the distribution of the respondents across countries,¹ turnover and industries. Respondents were managers responsible for the activities linked to RM. Personal interviews were conducted by means of the questionnaire (see Appendix A.3).

At the beginning of each interview, we provided the definition of RM given by Phillips (2005): 'Revenue Management refers to the strategy and tactics used by a number of industries . . . to manage the allocation of their capacity to different fare classes over time in order to maximize revenue'. By doing this, we ensured that there was a clear and consistent understanding of RM among the respondents.

¹ "Others" in Fig. 5.2 refers to Austria (with 12 respondents), Denmark (8), Poland (4) and Portugal (3).

Fig. 5.2 Distribution of interview partners per country

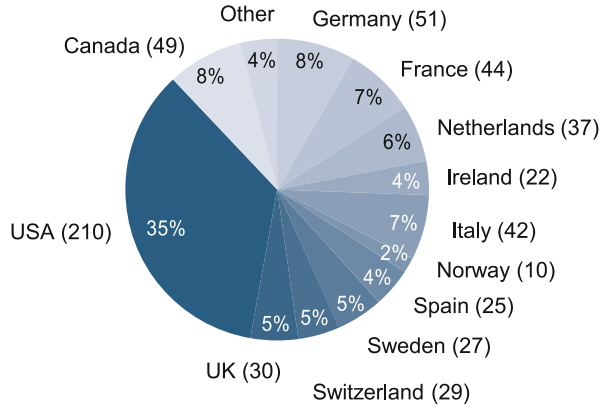


Fig. 5.3 Distribution of interview partners per turnover

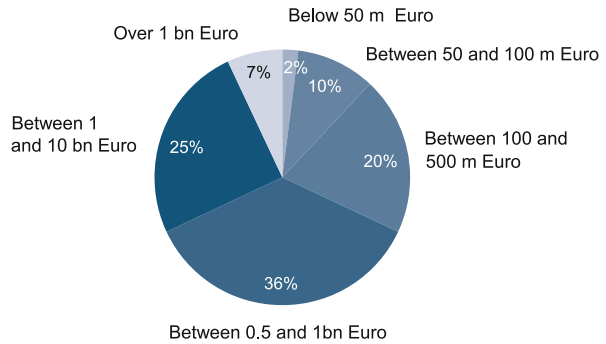
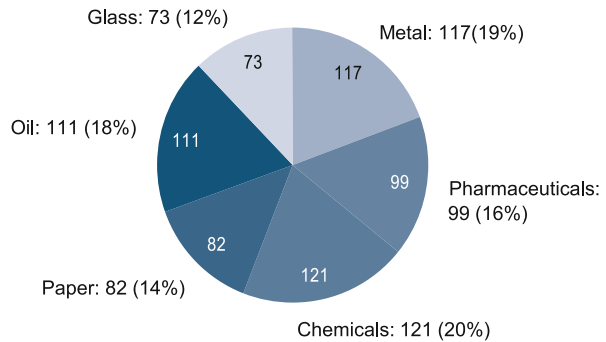


Fig. 5.4 Distribution of interview partners per industry



When discussing the profit generated by or expected from the introduction of RM, respondents were asked for *a priori* and *a posteriori* profit impacts. For confidentiality reasons the companies questioned did not share detailed data or balance sheets with the interviewer. Therefore, answers related to profit impact are based on the assessment of respondents.

To assess the validity of the results, it is relevant to verify that managers decided to participate in the study independently at their opinion on the importance of RM (Wolfe 2003). Therefore, to tackle this issue, all targeted interviewees were first asked to report the importance they attributed to RM within their company. Two per cent of the nonparticipating target interviewees and 1 % of the participating interviewees attributed a low importance to RM. This shows that there was no non-response bias.

5.4 Results: RM in Practice

5.4.1 *RM Profit Impact Evaluation and RM Years of Utilization*

A key aspect of the study is to assess the impact of RM on the profitability of companies. Respondents were therefore asked to evaluate how appropriate RM is to increase revenues on a Likert scale from 1 (not important) to 7 (very important). Although the overall score was high, there is a significant difference between Europe and North America. North America shows a higher overall assessment of the impact RM has on profit than does Europe. A two-tailed t-test reveals that the difference between the average (AV) in Europe (5.6) and North America (6.2) is highly significant ($P = 0.000$, $t = -6.733$, $DF = 509$). In our view this difference is due to a more intense and longer RM utilization in North America than in Europe.

Firms participating in this study and located in North America, on average, have been using RM for a longer time than firms based in Europe. This fact confirms the results of Kolisch and Zatta (2012) that North American manufacturing companies introduced RM on average earlier than their European peers, as in the case of service companies, such as airlines, where the early adopters were located in North America. This earlier introduction helped companies to recognize sooner the benefits of RM and re-enforce its application (see Smith et al. 1992). Another interesting aspect linked to early adoption is that several software companies started developing specific RM solutions (see Quante et al. 2009), most of them operating in North America.

Figure 5.5 reports the number of years of RM use and the evaluation of RM ability to increase profit in North America and in Europe. The average years of RM utilization is still low (4.2). A two-tailed t-test shows that the difference between the AV in Europe (3.6) compared to North America (4.9) is highly significant ($P = 0.000$, $t = -6.733$, $DF = 509$). This can be interpreted as a positive fact for RM, as it means that RM has significant potential not yet realized due to its limited application both in North America and Europe.

With the increasing availability of data, technology and software solution advances in RM, we expect that its utilization across the manufacturing industry will grow more rapidly in the near future than in the last few years.

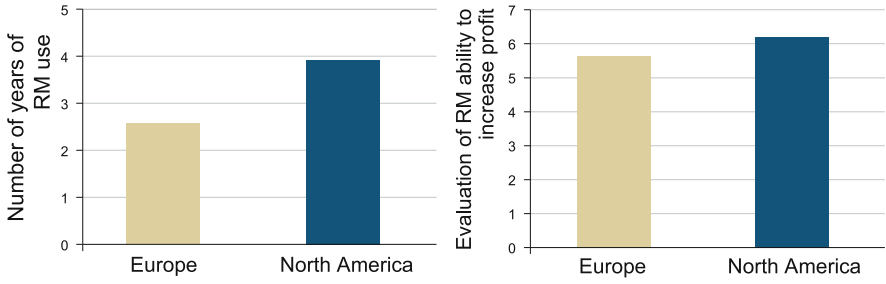


Fig. 5.5 Number of years of RM use and evaluation of RM ability to increase profit in North America and Europe

5.4.2 *RM Introduction and Use*

The majority (511 out of 603) of the firms that participated in this survey employ RM, which means that almost 85 % of the companies in the sample make use of RM. Companies with a higher level of internationalization, in terms of number of markets where they are active and with a higher turnover, are more likely to introduce RM.

The positive correlation between RM introduction and the number of markets ($R_{\text{Spearman}} = 0.227$, $P = 0.000$, two-tailed) indicates that companies operating in several markets are more likely to introduce and use RM. This can be explained by the fact that RM helps manage complexity, which is greater when customers from multiple markets with different willingnesses-to-pay for capacity and if the company is responding with capacity buckets spread out over multiple plants in different countries. The greater the complexity, the more beneficial RM is, as it helps match supply and demand in order to maximize revenues.

We also find a positive and significant correlation between RM introduction and firm revenue ($R_{\text{Spearman}} = 0.522$, $P = 0.000$, two-tailed).² This result is in line with previous findings (see Kolisch and Zatta 2012) which show that the importance of RM increases with turnover. Therefore, large firms are more willing to introduce RM because they often have an adequate pricing strategy and organization to support RM introduction and implementation.

In addition, higher turnover is typically linked with a broader international presence (Simon 2009). Figure 5.6 shows the distribution of revenues for companies that introduced RM (left) versus companies which have not (right). It is interesting to note that all 40 companies with a turnover of over 10 billion euros

²The Spearman correlation is used because the variable revenue has an ordinal level (revenue is clustered in ordinal categories). In the following analysis, we use the Spearman correlation when at least one of the variables is an ordinal variable. As we realized during the preparation of the survey, for several reasons (for example, privacy concerns) our participants preferred to give their answers in terms of categories rather than to reveal the numerical values.

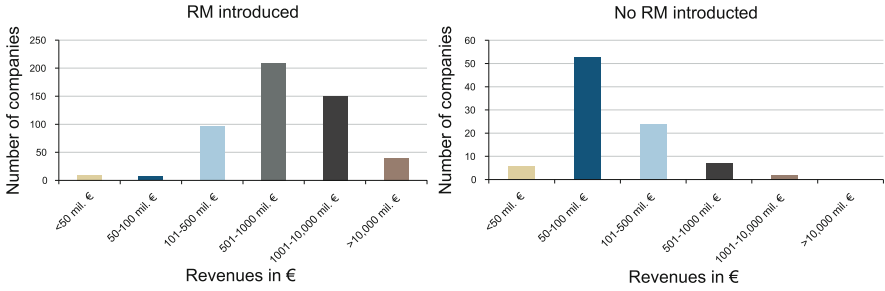


Fig. 5.6 Distribution of revenue for companies that introduced RM (*left*) versus companies that did not (*right*)

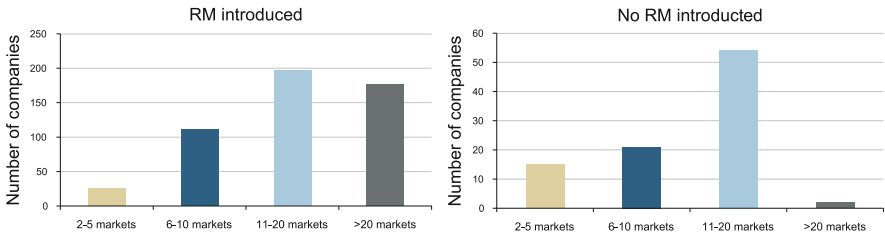


Fig. 5.7 Distribution of the number of markets for companies that introduced RM (*left*) versus companies that did not (*right*)

have introduced RM, whereas the large majority (53 out of 60) of the companies with a turnover between 50 and 100 million euros have not introduced RM.

Figure 5.7 shows the number of markets a company operates in for companies that introduced RM (left) versus companies that did not (right). It becomes evident that nearly all firms active in more than 20 markets (177 out of 179 companies) have introduced RM.

5.4.3 Impact of RM Utilisation on Profits

Respondents were asked to indicate how successful their companies have been in increasing profits through RM (Likert scale from 1—very unsuccessful, to 7—very successful). The average score was high (5.7), showing that the introduction of RM is perceived as leading to profit improvement.

A two-tailed t-test shows that the difference between the AV in Europe (5.4) compared to North America (6.0) is highly significant ($P=0.000$, $t=-6.966$, $DF=509$). North America shows greater success with respect to RM in terms of profits than Europe, and the explanation could be that North America introduced RM earlier than did Europe. The average number of years since RM introduction is

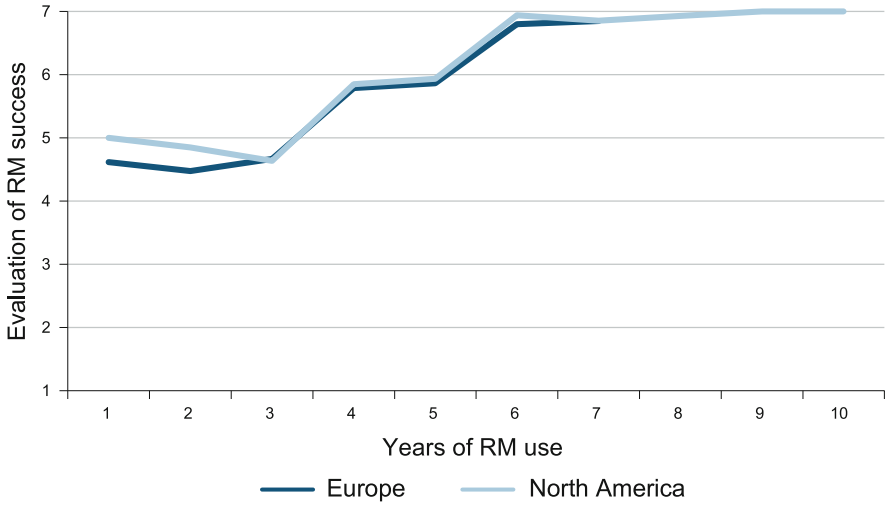


Fig. 5.8 RM success in increasing profit with respect to duration of use in North America and Europe

3.6 in Europe, while it is 4.9 in North America. Truly, a learning curve effect for the use of RM can be observed.

We further investigated the impact of the period of RM use on the success in increasing profits. We found a positive and highly significant correlation between period of use and success ($R_{\text{Spearman}} = 0.069$, $P = 0.000$, two-tailed). Hence, more experience with RM improves its success in terms of profitability (see Fig. 5.8). Moreover, there is a positive correlation between revenue and average yearly EBIT (Earning before Interest & Taxes) impact of RM ($R_{\text{Spearman}} = 0.087$, $P = 0.048$, two-tailed).

Therefore, larger firms are more likely to achieve a profit increase due to the introduction of RM. The explanation for this could be that large firms are more capable of identifying the appropriate RM approach and better exploiting RM, since they are more likely to have a coherent pricing strategy and adequate capabilities and resources. We also observed that larger firms in terms of turnover typically tend to have better organizational support for RM and place more importance on the lack of management support for RM as a barrier that hinders RM implementation ($R_{\text{Spearman}} = 0.337$, $P = 0.000$, two-tailed). Better organization support for RM often means that there are dedicated RM resources, for example an RM function typically led by an RM Director who manages RM analysts. Additionally, the senior management of larger firms tends to attribute greater importance to RM ($R_{\text{Spearman}} = 0.814$, $P = 0.000$, two-tailed).

5.4.4 *A Priori and a Posteriori Estimation of Profit Improvement Due to RM*

Based on the survey results, both the *a priori* assessment of expected profit improvement, due to RM before its introduction, and the profit increase 1 year after RM introduction, are assessed by the respondents as positive. The participants expect to achieve positive and high profit improvement due to the introduction of RM (average 5.6 %) and also report an increased profit due to RM 1 year after its introduction (average 3 %).

However, the expected profit improvement is higher than that observed after 1 year. There is a positive and highly significant correlation between expected profit improvement due to RM introduction and the period of RM use ($R_{\text{Spearman}}=0.634$, $P=0.000$, two tailed) and a highly significant and positive correlation between the observed profit after 1 year and the period of use ($R_{\text{Spearman}}=0.929$, $P=0.000$, two-tailed). This indicates that the longer RM is in use, the more effectively it is applied within a company and therefore the stronger the beneficial impact it has on profit improvement.

A two-tailed t-test shows that the difference in profit expectation in Europe (AV = 5.1 %) compared to North America (AV = 6.3 %) is highly significant ($P=0.000$, $t=-9.430$, $DF=509$). We find evidence of a significant difference between North America and Europe also with respect to observed profit improvement 1 year after RM introduction (Fig. 5.9). In this case, a two-tailed test shows that the difference in observed profit between Europe (AV = 2.5 %) and North America (AV = 3.6 %) again is highly significant ($P=0.000$, $t=-9.821$, $DF=509$).

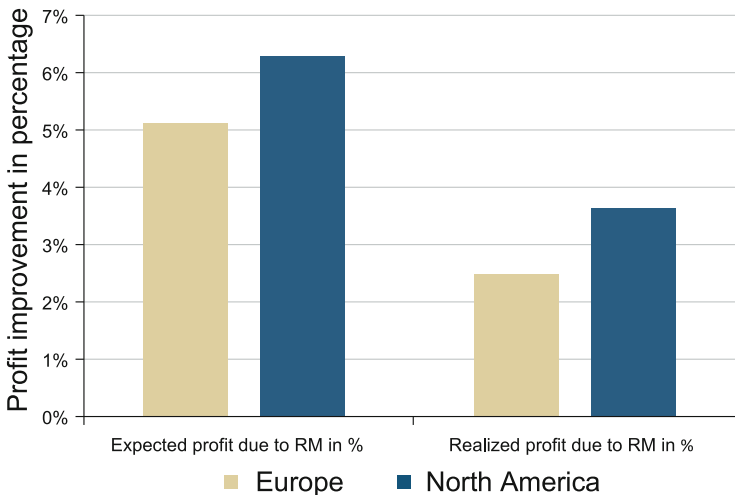


Fig. 5.9 A priori estimation of profit improvement due to RM and a posteriori realized profit improvement due to RM in North America and Europe

An explanation of this difference may be that RM in North America is more price-based and therefore the profit impact is stronger than in the case of a capacity-based approach, which is more widespread in Europe (see Kolisch and Zatta 2012). Moreover, previous literature (Kolisch and Zatta 2012) provides a further interpretation for these findings. RM is more system based in North America, whereas it is more manual based in Europe, which can lead to a profit impact that is realized earlier and turns out to be higher in North America than in Europe.

5.4.5 Barriers that Hinder RM Implementation

The respondents using RM mentioned a number of barriers that hinder the implementation of RM (Likert scale from 1—very weakly, to 7—very strongly). In decreasing order of importance, these are (see Fig. 5.10): (1) Lack of experience with RM, (2) no appropriate RM approach identified, (3) no clearly defined price strategy, (4) lack of management attention/support, (5) danger of a price-level decrease, (6) lack of customer acceptance, (7) lack of appropriate IT system, (8) lack of data availability, (9) no corporate culture, (10) fear of negative RM experience, and (11) fear of negative customer feedback.

These results are in line with previous findings of Kolisch and Zatta (2012). The two studies differ only slightly with respect to some factors. In Kolisch and Zatta (2012), the barrier ‘danger of a price decrease’ was in the third instead of the fifth position. A reason for this could be the fact that our study was conducted during a time when the global economy, compared to the time when the study of Kolisch and Zatta (2012) was undertaken, was suffering from a downturn. Therefore, prices had already decreased to a certain extent and this factor was therefore not perceived as a

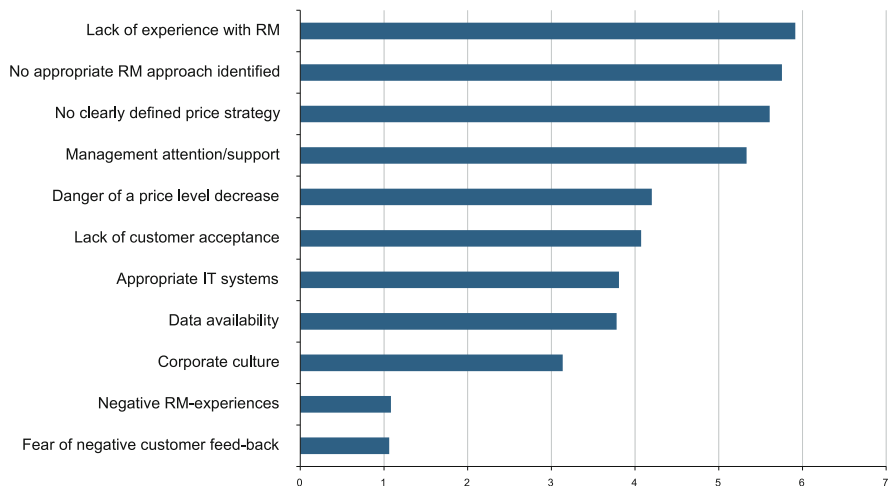


Fig. 5.10 Average importance of barriers to the introduction of RM

top barrier. Data availability is not considered a top barrier in our study, though it was a more relevant barrier in Kolisch and Zatta (2012). A possible reason for this difference might be due to technological advances in Supply Chain Planning and Revenue Management software solutions and accordingly greater data availability.

