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Lehrstuhl für Operations Management

## Implementation of Revenue Management in the Process Industry: State of the Art, Application and Profit Impact

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## ACRONYMS AND SYMBOLS

\$	US Dollar
€	Euro
%	percentage
$\chi^2$	observed chi-square value
AV	average value
BRIC	Brazil, Russia, India, China
CEO	chief executive officer
CRM	customer relationship management
DF	degree of freedom
ERP	enterprise resource planning
H	hypothesis
GE	General Electric
GNP	gross national product
IT	information technology
MTO	make-to-order
MTS	make-to-stock
P	probability
p	significance level
PI	process industry
RM	revenue management
RMS	revenue management system
SCM	supply chain management
t	observed t value
VP	vice president
YM	yield management



# 1 INTRODUCTION

## 1.1 Motivation and background

The motivation to conduct this research on the employment of revenue management (RM)<sup>1</sup> in the process industry (PI)<sup>2</sup> comes from a series of interactions with top executives of several corporations in different locations in my professional activity as management 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)<sup>3</sup>, 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,

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<sup>1</sup> The 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.

<sup>2</sup> The 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 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).

<sup>3</sup> 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, 2000) or for its innovation capabilities (Magee, 2009).

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"<sup>4</sup>. The sales and marketing VP of a corporation active in the metal industry made a similar statement: "We successfully reduced costs with a dedicated 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"<sup>5</sup>.

Employing RM and thus optimizing pricing in the manufacturing environment, and more specifically in the process industry, is considered by many corporations<sup>6</sup> 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 and 2014a), magazines for practitioners<sup>7</sup>, newspapers (Noack, 2005) other academic researchers from prestigious universities quoting our work (e.g. Buhl *et al*, 2011; Huefner and Largay, 2013; Kocabiyikoglu *et al*, 2010 and 2013; Mohaupt and Hilbert, 2013) and publishers (Zatta, 2007) was constantly high.

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<sup>4</sup> Source: Interview conducted during the exploratory research.

<sup>5</sup> Source: Interview conducted during the exploratory research.

<sup>6</sup> This was reported to me personally by more than 100 top executives of corporations that we met during my over 10 years of project work at the management consulting company Simon-Kucher as well as during the exploratory research that will be presented in the next sections.

<sup>7</sup> 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://limpresaonline.net/articolo.php?id=20744&t=Revenue%20Management%20nel%20settore%20industriale&a=Rainer%20Kolisch>.

## 1.2 Objectives of the dissertation

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 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 and 2014a).

## 1.3 Structure

An introduction to the background, motivation and objectives of the research can be found in Chapter 1. Chapter 2 contains a literature review and the following aspects are explored: The concepts of RM and PI, the origin of RM and its application in the manufacturing industry, similarities and differences between RM prerequisites in the service and process industries, price and capacity management and finally profit impact of 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 Chapter 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 Chapter 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.

### **1.3.1 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, as indicated in the its first section, 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.

This article is done through an exploratory qualitative study with 15 companies which represents the second part of the chapter and leads to the 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 was 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.

### **1.3.2 Chapter 4: Application of RM in Europe and North America**

The research discussed in Chapter 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 Chapter 4, a new study was conducted in Europe and North America and the results are presented in Chapter 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.

### **1.3.3 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 Chapter, 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 Chapter 5, a new study was conducted in Europe and North America and the results are illustrated in Chapter 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.

## 2 LITERATURE REVIEW

### 2.1 The concepts of RM and PI

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.

RM<sup>8</sup> 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) 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).

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).

### 2.2 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). The trigger for the development of RM was the airline fare deregulation. The Civil Aeronautics Board 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

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<sup>8</sup> Alternative names for RM are the English terms yield management, revenue optimization and demand management (Talluri and van Ryzin 2004).

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). 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 (Talluri and van Ryzin, 2004).

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 (2003) 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 et al. (2007) examine the success factors for RM in the hotel industry.

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, energy, 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 2005; Talluri and van Ryzin 2004).

### **2.3 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).

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.

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, 2011, 2014) was conducted by Kuhn and Defregger (2005). 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 2005; Talluri and van Ryzin 2004).

#### **2.4 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 2005; Netessine and Shumsky 2002; Talluri and van Ryzin 2004). Several works (Harris and Pinder 1995; Kimms and Müller-Bungart 2003; Kuhn and Defregger 2005) 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 1.1).

In Table 1.1 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.



Service industry	Process industry
<ol style="list-style-type: none"> <li>1. Heterogeneous demand and opportunity for customer segmentation.</li> <li>2. Stochastic demand.</li> <li>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.</li> <li>4. Largely fixed capacity and dynamic demand.</li> <li>5. High fixed costs and low marginal costs.</li> <li>6. Pre-booking option.</li> <li>7. Economic freedom to act.</li> <li>8. Data availability and information systems.</li> <li>9. Corporate culture and management support.</li> </ol>	<p>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.</p> <p>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.</p>

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

## 2.5 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<sup>9</sup>.

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.

## **2.6 Profit impact of RM**

Since its introduction, RM has been used throughout the airline industry and has made a substantial contribution to airlines' profit. 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 three-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 in 2005 (see Klophaus and Polt 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

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<sup>9</sup> The term "pricing" is also used at times in the preliminary study interviews presented in Section 4. However a distinction must be made between the latter and the concept of "dynamic pricing" (see for example Klein and Steinhardt 2008).

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 one billion dollars, the other 13 regions were short of their target by \$250 million (Blumenthal *et al*, 2008).

### **3 STATE OF THE ART AND PERSPECTIVES OF REVENUE MANAGEMENT IN THE PROCESS INDUSTRY**

#### **3.1 Background of the first empirical study**

After its success in the service industry, RM is now 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 dissertation, 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 dissertation was published in an academic journal (Kolisch and Zatta, 2009) and will be summarized in Chapter 3. This chapter of the dissertation is structured as follows: First, the results from the exploratory study are presented in Section 3.2 and then hypotheses are derived on the basis of the inputs received from practitioners in the PI. In Section 3.3 an overview on the collected data is presented. Section 3.4 contains the results of the quantitative empirical study. Trends and perspectives on the introduction and application of RM are examined in Section 3.5. Chapter 3 concludes with an illustration of the principal results and a discussion of the various limitations in Section 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 Section 3.4.

The surveys were conducted in personal interviews with the aid of a five-part questionnaire (see Appendix A, 8.1). 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 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 minutes on average. Figure 3.1 illustrates the companies involved per branch, and Figure 3.2 illustrates the distribution of annual turnover of the companies involved in the study.

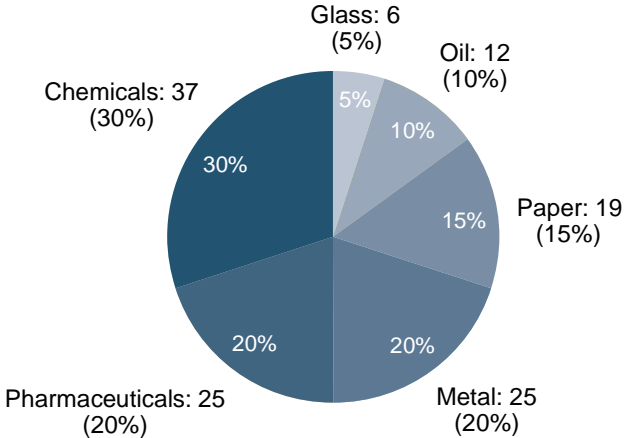


Figure 3.1 Companies surveyed per industry

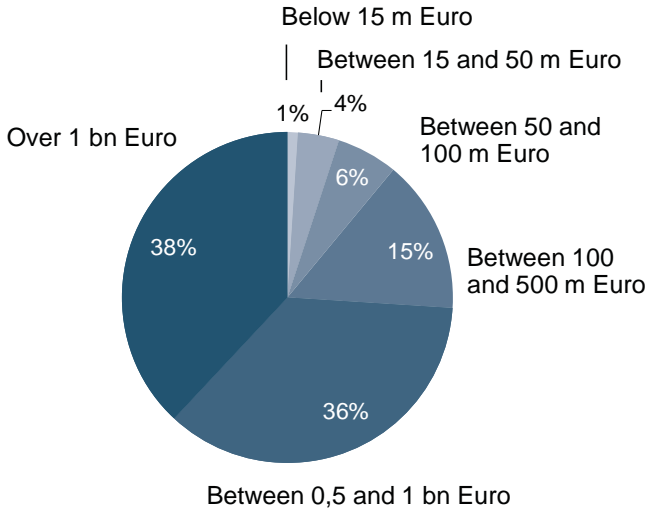


Figure 3.2 Annual turnover of companies surveyed

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 Section 3.4.2, while the various trends and opinions are illustrated in Section 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 Figure 3.3).



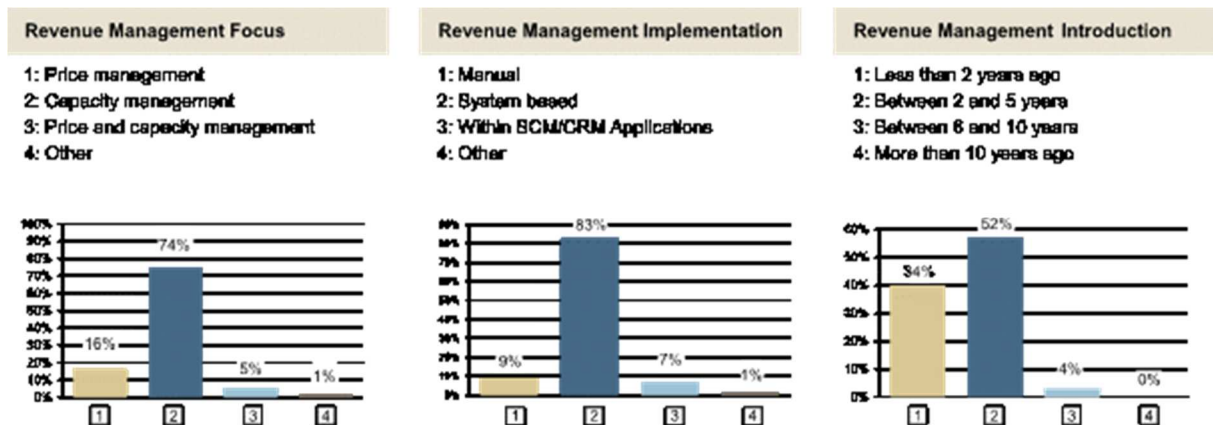


Figure 3.3 RM focus, implementation and introduction<sup>10</sup>

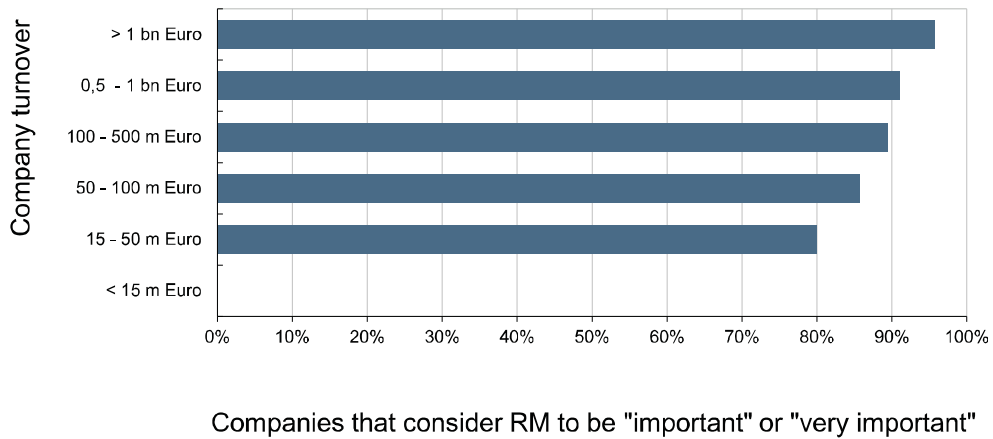
RM is implemented in the majority of cases (83%) by way of basic electronic data exchange, e.g. via spreadsheet files. The data is exchanged manually in 9% of cases. Only 7% of the companies surveyed use complex and highly automated systems. These systems are integrated within Supply Chain Management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

RM had been introduced within the past five 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 two years, 52% took place between two and five years prior to the data being collected and 4% took place between six and ten years prior to the data being collected. No such measures were introduced more than ten 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).

