

Chapter 3

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

3.1 Background of the First Empirical Study

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

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

3.2 Explorative Research and Hypothesis Derivation

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

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

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

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

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

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

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

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

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

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

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

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

3.3 Quantitative Study: Data Collection

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

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

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

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

Fig. 3.1 Companies surveyed per industry

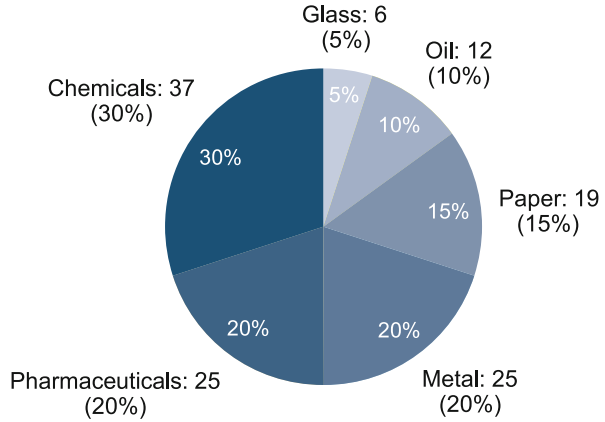
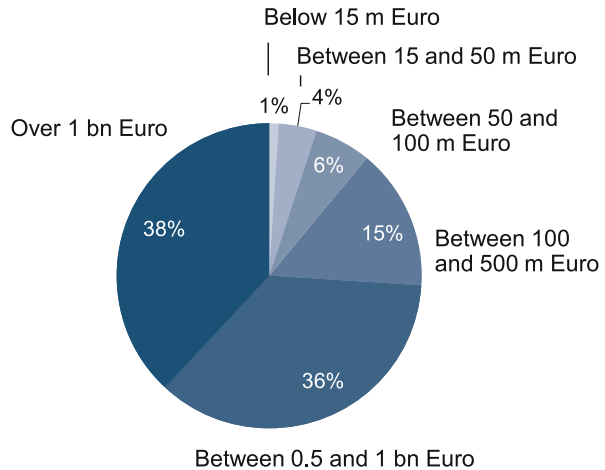


Fig. 3.2 Annual turnover of companies surveyed



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

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

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

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

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

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

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

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

3.4.1 *Focus, Implementation and Introduction*

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

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

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

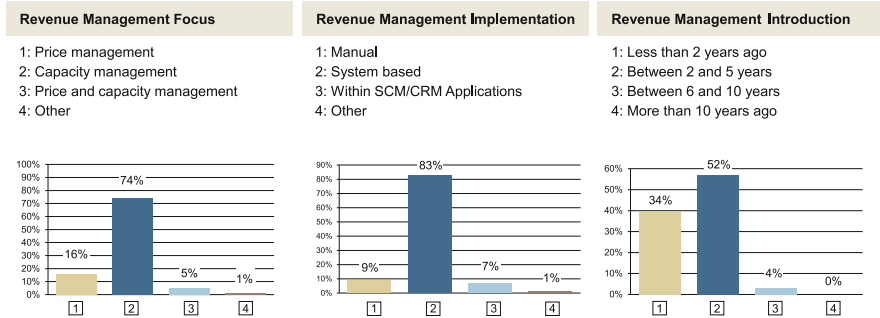


Fig. 3.3 RM focus, implementation and introduction [Questions asked: “Which of the following revenue management approaches are used?” (Revenue Management Focus), “In what form is revenue management used?” (Revenue Management Implementation), “How long has revenue management been used in your company?”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