The main reasons for not implementing RM are lack of experience, lack of approach identification, unclear price strategy definition and lack of management attention.

Inappropriate IT systems on the customer side, the lack of an RM culture within the company or inappropriate supporting processes and data are not considered critical barriers to the use of RM. Interviewees do not fear negative customer feedback or experiences. There is, however, a negative and significant correlation between the average score of the barrier 'danger of a price level decrease' and firm revenue ($R_{\text{Spearman}} = -0.106$, $P = 0.016$, two-tailed). Therefore, larger firms in terms of turnover are less worried about a price reduction due to RM. One explanation for this observation may be the fact that larger companies tend to have more developed pricing strategies in place than do smaller companies, which implies that they segment the market more precisely. A segment-specific pricing strategy prevents an undifferentiated price reduction.

On the other hand, bigger firms in terms of revenue are more worried about lack of management attention/support as a barrier to RM introduction ($R_{\text{Spearman}} = 0.337$, $P = 0.000$, two-tailed). This could be explained by the fact that in these larger firms the senior management changes more often than in mid-sized and smaller companies. Such changes can lead to disruptions in management direction and sponsored projects by senior managers, which in turn leads to vanishing management attention and support for RM projects.

North America and Europe differ significantly in the importance assigned to some critical barriers. In particular, the score on the barrier 'lack of a clearly defined price strategy' differs significantly between Europe ($AV = 5.98$) and North America ($AV = 5.13$) using a two-tailed t-test analysis ($P = 0.000$, $t = 10.740$, $DF = 509$). This reflects the fact that Northern American companies are typically ahead, compared to European companies, in the definition of a price strategy and therefore the lack of a price strategy is seen more often as a barrier in Europe. Furthermore, a two-tailed t-test ($P = 0.000$, $t = 10.740$, $DF = 509$) shows that management attention/support is a more important barrier to RM introduction in North America ($AV = 5.87$) than in Europe ($AV = 4.92$).

The above results are not driven by a difference in firm revenue between North America and Europe, since a t-test rejects the hypothesis that a significant difference in revenue exists between the two regions. Therefore, the greater importance attributed to management attention/support by companies in North America is not due to a difference in the size of the firms measured in revenue but correlates with the geographical location of the firms. The same is true for the lower importance attributed to the lack of a clearly defined price strategy by North American companies.

Another interesting issue is whether RM introduction has an impact on the evaluation of RM barriers. We compare similar questions that ask for an evaluation

of the importance of the barriers that hinder RM introduction for both RM users and non-users (Likert scale from 1 to 7 as described above). ANOVA and t-test show significant differences between RM users and non-users with respect to barrier assessment.

RM users do not fear negative customer feedback when deciding whether to introduce RM ($AV = 1.06$), whereas non-users assign medium importance to this barrier ($AV = 4.23$). A two-tailed t-test analysis finds that the difference between users and non-users is highly significant ($P = 0.000$, $t = -31.805$, $DF = 601$). This result indicates that once in use, RM is accepted by customers, who do not complain and do not provide significant negative feedback to the companies applying it. A two-tailed t-test shows that the difference in the average evaluation of corporate culture as a barrier for RM users (3.14) compared to nonusers of RM (4.32) is also highly significant ($P = 0.000$, $t = -6.461$, $DF = 601$).

RM users assign more importance to the lack of experience in hindering RM introduction ($AV = 5.91$) than non-users ($AV = 5.42$): A two-tailed t-test shows that the difference in the average score is statistically significant ($P = 0.000$, $t = 3.786$, $DF = 601$). Moreover, a two-tailed t-test shows that the difference in the average evaluation of unclearly defined price strategy as a barrier for users ($AV = 5.61$) compared to non-users (4.49) is also highly significant ($P = 0.000$, $t = 8.241$, $DF = 601$).

These findings shed light on the different perception of barrier importance prior to and after RM introduction. Firms hesitating to introduce RM could therefore evaluate, in light of the assessment of firms that have already experienced RM, whether the barriers they fear are realistic or if they are given undue weight.

5.4.6 Reasons for Not Implementing RM

Interviewees of companies that do not use RM reported a number of reasons for the lack of RM introduction (Likert scale from 1—no importance, to 7—strong importance). In decreasing order of importance, the relevant ones are (Fig. 5.11): (1) Waiting for more implementations in the industry, (2) other issues have higher priority, (3) no appropriate RM approach identified, (4) lack of management attention/support, (5) lack of experience with RM, (6) limited visibility by top management, and (7) no clearly defined price strategy.

Therefore, if companies decide not to introduce RM, this is typically due to the fact that there are other projects or activities with higher priority rather than a failure to recognize the benefits or potential of RM. Interviewees do not fear negative RM experiences or price-level decreases.

Furthermore, we investigate the impact of the barriers that led to the decision not to introduce RM. We run a logistic regression, where the dependent variable indicates RM introduction (RM introduction = 1, RM no introduction = 0). As independent variables we use the evaluations of the barriers that may hinder RM implementation (see Appendix B). The results show that three barriers have a

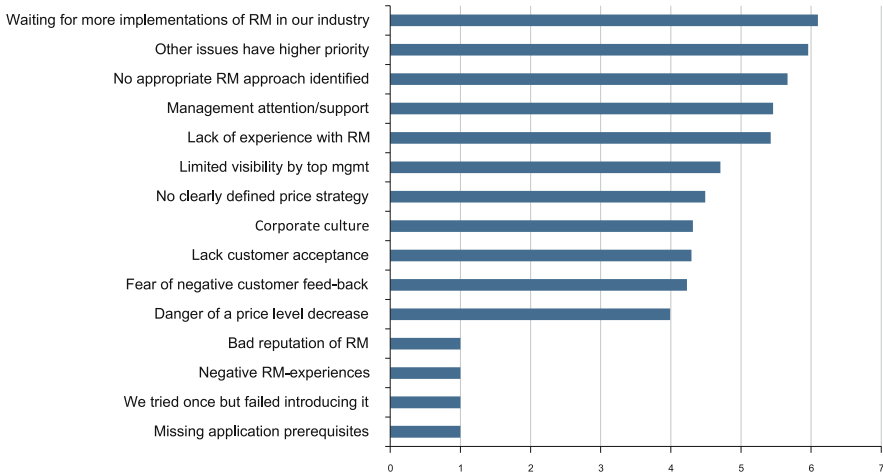


Fig. 5.11 Average importance of reasons for not introducing RM

significant impact on RM introduction. First, higher importance is attributed to an unclearly defined price strategy that leads to a higher probability of RM introduction. Second, the more important the barrier ‘fear of negative customer feedback’ is, the more likely it is that RM will not be introduced. Finally, the more important the barrier ‘corporate culture’ is, the more likely it is that RM will not be introduced. If a company intends to introduce RM, it should invest time in assessing these specific barriers to increase its chance of success.

5.5 Conclusions

To the best of our knowledge, this exploratory research based on interviews with 603 companies in North America and Europe comprises the first study that provides comparative insights into the profit impact of RM in the PI and also draws comparisons between these two regional clusters. The main results, limitations and outlook can be summarized as follows.

5.5.1 Results

This article contains the first study based on interviews with firms in Europe and North America that provides insight into the profit impact of RM in the PI.

In general, RM is regarded as contributing to profit. However, the results of this study show that the impact differs between North America and Europe with respect to both the period of time RM has been in use and the evaluation of RM. The impact

of RM in terms of profit increases with firm revenue and period of use, and differs between North America and Europe. The findings show that both the *a priori* estimation of profit improvement due to RM before its introduction and the *a posteriori* realized profit improvement due to RM are positive. The profit improvement due to RM increases with the period of use and differs between Europe and North America, being higher in the latter region.

The main barriers to RM implementation are the lack of RM experience and of approach identification, an unclear price strategy definition and the lack of management attention. North America and Europe assess the importance of some barriers differently. If companies decide not to introduce RM, this is typically due to the fact that companies are waiting for more RM implementations or that there are other projects or activities with higher priority rather than explicitly not recognizing the benefits or potential of RM.

We expect to see an increasing spread of RM in the PI, similar to its diffusion in the service industry, in the years to come, with its positive profit impact being the main driver of this development.

5.5.2 Limitations and Outlook

Our research involved 603 firms located in North America and Europe belonging to 6 industries, and therefore it is a cross-country analysis. However, this work does not take into account the dynamics over time. Therefore, to overcome this issue, a longitudinal research could be undertaken, which would also make causal relations possible (Rindfleisch et al. 2008).

Emerging regions such as Asia-Pacific or Latin America have not yet been explored but might be interesting to assess, following, for example, the hypothesis that RM introduction in these countries would be quicker compared with, for example, that observed in Northern America, for example, as available RM solutions and tested approaches would speed up the process. We would also expect differences in estimated profit impact and perceived barriers, as manufacturing companies in these regions would introduce RM at a more mature life cycle stage of RM, with a greater availability of RM tools, software solutions and case studies.

In addition, some countries had a limited number of respondents and therefore it was not possible to assess further differences and peculiarities across the countries in terms of RM use and the general perception of RM. Future studies may include more interviewees for each of the countries in scope.

Chapter 6

Conclusions

This chapter summarizes the results of the state of the art and profit impact of RM in the manufacturing industry and also provides directions for future research.

6.1 Summary and Results

In this book, we investigated the application of RM in the PI, conducting three empirical studies, each of which started with a preliminary qualitative exploratory research totaling 75 interviews (15, 22 and 38 respectively), followed by quantitative empirical research with a total of 1206 additional interviews (124, 479 and 603 respectively) from the same number of companies from six industries of the PI, between 2004 and 2013.

Chapter 2 started with providing the key concepts discussed in this manuscript. After the description of the origins of RM, the available research on RM in the manufacturing industry was presented. We then outlined the prerequisites of its application, comparing the employment of RM in the service vs. the PI. Additionally, we discussed RM instruments relevant for the present work, i.e. price and capacity management tools. Finally, the profit impact of RM in both service and manufacturing companies was discussed.

We presented the outcome of the first empirical study on the state of the art and perspectives of RM in the PI in Chap. 3. The results from the empirical study among 124 firms show that the overall importance of RM within the process industry is regarded as high. Furthermore, the perceived importance is positively correlated with company size, time since introduction, and IT-implementation. The type of RM system employed depends on the duration of its use: RMSs shift from capacity or price control to price and capacity control. The absence of a clearly defined pricing strategy, lack of experience, and lack of adequate approaches constitute barriers to RM introduction.

The geographic scope of the study presented in Chap. 3 was extended in Chap. 4, where the results of a quantitative study, based on 479 firms in the PI in North America and Europe, were discussed. The results show that the overall importance of RM in the PI is regarded as high and that the importance positively correlates with turnover, period of use and the extent of IT integration. The type of RM system used depends on its period of use: With increasing period of use, RM systems shift from capacity to price and capacity control. Barriers to the implementation of RM systems are seen in the absence of a clearly defined pricing strategy, lack of experience and lack of adequate approaches. Comparisons between North America and Europe indicate differences in the application of RM: In North America, RM is considered more important, was introduced earlier and is more price based.

In Chap. 5 we introduced the assessment of RM's profit impact on the PI. This chapter presented findings of a quantitative study based on 603 respondents working in PI companies in North America and Europe. RM is regarded as contributing to profit, but the results of this study show that the impact differs between North America and Europe, both with respect to the period of time RM is used and to the perception of RM. Moreover, the greater the turnover and the level of internationalization, the more likely a company is to use RM. The impact of RM in terms of profit increases with firm revenue, period of use but differs between North America and Europe. Both the *a priori* estimation of profit improvement due to RM before its introduction and the *a posteriori* realized profit improvement are positive; they increase with the period of use and differ between Europe and North America, being higher in the latter region. The main barriers to RM implementation are the lack of awareness of this approach, the inability to identify suitable systems, an unclear price strategy definition and the lack of management attention. North America and Europe assess the importance of some barriers differently. If companies decide not to introduce RM, this is typically due to the fact that other projects or activities have higher priority rather than that the benefits or potential of RM are not recognized.

6.2 Final Remarks and Future Research Directions

Despite the growing body of literature compared to when we started this work, the research on the application of RM in the manufacturing industry is far from over: While RM in the services industry has been an active field of research for more than 40 years, research on RM in manufacturing is still in its infancy. We identify four directions for future research: Leveraging technological progress to improve the application of RM and ideally develop some industry benchmarks; extending the geographical scope; extending the industry scope; and finally conducting a longitudinal study.

The technological progress presents great opportunities and according to us a first, key direction for researchers and practitioners to overcome the difficulties of applying RM in the PI. Nearly 50% of RM users in Europe have manual RMS

(Kolisch and Zatta 2012). They could probably improve the benefits and returns of RM with more technologically advanced solutions. In addition, smaller companies with regard to revenue tend not to introduce RM compared to larger companies (Kolisch and Zatta 2014). Technological progress, presenting a solution for smaller companies, could invert this trend. Finally, a technological solution could also help develop a benchmark solution in the PI that might inspire companies that today indicate that they have not found an appropriate RM approach, which is seen as a barrier (Kolisch and Zatta 2014). In the service industry success stories of single companies like that of American Airlines (see Sect. 2.2) triggered have further interest in and adoption of RM.

Second, from a geographical point of view, it would be interesting to extend the current work also to Asia, Latin America and Africa to verify the state of the art and perspectives of RM in the PI of these regions as well and to compare the outcomes with what was found in Europe and North America. It would certainly be worthwhile including the BRIC countries due to the dynamism of their economies. When doing this we recommend ensuring a sufficiently high number of respondents per country in order to assess in detail differences and peculiarities across the countries in terms of RM use and the general perception of RM.

A third future research direction would extend the research beyond the PI to other industries of the manufacturing sector. An area of interest could be e.g. the automotive sector: The achievements of Ford Motor Company in this regard seem to be very encouraging (Blumenthal et al. 2008).

Our research involved 1206 firms located in North America and Europe belonging to six industries, and therefore it is a cross-country analysis. However, this work does not take into account the dynamics over time. Therefore, to overcome this issue, a fourth direction for future research would be a longitudinal study, which would also make causal conclusions possible (Rindfleisch et al. 2008).

Given both the importance and the potential of RM in the PI we believe that exploring the areas indicated above will be of value to the companies using RM or intending to introduce it.

Appendix A: Questionnaires

A.1 Questionnaire for the First Empirical Study

Section I: Company Background

Respondent ID-No. (for internal use): _____

1. Which is your job title?

2. Which area do you belong to?

| | |
|--------------------------------------|---|
| <input type="checkbox"/> Purchasing | <input type="checkbox"/> Business Development |
| <input type="checkbox"/> Sales | <input type="checkbox"/> IT |
| <input type="checkbox"/> Production | <input type="checkbox"/> Finance |
| <input type="checkbox"/> Pricing | <input type="checkbox"/> Strategy |
| <input type="checkbox"/> Controlling | <input type="checkbox"/> Other: _____ |

3. In which area of the process industry does your company operate?

| | |
|--|--|
| <input type="checkbox"/> Chemical industry | <input type="checkbox"/> Pharmaceutical industry |
| <input type="checkbox"/> Oil industry | <input type="checkbox"/> Metal industry |
| <input type="checkbox"/> Glass industry | <input type="checkbox"/> Other industries: _____ |
| <input type="checkbox"/> Paper industry | |

4. How high are the total annual revenues of your company?

_____ million Euro

5. How many employees does your company have?

_____ employees

6. In how many markets does your company operate?

Number of markets: _____

7. In which markets are you active?
- Germany
 - Europe
 - USA
 - Worldwide
 - Other markets: _____
8. Are there production over-capacities?
- Yes
 - No
9. Does price pressure result e.g. from over-capacities?
- Yes
 - No

Section II: Application of RM

10. Which importance do RM applications have in relation to increasing over-capacities and stiffing price pressure in the process industry in general?

Please indicate your reply by circling the selected value in the following scale:

| | | |
|---|-------------------|-------------------|
| No importance | Medium importance | Strong importance |
| (1) _____ (2) _____ (3) _____ (4) _____ (5) _____ (6) _____ (7) _____ | | |

11. Is RM appropriate to increase revenues?

Please indicate your reply by circling the selected value in the following scale:

| | | |
|---|-----------------------|------------------|
| Not appropriate | Partially appropriate | Very appropriate |
| (1) _____ (2) _____ (3) _____ (4) _____ (5) _____ (6) _____ (7) _____ | | |

12. In which sectors of the process industry do you expect RM applications in the future?

Please indicate your reply by circling the selected value in the following scale:

| | | |
|---|--------|-------------|
| Very little | Medium | Very strong |
| (1) _____ (2) _____ (3) _____ (4) _____ (5) _____ (6) _____ (7) _____ | | |

| Process industry sectors | Degree of agreement |
|---------------------------------|-----------------------------|
| 1. Chemical industry | (1)-(2)-(3)-(4)-(5)-(6)-(7) |
| 2. Oil industry | (1)-(2)-(3)-(4)-(5)-(6)-(7) |
| 3. Glass industry | (1)-(2)-(3)-(4)-(5)-(6)-(7) |
| 4. Paper industry | (1)-(2)-(3)-(4)-(5)-(6)-(7) |

(continued)

| | |
|----------------------------|-----------------------------|
| 5. Pharmaceutical industry | (1)-(2)-(3)-(4)-(5)-(6)-(7) |
| 6. Metal industry | (1)-(2)-(3)-(4)-(5)-(6)-(7) |
| 7. Other industry: | (1)-(2)-(3)-(4)-(5)-(6)-(7) |

13. How important do you assess RM for the profit maximization of the companies in the process industry?

Please indicate your reply by circling the selected value in the following scale:

| | | |
|-------------------------------|-------------------------------|-------------------|
| No importance | Medium importance | Strong importance |
| (1) _____ (2) _____ (3) _____ | (4) _____ (5) _____ (6) _____ | (7) _____ |

| Statement based on time horizon | Degree of agreement |
|--|-----------------------------|
| 1. Short term (within the next 6 months) | (1)-(2)-(3)-(4)-(5)-(6)-(7) |
| 2. Medium term (in the next 6–18 months) | (1)-(2)-(3)-(4)-(5)-(6)-(7) |
| 3. Long term (not before the next 18 months) | (1)-(2)-(3)-(4)-(5)-(6)-(7) |

14. What are relevant implementation barriers of RM? Please do not indicate more than three.

| | |
|--|---|
| <input type="checkbox"/> Lack of experience with RM | <input type="checkbox"/> Data availability |
| <input type="checkbox"/> No appropriate RM approach identified | <input type="checkbox"/> Appropriate IT systems |
| <input type="checkbox"/> No clearly defined price strategy | <input type="checkbox"/> Management support/culture |
| <input type="checkbox"/> Danger of a price level decrease | <input type="checkbox"/> Negative RM-experiences |
| <input type="checkbox"/> Lack of customer acceptance | <input type="checkbox"/> Other: _____ |

15. Which chances and risks do you see in the implementation of RM applications?

- _____
- _____
- _____

16. Do you see alternative approaches besides RM, to face increasing over-capacities and stiffing price pressure in the process industry?