### 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  $r_{\text{pearson}}=0.224$ ;  $p < 0.05$ ).

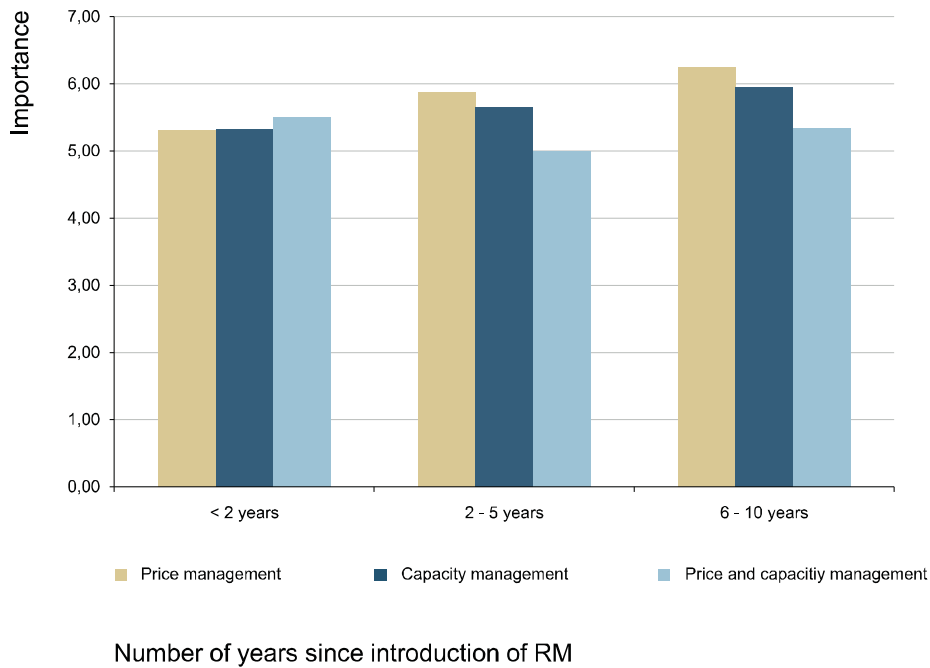
<sup>10</sup> Questions asked: "Which of the following revenue management approaches are used?" (Revenue Management Focus), "In what form is revenue management used?" (Revenue Management Implementation), "How long has revenue management been used in your company?" (Revenue Management Introduction).



**Figure 3.4 Importance of RM and company size**

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.



**Figure 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,  $df_1 = 2$ ,  $df_2 = 20.6$ ,  $p < 0.01$ ).

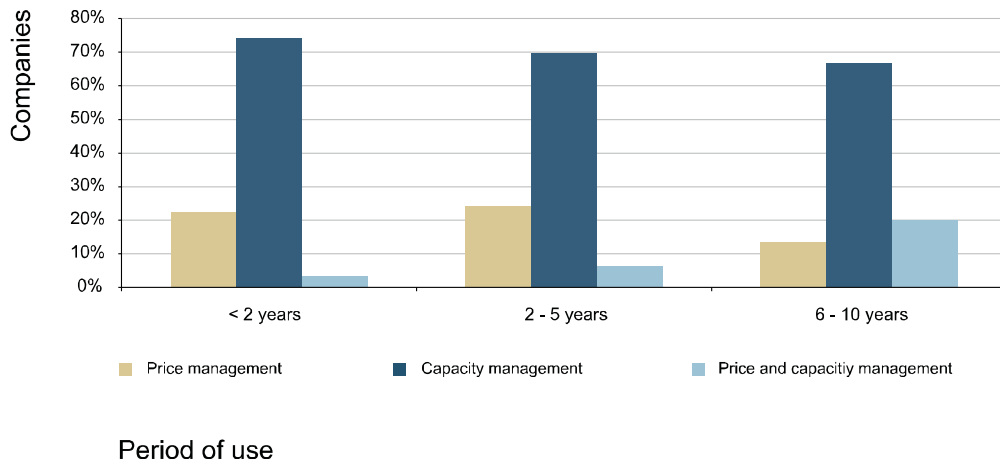


Figure 3.6 Type of RM-system depending on the duration of use

### 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.

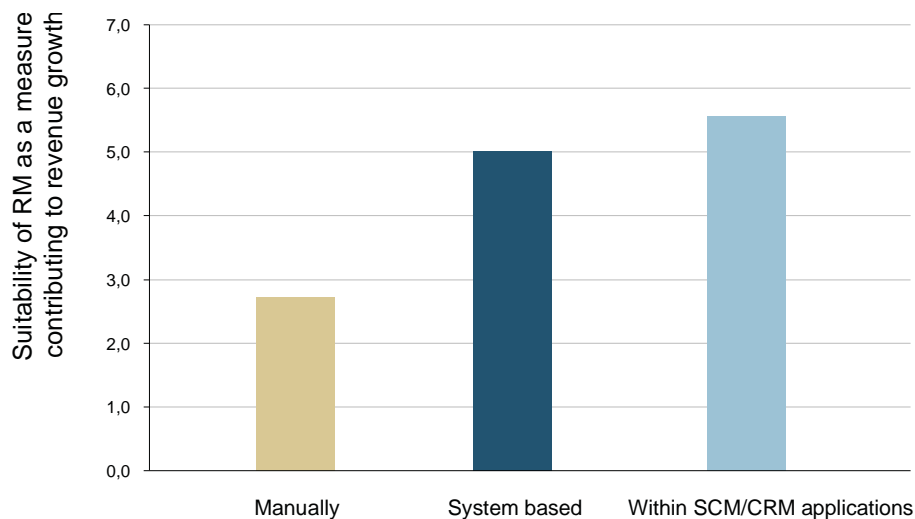


Figure 3.7 Importance of RM in relation to implementation

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 = 2, = 18.352,  $p < 0.000$ ).

**3.4.5 Future use of RM**

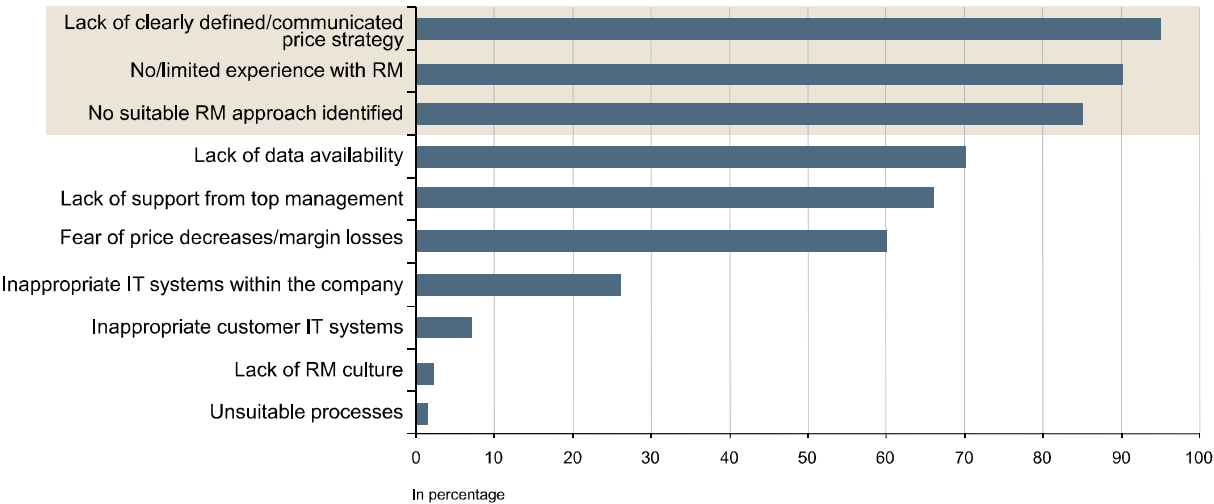
Many respondents expect there to be an increased prevalence of revenue management systems in the process industry (average 5.56; standard deviation 0.97; 1-7 Likert scale). However there are no significant mean differences identified across the industries surveyed (ANOVA;  $F = 1.864$ ;  $p > 0.1$ ).

**3.5 Trends and perspectives**

**3.5.1 Barriers to the Introduction of RM**

The reasons listed in Figure 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.



**Figure 3.8 Barriers to the introduction of RM**

### 3.5.2 Benefits and Risks of RM

When confronted with the benefits and risks of using RM, companies see more benefits than risks.<sup>11</sup> These were sorted according to the number of citations (Figure 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 (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.<sup>12</sup>

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.

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<sup>11</sup> This question was asked openly by the interviewer, i.e. the respondents were able to freely express their views without specifying possible answers.

<sup>12</sup> Other 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.

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

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

### 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 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 (Figure 3.10).

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.

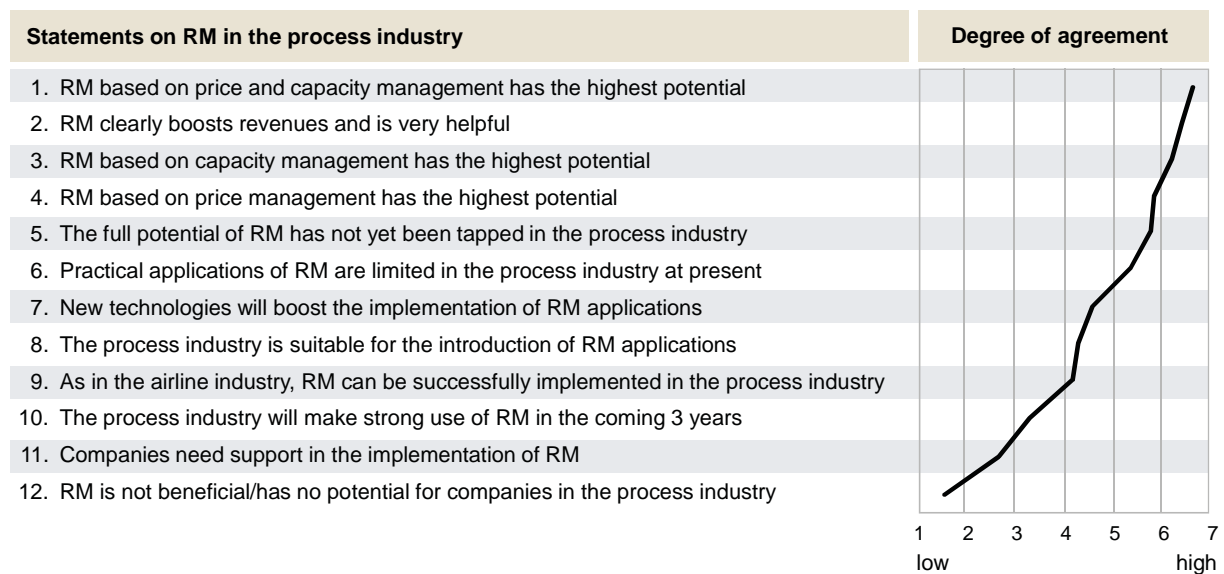


Figure 3.9 Degree of agreement with statements on RM



### **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 (2005). 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.