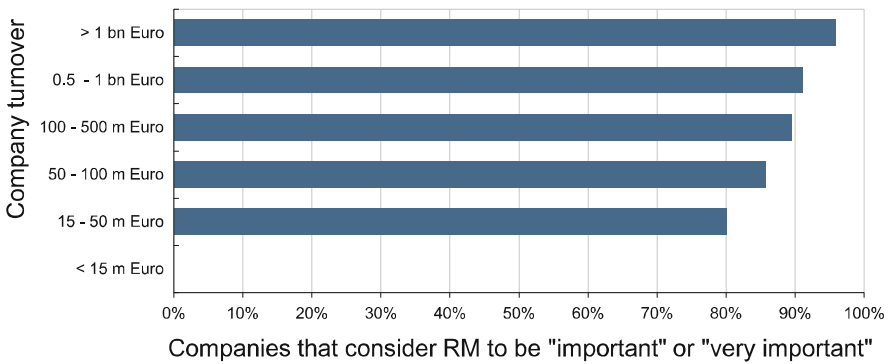


Fig. 3.4 Importance of RM and company size

3.4.2 Importance of RM

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

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

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

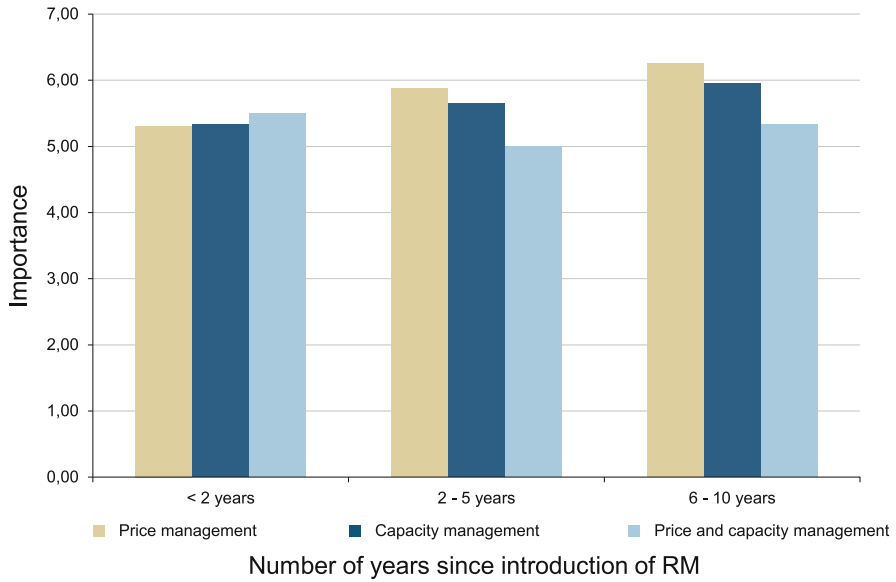


Fig. 3.5 Importance of RM in relation to the period of use and the management concept