- _____
- _____
- _____

17. Does your company apply RM?

- Yes ⇒ please continue with question number 15
- No ⇒ please continue with question number 16

18. **Please proceed with question number 15 only if RM is applied in your company:**

18.1 Which of the following RM approaches are implemented?

| | |
|--|--|
| <input type="checkbox"/> Price management | <input type="checkbox"/> Price and capacity management |
| <input type="checkbox"/> Capacity management | <input type="checkbox"/> Other: _____ |

18.2 Since when is RM used in your company?

- Less than 2 years; number of years: _____
- Between 2 and (including) 5 years; number of years: _____
- Between 6 and (including) 10 years; number of years: _____
- More than 10 years; number of years: _____

18.3 In which form is RM applied?

| | |
|---------------------------------------|---|
| <input type="checkbox"/> Manually | <input type="checkbox"/> Within Supply Chain Management/Customer Relationship Management applications |
| <input type="checkbox"/> System based | <input type="checkbox"/> Other form: _____ |

18.4 If RM is IT- or system-based, how was the application developed?

| | |
|--|---------------------------------------|
| <input type="checkbox"/> Own development | <input type="checkbox"/> Other: _____ |
| <input type="checkbox"/> IT-consultants | |

18.5 Which organizational areas or functions are involved in RM applications and who is responsible for them?

| Organizational area/Function | Involved | Responsible |
|---------------------------------|----------|-------------|
| (1) Marketing | | |
| (2) Sales | | |
| (3) Research & Development | | |
| (4) Production | | |
| (5) Strategic Planning | | |
| (6) Project-/Program-Management | | |
| (7) Logistics | | |
| (8) Purchasing | | |
| (9) Information Technology | | |
| (10) Supply Chain Management | | |
| (11) Controlling | | |
| (12) Other: | | |

Please continue with question number 19!

19. Please proceed with this question only if RM is NOT applied in your company:

19.1 Which of the following RM approaches are planned?

| | |
|--|---|
| <input type="checkbox"/> Price management | <input type="checkbox"/> Other: _____ |
| <input type="checkbox"/> Capacity management | <input type="checkbox"/> No RM-applications are planned |
| <input type="checkbox"/> Price and capacity management | |

19.2 When do you plan to use RM in your company?

- Not yet planned
- Planned within the coming 12 months; number of months: _____
- Between 1 and (including) 3 years; number of years: _____
- Between 3 and (including) 5 years; number of years: _____
- In more than 5 years; number of years: _____

19.3 In which form will RM be applied?

| | |
|---------------------------------------|---|
| <input type="checkbox"/> Manually | <input type="checkbox"/> Within Supply Chain Management/Customer Relationship Management applications |
| <input type="checkbox"/> System based | <input type="checkbox"/> Other form: _____ |

19.4 If RM will be IT- or system-based, how will the application be developed?

| | |
|--|---------------------------------------|
| <input type="checkbox"/> Own development | <input type="checkbox"/> Other: _____ |
| <input type="checkbox"/> IT-consultants | |

19.5 Which organizational areas or functions will be involved in RM applications and who will be responsible for them?

| Organizational area/Function | Will be involved | Will be responsible |
|---------------------------------|------------------|---------------------|
| (1) Marketing | | |
| (2) Sales | | |
| (3) Research & Development | | |
| (4) Production | | |
| (5) Strategic Planning | | |
| (6) Project-/Program-Management | | |
| (7) Logistics | | |
| (8) Purchasing | | |
| (9) Information Technology | | |
| (10) Supply Chain Management | | |
| (11) Controlling | | |
| (12) Other: | | |

Please continue with question number 20!

Section III: Statements on RM

20. To which degree do you agree with the following statements on RM?

Please indicate your reply by circling the selected value in the following scale:

| | | |
|---|------------------------------|--------------------|
| I disagree | I neither disagree nor agree | I completely agree |
| (1) _____ (2) _____ (3) _____ (4) _____ (5) _____ (6) _____ (7) _____ | | |

| Statement | Degree of agreement |
|---|-----------------------------|
| 1. RM clearly triggers revenue and is therefore very helpful. | (1)-(2)-(3)-(4)-(5)-(6)-(7) |
| 2. Practical RM-applications are very limited in the process industry. | (1)-(2)-(3)-(4)-(5)-(6)-(7) |
| 3. The process industry is very suitable for the application of RM. | (1)-(2)-(3)-(4)-(5)-(6)-(7) |
| 4. The use of RM will strongly increase within the process industry. | (1)-(2)-(3)-(4)-(5)-(6)-(7) |
| 5. The potential of RM has not yet been discovered in the process industry. | (1)-(2)-(3)-(4)-(5)-(6)-(7) |
| 6. As in the airline industry, RM can be applied in the process industry as well, if certain prerequisites are fulfilled. | (1)-(2)-(3)-(4)-(5)-(6)-(7) |
| 7. New technologies will speed up the adaptation of RM. | (1)-(2)-(3)-(4)-(5)-(6)-(7) |
| 8. Companies need support in the implementation of RM. | (1)-(2)-(3)-(4)-(5)-(6)-(7) |
| 9. RM based on price management is particularly valuable. | (1)-(2)-(3)-(4)-(5)-(6)-(7) |
| 10. RM based on capacity management is particularly valuable. | (1)-(2)-(3)-(4)-(5)-(6)-(7) |
| 11. RM based on both price and capacity management is particularly valuable. | (1)-(2)-(3)-(4)-(5)-(6)-(7) |

21. Which current and future challenges/issues of your business do you recognize?

- _____
- _____
- _____

22. How can RM represent a solution to the mentioned challenges/issues?

- _____
- _____
- _____

A.2 Questionnaire for the Second Empirical Study

Section I: Company Background

Respondent ID-No. (for internal use): _____

1. Which is your job title?

2. Which area do you belong to?

| | |
|--------------------------------------|---|
| <input type="checkbox"/> Purchasing | <input type="checkbox"/> Business Development |
| <input type="checkbox"/> Sales | <input type="checkbox"/> IT |
| <input type="checkbox"/> Production | <input type="checkbox"/> Finance |
| <input type="checkbox"/> Pricing | <input type="checkbox"/> Strategy |
| <input type="checkbox"/> Controlling | <input type="checkbox"/> Other: _____ |

3. In which area of the process industry does your company operate?

| | |
|--|--|
| <input type="checkbox"/> Chemical industry | <input type="checkbox"/> Pharmaceutical industry |
| <input type="checkbox"/> Oil industry | <input type="checkbox"/> Metal industry |
| <input type="checkbox"/> Glass industry | <input type="checkbox"/> Other industries: _____ |
| <input type="checkbox"/> Paper industry | |

4. How high are the total annual revenues of your company?

_____ million Euro

5. How many employees does your company have?

_____ employees

6. In how many markets does your company operate?

Number of markets: _____

7. In which markets are you active?

- Germany
- Europe
- USA
- Worldwide
- Other markets: _____

8. Are there production over-capacities?

- Yes
- No

9. Does price pressure result e.g. from over-capacities?

- Yes
- No

Section II: Application of RM

10. Which importance do RM applications have in relation to increasing over-capacities and stiffing price pressure in the process industry in general?

Please indicate your reply by circling the selected value in the following scale:

| | | |
|---------------|-------------------------------|-------------------------------|
| No importance | Medium importance | Strong importance |
| (1) _____ | (2) _____ (3) _____ (4) _____ | (5) _____ (6) _____ (7) _____ |

11. Is RM appropriate to increase revenues?

Please indicate your reply by circling the selected value in the following scale:

| | | |
|---|-----------------------|------------------|
| Not appropriate | Partially appropriate | Very appropriate |
| (1) _____ (2) _____ (3) _____ (4) _____ (5) _____ (6) _____ (7) _____ | | |

12. In which sectors of the process industry do you expect RM applications in the future?

Please indicate your reply by circling the selected value in the following scale:

| | | |
|---|--------|-------------|
| Very little | Medium | Very strong |
| (1) _____ (2) _____ (3) _____ (4) _____ (5) _____ (6) _____ (7) _____ | | |

| Process industry sectors | Degree of agreement |
|----------------------------|-----------------------------|
| 1. Chemical industry | (1)-(2)-(3)-(4)-(5)-(6)-(7) |
| 2. Oil industry | (1)-(2)-(3)-(4)-(5)-(6)-(7) |
| 3. Glass industry | (1)-(2)-(3)-(4)-(5)-(6)-(7) |
| 4. Paper industry | (1)-(2)-(3)-(4)-(5)-(6)-(7) |
| 5. Pharmaceutical industry | (1)-(2)-(3)-(4)-(5)-(6)-(7) |
| 6. Metal industry | (1)-(2)-(3)-(4)-(5)-(6)-(7) |
| 7. Other industry: | (1)-(2)-(3)-(4)-(5)-(6)-(7) |

13. How important do you assess RM for the profit maximization of the companies in the process industry?

Please indicate your reply by circling the selected value in the following scale:

| | | |
|---|-------------------|-------------------|
| No importance | Medium importance | Strong importance |
| (1) _____ (2) _____ (3) _____ (4) _____ (5) _____ (6) _____ (7) _____ | | |

| Statement based on time horizon | Degree of agreement |
|--|-----------------------------|
| 1. Short term (within the next 6 months) | (1)-(2)-(3)-(4)-(5)-(6)-(7) |
| 2. Medium term (in the next 6 to 18 months) | (1)-(2)-(3)-(4)-(5)-(6)-(7) |
| 3. Long term (not before the next 18 months) | (1)-(2)-(3)-(4)-(5)-(6)-(7) |

14. What are relevant implementation barriers of RM? Please do not indicate more than three.

| | |
|--|---|
| <input type="checkbox"/> Lack of experience with RM | <input type="checkbox"/> Data availability |
| <input type="checkbox"/> No appropriate RM approach identified | <input type="checkbox"/> Appropriate IT systems |
| <input type="checkbox"/> No clearly defined price strategy | <input type="checkbox"/> Management support/culture |
| <input type="checkbox"/> Danger of a price level decrease | <input type="checkbox"/> Negative RM-experiences |
| <input type="checkbox"/> Lack of customer acceptance | <input type="checkbox"/> Other: _____ |

15. Which chances and risks do you see in the implementation of RM applications?

- _____
- _____
- _____

16. Do you see alternative approaches besides RM, to face increasing over-capacities and stiffing price pressure in the process industry?

- _____
- _____
- _____

17. Does your company apply RM?

- Yes => please continue with question number 18
- No => please continue with question number 19

18. Please proceed with this question only if RM is applied in your company:

18.1 Which of the following RM approaches are implemented?

| | |
|--|--|
| <input type="checkbox"/> Price management | <input type="checkbox"/> Price and capacity management |
| <input type="checkbox"/> Capacity management | <input type="checkbox"/> Other: _____ |

18.2 Since when is RM used in your company?

- Less than 2 years; number of years: _____
- Between 2 and (including) 5 years; number of years: _____
- Between 6 and (including) 10 years; number of years: _____
- More than 10 years; number of years: _____

18.3 In which form is RM applied?

| | |
|---------------------------------------|---|
| <input type="checkbox"/> Manually | <input type="checkbox"/> Within Supply Chain Management/Customer Relationship Management applications |
| <input type="checkbox"/> System based | <input type="checkbox"/> Other form: _____ |

18.4 If RM is IT- or system-based, how was the application developed?

| | |
|--|---------------------------------------|
| <input type="checkbox"/> Own development | <input type="checkbox"/> Other: _____ |
| <input type="checkbox"/> IT-consultants | |

18.5 Which organizational areas or functions are involved in RM applications and who is responsible for them?

| Organizational area/Function | Involved | Responsible |
|------------------------------|----------|-------------|
| (1) Marketing | | |
| (2) Sales | | |
| (3) Research & Development | | |
| (4) Production | | |

(continued)

| | | |
|---------------------------------|--|--|
| (5) Strategic Planning | | |
| (6) Project-/Program-Management | | |
| (7) Logistics | | |
| (8) Purchasing | | |
| (9) Information Technology | | |
| (10) Supply Chain Management | | |
| (11) Controlling | | |
| (12) Other: | | |

Please continue with question number 20!

19. Please proceed with this question only if RM is NOT applied in your company:

19.1 Which of the following RM approaches are planned?

| | |
|--|---|
| <input type="checkbox"/> Price management | <input type="checkbox"/> Other: _____ |
| <input type="checkbox"/> Capacity management | <input type="checkbox"/> No RM-applications are planned |
| <input type="checkbox"/> Price and capacity management | |

19.2 When do you plan to use RM in your company?

- Not yet planned
- Planned within the coming 12 months; number of months: _____
- Between 1 and (including) 3 years; number of years: _____
- Between 3 and (including) 5 years; number of years: _____
- In more than 5 years; number of years: _____

19.3 In which form will RM be applied?

| | |
|---------------------------------------|---|
| <input type="checkbox"/> Manually | <input type="checkbox"/> Within Supply Chain Management/Customer Relationship Management applications |
| <input type="checkbox"/> System-based | <input type="checkbox"/> Other form: _____ |

19.4 If RM will be IT- or system-based, how will the application be developed?

| | |
|--|---------------------------------------|
| <input type="checkbox"/> Own development | <input type="checkbox"/> Other: _____ |
| <input type="checkbox"/> IT-consultants | |

19.5 Which organizational areas or functions will be involved in RM applications and who will be responsible for them?

| Organizational area/Function | Will be involved | Will be responsible |
|------------------------------|------------------|---------------------|
| (1) Marketing | | |
| (2) Sales | | |
| (3) Research & Development | | |
| (4) Production | | |

(continued)

| | | |
|---------------------------------|--|--|
| (5) Strategic Planning | | |
| (6) Project-/Program-Management | | |
| (7) Logistics | | |
| (8) Purchasing | | |
| (9) Information Technology | | |
| (10) Supply Chain Management | | |
| (11) Controlling | | |
| (12) Other: | | |

Please continue with number 20!

Section III: Statements on RM

20. To which degree do you agree with the following statements on RM?

Please indicate your reply by circling the selected value in the following scale:

| | | |
|------------|---|---------------------|
| I disagree | I neither disagree nor agree | I completely agree |
| (1) _____ | (2) _____ (3) _____ (4) _____ (5) _____ | (6) _____ (7) _____ |

| Statement | Degree of agreement |
|---|-----------------------------|
| 1. RM clearly triggers revenue and is therefore very helpful. | (1)-(2)-(3)-(4)-(5)-(6)-(7) |
| 2. Practical RM-applications are very limited in the process industry. | (1)-(2)-(3)-(4)-(5)-(6)-(7) |
| 3. The process industry is very suitable for the application of RM. | (1)-(2)-(3)-(4)-(5)-(6)-(7) |
| 4. The use of RM will strongly increase within the process industry. | (1)-(2)-(3)-(4)-(5)-(6)-(7) |
| 5. The potential of RM has not yet been discovered in the process industry. | (1)-(2)-(3)-(4)-(5)-(6)-(7) |
| 6. As in the airline industry, RM can be applied in the process industry as well, if certain prerequisites are fulfilled. | (1)-(2)-(3)-(4)-(5)-(6)-(7) |
| 7. New technologies will speed up the adaptation of RM. | (1)-(2)-(3)-(4)-(5)-(6)-(7) |
| 8. Companies need support in the implementation of RM. | (1)-(2)-(3)-(4)-(5)-(6)-(7) |
| 9. RM based on price management is particularly valuable. | (1)-(2)-(3)-(4)-(5)-(6)-(7) |
| 10. RM based on capacity management is particularly valuable. | (1)-(2)-(3)-(4)-(5)-(6)-(7) |
| 11. RM based on both price and capacity management is particularly valuable. | (1)-(2)-(3)-(4)-(5)-(6)-(7) |

21. Which current and future challenges/issues of your business do you recognize?

- _____
- _____
- _____

22. How can RM represent a solution to the mentioned challenges/issues?

- _____
- _____
- _____

A.3 Questionnaire for the Third Empirical Study

Section I: Company Background

Respondent ID-No. (for internal use): _____

1. Which is your job title?

2. Which area do you belong to?

| | |
|--------------------------------------|---|
| <input type="checkbox"/> Purchasing | <input type="checkbox"/> Business Development |
| <input type="checkbox"/> Sales | <input type="checkbox"/> IT |
| <input type="checkbox"/> Production | <input type="checkbox"/> Finance |
| <input type="checkbox"/> Pricing | <input type="checkbox"/> Strategy |
| <input type="checkbox"/> Controlling | <input type="checkbox"/> Other: _____ |

3. In what area of the process industry does your company operate?

| | |
|--|--|
| <input type="checkbox"/> Chemical industry | <input type="checkbox"/> Pharmaceutical industry |
| <input type="checkbox"/> Oil industry | <input type="checkbox"/> Metal industry |
| <input type="checkbox"/> Glass industry | <input type="checkbox"/> Other industries: _____ |
| <input type="checkbox"/> Paper industry | |

4. How high are the total annual revenues of your company?

_____ million Euro

5. How many employees does your company have?

_____ employees

6. In how many markets does your company operate?

Number of markets: _____

7. In which markets are you active?

- Germany
- Europe
- USA
- Worldwide
- Other markets: _____

8. How strongly is the concept of RM linked to pricing and/or capacity management valued as important by the management of your company?