## **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 (2005), 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 per cent of the companies analyzed fulfill the prerequisites but that RM is still not widely spread. The second study by Kolisch and Zatta (2009a) 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 five hundred 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 Figures 4.1 to 4.3.

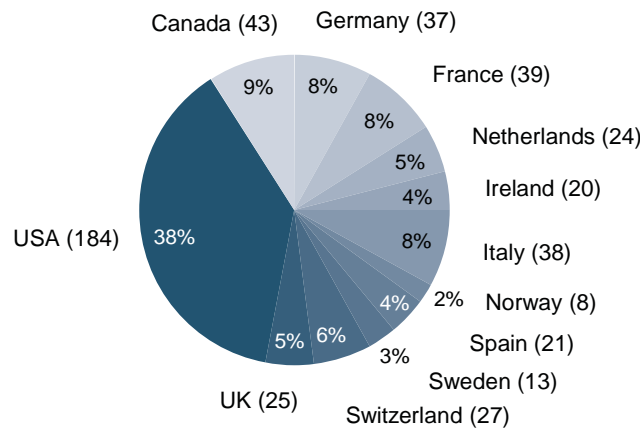


Figure 4.1: Distribution of the interview partners per country

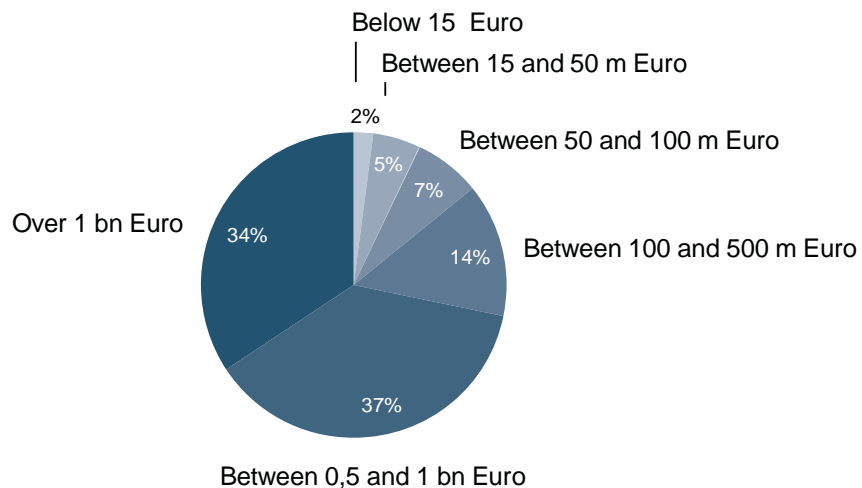
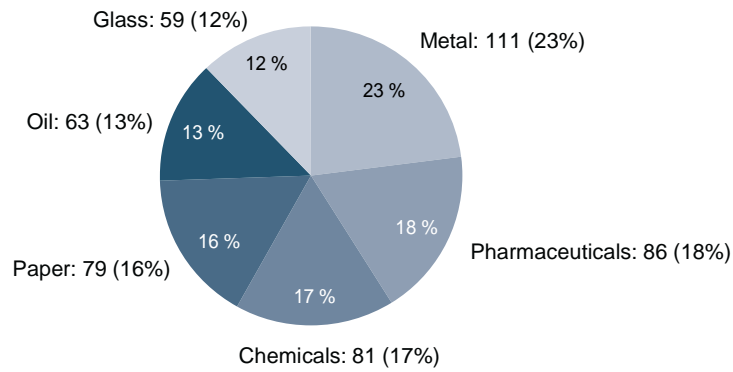


Figure 4.2: Distribution of the interview partners per turnover



**Figure 4.3: Distribution of the interview partners per industry**

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, 8.2). At the beginning of each interview, we provided the definition of RM given by Philips (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.

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 per cent 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 six 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 per cent of RM applications are capacity based, whereas only 22 per cent are based on price management and 11 per cent 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 Figures 4.5 and 4.6: Companies in North America use proportionally more price-based approaches, that is 47 per cent of the North American companies choose price- or price- and capacity-based RM applications, compared to European companies, where this percentage amounts to 21 per cent.

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

RM implementation is carried out by over half of the companies through electronic data interchange (52 per cent), for example Excel-based tools. In 29 per cent of the cases, the data are recorded manually, whereas in 17 per cent it is processed through automated IT-systems,

typically integrated in SCM or CRM applications, as illustrated in Figure 4.4. In Europe, manual applications prevail with a share of 46 per cent, followed by system-based applications with 39 per cent and SCM/CRM applications with 12 per cent (see Figure 2c). In North America, the dissemination of system-based applications is with the highest 67 per cent, followed by SCM/CRM applications with 22 per cent and manual applications with 11 per cent (see Figure 4.5). This indicates a more sophisticated use of RM in North American companies.

In 63 per cent of the cases, the period of use of RM is 5 years or less, as illustrated in Figure 4.4. More specifically, the period of use of 42 per cent of the respondents is 2 years or less, whereas for 21 per cent of the respondents the period of use is between 2 and 5 years and 33 per cent 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 per cent. 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 years previously ( $P=0.000$ ,  $\chi^2=175.45$ ,  $DF=3$ , see Figures 4.5 and 4.6). As illustrated in Figure 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 ( $P=0.000$ ,  $\chi^2=26.770$ ,  $DF=3$ ). Apart from the above stated differences between European countries, no further significant differences could be found.