3.4.3 Type of RM System

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

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

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

3.4.4 RM as a Lever Contributing to Profit Growth

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

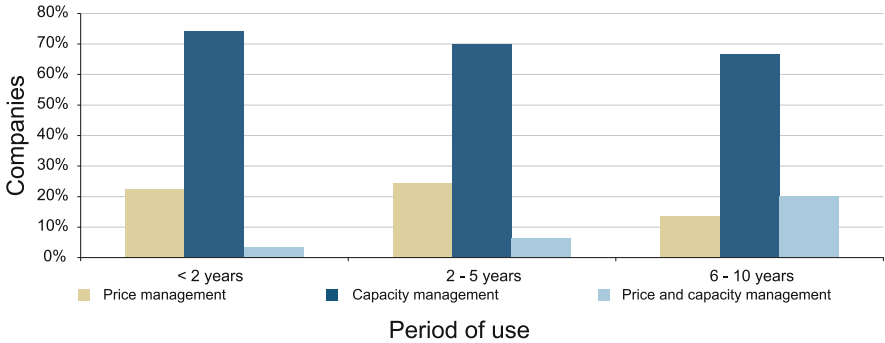


Fig. 3.6 Type of RM-system depending on the duration of use

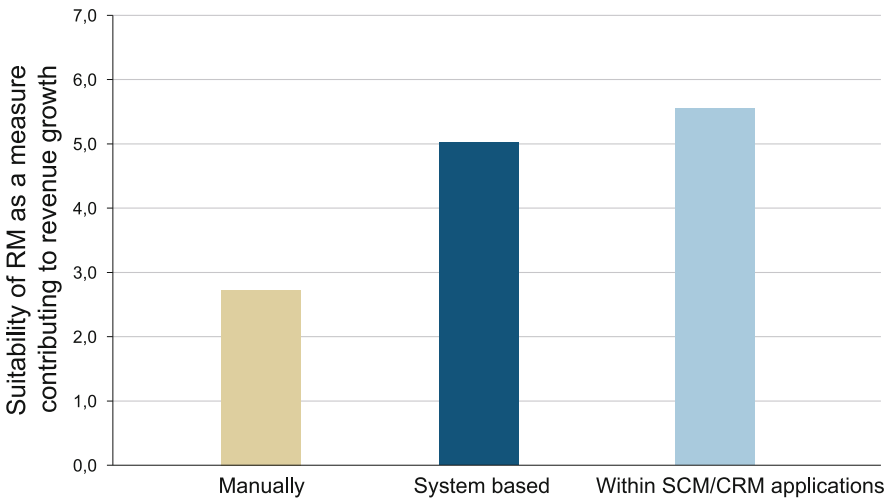


Fig. 3.7 Importance of RM in relation to implementation

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

3.4.5 Future Use of RM

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

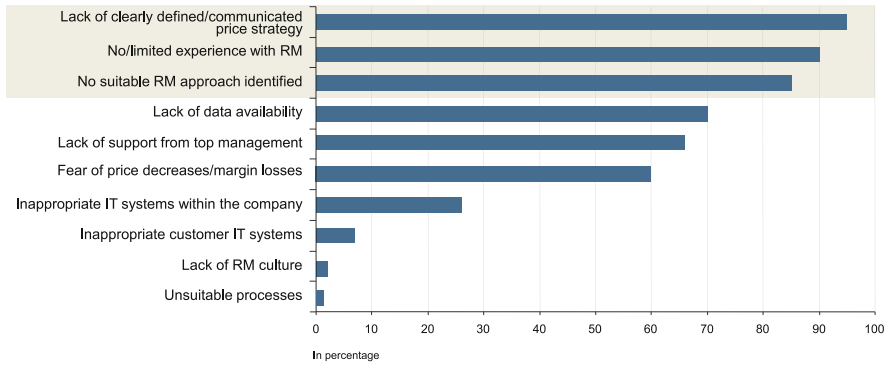


Fig. 3.8 Barriers to the introduction of RM

3.5 Trends and Perspectives

3.5.1 Barriers to the Introduction of RM

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

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

3.5.2 Benefits and Risks of RM

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

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

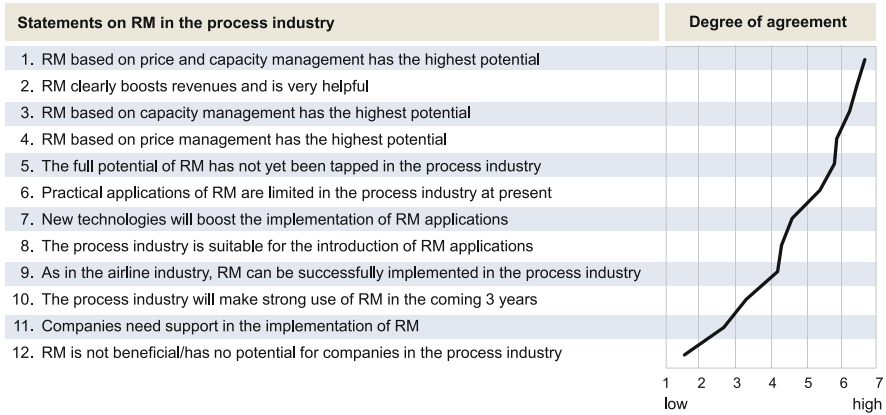


Fig. 3.9 Degree of agreement with statements on RM

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

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

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

3.5.3 Alternatives to RM

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

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

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

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

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

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

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

3.5.4 *Statements on RM*

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

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

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

3.6 Conclusions

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

3.6.1 Results

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

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

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

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

3.6.2 Limitations and Outlook

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

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

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

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