Please indicate your reply by circling the selected value in the following scale:

| | | |
|------------------------|---|------------------|
| Completely unimportant | Partially important | Highly important |
| (1) _____ | (2) _____ (3) _____ (4) _____ (5) _____ (6) _____ (7) _____ | |

Section II: Application and Success of RM (For Companies Using It)

9. Do you apply RM in your company?
 Yes ⇒ please continue with the next question (question number 10)
 No ⇒ please continue with question no. 18
10. Do you think RM is appropriate for increasing revenues?

Please indicate your reply by circling the selected value in the following scale:

| | | |
|-----------------|---|------------------|
| Not appropriate | Partially appropriate | Very appropriate |
| (1) _____ | (2) _____ (3) _____ (4) _____ (5) _____ (6) _____ (7) _____ | |

11. How long has RM been used in your company?

| | |
|----------------------------------|--|
| <input type="checkbox"/> 0 year | <input type="checkbox"/> 6 years |
| <input type="checkbox"/> 1 year | <input type="checkbox"/> 7 years |
| <input type="checkbox"/> 2 years | <input type="checkbox"/> 8 years |
| <input type="checkbox"/> 3 years | <input type="checkbox"/> 9 years |
| <input type="checkbox"/> 4 years | <input type="checkbox"/> 10 years |
| <input type="checkbox"/> 5 years | <input type="checkbox"/> More than 10 years (If possible, state how many years: _____) |

12. How successful has your company been in increasing profits through RM?

Please indicate your reply by circling the selected value in the following scale:

| | | |
|-------------------|---|-----------------|
| Very unsuccessful | Medium | Very successful |
| (1) _____ | (2) _____ (3) _____ (4) _____ (5) _____ (6) _____ (7) _____ | |

13. How did your company estimate the profit impact of RM prior to its introduction? If possible indicate a percentage increase your company expected.
 _____%

14. By how much have the profits increased 1 year after the introduction of RM?

| | |
|---|---|
| <input type="checkbox"/> There was no profit impact | <input type="checkbox"/> By 3.5 % |
| <input type="checkbox"/> By 0.5 % | <input type="checkbox"/> By 4 % |
| <input type="checkbox"/> By 1 % | <input type="checkbox"/> By 4.5 % |
| <input type="checkbox"/> By 1.5 % | <input type="checkbox"/> By 5 % |
| <input type="checkbox"/> By 2 % | <input type="checkbox"/> By 5.5 % |
| <input type="checkbox"/> By 2.5 % | <input type="checkbox"/> By 6 % |
| <input type="checkbox"/> By 3 % | <input type="checkbox"/> By 6.0 % or more |
| (if possible, state how much: _____%) | |

15. What is the average yearly EBIT-impact due to RM?
 _____%

16. In your experience, how important is RM for the profit maximization of the companies in the process industry?

Please indicate your reply by circling the selected value in the following scale:

| | | |
|---|-------------------|-------------------|
| No importance | Medium importance | Strong importance |
| (1) _____ (2) _____ (3) _____ (4) _____ (5) _____ (6) _____ (7) _____ | | |

| Statement based on time horizon | Degree of agreement |
|--|---|
| 1. Short term (within the next 6 months) | No importance strong importance (1)-(2)-(3)-(4)-(5)-(6)-(7) |
| 2. Medium term (in the next 6 to 18 months) | No importance strong importance (1)-(2)-(3)-(4)-(5)-(6)-(7) |
| 3. Long term (not before the next 18 months) | No importance strong importance (1)-(2)-(3)-(4)-(5)-(6)-(7) |

17. What are relevant implementation barriers of RM? Please rank the three most important barriers from 1 to 3 (1 for the most important one).

| | |
|---|---|
| ___ Lack of experience with RM | ___ Appropriate IT systems |
| ___ No appropriate RM approach identified | ___ Management support |
| ___ No clearly defined price strategy | ___ Corporate culture |
| ___ Danger of a price level decrease | ___ Negative RM-experiences |
| ___ Lack of customer acceptance | ___ Fear of negative customer feed-back (RM seen as not appropriate) |
| ___ Data availability | ___ Other: _____ |

Pls. elaborate on the above:

17.1 How strongly does the lack of experience hinder the implementation of RM?

Please indicate your reply by circling the selected value in the following scale:

| | | |
|-------------------------------|-------------------------------|---------------|
| Very weakly | Medium | Very strongly |
| (1) _____ (2) _____ (3) _____ | (4) _____ (5) _____ (6) _____ | (7) _____ |

17.2 How strongly does the *lack of an appropriate RM approach* hinder the implementation of RM?

Please indicate your reply by circling the selected value in the following scale:

| | | |
|-------------------------------|-------------------------------|---------------|
| Very weakly | Medium | Very strongly |
| (1) _____ (2) _____ (3) _____ | (4) _____ (5) _____ (6) _____ | (7) _____ |

17.3 How strongly does the *not clearly defined price strategy* hinder the implementation of RM?

Please indicate your reply by circling the selected value in the following scale:

| | | |
|-------------------------------|-------------------------------|---------------|
| Very weakly | Medium | Very strongly |
| (1) _____ (2) _____ (3) _____ | (4) _____ (5) _____ (6) _____ | (7) _____ |

17.4 How strongly does the danger of a price level decrease hinder the implementation of RM?

Please indicate your reply by circling the selected value in the following scale:

| | | |
|-------------------------------|-------------------------------|---------------|
| Very weakly | Medium | Very strongly |
| (1) _____ (2) _____ (3) _____ | (4) _____ (5) _____ (6) _____ | (7) _____ |

17.5 How strongly does the *lack of customer acceptance* hinder the implementation of RM?

Please indicate your reply by circling the selected value in the following scale:

| | | |
|-------------------------------|-------------------------------|---------------|
| Very weakly | Medium | Very strongly |
| (1) _____ (2) _____ (3) _____ | (4) _____ (5) _____ (6) _____ | (7) _____ |

17.6 How strongly does the *lack of data availability* hinder the implementation of RM?

Please indicate your reply by circling the selected value in the following scale:

| | | |
|---|--------|---------------|
| Very weakly | Medium | Very strongly |
| (1) _____ (2) _____ (3) _____ (4) _____ (5) _____ (6) _____ (7) _____ | | |

17.7 How strongly do *not appropriate IT systems* hinder the implementation of RM?

Please indicate your reply by circling the selected value in the following scale:

| | | |
|---|--------|---------------|
| Very weakly | Medium | Very strongly |
| (1) _____ (2) _____ (3) _____ (4) _____ (5) _____ (6) _____ (7) _____ | | |

17.8 How strongly does the *management support* hinder the implementation of RM?

Please indicate your reply by circling the selected value in the following scale:

| | | |
|---|--------|---------------|
| Very weakly | Medium | Very strongly |
| (1) _____ (2) _____ (3) _____ (4) _____ (5) _____ (6) _____ (7) _____ | | |

17.9 How strongly does the corporate culture hinder the implementation of RM?

Please indicate your reply by circling the selected value in the following scale:

| | | |
|---|--------|---------------|
| Very weakly | Medium | Very strongly |
| (1) _____ (2) _____ (3) _____ (4) _____ (5) _____ (6) _____ (7) _____ | | |

17.10 How strongly do *negative RM-experiences* hinder the implementation of RM?

Please indicate your reply by circling the selected value in the following scale:

| | | |
|---|--------|---------------|
| Very weakly | Medium | Very strongly |
| (1) _____ (2) _____ (3) _____ (4) _____ (5) _____ (6) _____ (7) _____ | | |

17.11 How strongly does *fear of negative customer feedback* (RM seen as not appropriate) hinder the implementation of RM?

Please indicate your reply by circling the selected value in the following scale:

| | | |
|---|--------|---------------|
| Very weakly | Medium | Very strongly |
| (1) _____ (2) _____ (3) _____ (4) _____ (5) _____ (6) _____ (7) _____ | | |

17.12 How strongly do *other factors* hinder the implementation of RM?
 (If possible, state the other factors: _____)

Please indicate your reply by circling the selected value in the following scale:

| | | |
|---|--------|---------------|
| Very weakly | Medium | Very strongly |
| (1) _____ (2) _____ (3) _____ (4) _____ (5) _____ (6) _____ (7) _____ | | |

Section III: Reasons for Not Employing RM (For Companies Not Using It)

18. In your experience, how important is RM for the profit maximization of the companies in the process industry?

Please indicate your reply by circling the selected value in the following scale:

| | | |
|---|-------------------|-------------------|
| No importance | Medium importance | Strong importance |
| (1) _____ (2) _____ (3) _____ (4) _____ (5) _____ (6) _____ (7) _____ | | |

| Statement based on time horizon | Degree of agreement |
|--|---|
| 1. Short term (within the next 6 months) | No importance strong importance (1)-(2)-(3)-(4)-(5)-(6)-(7) |
| 2. Medium term (in the next 6 to 18 months) | No importance strong importance (1)-(2)-(3)-(4)-(5)-(6)-(7) |
| 3. Long term (not before the next 18 months) | No importance strong importance (1)-(2)-(3)-(4)-(5)-(6)-(7) |

19. Why do you not employ RM in your company? Please rank the three most important reasons from 1 to 3 (1 for the most important one).

| | |
|--|---|
| <input type="checkbox"/> Other issues have higher priority (and thus lack of awareness) <input type="checkbox"/> Missing application prerequisites <input type="checkbox"/> We tried once but failed introducing it <input type="checkbox"/> Waiting for more applications of it in our industry <input type="checkbox"/> Limited visibility on it by top mgmt. <input type="checkbox"/> Lack of customer acceptance <input type="checkbox"/> Lack of experience with RM <input type="checkbox"/> No clearly defined price strategy | <input type="checkbox"/> Danger of a price level decrease <input type="checkbox"/> Negative RM experiences <input type="checkbox"/> No appropriate RM approach identified <input type="checkbox"/> Fear of negative customer feed-back (RM seen as not appropriate) <input type="checkbox"/> Management support <input type="checkbox"/> Corporate culture <input type="checkbox"/> Bad reputation of RM <input type="checkbox"/> Other: _____ |
|--|---|

Please elaborate on the above (e.g. if the 1st reason on the top left was chosen, please mention which issues have a higher priority):

19.1 How important is that *other issues have higher priority* to explain the lack of application of RM in your company?

Please indicate your reply by circling the selected value in the following scale:

| | | |
|-------------------------------|-------------------------------|-------------------|
| No importance | Medium importance | Strong importance |
| (1) _____ (2) _____ (3) _____ | (4) _____ (5) _____ (6) _____ | (7) _____ |

19.2 How important are *missing application prerequisites* to explain the lack of application of RM in your company?

Please indicate your reply by circling the selected value in the following scale:

| | | |
|-------------------------------|-------------------------------|-------------------|
| No importance | Medium importance | Strong importance |
| (1) _____ (2) _____ (3) _____ | (4) _____ (5) _____ (6) _____ | (7) _____ |

19.3 How important is the *fact that you tried once but failed introducing it* to explain the lack of application of RM in your company?

Please indicate your reply by circling the selected value in the following scale:

| | | |
|-------------------------------|-------------------------------|-------------------|
| No importance | Medium importance | Strong importance |
| (1) _____ (2) _____ (3) _____ | (4) _____ (5) _____ (6) _____ | (7) _____ |

19.4 How important is it to *wait for more applications of it in your industry* to explain the lack of application of RM in your company?

Please indicate your reply by circling the selected value in the following scale:

| | | |
|-------------------------------|-------------------------------|-------------------|
| No importance | Medium importance | Strong importance |
| (1) _____ (2) _____ (3) _____ | (4) _____ (5) _____ (6) _____ | (7) _____ |

19.5 How important is the *limited visibility on it by top management* to explain the lack of application of RM in your company?

Please indicate your reply by circling the selected value in the following scale:

| | | |
|-------------------------------|-------------------------------|-------------------|
| No importance | Medium importance | Strong importance |
| (1) _____ (2) _____ (3) _____ | (4) _____ (5) _____ (6) _____ | (7) _____ |

19.6 How important is the *lack of customer acceptance* to explain the lack of application of RM in your company?

Please indicate your reply by circling the selected value in the following scale:

| | | |
|---|-------------------|-------------------|
| No importance | Medium importance | Strong importance |
| (1) _____ (2) _____ (3) _____ (4) _____ (5) _____ (6) _____ (7) _____ | | |

19.7 How important is the *lack of experience with RM* to explain the lack of application of RM in your company?

Please indicate your reply by circling the selected value in the following scale:

| | | |
|---|-------------------|-------------------|
| No importance | Medium importance | Strong importance |
| (1) _____ (2) _____ (3) _____ (4) _____ (5) _____ (6) _____ (7) _____ | | |

19.8 How important is the *unclearly defined price strategy* to explain the lack of application of RM in your company?

Please indicate your reply by circling the selected value in the following scale:

| | | |
|---|-------------------|-------------------|
| No importance | Medium importance | Strong importance |
| (1) _____ (2) _____ (3) _____ (4) _____ (5) _____ (6) _____ (7) _____ | | |

19.9 How important is the *danger of a price level decrease* to explain the lack of application of RM in your company?

Please indicate your reply by circling the selected value in the following scale:

| | | |
|---|-------------------|-------------------|
| No importance | Medium importance | Strong importance |
| (1) _____ (2) _____ (3) _____ (4) _____ (5) _____ (6) _____ (7) _____ | | |

19.10 How important are *negative RM experiences* to explain the lack of application of RM in your company?

Please indicate your reply by circling the selected value in the following scale:

| | | |
|---|-------------------|-------------------|
| No importance | Medium importance | Strong importance |
| (1) _____ (2) _____ (3) _____ (4) _____ (5) _____ (6) _____ (7) _____ | | |

19.11 How important is that no appropriate RM approach has been identified to explain the lack of application of RM in your company?

Please indicate your reply by circling the selected value in the following scale:

| | | |
|---|-------------------|-------------------|
| No importance | Medium importance | Strong importance |
| (1) _____ (2) _____ (3) _____ (4) _____ (5) _____ (6) _____ (7) _____ | | |

19.12 How important is the *fear of negative customer feedback (RM seen as not appropriate)* to explain the lack of application of RM in your company?

Please indicate your reply by circling the selected value in the following scale:

| | | |
|---|-------------------|-------------------|
| No importance | Medium importance | Strong importance |
| (1) _____ (2) _____ (3) _____ (4) _____ (5) _____ (6) _____ (7) _____ | | |

19.13 How important is the *management support* to explain the lack of application of RM in your company?

Please indicate your reply by circling the selected value in the following scale:

| | | |
|---|-------------------|-------------------|
| No importance | Medium importance | Strong importance |
| (1) _____ (2) _____ (3) _____ (4) _____ (5) _____ (6) _____ (7) _____ | | |

19.14 How important is *corporate culture* to explain the lack of application of RM in your company?

Please indicate your reply by circling the selected value in the following scale:

| | | |
|---|-------------------|-------------------|
| No importance | Medium importance | Strong importance |
| (1) _____ (2) _____ (3) _____ (4) _____ (5) _____ (6) _____ (7) _____ | | |

19.15 How important is the *bad reputation of RM* to explain the lack of application of RM in your company?

Please indicate your reply by circling the selected value in the following scale:

| | | |
|---|-------------------|-------------------|
| No importance | Medium importance | Strong importance |
| (1) _____ (2) _____ (3) _____ (4) _____ (5) _____ (6) _____ (7) _____ | | |

19.16 How important are *other factors* to explain the lack of application of RM in your company? (If possible, state the other factors: _____)

Please indicate your reply by circling the selected value in the following scale:

| | | |
|---|-------------------|-------------------|
| No importance | Medium importance | Strong importance |
| (1) _____ (2) _____ (3) _____ (4) _____ (5) _____ (6) _____ (7) _____ | | |

Appendix B: Correlation Matrixes

B.1 Impact of the Barriers' Evaluations on Real Decision to Introduce RM

| Omnibus-tests of the model coefficients | | | | |
|---|-------|------------|----|-------|
| | | Chi-square | df | Sig. |
| Step 1 | Step | 350.037 | 8 | 0.000 |
| | Block | 350.037 | 8 | 0.000 |
| | Model | 350.037 | 8 | 0.000 |

| Model synthesis | | | |
|-----------------|----------------------|----------------------|---------------------|
| Step 1 | −2 Log-Likelihood | Cox & Snell R-Square | Nagelkerke R-Square |
| | 165.097 ^a | 0.440 | 0.767 |

| Variables in the equation | | | | | | | |
|---------------------------|-------------|--------------------------|----------------|--------|----|-------|--------|
| | | Regression-coefficient B | Standard error | Wald | df | Sig. | Exp(B) |
| Step 1 ^a | Q175_Q196 | −0.075 | 0.163 | 0.215 | 1 | 0.643 | 0.927 |
| | Q171_Q197 | 0.264 | 0.202 | 1.706 | 1 | 0.191 | 1.302 |
| | Q173_Q198 | 0.807 | 0.146 | 30.498 | 1 | 0.000 | 2.241 |
| | Q174_Q199 | 0.133 | 0.138 | 0.932 | 1 | 0.334 | 1.142 |
| | Q172_Q1911 | 0.358 | 0.196 | 3.352 | 1 | 0.067 | 1.431 |
| | Q1711_Q1912 | −1.700 | 0.195 | 75.663 | 1 | 0.000 | 0.183 |
| | Q178_Q1913 | 0.010 | 0.140 | 0.005 | 1 | 0.941 | 1.010 |
| | Q179_Q1914 | −0.462 | 0.135 | 11.668 | 1 | 0.001 | 0.630 |
| | Constant | −1.212 | 2.370 | 0.261 | 1 | 0.609 | 0.298 |

^aIn step 1 inserted variables: Q175_Q196, Q171_Q197, Q173_Q198, Q174_Q199, Q172_Q1911, Q1711_Q1912, Q178_Q1913, Q179_Q1914

$$\begin{aligned} \text{odds}_{(0 = \text{no}/1 = \text{yes})} = & 0.298 + 0.927 Q175.Q196 \\ & + 1.302 Q171.Q197 + 2.241 Q173.Q198 + 1.142 Q174.Q199 \\ & + 1.431 Q172.Q1911 + 0.183 Q1711.Q1912 \\ & + 1.010 Q178.Q1913 + 0.630 Q179.Q1914 \end{aligned}$$

B.2 Spearman Correlation Matrix of the Metric Variables

Appendix C: State of the Art and Implementation of Revenue Management in Germany¹

Zusammenfassung

Nach Erfolgen in der Dienstleistungsindustrie wird zunehmend der Einsatz von Revenue Management in der Sachleistungsindustrie diskutiert. Die Ergebnisse einer Studie mit 124 teilnehmenden Unternehmen aus der Prozessindustrie zeigen, dass die Bedeutung von Revenue Management als generell hoch eingeschätzt wird und zudem mit der Unternehmensgröße, der Einsatzdauer bestehender Systeme und der Umsetzung in IT-Systemen positiv korreliert. Dabei ist die Ausprägung des Revenue Management-Ansatzes abhängig von dessen Einsatzdauer: Im Laufe der Anwendung werden zunehmend Kapazitäts- und Preissteuerung statt einer isolierten Kapazitäts- oder Preissteuerung eingesetzt. Als wesentliche Hindernisse bei der Einführung von Revenue Management werden das Fehlen einer klaren Preisstrategie, begrenzte Erfahrungen sowie das Fehlen geeigneter Ansätze genannt.