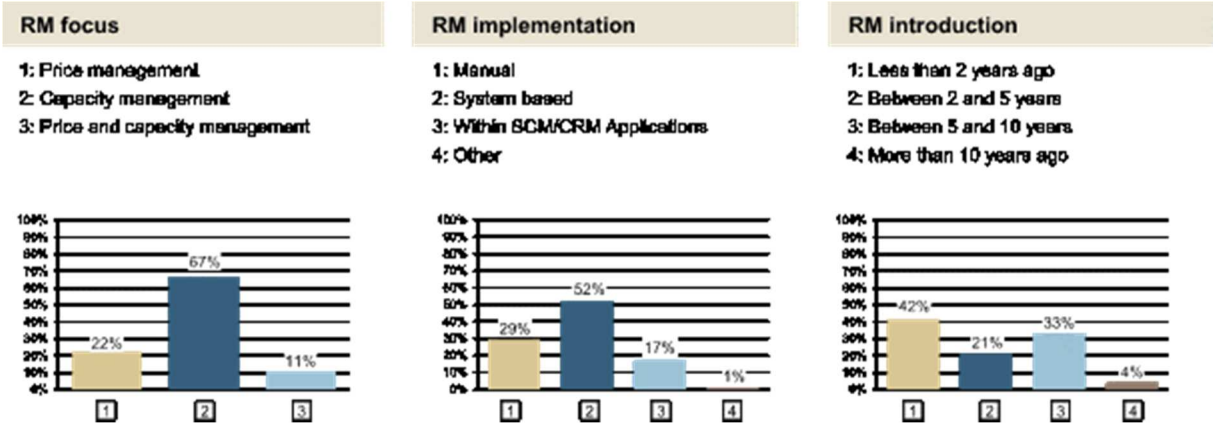


Figure 4.4 Focus, implementation and period of use



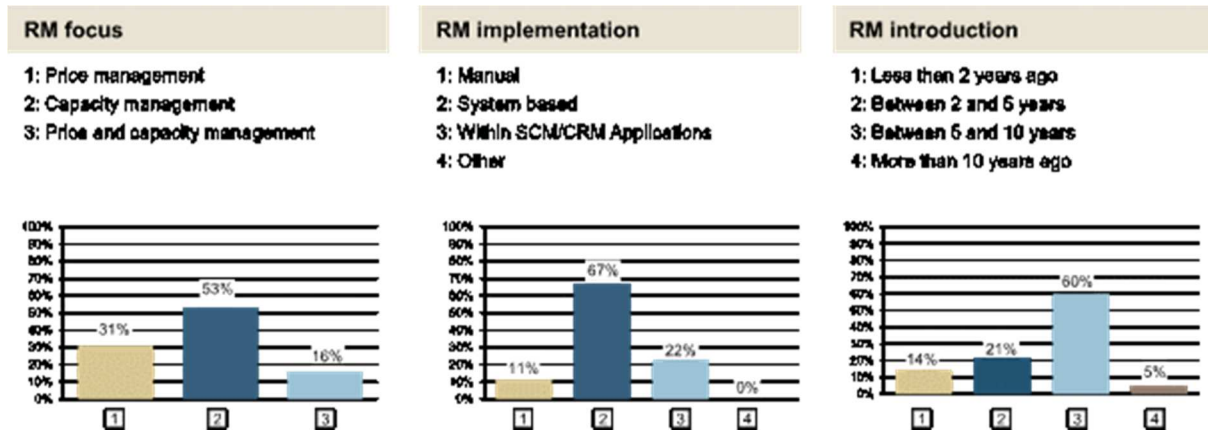


Figure 4.5 Focus, implementation and period of use in North America

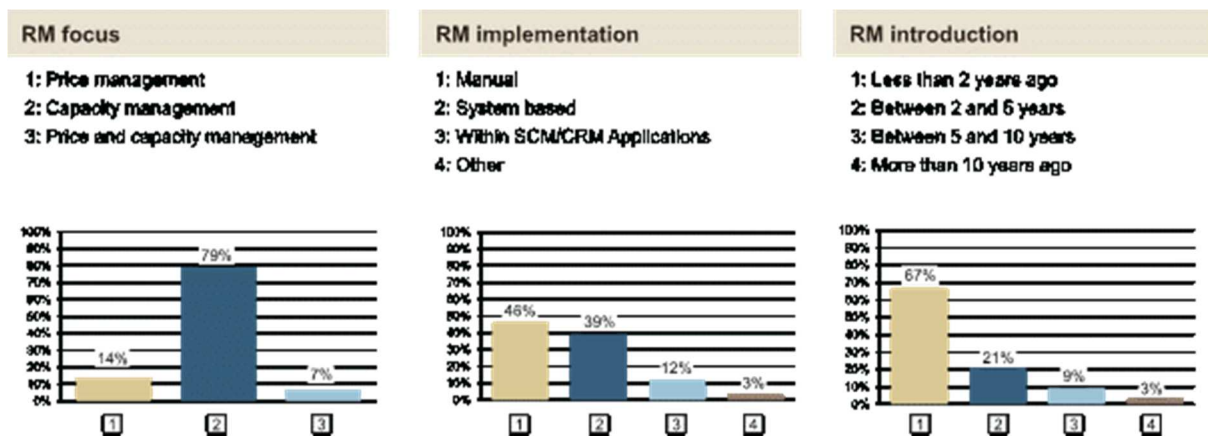


Figure 4.6 Focus, implementation and period of use in Europe

#### 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.

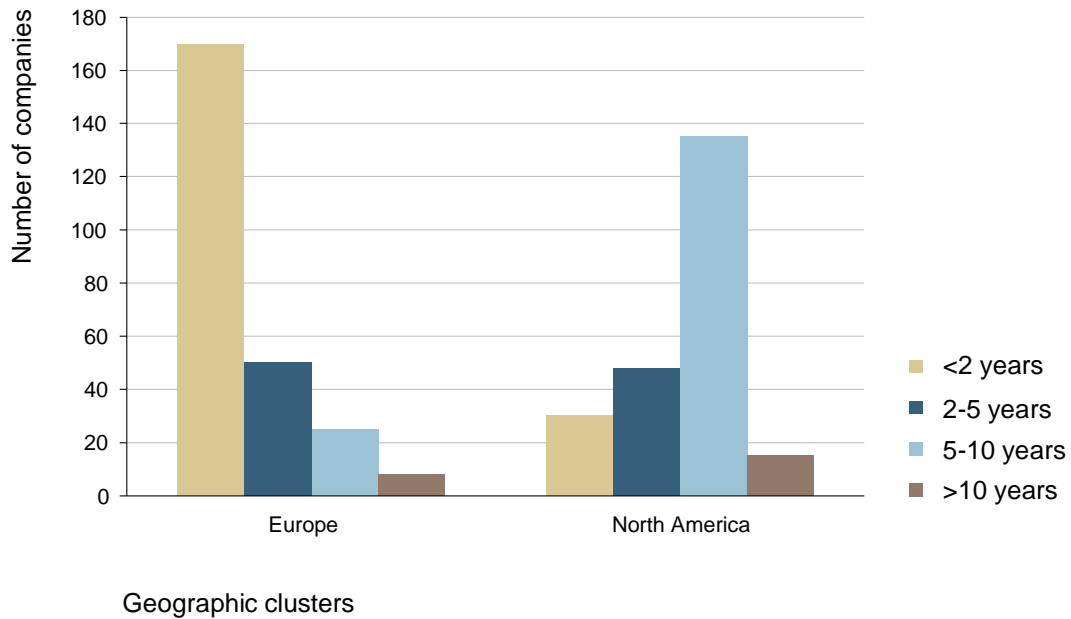


Figure 4.7: Period of use in North America and Europe

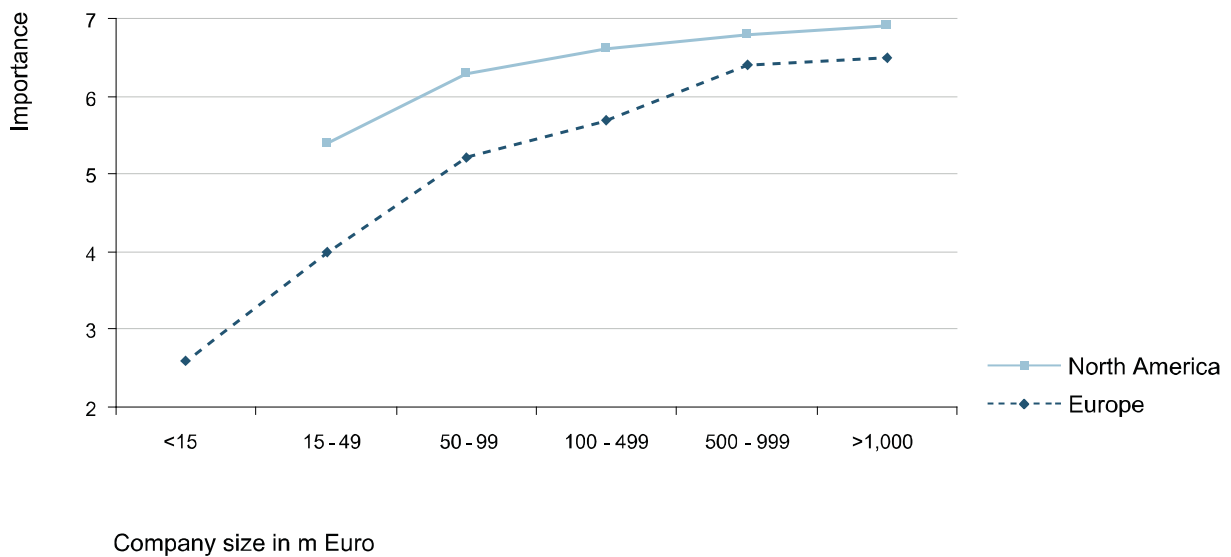


Figure 4.8: Importance of RM in relation to company size (turnover)

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 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 Figure 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,  $P=0.007$ ).

#### 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.

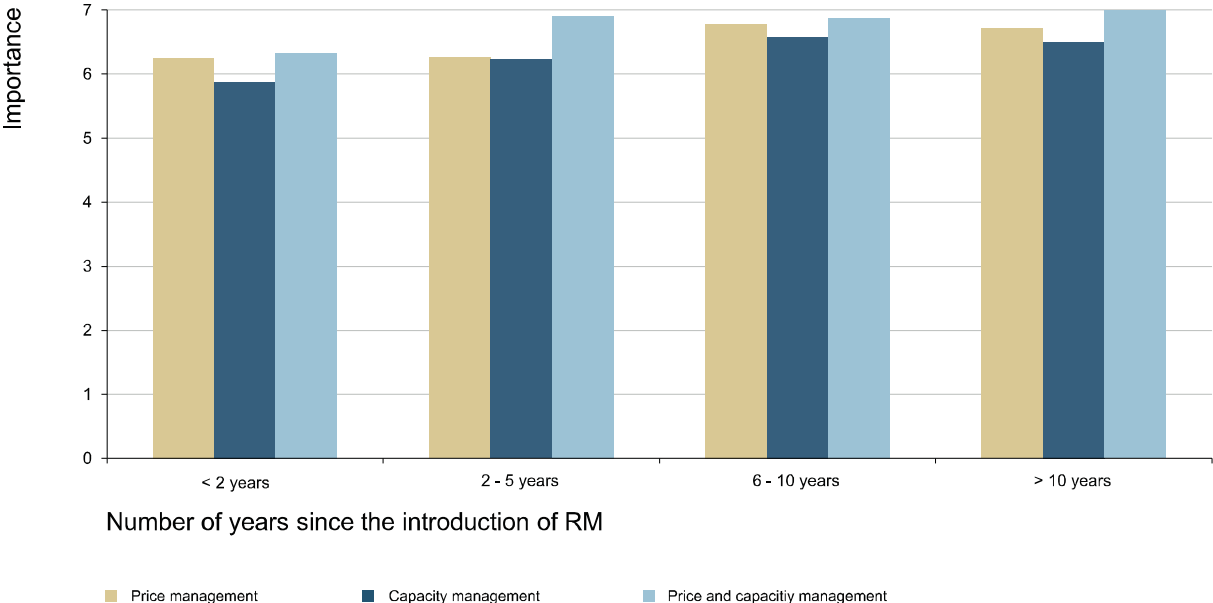


Figure 4.9: Perceived importance of RM concepts in relation to period of use

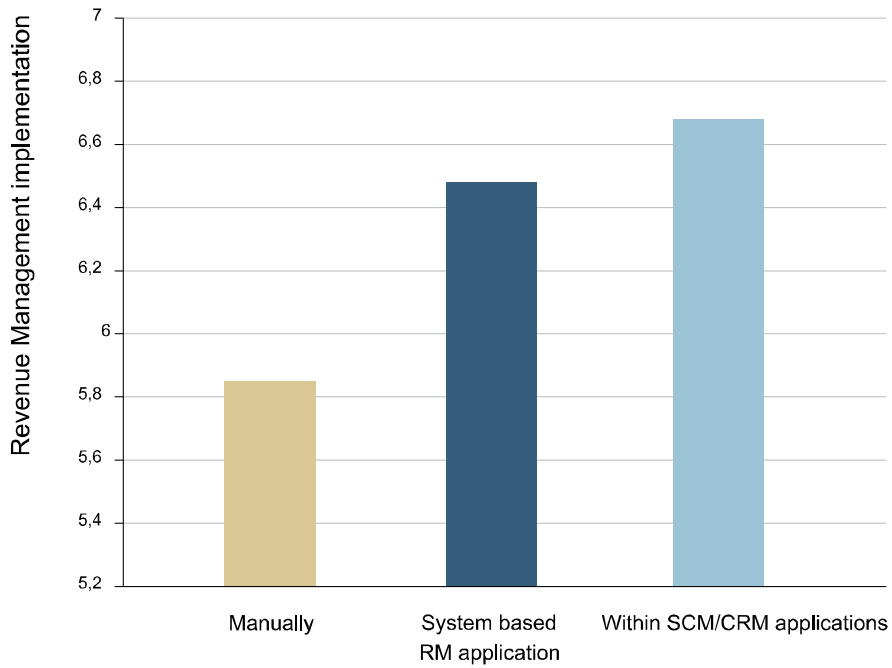


Figure 4.10: Importance of RM in relation to its implementation

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

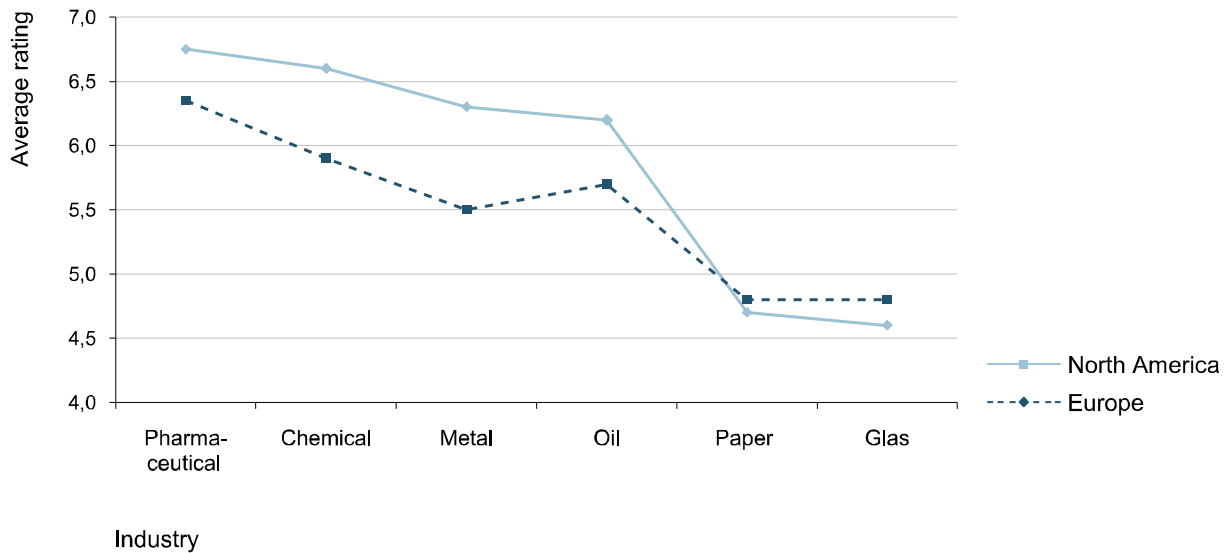


Figure 4.11: Future use of RM in different industries in Europe and North America

## 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 (Figure 4.12). In decreasing order of importance, these are: (i) Lack of a clearly defined and/or communicated price strategy, (ii) no suitable RM approach identified, (iii) fear of price decreases or margin losses, (iv) no or limited experience with RM, (v) lack of data availability, (vi) inappropriate or lack of IT-systems for the support of RM applications and (vii) lack of support from top management.