C.1 Problemstellung

Revenue Management² umfasst den systematischen Einsatz von taktisch-operativen Instrumenten zur Erlösmaximierung bei mittelfristig fixen Kapazitäten, stochastischer Nachfrage und der fehlenden Möglichkeit der Lagerfertigung. Der

¹ This appendix has been adapted with the kind permission of Springer from Kolisch, R. and Zatta, D. (2009) Stand und Perspektiven des Einsatzes von Revenue Management in der Prozessindustrie. *Zeitschrift für Planung und Unternehmenssteuerung*, 20(2): 197–214.

² Alternative Bezeichnungen für Revenue Management sind die englischen Begriffe Yield Management, Revenue Optimization und Demand Management (vgl. Talluri u. van Ryzin 2004) sowie die deutsche Bezeichnung Erlösmanagement (vgl. Klein 2001).

Ansatz wurde in den 70er Jahren in der amerikanischen Luftverkehrsindustrie entwickelt (vgl. Belobaba 1989; Lindenmeier u. Tschulin 2003; Littlewood 1972; Rothstein 1971; Smith et al. 1992; Weatherford u. Bodily 1992). Mittlerweile wird Revenue Management flächendeckend in der Luftfahrtbranche eingesetzt und steuert wesentlich zum Ertrag der Luftverkehrsunternehmen bei. So konnte die Lufthansa im Jahr 2005 durch Revenue Management 105 Millionen Euro an zusätzlichen Ertrag erwirtschaften (vgl. Klophaus u. Pölt 2007). Über die Luftfahrtindustrie hinaus hat Revenue Management Verwendung in vielen anderen Dienstleistungsbranchen wie z.B. Autovermietung, Gastronomie, Energie, Gesundheit, Internet, Medien, Logistik und Touristik gefunden (vgl. Defregger u. Kuhn 2007; Klein u. Steinhardt 2008; Talluri u. van Ryzin 2004). In jüngster Zeit finden sich eine Reihe von Arbeiten, in denen Modelle für den Einsatz von Revenue Management in der Sachleistungsindustrie entwickelt werden (vgl. Chamsirisakskul et al. 2006; Defregger u. Kuhn 2007; Kimms u. Müller-Bungart 2003; Spengler u. Rehkopf 2005; Spengler et al. 2007; Watanapa u. Techanitasawad 2005a, b). Allerdings haben diese Arbeiten konzeptionell-normativen Charakter und beschäftigen sich mit der Ausnahme von Fallstudien nicht mit dem Stand des Einsatzes von Revenue Management in der Sachleistungsindustrie. Hier setzt der vorliegende Beitrag an. Am Beispiel der Prozessindustrie, die in Deutschland mit einem Anteil von ca. 56 % an der Bruttowertschöpfung des verarbeitenden Gewerbes, einem Beitrag zum Bruttoinlandsprodukt von über 202 Milliarden Euro und über 3,7 Millionen Erwerbstätigen die bedeutendste Branche des produzierenden Gewerbes ist (vgl. Statistisches Bundesamt 2008), stellen wir auf der Basis einer empirischen Untersuchung Stand und Perspektiven zum Einsatz von Revenue Management dar.

Der Beitrag ist wie folgt gegliedert: Zunächst prüfen wir in Abschn. 2 die Anwendungsvoraussetzungen für den Einsatz von Revenue Management in der Prozessindustrie und stellen die für den Einsatz geeigneten Instrumente vor. In Abschn. 3 referieren wir den aktuellen Stand empirischer Untersuchungen zum Revenue Management. Anschließend stellen wir in Abschn. 4 die Ergebnisse der explorativen Untersuchung sowie die daraus abgeleiteten Arbeitshypothesen vor. Das Abschn. 5 beinhaltet die Ergebnisse der empirischen Studie. Der Beitrag schließt in Abschn. 6 mit der Darstellung der wesentlichen Ergebnisse sowie einer Diskussion der Limitationen.

C.2 Anwendungsvoraussetzungen und Instrumente für Revenue Management in der Prozessindustrie

C.2.1 Anwendungsvoraussetzungen

In der Literatur werden eine Reihe von Voraussetzungen für den erfolgreichen Einsatz von Revenue Management genannt (vgl. Kimms u. Klein 2005; Klein

u. Steinhardt 2008; Kuhn u. Defregger 2005; Netessine u. Shumsky 2002; Talluri u. van Ryzin 2004). Mehrere Arbeiten (vgl. Harris u. Pinder 1995; Kimms u. Müller-Bungart 2003; Kuhn u. Defregger 2005) prüfen die Anwendungsvoraussetzungen von Revenue Managements bei der Auftragsfertigung von Sachgütern und kommen zu dem Schluss, dass diese prinzipiell als erfüllt betrachtet werden können (Tabelle C.1).

Tabelle C.1 Vergleich der Anwendungsvoraussetzungen von Revenue Management für die Dienstleistungs- und die Prozessindustrie (vgl. auch Talluri u. van Ryzin 2004, S.13–16, S. 574–576; Watanapa 2004)

| | Dienstleistungsindustrie | Prozessindustrie |
|----|--|---|
| 1. | Heterogene Nachfrage und Möglichkeit der Kundensegmentierung. | |
| 2. | Stochastische Nachfrage. | |
| 3. | Die Kapazität ist in diskreten Perioden verfügbar und verfällt zu Periodenbeginn. Aufträge sind einzelnen Perioden exakt zugeordnet. Eine Ablaufplanung ist daher nicht notwendig. | Die Kapazität ist kontinuierlich verfügbar und verfällt kontinuierlich. Die Auslieferung des Auftrags ist zeitpunktbezogen. Eine Ablaufplanung der Aufträge ist notwendig. |
| 4. | Weitgehend fixe Kapazität und dynamische Nachfrage. | Weitgehend fixe Kapazität und dynamische Nachfrage, die durch vom Kunden gewünschte Liefertermine, dem Zustand der Ressourcen und dem Ergebnis der Ablaufplanung bestimmt wird. Die Änderung des Kapazitätsangebots ist in Grenzen durch eine Intensitätsanpassung möglich. |
| 5. | Hohe Fixkosten und geringe Grenzkosten. | |
| 6. | Vorausbuchungsmöglichkeit. | |
| 7. | Wirtschaftliche Handlungsfreiheit. | |
| 8. | Datenverfügbarkeit und Informationssysteme. | |
| 9. | Unternehmenskultur und Managementunterstützung. | |

C.2.2 Instrumente: Preis- und Kapazitätsmanagement

Von den Instrumenten des Revenue Managements (für einen Überblick vgl. Klein u. Steinhardt 2008; Talluri u. van Ryzin 2004) wollen wir im Folgenden nur die für die Sachleistungsindustrie im Allgemeinen und die auftragsgebundene Prozessindustrie im Besonderen geeignete Preis-Mengen-Steuerung (vgl. Klein 2001) betrachten. Die Preis-Mengen-Steuerung wird in eine erlös- und eine mengenorientierte Steuerung unterschieden (vgl. Klein u. Steinhardt 2008). Bei der mengenorientierten Steuerung wird die Gesamtkapazität in Teilkapazitäten mit unterschiedlichen Preisen aufgeteilt. Im Bereich der Luftverkehrsindustrie entsprechen die Teilkapazitäten den Kontingenten einzelner Buchungsklassen, bei der Auftragsfertigung handelt es sich um Teilkapazitäten, die für bestimmte

Auftragstypen wie bspw. großvolumige Aufträge mit spätem Liefertermin reserviert sind. Für die Aufteilung der Kapazitäten existieren in der Literatur eine Reihe von teilweise branchenspezifischen Planungsansätzen (vgl. bspw. Talluri u. van Ryzin 2004). Eine Nachfrage wird angenommen, wenn die explizit oder implizit nachgefragte Teilkapazität noch in ausreichendem Umfang verfügbar ist. Bei der erlösorientierten Steuerung wird der vom Nachfrager angebotene Preis mit einem internen, auf der Basis von Opportunitätskosten ermittelten Referenzpreis verglichen. Liegt der angebotene Preis über dem Referenzpreis, wird die Nachfrage akzeptiert, andernfalls wird sie abgelehnt. Die erlösorientierte Steuerung ermöglicht einen Verhandlungsprozess mit dem Kunden, indem unterschiedliche (Referenz-)Preise in Abhängigkeit verschiedener Lieferterminen bestimmt werden (vgl. bspw. Keskinocak u. Tayur 2004). Im Weiteren bezeichnen wir die mengenorientierte Steuerung als Kapazitätsmanagement bzw. Kapazitätssteuerung und die erlösorientierte Steuerung als Preismanagement bzw. Preissteuerung.³ Ein Preis- und Kapazitätsmanagement liegt vor, wenn beide Steuerungselemente nebeneinander eingesetzt werden, indem bspw. sowohl Teilkapazitäten für bestimmte Auftragsarten reserviert werden als auch über die Annahme von Aufträgen anhand von Referenzpreisen entschieden wird.

C.3 Stand der Forschung

Beginnend mit der Arbeit von Littlewood (1972) findet sich eine Fülle von Arbeiten zu Revenue Management-Planungsansätzen für die Dienstleistungsindustrie und hier vor allem die Luftverkehrsindustrie. Eine Übersicht findet sich bspw. in Talluri u. van Ryzin (2004). Ebenso existieren eine Reihe von empirischen Studien zum Revenue Management in der Dienstleistungsindustrie. So untersuchen bspw. Kimes (1994), Kimes u. Wirtz (2003) sowie Wirtz u. Kimes (2007) inwieweit Kunden Revenue Management als fair empfinden. Wangenheim u. Bayón (2006, 2007) analysieren die Auswirkungen von Revenue Management-Maßnahmen eines Flugunternehmens auf die Kundenzufriedenheit und Crystal et al. (2007) untersuchen Erfolgsfaktoren für Revenue Management in der Hotelindustrie.

Planungsansätze für den Einsatz von Revenue Management in der Sachleistungsindustrie sind erst vergleichsweise spät erschienen. Die Arbeiten unterscheiden sich im Hinblick auf die Steuerungsgrößen in Ansätze zur Auftragsannahmeentscheidung für preislich und terminlich fixierte Auftragsanfragen (vgl. Defregger u. Kuhn 2007; Elimam u. Dodin 2001; Kimms u. Müller-Bungart 2003; Kniker u. Burman 2001; Spengler u. Rehkopf 2005; Spengler et al. 2007), Ansätze zur Bestimmung von Lieferterminen für preisliche fixierte Aufträge (vgl.

³ In den in Abschn. 4 dargestellten Interviews der Vorstudie wird teilweise auch von "Pricing" gesprochen. Letzteres ist jedoch vom Konzept des "Dynamic Pricing" (vgl. bspw. Klein u. Steinhardt 2008) abzugrenzen.

Keskinocak et al. 2001) sowie Ansätze zur Bestimmung von Angebotspreisen und Lieferterminen für Auftragsanfragen (vgl. Charnsirisakskul et al. 2006; Watanapa u. Techanitasawad 2005a, b). Die bisher einzige empirische Studie zum Einsatz von Revenue Management in der Sachgüterindustrie stammt unseres Wissens von Defregger u. Kuhn (2005). Anhand von 107 Unternehmen aus der Papier-, Stahl- und Aluminiumindustrie wird in dieser Studie untersucht, inwieweit in den genannten Branchen die Voraussetzungen für den Einsatz von Revenue Management gegeben sind und in welchem Umfang Revenue Management derzeit angewendet wird. Aufgrund der Stichprobe wird geschätzt, dass ca. 60 % der Unternehmen in den genannten Industrien die Anwendungsvoraussetzungen für Revenue Management erfüllen, Revenue Management aber noch nicht flächendeckend eingesetzt wird.

C.4 Qualitative Vorstudie und Arbeitshypothesen

Nachdem festgestellt werden konnte, dass die Prozessindustrie grundsätzlich für den Einsatz von Revenue Management geeignet ist, stellt sich die Frage nach der Akzeptanz, der Verbreitung und den konkreten Ausgestaltungsformen solcher Systeme.

Zu diesem Zweck wurden im Vorfeld der quantitativen Untersuchung 15 Vorgespräche mit Experten aus der Prozessindustrie, insbesondere aus der Chemie-(4), Pharma-(4), Metall-(3), Papier-(1), Erdöl-(2) und Glasindustrie(1), durchgeführt.

Die Relevanz von Revenue Management wurde branchenübergreifend weitestgehend als hoch betrachtet: “In den letzten Jahren hat sich die Prozessindustrie stark auf Kostensenkungsaktivitäten fokussiert. Das ist vielen Unternehmen gut gelungen. Die zusätzlichen Kostensenkungspotenziale sind jedoch gering. Daher wird Revenue Management eine zunehmend wichtigere Rolle für die Erlössteigerung einnehmen” (Vorstandsvorsitzender Metallunternehmen). “Der Einsatz von Revenue Management in der Prozessindustrie ist in den Startlöchern. Viele Unternehmen unserer Branche beschäftigen sich hiermit, es gibt aber noch keine einheitliche Standardlösung—wenn es eine geben wird, dann wird keiner darauf verzichten” (Bereichsleiter Pharmaunternehmen).

Verschiedene Manager, die im Vorfeld befragt wurden, stellten fest, dass die Bedeutung von Revenue Management generell für Unternehmen der Prozessindustrie hoch ist und mit steigender Unternehmensgröße sowie längerer Einsatzdauer steigt. Hierzu der Vice President Vertrieb eines führenden Erdölunternehmens: “Wir arbeiten seit Jahren an den Ertragshebeln Kostensenkung und Volumenzuwachs. Revenue Management und Pricing sind hingegen erst seit kurzem von uns aber auch zahlreichen anderen Wettbewerbern entdeckt worden. Was auffällt ist, dass je größer die Unternehmensgröße ist, desto professioneller kann Revenue Management eingesetzt werden, weil größere Budgets und mehr Ressourcen hierfür zu Verfügung stehen als in kleinen Betrieben”. Auch die Einsatzdauer wirkt sich positiv aus: “Je länger Revenue Management im Einsatz

ist, um so stärker sind die Learning-by-Doing-Effekte, vor allem in den ersten Jahren, und so erfolgreicher kann dieses Tool eingesetzt werden”.

Hinsichtlich der Ausgestaltung als preis- oder mengenbasiertes System scheint sich eine Entwicklung von einer reinen Kapazitätssteuerung hin zu einer kombinierten Preis- und Kapazitätssteuerung zu vollziehen: “In den ersten Jahren des Einsatzes war Revenue Management rein durch Kapazitätssteuerung geprägt. Schon ab dem dritten Jahr wurde die Preiskomponente miteinbezogen. Heute basiert Revenue Management auf einer Integration von Preis- und Kapazitätsmanagement” (Mitglied der Geschäftsführung eines internationalen Generikaherstellers).

Ebenfalls wurde von den Gesprächspartnern aus der Praxis hervorgehoben, dass die positive Auswirkung von Revenue Management mit der Integration in die Informationstechnologie zunimmt: “Die Vorteile des Revenue Managements wurden eindeutig erkennbar, als wir von einer Excel- zu einer SCM-Anwendung übergegangen sind, die es ermöglicht hat, z.B. die Auslastung des Maschinenparks verschiedener Werke noch effizienter und zeitnaher zu gestalten und die Akzeptanz von Revenue Management im Unternehmen zu erhöhen” (Produktionsleiter eines Chemiekonzerns).

Mit der Frage konfrontiert, wie sich der zukünftige Einsatz von Revenue Management entwickeln wird, gehen die befragten Experten von einer zunehmenden Verbreitung von Revenue Management Systemen aus: “Es gibt einen klaren Trend, die Themen Revenue Management und insbesondere Pricing auf die Agenda des Managements zu setzen. Das wird sich künftig verstärken, einfach weil sich weniger Unternehmen leisten können, Profitabilitätsquellen zu ignorieren. Revenue Management und Preisoptimierungen bieten solch eine Quelle, die in der Vergangenheit nicht genügend ausgeschöpft wurde” (Supply Chain Manager, Papier- und Verpackungsunternehmen).

Da die Hauptstudie überwiegend explorativen Charakter hat, steht die Überprüfung von (theoriegeleiteten) Hypothesen nicht im Mittelpunkt. Nichtsdestotrotz lassen sich die Äußerungen der Experten auf hypothesenähnliche Aussagen zuspitzen und werden im Verlauf der Untersuchung überprüft. Auf Basis dieser Vorgespräche wurden folgende Arbeitshypothesen formuliert:

Hypothese 1 Die Wichtigkeit von Revenue Management ist generell als hoch zu betrachten. Zudem steigt sie mit dem Umsatz und der Einsatzdauer im Unternehmen.

Hypothese 2 Die Ausprägung des Revenue Management-Ansatzes ist abhängig von der Dauer des Einsatzes im Unternehmen. Im Zeitablauf nimmt der Einsatz von preis- und kapazitätsgesteuerten System gegenüber reinen kapazitätsgesteuerten Systemen zu.

Hypothese 3 Die Einschätzung darüber, in welchem Maße Revenue Management zur Verbesserung der Erlössituation beiträgt, ist abhängig von der Implementierung.

Die Forschungsfrage des vorliegenden Beitrages ist es, Einsichten darüber zu gewinnen, wie Revenue Management von den Verantwortlichen in der

Prozessindustrie bewertet und eingesetzt wird. Im Fokus stehen dabei die aus Vorgesprächen abgeleiteten Arbeitshypothesen. Diese werden anhand der folgenden empirischen quantitativen Untersuchung überprüft.

C.5 Empirische Untersuchung

C.5.1 Datenerhebung

Die Datenerhebung wurde in dem Zeitraum Juli 2004 bis Februar 2005 in Deutschland durchgeführt. Anschließend wurde im Zeitraum November 2007 bis Mai 2008 bei ausgewählten Unternehmen eine Nacherhebung unternommen. Befragt wurden Mitarbeiter, die Führungsaufgaben im Rahmen der in Abschn. 3 dargestellten Aufgaben des Revenue Managements wahrnahmen. Die Befragung erfolgte durch persönliche Interviews anhand eines fünfteiligen Fragebogens. Die Teile eins und fünf des Fragebogens enthielten Hintergrundinformationen zur Studie. Die drei zentralen Teile umfassten die Erhebung wichtiger betriebswirtschaftlicher Kenngrößen des Unternehmens, Fragen zur Anwendung von Revenue Management im Unternehmen und Fragen zur generellen Einschätzung von Revenue Management (jeweils auf einer 1–7 Likert-Skala) sowie Doppelfragen zur Konsistenzprüfung. Zur Ermittlung der Gesprächspartner wurden zunächst 270 Unternehmen der Prozessindustrie (Pharmazeutische Industrie, Glas-, Erdöl-, Papier-, Metall- und Chemieindustrie) mit Firmensitz in Deutschland aus der Hoppenstedt- und der IHK-Unternehmensdatenbank zufällig ausgewählt. Anschließend wurde je Unternehmen ein relevanter Gesprächspartner aus den Bereichen Geschäftsführung, Geschäftsbereichsleitung, Produktionsmanagement und Werksleitung, Supply Chain Management, Customer Relationship Management oder Strategische Planung über die Presse- oder Kommunikationsabteilung des Unternehmens ermittelt und telefonisch nach der Bereitschaft zur Teilnahme an der Studie gefragt. Jeder Person, die sich zu einer Teilnahme an der Studie bereit erklärte, wurde der Fragebogen sowie ein Anschreiben, in dem die Ziele der Studie dargestellt und die wesentlichen Fachbegriffe erläutert wurden, zugesandt und es wurde ein Interviewtermin vereinbart. Zu Beginn des Interviewtermins wurden die wesentlichen Fachbegriffe erneut erläutert und sichergestellt, dass der Interviewpartner aufgrund seiner Ausbildung und seiner Funktion im Unternehmen in der Lage war, die Fragen korrekt zu beantworten. Durch diese Vorgehensweise sollte die Problematik des “wrong key informant” ausgeschlossen werden. Insgesamt wurden Interviews mit 124 Personen (46 % Prozent der kontaktierten Unternehmen) durchgeführt. Im Durchschnitt dauerte die Befragung 90 Minuten. Abbildung C.1 gibt die Branchenzugehörigkeit der beteiligten Unternehmen wieder. Abbildung C.2 stellt die Verteilung des Jahrumsatzes der an der Studie beteiligten Unternehmen dar.

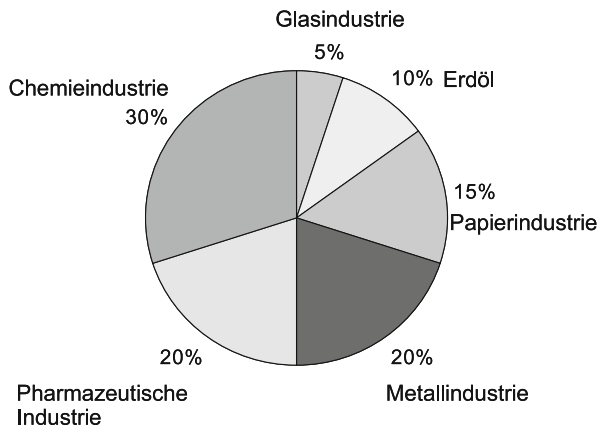


Abb. C.1 Industriezugehörigkeit der befragten Unternehmen

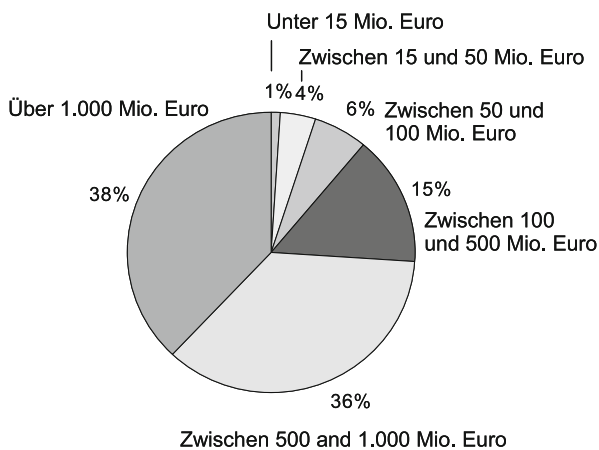


Abb. C.2 Jahresumsatz der befragten Unternehmen

Für die Allgemeingültigkeit der Ergebnisse ist relevant, ob ein “Non-Response-Bias” ausgeschlossen werden kann, d.h. die Teilnahme an der empirischen Studie unabhängig von der Einschätzung der Bedeutung von Revenue Management erfolgte (vgl. Friedrichs 1990). Um dies zu überprüfen, wurden beim ersten Kontakt alle Personen zur Bedeutung des Revenue Managements in ihrem Unternehmen befragt. 7 % der Nichtteilnehmer und 5 % der Teilnehmer maßen dem Thema eine geringe Bedeutung zu. Es kann somit davon ausgegangen werden, dass kein “Non-Response-Bias” vorliegt. Unter den Teilnehmern hat die Funktion innerhalb des Unternehmens keinen Einfluss auf die wahrgenommene Bedeutung von Revenue Management (ANOVA, $F = 0,986$; $p > 0,4$).

Als statistische Testmethoden zur Überprüfung der oben genannten Arbeitshypothesen kamen Korrelationsanalysen (nach Pearson, da metrische

Variablen), t-Tests und Varianzanalysen (ANOVA) zum Einsatz. Im Fall von heterogenen Varianzen (Levene-Test mit $p < 0,2$) haben wir im Rahmen der Varianzanalyse statt des F-Tests den Brown-Forsyth-Test verwendet.

Im Folgenden geben wir die Resultate der Studie wieder. Dabei werden in Abschn. 5.2 zunächst die Ergebnisse zum derzeitigen Stand des Revenue Managements dargestellt. Anschließend erfolgt die Darstellung von Trends und Meinungen in Abschn. 5.3.

C.5.2 Ergebnisse: Derzeitiger Stand des Revenue Managements in der Prozessindustrie

Ca. 80 % der befragten Unternehmen setzen nach eigener Aussage Revenue Management in (irgend-) einer, nicht zwingend systemgestützten Form ein. Im Folgenden werden diese Anwendungen analysiert.

C.5.2.1 Fokus, Umsetzung und Einführungszeitraum

Mit 74 % liegt die Mehrzahl der Anwendungen im Bereich des Kapazitätsmanagements, während nur 15 % der Applikationen preisbasiert und nur 5 % sowohl kapazitäts- als auch preisbasiert sind (vgl. Abb. C.3).

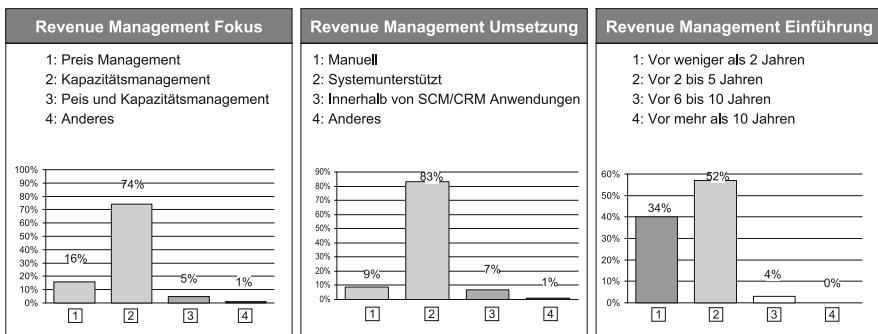


Abb. C.3 “Welche der folgenden Revenue Management-Ansätze werden angewendet?” (Revenue Management Fokus), “In welcher Form wird Revenue Management angewendet?” (Revenue Management Umsetzung), “Seit wann wird in Ihrem Unternehmen Revenue Management angewendet?” (Revenue Management Einführung)

Die Umsetzung von Revenue Management erfolgt in der Mehrzahl der Fälle (83 %) mittels einfachem elektronischen Datenaustausch, bspw. durch Tabellenkalkulations-Dateien. In 9 % der Fälle erfolgt der Datenaustausch manuell.

Nur 7 % der befragten Unternehmen wenden komplexe und weitgehend automatisierte Systeme an. Diese sind in Supply Chain Management oder Customer Relationship Management Applikationen integriert.

Die Einführung von Revenue Management erfolgte in 86 % der Fälle innerhalb der letzten fünf Jahre, wobei die Einführung zum Zeitpunkt der Befragung teilweise noch nicht vollständig abgeschlossen war. 34 % der Einführungen erfolgte innerhalb der letzten zwei Jahre, 52 % in einem Zeitraum zwischen fünf und zwei Jahren vor dem Erhebungszeitpunkt und 4 % in einem Zeitraum zwischen zehn und sechs Jahren vor dem Erhebungszeitpunkt. Keine Einführung liegt weiter zurück als zehn Jahre. Im Vergleich zu Anwendungen im Dienstleistungsbereich und hier insbesondere in der Luftfahrtindustrie, die bereits seit den 70er Jahren mit Revenue Management arbeitet, besitzt die Prozessindustrie damit noch keine langjährigen Erfahrungen mit Revenue Management (vgl. Talluri u. van Ryzin 2004; Weatherford u. Bodily 1992).

C.5.2.2 Bedeutung von Revenue Management

Abbildung C.4 zeigt den Anteil der nach Größenklassen (gemessen in Umsatz) differenzierten Unternehmen, die Revenue Management als “wichtig” oder “sehr wichtig” erachten. Die betrachtete Wichtigkeit ist generell als hoch einzuschätzen, und steigt zudem—wie aufgrund der Vorgespräche bereits vermutet (H1)—mit dem Umsatz des Unternehmens (mäßige signifikante Korrelation zwischen Wichtigkeit und Umsatz $r_{\text{pearson}} = 0,224$; $p < 0,05$).

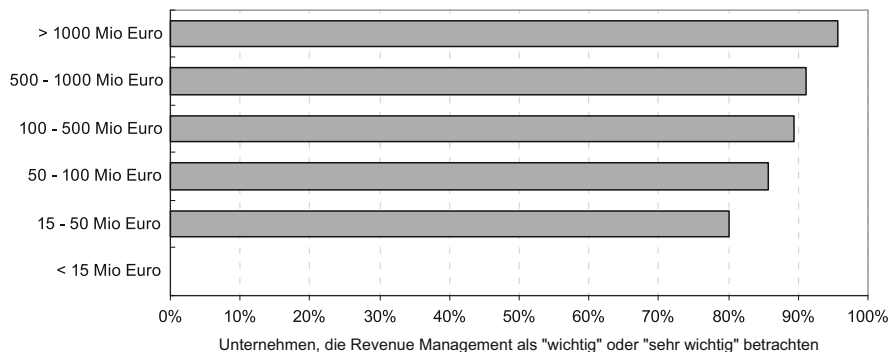


Abb. C.4 Wichtigkeit von Revenue Management und Unternehmensgröße

Abbildung C.5 stellt die durchschnittliche Bedeutung, die Revenue Management auf einer 1–7 Likert-Skala beigemessen wird, in Abhängigkeit des Steuerungskonzepts (Preis, Kapazität, Preis und Kapazität) sowie der Einsatzdauer dar.

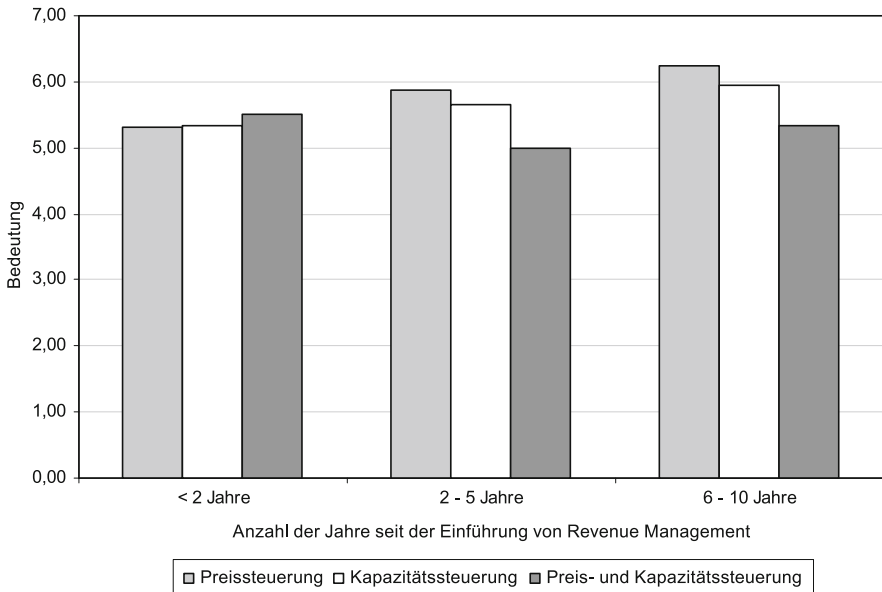


Abb. C.5 Bedeutung von Revenue Management in Abhängigkeit der Einsatzdauer und des Steuerungskonzepts

Generell korrelieren Einsatzdauer (in Jahren) und Bedeutung schwach positiv ($r_{\text{pearson}} = 0,233$, $p < 0,001$). Der Grund hierfür kann entweder in einer im Zeitablauf steigenden Bedeutung liegen oder darin liegen, dass diejenigen Unternehmen, die dem Revenue Management eine hohe Bedeutung beimessen, bereits früh solche Systeme implementiert haben.

C.5.2.3 Ausprägung des Revenue Management Systems

Abbildung C.6 zeigt die Ausprägung des Revenue Management-Systems (Preissteuerung, Kapazitätssteuerung sowie Preis- und Kapazitätssteuerung) in Abhängigkeit der Einsatzdauer von Revenue Management im Unternehmen. Die Hypothese H2 wird insofern gestützt, als mit zunehmender Einsatzdauer der Anteil der reinen kapazitätsgesteuerten oder preisgesteuerten Revenue Management-Systeme abnimmt, während der Anteil der kapazitäts- und preisgesteuerten Systeme zunimmt. Diese Tatsache spiegelt sich auch in der signifikant unterschiedlichen mittleren Einsatzdauer von Revenue Management in Abhängigkeit der Ausprägung wider: Die mittlere Einsatzdauer von Revenue Management beträgt im Falle der

Preissteuerung 2,52 Jahre, im Falle der Kapazitätssteuerung 3,41 Jahre und im Falle der kombinierten Preis- und Kapazitätssteuerung 5,91 Jahre (ANOVA; Brown-Forsythe = 4,858, $df_1 = 2$, $df_2 = 20,6$, $p < 0,01$).

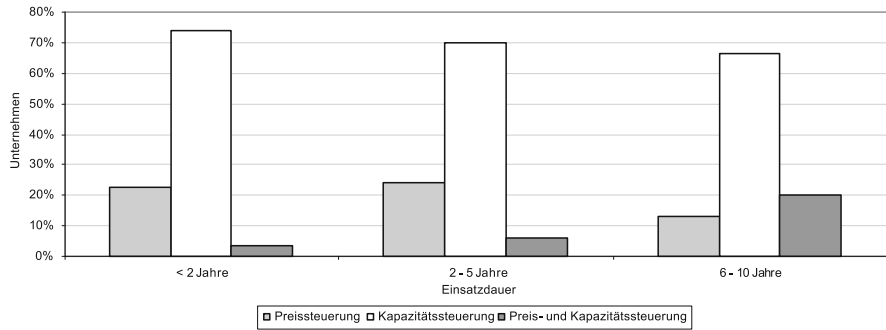


Abb. C.6 Ausprägung des Revenue Management-Systems in Abhängigkeit der Einsatzdauer von Revenue Management

C.5.2.4 Revenue Management als Massnahme zur Erkösverbesserung

Abbildung C.7 gibt die Bedeutung, die Revenue Management für die Verbesserung der Erlössituation auf einer 1–7 Likert-Skala zugemessen wird, in Abhängigkeit der Implementierung wieder (H3). Im Falle einer manuellen Implementierung liegt keine systematische IT-Einbindung vor, bei einer systemgestützten Implementierung ist Revenue Management in Form (irgend-) eines IT-Systems, in der Regel mittels Office-Systemen, realisiert und bei einer SCM/CRM-Implementierung ist Revenue Management innerhalb eines Supply Chain Management (SCM) oder Customer Relationship Management (CRM) Systems umgesetzt. Im Mittel wird die Bedeutung von Revenue Management je höher eingeschätzt, desto stärker die IT-Implementierung ist (ANOVA; Brown-Forsythe = 16,965, $df_1 = 2$, $df_2 = 18,352$, $p < 0,000$).

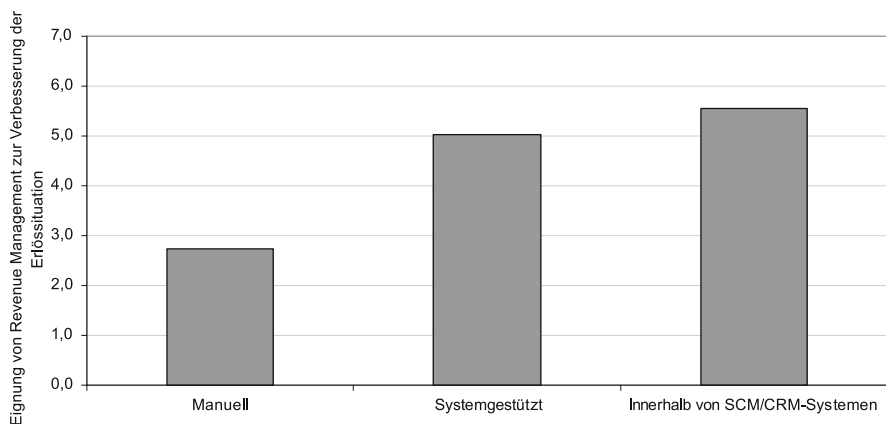


Abb. C.7 Einschätzung der Bedeutung von Revenue Management in Abhängigkeit der Implementierung

C.5.2.5 Zukünftiger Einsatz von Revenue Management

In der Prozessindustrie wird überwiegend von einer zunehmenden Verbreitung von Revenue Management Systemen ausgegangen (Mittelwert 5,56; Standardabweichung 0,97; 1–7 Likert-Skala). Es sind keine signifikanten Mittelwertsunterschiede innerhalb der betrachteten Branchen feststellbar (ANOVA; $F = 1,864$; $p > 0,1$)

C.5.3 Trends und Meinungen

C.5.3.1 Hindernisse bei der Einführung von Revenue Management

Als Hindernisse bei der Einführung von Revenue Management werden die in Abbildung C.8 aufgeführten Gründe genannt. In absteigender Reihenfolge der Häufigkeit ihrer Nennung sind dies: (1) Keine klar definierte und/oder kommunizierte Preisstrategie, (2) keine oder beschränkte Erfahrung mit Revenue Management, (3) das Fehlen eines geeigneten Revenue Management-Ansatzes, (4) das Fehlen relevanter Daten, (5) fehlende Unterstützung durch die Unternehmensleitung, (6) Preisverfall bei einer branchenweiten Etablierung von Revenue Management sowie, (7) ungeeignete oder fehlende IT-Systeme zur Unterstützung der Revenue Management-Anwendungen.