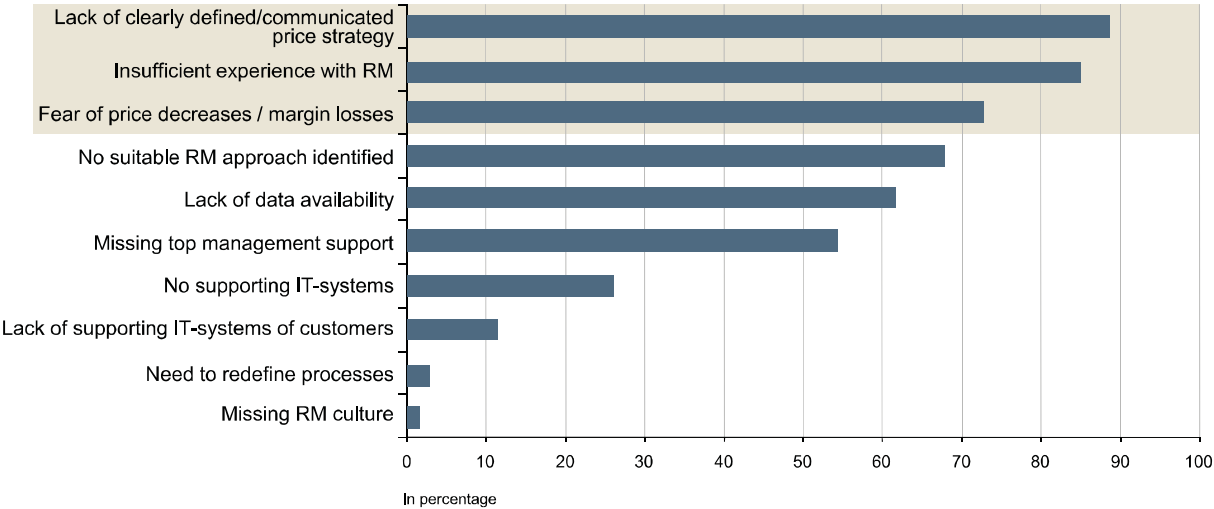


Figure 4.12: Barriers to the introduction of RM

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.

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

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

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.

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 Figure 4.13).

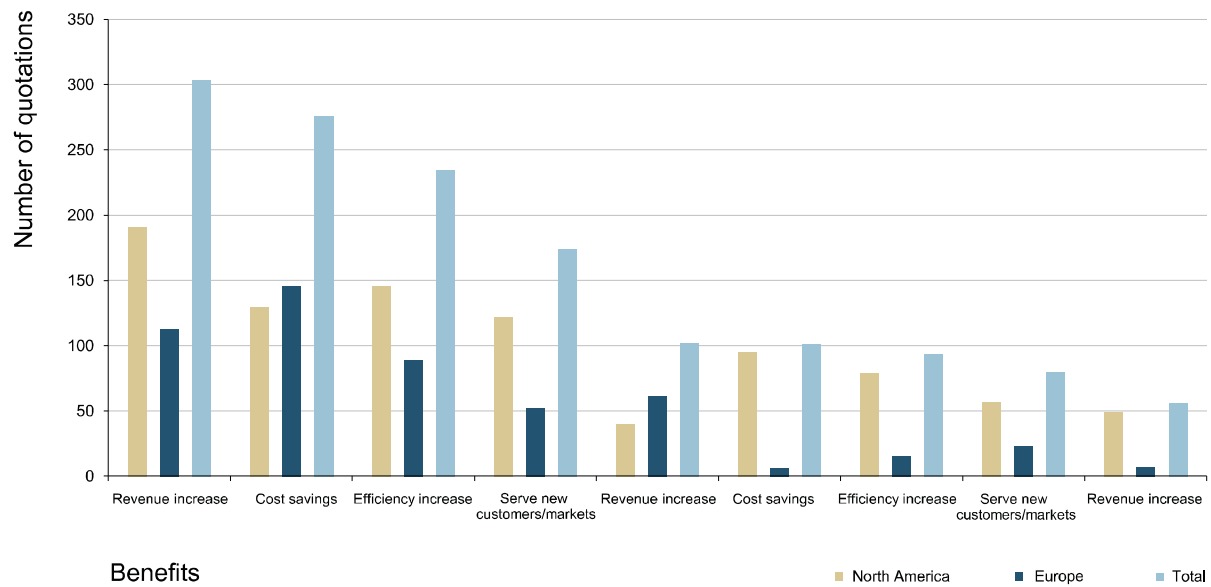


Figure 4.13: Benefits named by North American versus European companies

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 Figure 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.

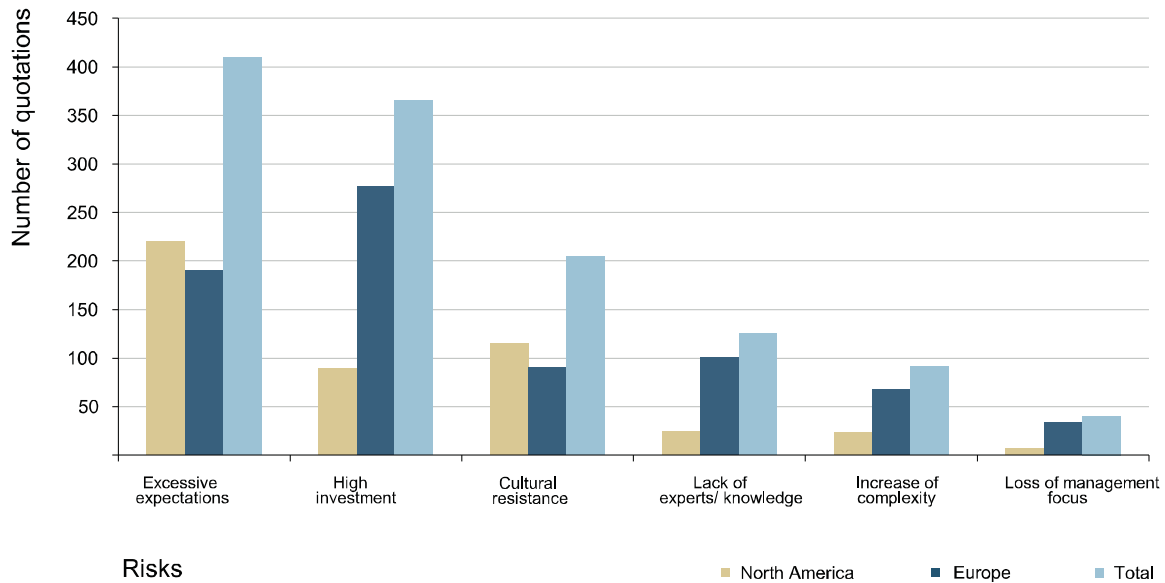


Figure 4.14: Risks named by North American versus European companies

#### 4.5.3 Alternatives to RM

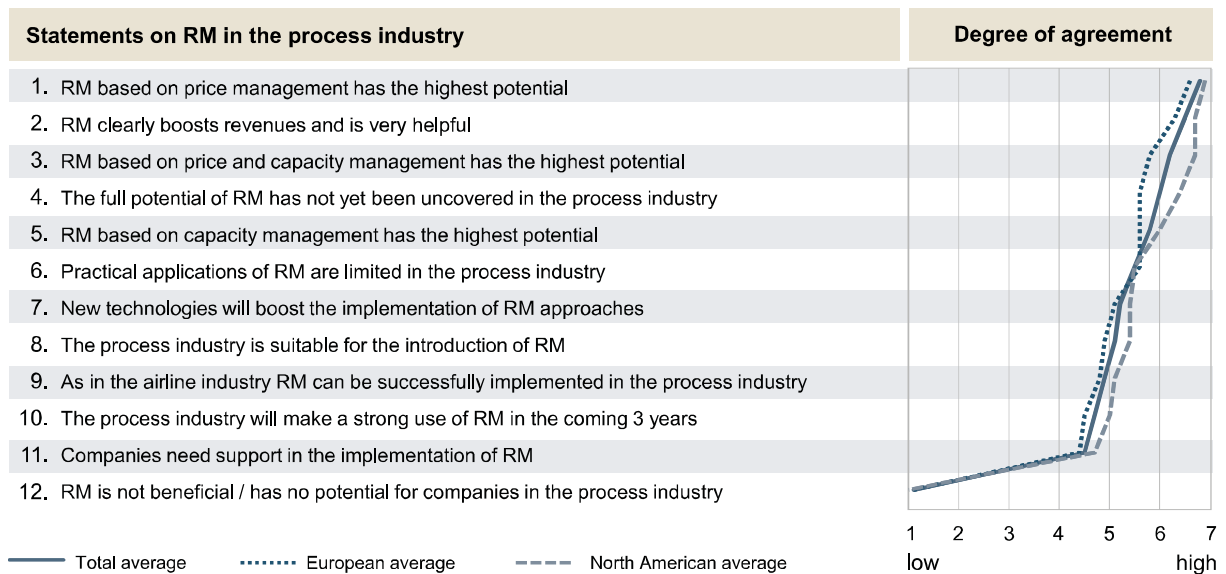
When asked for alternative approaches to RM, approximately 35 per cent of the interviewees mentioned various alternatives to introduce flexible production capacities. More specifically, the following alternatives were mentioned: (1) Outsourcing of production capacities to legally and economically independent 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 per cent 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 per cent of interviewees.

#### 4.5.4 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 Figure 4.15).





**Figure 4.15: Statements on RM**

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). 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.

## **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).

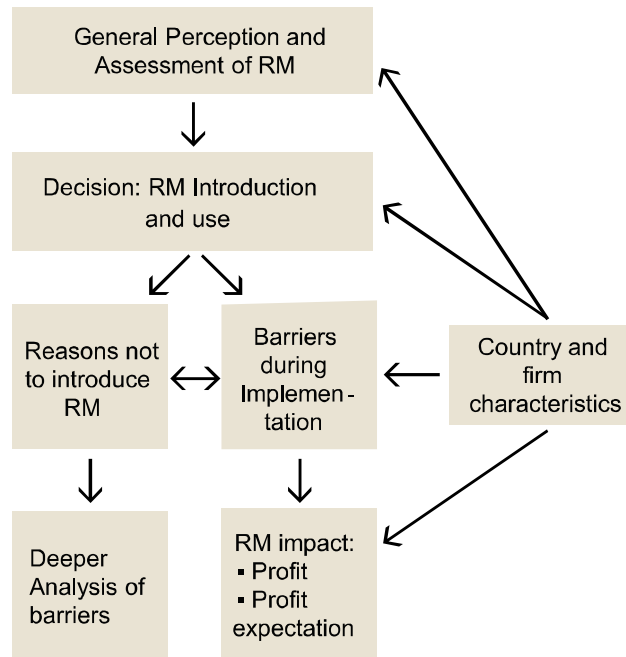
This third line of research builds upon the studies of Kolisch and Zatta (2009, 2011). Kolisch and Zatta (2009) analyze the current status and perspectives of RM in the PI in Germany, as one of Europe's key markets. The study involves 124 companies interviewed between June 2004 and February 2005. The 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 (2011), 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 America, RM is considered more important, was introduced earlier and is more price based.

As in Kolisch and Zatta (2009, 2011), 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 Figure 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?



**Figure 5.1: The structure of this study**

*Note: Arrows represent relations that have been investigated in detail.*

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 two countries were located in the regional cluster North America (Canada and USA), whereas 344 companies of fourteen 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 to 5.4 show the distribution of the respondents across countries<sup>13</sup>, 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, 8.3).

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

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<sup>13</sup>"Others" in Figure 5.2. refers to Austria (with 12 respondents), Denmark (8), Poland (4) and Portugal (3).

order to maximize revenue'. By doing this, we ensured that there was a clear and consistent understanding of RM among the respondents. 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.

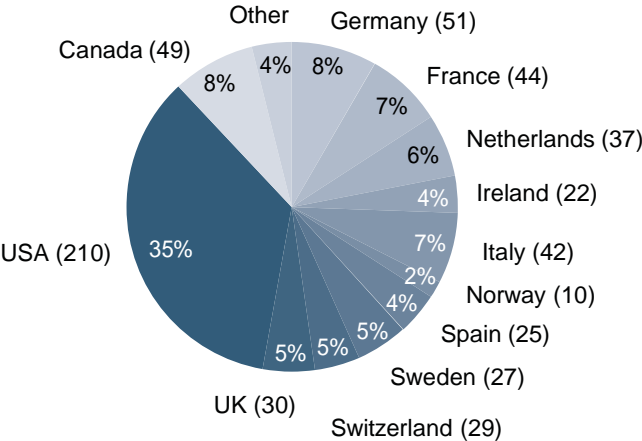


Figure 5.2: Distribution of interview partners per country

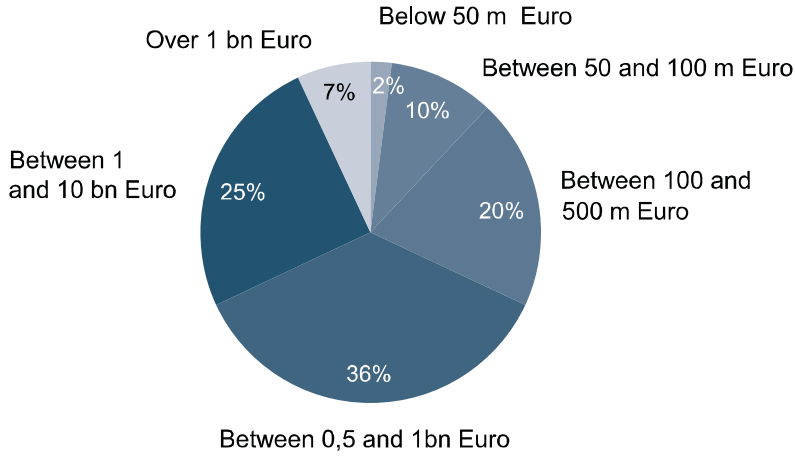
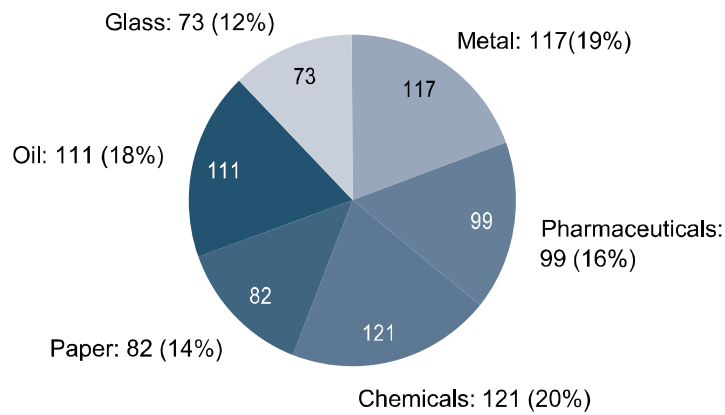


Figure 5.3: Distribution of interview partners per turnover





**Figure 5.4: Distribution of interview partners per industry**

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 one per cent 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 (2011) 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.

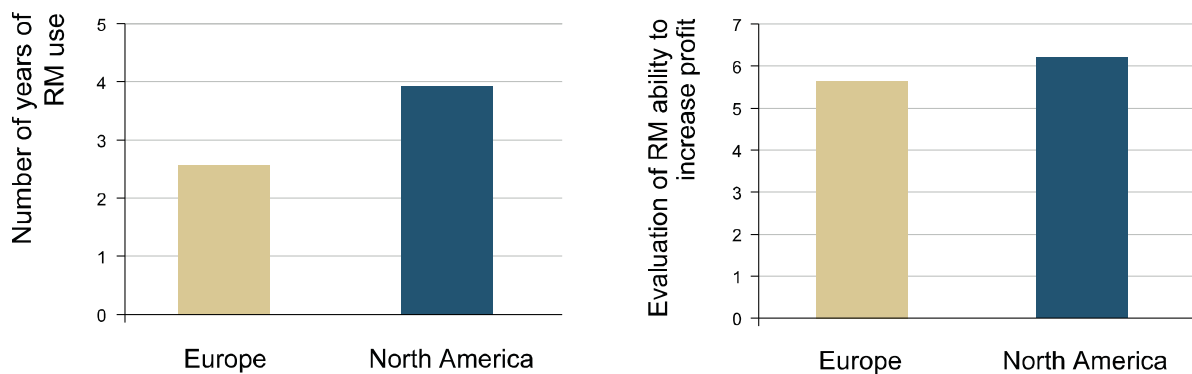


Figure 5.5: Number of years of RM use and evaluation of RM ability to increase profit in North America and Europe

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.

#### 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 per cent 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)<sup>14</sup>. This result is in line with previous findings (see Kolisch and Zatta, 2011) 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 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.

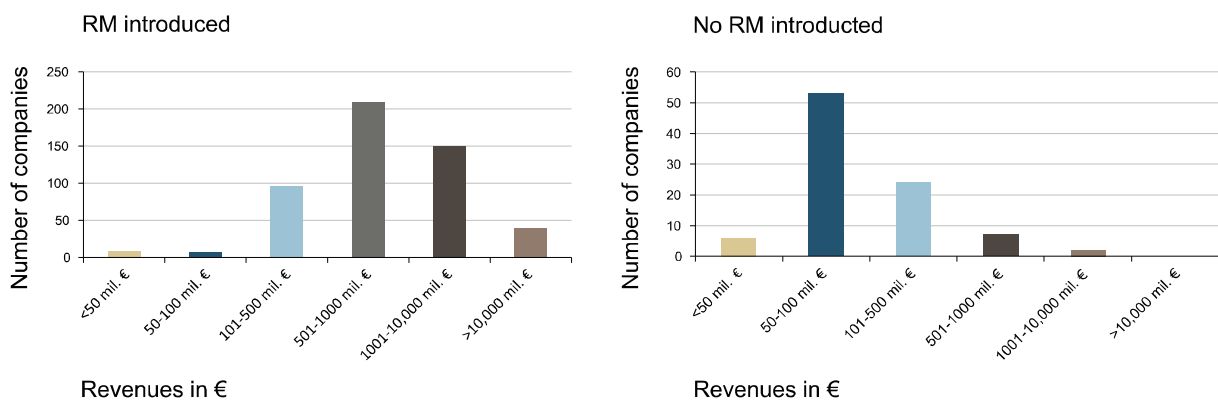
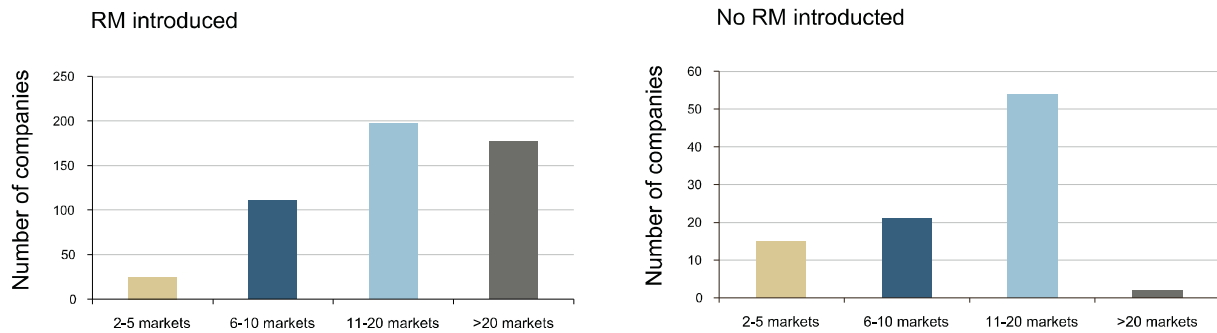


Figure 5.6: Distribution of revenue for companies that introduced RM (left) versus companies that did not (right)

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.

<sup>14</sup> The 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.



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

### 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 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 Figure 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).

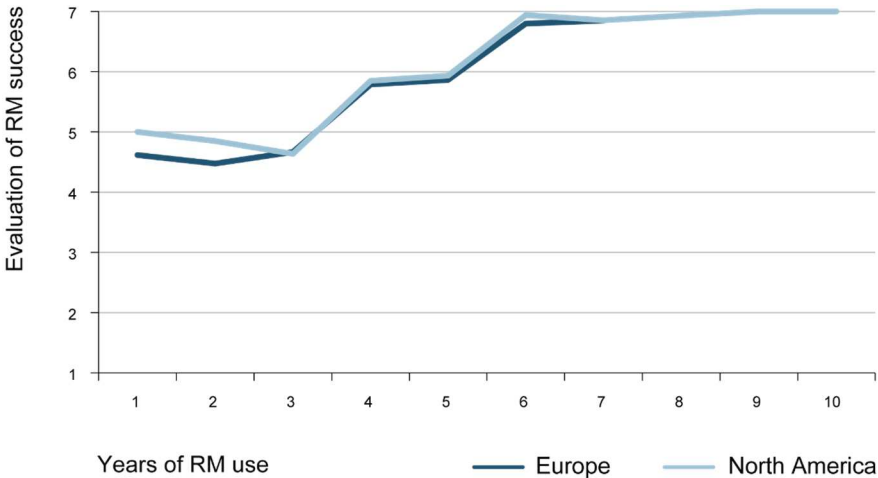


Figure 5.8: RM success in increasing profit with respect to duration of use in North America and Europe

**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 one 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 per cent) and also report an increased profit due to RM one year after its introduction (average 3 per cent).