Als keine wesentlichen Hindernisse werden unzureichende IT-Systeme auf der Kundenseite, das Fehlen einer Revenue Management-Kultur im Unternehmen sowie ungeeignete oder fehlende Prozesse im Unternehmen beurteilt. Überhaupt nicht genannt wird die fehlende Akzeptanz von Revenue Management durch die Kunden. Insbesondere wird nicht befürchtet, dass sich die Kunden dauerhaft am kurzfristig möglichen niedrigen Preisniveau orientieren.

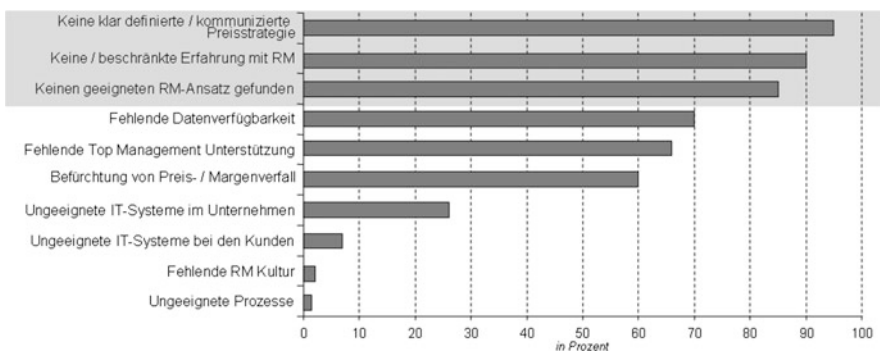


Abb. C.8 Hindernisse bei der Einführung von Revenue Management

C.5.3.2 Chancen und Risiken von Revenue Management

Nach den Chancen und Risiken beim Einsatz von Revenue Management befragt, sehen die Unternehmen mehr Chancen als Risiken.⁴ Diese wurden nach Häufigkeit der Nennungen sortiert (Abb. C.9). Bei den Chancen werden die Erhöhung des Umsatzes und der Kapazitätsauslastung, die Verringerung der Kosten durch bessere Auslastung der vorhandenen Kapazitäten oder den Abbau von (Über-) Kapazitäten, die Erhöhung der Effizienz sowie die Erschließung neuer Kunden und Märkte genannt. Weitere "weiche" Chancen werden im "Job Enrichment" von Stellen, bspw. der Stelle des Produktionsmanagers, der standortübergreifenden Harmonisierung von Kapazitätssteuerungsansätzen, im verbesserten Controlling der Kapazitäten sowie in der Einführung einer Unternehmenskultur der Erlösmaximierung gesehen.⁵

Als Risiken werden zu hohe Erwartungen an Erlössteigerungen, hohe Investitionen in IT-Systeme, die Resistenz gegenüber Revenue Management im Unternehmen, fehlendes Know How, die Erhöhung der Komplexität sowie der Verlust von Managementfokus genannt.

| Chancen | Risiken |
|--|--|
| <ul style="list-style-type: none"> • Umsatzwachstum durch verbessertes Pricing und optimierte Kapazitätsauslastung • Kosteneinsparungen aufgrund eines besseren Managements vorhandener Kapazitäten • Erschließung neuer Märkte oder Bedienen neuer Kunden • Erweiterung der Verantwortungsbereiche zum Beispiel im Bereich Produktionsleitung und der professionellen Entwicklungsmöglichkeiten • Harmonisierung von Kapazitätssteuerungsansätzen zum Beispiel in Unternehmensgruppen • Verbesserte Überwachung vorhandener Produktionskapazitäten und deren Auslastung • Einführung einer erlösmaximierenden Kultur | <ul style="list-style-type: none"> • Schaffung von zu hohen Erlös- oder Umsatzwachstumserwartungen • Hohe Investitionen in neue IT-Systeme oder deren Aufrüstung • Aufbau von Umsetzungsengpässen durch eine RM-resistente Unternehmenskultur • Fehlendes RM-Know-How sowie Mitarbeiter, denen man RM-Aufgaben anvertrauen kann • Erhöhung der Komplexität • Verlust von Managementfokus |

Abb. C.9 Chancen und Risiken bei der Einführung von Revenue Management

⁴ Diese Frage wurde offen gestellt, d.h. die Befragten konnten sich frei hierzu äußern, ohne Vorgabe von Antwortmöglichkeiten.

⁵ Weitere positive Effekte sind die standortübergreifende Harmonisierung von Kapazitätssteuerungsansätzen zum Beispiel in Unternehmen, die über verschiedene Produktionsstandorte mit unterschiedlichen Kapazitätssteuerungskonzepten verfügen. Durch die unternehmensweite Einführung eines einheitlichen Revenue Management-Ansatzes werden Abweichungen im Preis- und Kapazitätsmanagement zwischen den Standorten vermieden und es wird Komplexität abgebaut. Somit lassen sich zusätzlich positive Erfahrungen zur Kapazitätssteuerung leichter von einem Standort auf den anderen übertragen. Die verbesserte Überwachung der vorhandenen Produktionskapazität und deren Auslastung stellen einen weiteren Vorteil dar, der insbesondere bei Produktionsanlagen mit unterschiedlichen Linien oder Unternehmensgruppen mit mehr als einem Standort das Controlling der Kapazitäten und deren Auslastung erleichtert.

C.5.3.3 Alternativen zu Revenue Management

Als Alternative zum Revenue Management werden von ca. 60 % der Befragten verschiedene Varianten der Auslagerung von Produktionskapazität gesehen, um dadurch das Fixkostenrisiko zu reduzieren. Im Einzelnen sind dies: (1) Die Auslagerung der Produktionskapazitäten an rechtlich und wirtschaftlich unabhängige Unternehmen, (2) die Verlagerung von Wertschöpfung an Zulieferer, (3) die Kooperation mit rechtlich und wirtschaftlich selbständigen Unternehmen im Rahmen von Produktionsnetzwerken sowie, (4) die Verlagerung der Produktionskapazitäten an eigene Standorte in Niedriglohnländer. Ca. 15 % der befragten Unternehmen sehen jedoch keine Alternativen zu Revenue Management und sagen aus, dass es heute bereits zahlreiche Anwendungen von Revenue Management gibt, die jedoch nicht mit dieser Bezeichnung gekennzeichnet werden, sondern mit alternativen Begriffen wie z.B. EBIT-Optimierung in der Produktion, Preis- und Erlös-Management, Preis- und Erlös-Optimierung, Erlös und Pricing Prozess Optimierung bzw. Management und Yield Management. Als weitere Alternative wird die Einführung und Nutzung von Produktionsplanungssystemen zur besseren Einplanung von Aufträgen auf die vorhandenen Kapazitäten genannt (ca. 15 %).

C.5.3.4 Positionen zum Revenue Management

Im letzten Abschnitt der Erhebung wurden die Teilnehmer nach der Zustimmung zu verschiedenen Positionen im Hinblick auf Revenue Management befragt (Abb. C.10).

Einem Revenue Management-Ansatz mit Fokus auf Preis- und Kapazitätsmanagement wird ein höheres Potential als einem reinen Preis- oder Kapazitätsmanagement eingeräumt. Im Zusammenhang mit dieser Aussage wird hervorgehoben, dass das Kapazitätsmanagement in der Vergangenheit im Vordergrund stand, während das Preismanagement in den letzten Jahren an Bedeutung gewonnen hat. Die zweithöchste Zustimmung erfährt die Aussage, dass der Einsatz von Revenue Management zu Umsatzwachstum führt. Deutlich wird die Aussage verneint, dass Revenue Management kein Potential in der Prozessindustrie besitzt.

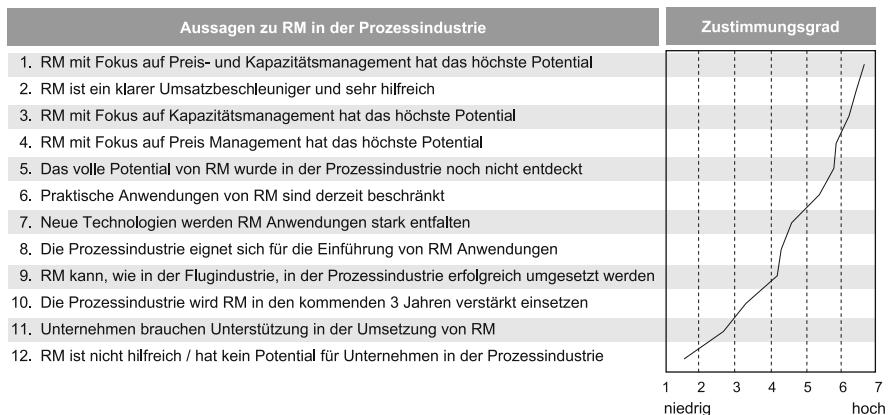


Abb. C.10 Zustimmungsgrad zu Aussagen zum Revenue Management

C.6 Wesentliche Ergebnisse und Limitationen der Studies

C.6.1 Wesentliche Ergebnisse

Die vorliegende Untersuchung ist unseres Wissens die erste Studie, die auf Basis einer Befragung von mehr als 120 Unternehmen deskriptive und schließende Aussagen zum Einsatz von Revenue Management in der Prozessindustrie liefert. Dabei konnten die folgenden wesentlichen Ergebnisse erzielt werden:

In der überwiegenden Mehrzahl der von uns befragten Unternehmen werden Revenue Management Konzepte im weiteren Sinne eingesetzt. Wurde bereits in einer Reihe von Studien darauf hingewiesen, dass für die auftragsfertige Sachleistungsindustrie die Voraussetzungen für den Einsatz von Revenue Management erfüllt sind, so wird in unserer Studie zum ersten Mal gezeigt, dass Revenue Management auch tatsächlich eingesetzt wird. Der ermittelte Anteil der Unternehmen in Höhe von 80 % liegt dabei noch deutlich über den von Defregger u. Kuhn (2005) geschätzten 60 %. Allerdings ist zu konstatieren, dass im Vergleich zum Stand der Wissenschaft in der Mehrzahl der Fälle vergleichsweise rudimentäre Konzepte Verwendung finden.

Im schließenden Teil der Studie konnten insbesondere zwei Punkte aufgezeigt werden. Zum einen steigt die dem Revenue Management beigemessene Bedeutung mit der Unternehmensgröße. Größere Unternehmen scheinen also im Hinblick auf den Einsatz des vergleichsweise neuen Konzeptes eher als (Prozess-) Innovatoren aufzutreten. Des Weiteren nehmen mit der Einsatzdauer die dem Revenue Management beigemessene Bedeutung sowie der Anteil kombinierter Preis- und Kapazitätskonzepte zu, während sich gleichzeitig eine zunehmende IT-Umsetzung der Konzepte positiv auf deren Bewertung auswirkt. Der erfolgreiche Einsatz von

Revenue Management Systemen erfordert also einen langfristigen Lernprozess, in dessen Verlauf zunehmend komplexere Systeme zum Einsatz kommen.

Im offenen Teil der Studie zeigt sich, dass die wesentlichen Hindernisse bei der Einführung von Revenue Management in der Prozessindustrie in der fehlenden Preisstrategie, geringen Erfahrungen und dem Fehlen geeigneter Konzepte zu finden sind. An dieser Stelle ist die Wissenschaft—über die bereits erfolgten Beiträge hinaus—aufgefordert, die vorhandenen Ansätze auf die spezifischen Belange der Prozessindustrie anzupassen und mit belastbaren Preisstrategien zu verbinden.

C.6.2 Limitationen

Unsere Studie besitzt jedoch auch eine Reihe von Limitationen. Erstens wurde diese Studie als Querschnittsuntersuchung in einem bestimmten Zeitraum durchgeführt und stellt daher nicht dar, wie sich Perspektiven im Laufe der Zeit verändert haben. Darauf aufbauende Längsschnittstudien können zum einen zeigen, wie sich die Einstellungen zu Revenue Management im Laufe der Zeit ändern und erhöhen zum anderen die Gültigkeit von kausalen Schlüssen speziell in theoretisch bislang wenig erschlossenen Bereichen (Rindfleisch et al. 2008). Zweitens ist die Studie geographisch auf Deutschland beschränkt. Interessant wäre eine Ausdehnung auf den europäischen oder nordamerikanischen Wirtschaftsraum, um Unterschiede und Gemeinsamkeiten zwischen den Wirtschaftsregionen herauszuarbeiten. Drittens ist ein Single-Source-Bias nicht auszuschließen, da wir nur eine Person je Unternehmen befragt haben. Zwar wurden die Interviewpartner als Zuständige für Revenue Management identifiziert, allerdings gehören sie unterschiedlichen Funktionsbereichen im Unternehmen (Marketing, Vertrieb, Produktion, Supply Chain Management, Strategische Planung) an. Künftige Studien sollten mehrere Personen in verschiedenen Funktionen eines Unternehmens befragen, um eine funktionsspezifische Differenzierung der Perspektiven zu ermöglichen.

Literatur

- Belobaba, P. P. (1989). Application of a probabilistic decision model to airline seat inventory control. *Operations Research*, 37(2), 183–197.
- Charnsirisakskul, K., Griffin, P. M., & Keskinocak, P. (2006). Pricing and scheduling decisions with leadtime flexibility. *European Journal of Operations Research*, 171(1), 153–169.
- Crystal, C. R. (2007). *Revenue management performance drivers: An empirical analysis in the hotel industry*. PhD Dissertation, Georgia Institute of Technology.
- Defregger, F., & Kuhn, H. (2007). Revenue management for a make-to-order company with limited inventory capacity. *OR Spectrum*, 29(1), 137–156.

- Elimam, A. A., & Dodin, B. M. (2001). Incentives and yield management in improving productivity of manufacturing facilities. *IIE Transactions*, 33(6), 449–462.
- Friedrichs, J. (1990). *Methoden der Empirischen Sozialforschung*, 14. Aufl. Opladen: Westdeutscher Verlag.
- Harris, F. H., & Pinder, J. P. (1995). A revenue management approach to demand management and order booking in assemble-to-order manufacturing. *Journal of Operations Management*, 13(4), 299–309.
- Keskinocak, P., Ravi, R., & Tayur, S. (2001). Scheduling and reliable lead-time quotation for orders with availability intervals and lead-time sensitive revenues. *Management Science*, 47(2), 264–279.
- Keskinocak, P., & Tayur, S. (2004). Due-date management policies. In D. Simchi-Levi, S. D. Wu, & Z. M. Shen (Eds.), *Handbook of quantitative supply chain analysis: Modelling in the e-business era. International series in operations research and management science* (pp. 485–553). Norwell: Kluwer.
- Kimes, S. E. (1994). Perceived fairness of yield management. *Cornell Hotel and Restaurant Administration Quarterly*, 35(1), 22–29.
- Kimes, S. E., & Wirtz, J. (2003). Has revenue management become acceptable? Findings from an international study on the perceived fairness of rate fences. *Journal of Service Research*, 6(2), 125–135.
- Kimms, A., & Klein, R. (2005). Revenue management im Branchenvergleich. *Zeitschrift für Betriebswirtschaft*. Ergänzungsheft 1 “Revenue Management”, 1–30.
- Kimms, A., & Müller-Bungart, M. (2003). Revenue Management beim Verkauf auftragsorientierter Sachleistungen. Arbeitspapier, Lehrstuhl für Produktion und Logistik, Technischen Universität Bergakademie Freiberg.
- Klein, R. (2001). Revenue management: Quantitative Methoden zur Erlösmaximierung in der Dienstleistungsproduktion. *Betriebswirtschaftliche Forschung und Praxis*, 53(3), 245–259.
- Klein, R., & Steinhardt, C. (2008). *Revenue management: Grundlagen und Mathematische Methoden*. Berlin: Springer.
- Klophaus, R., & Pölt, S. (2007). Airline overbooking with dynamic spoilage costs. *Journal of Revenue Management & Pricing*, 6(1), 9–18.
- Kniker, T. S., & Burman, M. H. (2001). *Applications of revenue management to manufacturing*. Proceedings of the Third Aegean International Conference on Design and Analysis of Manufacturing Systems, Tinos Island, Greece, 19–22 May 2001.
- Kuhn, H., & Defregger, F. (2005). *Revenue Management in der Sachleistungswirtschaft: Eine empirische Untersuchung am Beispiel der Papier-, Stahl- und Aluminiumindustrie* (Diskussionsbeiträge der Wirtschaftswissenschaftlichen Fakultät Ingolstadt, Nr. 171). Katholische Universität Eichstätt-Ingolstadt.
- Lindenmeier, J., & Tscheulin, D. K. (2003). Yield management—Ein state-of-the-art. *Zeitschrift für Betriebswirtschaft*, 73(6), 629–662.