However, the expected profit improvement is higher than that observed after one 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 one 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 per cent) compared to North America (AV=6.3 per cent) 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 one year after RM introduction (Figure 5.9). In this case, a two-tailed test shows that the difference in observed profit between Europe (AV=2.5

per cent) and North America (AV=3.6 per cent) again is highly significant (P=0.000, t=-9.821, DF=509).

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, 2011). Moreover, previous literature (Kolisch and Zatta, 2011) 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.

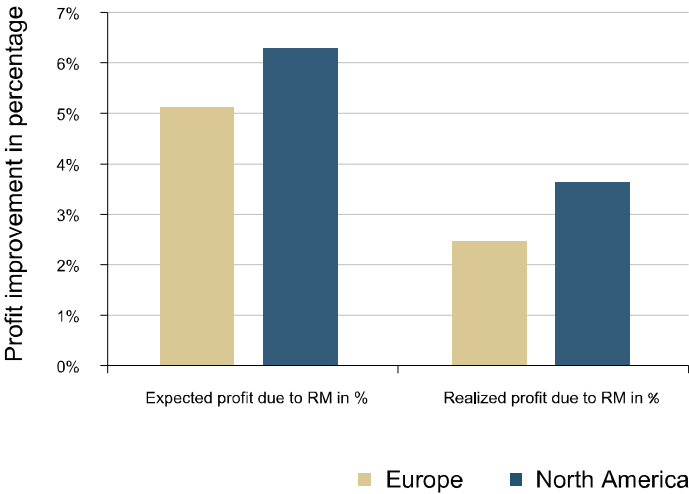


Figure 5.9: A priori estimation of profit improvement due to RM and a posteriori realized profit improvement due to RM in North America and Europe

#### 5.4.4 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 Figure 5.10): (i) Lack of experience with RM, (ii) no appropriate RM approach identified, (iii) no clearly defined price strategy, (iv) lack of management attention/support, (v) danger of a price-level decrease, (vi) lack of customer acceptance, (vii) lack of appropriate IT system, (viii) lack of data availability, (ix) no corporate culture, (x) fear of negative RM experience, and (xi) fear of negative customer feedback.

These results are in line with previous findings of Kolisch and Zatta (2011). The two studies differ only slightly with respect to some factors. In Kolisch and Zatta (2011), 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 (2011) 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 top barrier. Data availability is not considered a top barrier in our study, though it was a more relevant barrier in Kolisch and Zatta (2011). 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.

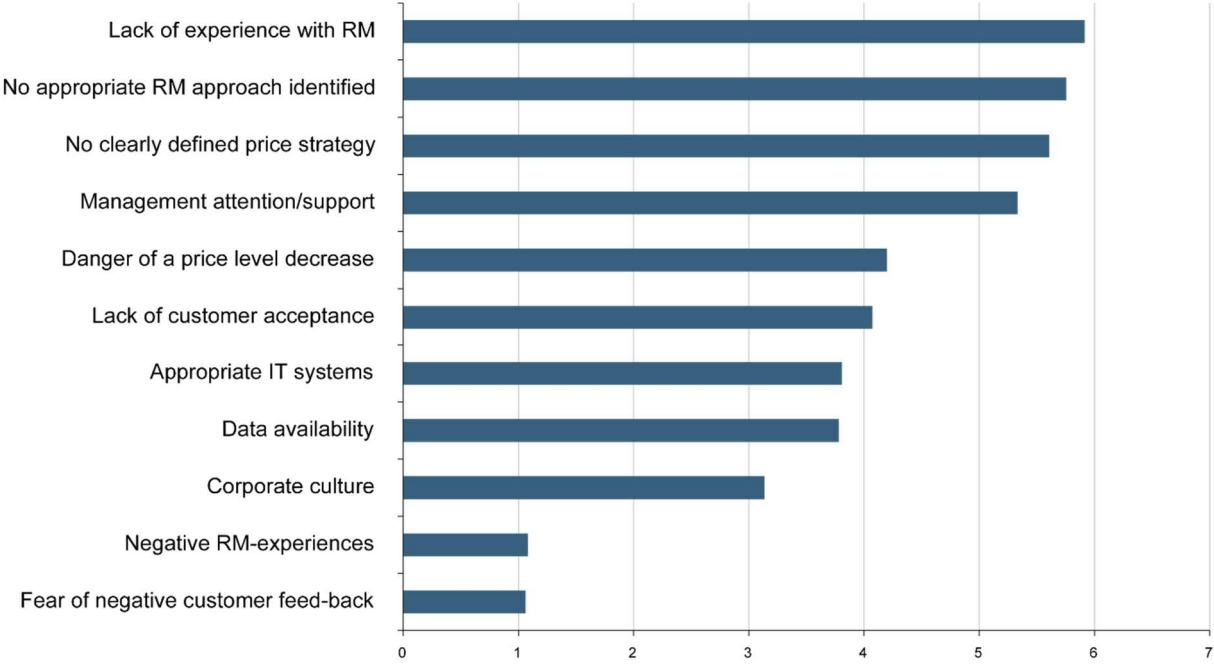


Figure 5.10: Average importance of barriers to the introduction of RM

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).

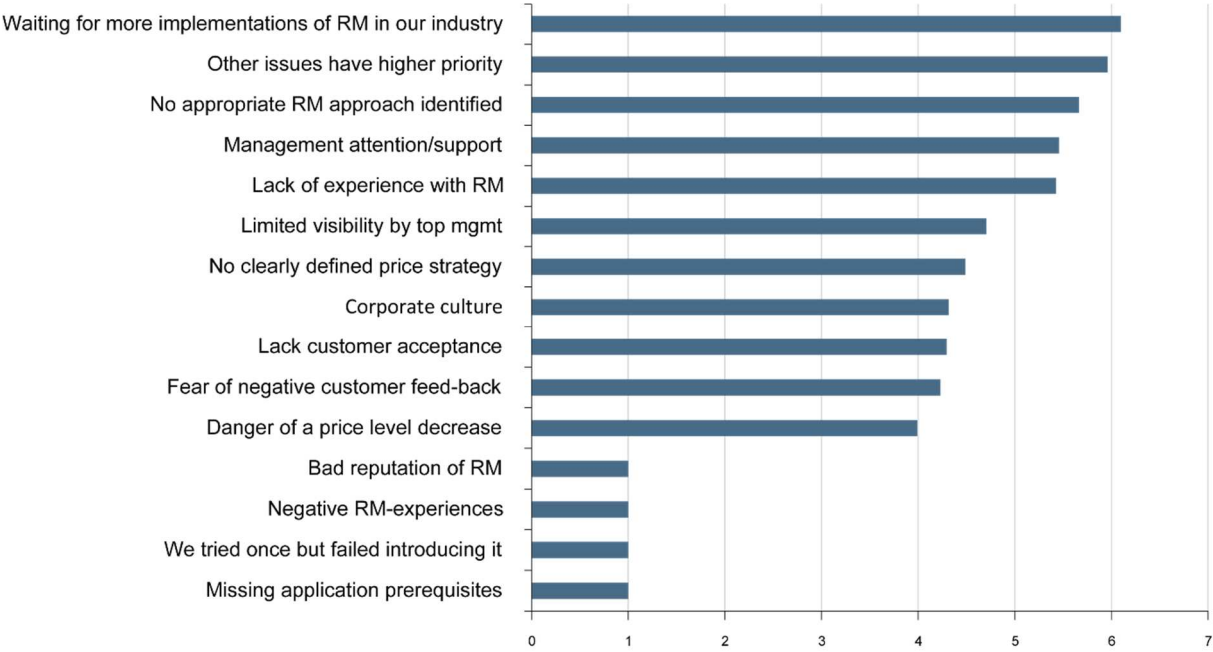


Figure 5.11: Average importance of reasons for not introducing RM

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 (Figure 5.11): (i) Waiting for more implementations in the industry, (ii) other issues have higher priority, (iii) no appropriate RM approach identified, (iv) lack of management attention/support, (v) lack of experience with RM, (vi) limited visibility by top management, and (vii) 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 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 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 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.

## **6 CONCLUSIONS**

### **6.1 Summary and results**

In this dissertation, 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 1,206 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 dissertation. 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 Chapter 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 Chapter 3 was extended in Chapter 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 Chapter 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 Section 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 1,206 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.

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## 8 APPENDIX A: QUESTIONNAIRES

### 8.1 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)

<b>Process industry sectors</b>	<b>Degree of agreement</b>
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)		

<b>Statement based on time horizon</b>	<b>Degree of agreement</b>
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.**

- Lack of experience with RM
- No appropriate RM approach identified
- No clearly defined price strategy
- Danger of a price level decrease
- Lack of customer acceptance
- Data availability
- Appropriate IT systems
- Management support/culture
- Negative RM-experiences
- 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 on page 5 (question number 15)
- No        => please continue on page 6 (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?**

- Price management
- Price and capacity management
- Capacity management
- 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?**

- Manually
- Within Supply Chain Management / Customer Relationship Management applications
- System based
- Other form: \_\_\_\_\_

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

- Own development
- Other: \_\_\_\_\_
- 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?**

- Price management
- Capacity management
- Price and capacity management
- Other: \_\_\_\_\_
- No RM-applications are planned

**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?**

- Manually
- System based
- Within Supply Chain Management / Customer Relationship Management applications
- Other form: \_\_\_\_\_

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

- Own development
- IT-consultants
- Other: \_\_\_\_\_
- 

**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
13) Marketing		
14) Sales		
15) Research & Development		
16) Production		
17) Strategic Planning		
18) Project-/Program-Management		
19) Logistics		
20) Purchasing		
21) Information Technology		
22) Supply Chain Management		
23) Controlling		
24) 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?**

- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_

## 8.2 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)		

<b>Process industry sectors</b>	<b>Degree of agreement</b>
8. Chemical industry	(1)-(2)-(3)-(4)-(5)-(6)-(7)
9. Oil industry	(1)-(2)-(3)-(4)-(5)-(6)-(7)
10. Glass industry	(1)-(2)-(3)-(4)-(5)-(6)-(7)
11. Paper industry	(1)-(2)-(3)-(4)-(5)-(6)-(7)
12. Pharmaceutical industry	(1)-(2)-(3)-(4)-(5)-(6)-(7)
13. Metal industry	(1)-(2)-(3)-(4)-(5)-(6)-(7)
14. 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)		

<b>Statement based on time horizon</b>	<b>Degree of agreement</b>
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.**

- Lack of experience with RM
- Data availability
- No appropriate RM approach identified
- Appropriate IT systems
- No clearly defined price strategy
- Management support/culture
- Danger of a price level decrease
- Negative RM-experiences
- Lack of customer acceptance
- 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

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

**18.1 Which of the following RM approaches are implemented?**

- Price management
- Capacity management
- Price and capacity management
- 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?**

- Manually
- System based
- Within Supply Chain Management / Customer Relationship Management applications
- Other form: \_\_\_\_\_

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

- Own development
- IT-consultants
- Other: \_\_\_\_\_

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

<b>Organizational area/Function</b>	<b>Involved</b>	<b>Responsible</b>
25) Marketing		
26) Sales		
27) Research & Development		
28) Production		

- 29) Strategic Planning
- 30) Project-/Program-Management
- 31) Logistics
- 32) Purchasing
- 33) Information Technology
- 34) Supply Chain Management
- 35) Controlling
- 36) Other:

**Please continue with question number 20!**

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

**19.1 Which of the following RM approaches are planned?**

- Price management
- Capacity management
- Price and capacity management
- Other: \_\_\_\_\_
- No RM-applications are planned

**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?**

- Manually
- System-based
- Within Supply Chain Management / Customer Relationship Management applications
- Other form: \_\_\_\_\_

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

- Own development
- IT-consultants
- Other: \_\_\_\_\_

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

<b>Organizational area/Function</b>	<b>Will be involved</b>	<b>Will be responsible</b>
37) Marketing		
38) Sales		
39) Research & Development		
40) Production		
41) Strategic Planning		
42) Project-/Program-Management		
43) Logistics		
44) Purchasing		
45) Information Technology		
46) Supply Chain Management		
47) Controlling		
48) Other:		

**Please continue with number 20!**

### Section III – Statements on RM

#### 19. 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
12. RM clearly triggers revenue and is therefore very helpful.	(1)-(2)-(3)-(4)-(5)-(6)-(7)
13. Practical RM-applications are very limited in the process industry.	(1)-(2)-(3)-(4)-(5)-(6)-(7)
14. The process industry is very suitable for the application of RM.	(1)-(2)-(3)-(4)-(5)-(6)-(7)
15. The use of RM will strongly increase within the process industry.	(1)-(2)-(3)-(4)-(5)-(6)-(7)
16. The potential of RM has not yet been discovered in the process industry.	(1)-(2)-(3)-(4)-(5)-(6)-(7)
17. 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)
18. New technologies will speed up the adaptation of RM.	(1)-(2)-(3)-(4)-(5)-(6)-(7)
19. Companies need support in the implementation of RM.	(1)-(2)-(3)-(4)-(5)-(6)-(7)
20. RM based on price management is particularly valuable.	(1)-(2)-(3)-(4)-(5)-(6)-(7)
21. RM based on capacity management is particularly valuable.	(1)-(2)-(3)-(4)-(5)-(6)-(7)
22. RM based on both price and capacity management is particularly valuable.	(1)-(2)-(3)-(4)-(5)-(6)-(7)

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

- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_

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

- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_



### 8.3 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?

- 0 year
- 1 years
- 2 years
- 3 years
- 4 years
- 5 years
- 6 years
- 7 years
- 8 years
- 9 years
- 10 years
- 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 (1)-(2)-(3)-(4)-(5)-(6)-(7) strong importance
2. Medium term (in the next 6 to 18 months)	no importance (1)-(2)-(3)-(4)-(5)-(6)-(7) strong importance
3. Long term (not before the next 18 months)	no importance (1)-(2)-(3)-(4)-(5)-(6)-(7) strong importance

**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).**

- |  |   |
|--|---|
| <input type="checkbox"/> Lack of experience with RM            | <input type="checkbox"/> Appropriate IT systems   |
| <input type="checkbox"/> No appropriate RM approach identified | <input type="checkbox"/> Management support   |
| <input type="checkbox"/> No clearly defined price strategy     | <input type="checkbox"/> Corporate 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"/> Fear of negative customer feed-back (RM seen as not appropriate) |
| <input type="checkbox"/> Data availability                     | <input type="checkbox"/> Other: _____   |

Pls. elaborate on the above:

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**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)







**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)

<b>Statement based on time horizon</b>	<b>Degree of agreement</b>						
1. Short term (within the next 6 months)	<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 33%; text-align: right;">no importance</td> <td style="width: 33%;"></td> <td style="width: 33%; text-align: left;">strong importance</td> </tr> <tr> <td colspan="3" style="text-align: center;">(1)-(2)-(3)-(4)-(5)-(6)-(7)</td> </tr> </table>	no importance		strong importance	(1)-(2)-(3)-(4)-(5)-(6)-(7)		
no importance		strong importance					
(1)-(2)-(3)-(4)-(5)-(6)-(7)							
2. Medium term (in the next 6 to 18 months)	<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 33%; text-align: right;">no importance</td> <td style="width: 33%;"></td> <td style="width: 33%; text-align: left;">strong importance</td> </tr> <tr> <td colspan="3" style="text-align: center;">(1)-(2)-(3)-(4)-(5)-(6)-(7)</td> </tr> </table>	no importance		strong importance	(1)-(2)-(3)-(4)-(5)-(6)-(7)		
no importance		strong importance					
(1)-(2)-(3)-(4)-(5)-(6)-(7)							
3. Long term (not before the next 18 months)	<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 33%; text-align: right;">no importance</td> <td style="width: 33%;"></td> <td style="width: 33%; text-align: left;">strong importance</td> </tr> <tr> <td colspan="3" style="text-align: center;">(1)-(2)-(3)-(4)-(5)-(6)-(7)</td> </tr> </table>	no importance		strong importance	(1)-(2)-(3)-(4)-(5)-(6)-(7)		
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<br>(and thus lack of awareness) | <input type="checkbox"/> Danger of a price level decrease                                     |
| <input type="checkbox"/> Missing application prerequisites                                 | <input type="checkbox"/> Negative RM experiences  |
| <input type="checkbox"/> We tried once but failed<br>introducing it                        | <input type="checkbox"/> No appropriate RM approach<br>identified                             |
| <input type="checkbox"/> Waiting for more applications of<br>it in our industry            | <input type="checkbox"/> Fear of negative customer feed-<br>back (RM seen as not appropriate) |
| <input type="checkbox"/> Limited visibility on it by top mgmt.                             | <input type="checkbox"/> Management support   |
| <input type="checkbox"/> Lack of customer acceptance                                       | <input type="checkbox"/> Corporate culture  |
| <input type="checkbox"/> Lack of experience with RM  | <input type="checkbox"/> Bad reputation of RM   |
| <input type="checkbox"/> No clearly defined price strategy                                 | <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):

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**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)

## 9 APPENDIX B: CORRELATION MATRIXES

### 9.2 Impact of the barriers' evaluations on real decision to introduce RM

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#### Omnibus-Tests of the model coefficients

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		Chi-Square	df	Sig.
	Step	350,037	8	,000
Step 1	Block	350,037	8	,000
	Model	350,037	8	,000

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#### Model synthesis

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Step	-2 Log-Likelihood	Cox & Snell R-Square	Nagelkerke R-Square
1	165,097 <sup>a</sup>	,440	,767

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### Variables in the equation

	Regression-coefficient B	Standard error	Wald	df	Sig.	Exp(B)
Q175_Q196	-,075	,163	,215	1	,643	,927
Q171_Q197	,264	,202	1,706	1	,191	1,302
Q173_Q198	,807	,146	30,498	1	,000	2,241
Q174_Q199	,133	,138	,932	1	,334	1,142
Q172_Q1911	,358	,196	3,352	1	,067	1,431
Q1711_Q1912	-1,700	,195	75,663	1	,000	,183
Q178_Q1913	,010	,140	,005	1	,941	1,010
Q179_Q1914	-,462	,135	11,668	1	,001	,630
Constant	-1,212	2,370	,261	1	,609	,298

a. In step 1 inserted variables: Q175\_Q196, Q171\_Q197, Q173\_Q198, Q174\_Q199, Q172\_Q1911, Q1711\_Q1912, Q178\_Q1913, Q179\_Q1914.

$$\text{odds}_{(0=\text{no}/1=\text{yes})} = 0,298 + 0,927 \text{ Q175\_Q196} + 1,302 \text{ Q171\_Q197} + 2,241 \text{ Q173\_Q198} + 1,142 \text{ Q174\_Q199} + 1,431 \text{ Q172\_Q1911} + 0,183 \text{ Q1711\_Q1912} + 1,010 \text{ Q178\_Q1913} + 0,630 \text{ Q179\_Q1914}$$



## 9.2 Spearman correlation matrix of the metric variables

		Q4_revenue	Q05_employees	Q06_n_markets	Q08_RM_linked_pricing	Q10_RM_increase_revenues	Q11_years_RM_utilization	Q12_successful_RM_incr_profits	Q13_RM_profit_impact_expectation	Q14_profit_increase_1y_RM	Q15_Av_yearly_EBIT_impact
Q4_revenue	Corr. Coeff.	1.000	.824	.752	.814	.125	.063	.011	.047	.068	.087
	Sig. (2-tailed)	.	.000	.000	.000	.005	.152	.802	.287	.124	.048
	N	603	603	602	603	511	511	511	511	511	511
Q05_employees	Corr. Coeff.	.824	1.000	.923	.619	.090	.019	-.043	.045	.036	.046
	Sig. (2-tailed)	.000	.	.000	.000	.043	.669	.334	.312	.416	.299
	N	603	603	602	603	511	511	511	511	511	511
Q06_n_markets	Corr. Coeff.	.752	.923	1.000	.571	.100	.028	-.013	.043	.047	.058
	Sig. (2-tailed)	.000	.000	.	.000	.025	.535	.764	.332	.288	.188
	N	602	602	602	602	510	510	510	510	510	510
Q08_RM_linked_pricing	Corr. Coeff.	.814	.619	.571	1.000	.031	.010	-.016	-.049	.008	.032
	Sig. (2-tailed)	.000	.000	.000	.	.478	.822	.717	.265	.859	.468
	N	603	603	602	603	511	511	511	511	511	511
Q10_RM_increase_revenues	Corr. Coeff.	.125	.090	.100	.031	1.000	.196	.218	.223	.232	.242
	Sig. (2-tailed)	.005	.043	.025	.478	.	.000	.000	.000	.000	.000
	N	511	511	510	511	511	511	511	511	511	511
Q11_years_RM_utilization	Corr. Coeff.	.063	.019	.028	.010	.196	1.000	.869	.634	.929	.926
	Sig. (2-tailed)	.152	.669	.535	.822	.000	.	.000	.000	.000	.000
	N	511	511	510	511	511	511	511	511	511	511
Q12_successful_RM_incr_profit	Corr. Coeff.	.011	-.043	-.013	-.016	.218	.869	1.000	.533	.795	.779
	Sig. (2-tailed)	.802	.334	.764	.717	.000	.000	.	.000	.000	.000
	N	511	511	510	511	511	511	511	511	511	511
Q13_RM_profit_impact_expectation	Corr. Coeff.	.047	.045	.043	-.049	.223	.634	.533	1.000	.710	.729
	Sig. (2-tailed)	.287	.312	.332	.265	.000	.000	.000	.	.000	.000
	N	511	511	510	511	511	511	511	511	511	511
Q14_profit_increase_1y_RM	Corr. Coeff.	.068	.036	.047	.008	.232	.929	.795	.710	1.000	.964
	Sig. (2-tailed)	.124	.416	.288	.859	.000	.000	.000	.000	.	.000
	N	511	511	510	511	511	511	511	511	511	511
Q15_Av_yearly_EBIT_impact	Corr. Coeff.	.087	.046	.058	.032	.242	.926	.779	.729	.964	1.000
	Sig. (2-tailed)	.048	.299	.188	.468	.000	.000	.000	.000	.000	.
	N	511	511	510	511	511	511	511	511	511	511