- Littlewood, K. (1972). *Forecasting and control of passenger bookings*. AGIFORS Symposium Proceedings 12, 95–117.
- Netessine, S., & Shumsky, R. (2002). Introduction to the theory and practice of yield management. *INFORMS Transactions on Education*, 3(1), 34–44.
- Rindfleisch, A., Malter, A. J., Ganesan, S., & Moorman, C. (2008). Cross-sectional versus longitudinal survey research. *Journal of Marketing Research*, 45(3), 261–279.
- Rothstein, M. (1971). An airline overbooking model. *Transportation Science*, 5(2), 180–192.
- Smith, B. C., Leimkuhler, J. F., & Darrow, R. M. (1992). Yield management at American Airlines. *Interfaces*, 22(1), 8–31.
- Spengler, T., & Rehkopf, S. (2005). Revenue management Konzepte zur Entscheidungsunterstützung bei der Annahme von Kundenaufträgen. *Zeitschrift für Planung*, 16(2), 123–146.
- Spengler, T., Rehkopf, S., & Volling, T. (2007). Revenue management in make-to-order manufacturing—An application to the iron and steel industry. *OR Spectrum*, 29(1), 157–171.
- Statistisches Bundesamt. (2008). Volkswirtschaftliche Gesamtrechnungen—Inlandsproduktberechnung Stand Mai 2008. Fachserie 18, Reihe 1.4. Wiesbaden.
- Talluri, K. T., & van Ryzin, G. J. (2004). *Revenue management*. Boston: Kluwer.
- Wangenheim, F., & Bayón, T. (2006). Effects of capacity-driven service experiences on customer usage levels: Why revenue management systems are due for change. *MSI Reports*, 1, 69–87.
- Wangenheim, F., & Bayón, T. (2007). Behavioral consequences of overbooking service capacity. *Journal of Marketing*, 71(4), 36–47.
- Watanapa, B. (2004). Make-to-order bidding models with contingent orders and multiple customer classes: A revenue management approach. Doctoral thesis, Asian Institute of Technology, Bangkok.
- Watanapa, B., & Techanitasawad, A. (2005a). Simultaneous price and due date settings for multiple customer classes. *European Journal of Operational Research*, 166(2), 351–368.
- Watanapa, B., & Techanitasawad, A. (2005b). A genetic algorithm for the multi-class contingent bidding model. *OR Spectrum*, 27(4), 425–549.
- Weatherford, L. R., & Bodily, S. E. (1992). A taxonomy and research overview of perishable-asset revenue management: Yield management, overbooking, and pricing. *Operations Research*, 40(5), 831–844.
- Wirtz, J., & Kimes, S. E. (2007). The moderating role of familiarity in fairness perceptions of revenue management pricing. *Journal of Service Research*, 9(3), 229–240.

About the Author

Dr. Danilo Zatta, Partner and Managing Director at The Boston Consulting Group (BCG) in Munich, is a leading expert in topline growth with over 20 years of consulting experience. He specialized in profit improvement on the revenue side. Before joining BCG, he worked for several of the world's leading consultancies in the fields of strategy and marketing.

Danilo has conducted hundreds of projects both in Europe and globally for large corporations as well as for medium-sized companies and private equity investors in numerous sectors. He was thus able to develop strong expertise in e.g. strategies, sales and pricing excellence programs, M&A and post-merger integration, pricing processes, as well as business and revenue models.

He has published over 20 books on topics including corporate strategies and pricing. His articles are regularly published in e.g. Harvard Business Review and The Journal of Revenue and Pricing Management. He is a regular speaker and chairman at events, forums and leading business schools.

Danilo studied Economics at the Luiss University in Rome, Italy as well as at the UCD in Dublin, Ireland. He holds a Master of Business Administration (MBA) from INSEAD of Fontainebleau, France and Singapore. He received his doctoral degree (Ph.D.) in revenue management and pricing at the Technical University of Munich, Germany.

You can reach out to Danilo using the following email for feedbacks about the book or exchanges on e.g. revenue management, pricing and sales excellence:

danilo.zatta@alumni.insead.edu

References

- AMR Research. (2010). *Revenue management: A key to profitability for the high-tech industry*. Redwood Shores, CA: AMR Research Custom Executive Summary in Collaboration with Model N.
- Bailey, E. E., Graham, D. R., & Kaplan, D. P. (1985). *Deregulating the airlines*. Cambridge, MA: MIT Press.
- Barut, M., & Sridharan, V. (2005). Revenue management in order-driven production systems. *Decision Sciences*, 36(2), 287–316.
- Beckmann, D., Menkhoff, L., & Suto, M. (2008). Does culture influence asset managers' views and behavior? *Journal of Economic Behavior and Organization*, 67(1), 624–643.
- Belobaba, P. P. (1989). Application of a probabilistic decision model to airline seat inventory control. *Operations Research*, 37(2), 183–197.
- Blumenthal, P., Petersen, I., & Schubert, T. (2008). *Application of revenue management to the manufacturing industry* (Technical Report). Braunschweig: Braunschweig University of Technology.
- Boyd, E. A. (1998). Airline alliance revenue management. *OR/MS Today*, 25, 28–31.
- Buhl, H. U., Klein, R., Kolb, J., & Landherr, A. (2011). CR²M—An approach for capacity control considering long-term effects on the value of a customer for the company. *Journal of Management Control*, 22(2), 187–204.
- Charnsirisakskul, K., Griffin, P. M., & Keskinocak, P. (2006). Pricing and scheduling decisions with leadtime flexibility. *European Journal of Operations Research*, 171(1), 153–169.
- Chiang, W.-C., Chen, J. C. H., & Xu, X. (2007). An overview of research on revenue management: Current issues and future research. *International Journal of Revenue Management*, 1(1), 97–128.
- Choi, S., & Mattila, A. S. (2004). Hotel revenue management and its impact on customers' perception of fairness. *Journal of Revenue & Pricing Management*, 2(4), 303–314.
- Coy, P. (2000, April 10). The power of smart pricing: Companies are fine-tuning their price strategies—And it's paying off. *Business Week*, 160–164.
- Cross, R. (1997). *Revenue management: Hard-core tactics for market domination*. New York: Broadway Books.
- Crystal, C. R. (2007). *Revenue management performance drivers: An empirical analysis in the hotel industry*. Thesis, Georgia Institute of Technology, Atlanta.
- Daly, J. L. (2002). *Pricing for profitability: Activity-based pricing for competitive advantage*. New York: Wiley.

- Defregger, F., & Kuhn, H. (2005). *Revenue management in der Sachleistungswirtschaft: Eine empirische Untersuchung am Beispiel der Papier-, Stahl- und Aluminiumindustrie* (Research Report no. 171). Ingolstadt, DE: Katholische Universität Eichstätt-Ingolstadt.
- Defregger, F., & Kuhn, H. (2007). Revenue management for a make-to-order company with limited inventory capacity. *OR Spectrum*, 29(1), 137–156.
- Destatis—Federal Statistics Office Germany. (2013). Volkswirtschaftliche Gesamtrechnungen—Inlandsproduktberechnung, published on 5 March. Fachserie 18, Reihe 1.4. Wiesbaden.
- Dun & Bradstreet Sales & Marketing Database. (2005). Retrieved from <http://www.dnb.com/sales-marketing/14881774-1.html>
- Dun & Bradstreet Sales & Marketing Database. (2012). Retrieved January 4, 2012, from <http://www.dnb.com/sales-marketing/14881774-1.html>
- Eckes, G. (2001). *General electric's six sigma revolution: How general electric and others turned process into profits*. New York: Wiley.
- Elimam, A. A., & Dodin, B. M. (2001). Incentives and yield management in improving productivity of manufacturing facilities. *IIE Transactions*, 33(6), 449–462.
- Elliott, T. L. (2003). Maximising revenue production while cutting costs: An airline industry mandate. *Journal of Revenue and Pricing Management*, 1(4), 355–368.
- Fleischmann, M., Hall, J. M., & Pyke, D. F. (2004). Smart pricing. *MIT Sloan Management Review*, 45(2), 9–13.
- Friedrichs, J. (1990). *Methoden der Empirischen Sozialforschung* (14th ed.). Opladen: Westdeutscher Verlag.
- Harris, F. H., & Pinder, J. P. (1995). A revenue management approach to demand management and order booking in assemble-to-order manufacturing. *Journal of Operations Management*, 13(4), 299–309.
- Hintsches, A., Spengler, T., Volling, T., Witting, K., & Priegnitz, G., (2009). *Capacity control in make-to-order manufacturing: Introducing revenue management to ThyssenKrupp VDM* (Working Paper). Braunschweig: Braunschweig University of Technology.
- Huefner, R. J., & Largay, J. A. (2013). Identifying revenue opportunities via capacity analysis. *Journal of Revenue and Pricing Management*, 12(3), 305–312.
- IIE. (2013). *Webpage of the Institute of Industrial Engineers*. Retrieved February 7, 2013 from <http://www.iienet.org/Landing.aspx?id=887>
- Immelt, J. R., & Stewart, T. A. (2006). Growth as a process: The HBR interview. *Harvard Business Review*, 1–12.
- Kahneman, D., Knetsch, J. L., & Thaler, R. (1986). Fairness as a constraint on profit seeking: Entitlements in the market. *American Economic Review*, 76(4), 728–741.
- Keskinocak, P., Ravi, R., & Tayur, S. (2001). Scheduling and reliable lead-time quotation for orders with availability intervals and lead-time sensitive revenues. *Management Science*, 47(2), 264–279.
- Keskinocak, P., & Tayur, S. (2004). Due-date management policies. In D. Simchi-Levi, S. D. Wu, & Z. M. Shen (Eds.), *Handbook of quantitative supply chain analysis: Modelling in the e-business era* (International series in operations research and management science, pp. 485–553). Norwell, MA: Kluwer.
- Kimes, S. E. (1994). Perceived fairness of yield management. *Cornell Hotel and Restaurant Administration Quarterly*, 35(1), 22–29.
- Kimes, S. E., & Wirtz, J. (2003a). Has revenue management become acceptable? Findings from an international study on the perceived fairness of rate fences. *Journal of Service Research*, 6(2), 125–135.
- Kimes, S. E., & Wirtz, J. (2003b). Perceived fairness of RM in the US golf industry. *Journal of Revenue & Pricing Management*, 1(4), 332–345.
- Kimms, A., & Klein, R. (2005). Revenue management im Branchenvergleich. *Zeitschrift für Betriebswirtschaft*. Ergänzungsheft 1 “Revenue Management”, 1–30.

- Kimms, A., & Müller-Bungart, M. (2003). Revenue Management beim Verkauf auftragsorientierter Sachleistungen (Arbeitspapier). Germany: Lehrstuhl für Produktion und Logistik, Technischen Universität Bergakademie Freiberg.
- Klein, R. (2001). Revenue management: Quantitative Methoden zur Erlösmaximierung in der Dienstleistungsproduktion. *Betriebswirtschaftliche Forschung und Praxis*, 53(3), 245–259.
- Klein, R., & Steinhardt, C. (2008). *Revenue management: Grundlagen und Mathematische Methoden*. Berlin, Germany: Springer.
- Klophaus, R., & Pölt, S. (2007). Airline overbooking with dynamic spoilage costs. *Journal of Revenue Management and Pricing*, 6(1), 9–18.
- Kniker, T. S., & Burman, M. H. (2001). *Applications of revenue management to manufacturing*. Proceedings of the Third Aegean International Conference on Design and Analysis of Manufacturing Systems, Tinos Island, Greece, 19–22 May 2001.
- Kocabiyikoglu, A., Popescu, I., & Stefanescu, C. (2010). *Pricing and revenue management with stochastic demand: Coordinated vs. hierarchical approaches* (Working Paper). Fontainebleau : INSEAD.
- Kocabiyikoglu, A., Popescu, I., & Stefanescu, C. (2013). *Pricing and revenue management: The value of coordination* (Working Paper). Fontainebleau: INSEAD.
- Kolisch, R., & Zatta, D. (2009). Stand und Perspektiven des Einsatzes von Revenue Management in der Prozessindustrie. *Zeitschrift für Planung und Unternehmenssteuerung*, 20(2), 197–214.
- Kolisch, R., & Zatta, D. (2012). Implementation of revenue management in the process industry of North America and Europe. *Journal of Revenue and Pricing Management*, 11(2), 191–209.
- Kolisch, R., & Zatta, D. (2014). Profit impact of revenue management in the process industry. *Journal of Revenue and Pricing Management*, 13, 483–507.
- Kuhn, H., & Defregger, F. (2005a). *Revenue Management in der Sachleistungswirtschaft: Eine empirische Untersuchung am Beispiel der Papier-, Stahl- und Aluminiumindustrie* (Diskussionsbeiträge der Wirtschaftswissenschaftlichen Fakultät Ingolstadt, Nr. 171). Ingolstadt, DE: Katholische Universität Eichstätt-Ingolstadt.
- Kuhn, H., & Defregger, F. (2005b). *Revenue management in der Sachleistungswirtschaft: Eine empirische Untersuchung am Beispiel der Papier-, Stahl- und Aluminiumindustrie* (Research Report no. 171). Ingolstadt, DE: Katholische Universität Eichstätt-Ingolstadt.
- Lindenmeier, J., & Tscheulin, D. K. (2003). Yield management—Ein state-of-the-art. *Zeitschrift für Betriebswirtschaft*, 73(6), 629–662.
- Littlewood, K. (1972). *Forecasting and control of passenger bookings*. AGIFORS Symposium Proceedings, 12, 95–117.
- Magee, D. (2009). *Jeff Immelt and the new GE way: Innovation, transformation and winning in the 21st century*. New York: McGraw-Hill.
- Martin, G. S., Resick, C. S., Keatingand, M. A., & Dickson, M. W. (2009). Ethical leadership across cultures: A comparative analysis of German and US perspectives. *Business Ethics*, 18(2), 127–144.
- McMahon-Beattie, U., Yeoman, I., Palmer, A., & Mudie, P. (2002). Customer perceptions of pricing and the maintenance of trust. *Journal of Revenue & Pricing Management*, 1(1), 25–35.
- Mohaupt, M., & Hilbert, A. (2014). Customer-centric revenue management in manufacturing—A decision support system. Twenty Second European Conference on Information Systems, Tel Aviv, Israel, 1–15.
- Morrison, S., & Winston, C. (1995). *The evolution of the airline industry*. Washington, DC: The Brookings Institution.
- Müller-Bungart, M. (2006). *Revenue management with flexible products—Models and methods for the broadcasting industry*. Berlin: Springer.
- Netessine, S., & Shumsky, R. (2002). Introduction to the theory and practice of yield management. *INFORMS Transactions on Education*, 3(1), 34–44.
- Noack, H. C. (2005). Blickpunkt Kapazitätsmanagement: Revenue management gewinnt in der Prozessindustrie an Bedeutung. *Frankfurter Allgemeine Zeitung*, 10 October, p. 22.
- Phillips, R. L. (2005). *Pricing and revenue optimization*. Stanford, CA: Stanford Business Books.

- Quante, R., Meyr, H., & Fleischmann, M. (2009). Revenue management and demand fulfillment: Matching applications, models, and software. *OR Spectrum*, 31(1), 31–62.
- Rindfleisch, A., Malter, A. J., Ganesan, S., & Moorman, C. (2008). Cross-sectional versus longitudinal survey research. *Journal of Marketing Research*, 45(3), 261–279.
- Rothstein, M. (1971). An airline overbooking model. *Transportation Science*, 5(2), 180–192.
- Simon, H. (2009). *Hidden champions of the 21st century: Success strategies of unknown world market leaders*. New York: Springer.
- Simon, H., Bilstein, F. F., & Luby, F. (2006). *Manage for profit, not for market share: A guide to greater profits in highly contested markets*. Boston: Harvard Business School Publishing.
- Simon, H., Fasnacht, M., & Zatta, D. (2013). *Price management*. Milan: Franco Angeli.
- Smith, B. C., Leimkuhler, J. F., & Darrow, R. M. (1992). Yield management at American airlines. *Interfaces*, 22(1), 8–31.
- Spengler, T., & Rehkopf, S. (2005). Revenue management Konzepte zur Entscheidungsunterstützung bei der Annahme von Kundenaufträgen. *Zeitschrift für Planung und Unternehmenssteuerung*, 16(2), 123–146.
- Spengler, T., Rehkopf, S., & Volling, T. (2007). Revenue management in make-to-order manufacturing—An application to the iron and steel industry. *OR Spectrum*, 29(1), 157–171.
- Spengler, T., Volling, T., & Hintsches, A. (2008). Integration von revenue management Konzepten in der Auftragsannahme—konkretisiert für Unternehmen der eisen- und stahlerzeugenden Industrie [Special Issue]. *Zeitschrift für Betriebswirtschaft*, 4, 125–151.
- Statistisches Bundesamt. (2008). *Volkswirtschaftliche Gesamtrechnungen—Inlandsproduktberechnung Stand Mai 2008*. Fachserie 18, Reihe 1.4. Wiesbaden.
- Tacke, G., Ehrhardt, A., & Vidal, D. (2012). *The key to higher profits: Pricing power*. Bonn: Simon-Kucher & Partners. Retrieved from <https://itunes.apple.com/it/book/key-to-higher-profits-pricing/id625444865?mt=11>
- Talluri, K. T., & van Ryzin, G. J. (2004). *The theory and practice of revenue management*. Dordrecht, MA: Kluwer Academic.
- Tsubone, H., & Kobayashi, Y. (2002). Production seat booking system for the combination of make-to-order and make-to-stock products. *Production Planning & Control*, 13(4), 394–401.
- Voigt, K. I., Saatmann, M., & Schorr, S. (2008). Flexibility and revenue management in the automotive industry. *Journal of Enterprise Information Management*, 21(4), 424–439.
- Wallace, T. F. (1984). *APICS dictionary* (5th ed.). Falls Church, VA: American Production and Inventory Control Society.
- Wangenheim, F., & Bayón, T. (2006). Effects of capacity-driven service experiences on customer usage levels: Why revenue management systems are due for change. *MSI Reports*, 1, 69–87.
- Wangenheim, F., & Bayón, T. (2007). Behavioral consequences of overbooking service capacity. *Journal of Marketing*, 71(4), 36–47.
- Watanapa, B. (2004). *Make-to-order bidding models with contingent orders and multiple customer classes: A revenue management approach*. Doctoral Thesis, Asian Institute of Technology, Bangkok.
- Watanapa, B., & Techanitasawad, A. (2005a). Simultaneous price and due date settings for multiple customer classes. *European Journal of Operational Research*, 166(2), 351–368.
- Watanapa, B., & Techanitasawad, A. (2005b). A genetic algorithm for the multi-class contingent bidding model. *OR Spectrum*, 27(4), 425–549.
- Weatherford, L. R. (2009). Survey results from airlines that use revenue management software systems. *Journal of Revenue and Pricing Management*, 8(4), 323–329.
- Weatherford, L. R., & Bodily, S. E. (1992). A taxonomy and research overview of perishable-asset revenue management: Yield management, overbooking, and pricing. *Operations Research*, 40(5), 831–844.
- Weber, E. U., & Hsee, C. (1998). Cross-cultural differences in risk perception, but cross-cultural similarities in attitudes towards perceived risk. *Management Science*, 44(9), 1205–1217.
- Welch, D. (2003, May 5). Ford tames the rebate monster. *Business Week*, 5–6.

- Wirtz, J., & Kimes, S. E. (2007). The moderating role of familiarity in fairness perceptions of revenue management pricing. *Journal of Service Research*, 9(3), 229–240.
- Wolfe, E. W. (2003). Using logistic regression to detect item-level non-response bias in surveys. *Journal of Applied Measurement*, 4(3), 234–248.
- Zatta, D. (2007). *Revenue management*. Milan: Hoepli.