BACHELOR THESIS
Spring 2013

Kristianstad University
International Business Administration Program

Revenue Management

A model for capacity and pricing strategies in a manufacturing multinational

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Abstract

Revenue management is a concept aimed to maximize capacity utilization and through that maximize revenues. It originated in the airline industry in the 70's and due to its effectiveness quickly spread to other sectors of the service industry. Today it is used in several industries like hotels, television and radio broadcasters, and energy transition companies to name a few. Since revenue management was developed in and for the service industry, most studies on revenue management are done on the service industry, creating a rather large research cap. Recently this concept has spread to the manufacturing industry as well. Despite this, there is very limited research done on revenue management in the manufacturing industry. Therefore, this paper's aim is to partially filling this research gap by studying capacity management and pricing strategies (two mechanisms of revenue management), and how they have been shaped when implemented in a manufacturing company.

This paper was done with a case study done on a multinational manufacturing company, who recently implemented revenue management. Interviews were conducted with people in key positions with good insight to the usage of revenue management in this company. Some of the most important result was that in this manufacturing company it is not possible to nest capacity on a customer segment level. However, in this company nesting was done on a market level instead. Also the pricing strategy differed between the service industry theory and this company. Instead of having a dynamic price that changed the total price up or down to change demand, this company had more of a fixed total price, and instead added more features to the product, decreasing the profit margin. The conclusion was drawn that the industry characteristics of the manufacturing industry have forced a rather large modification of revenue management. However, since this was a qualitative case study, no generalizing conclusions for the entire manufacturing industry can be drawn.

Key words: Revenue management, Manufacturing industry, Capacity management, Pricing strategy, Nesting, Dynamic pricing, Threshold pricing.

Acknowledgment

This bachelor dissertation concludes our studies at Kristianstad University. When reflecting on the past three years here, it is truly astounding how much we have learned and how much we have developed in the field of business.

We would like to thank our supervisor Elin Smith, for the good support and guidance throughout the dissertation process. We would also thank Annika Fjelkner for helping us making this dissertation readable and understandable. Also thanks to Timurs Umans for the help and inspiration given at various seminars. A special thanks to the company used in this case for giving us the inspiration and opportunity to study revenue management in your company. We are truly grateful for the time taken from your otherwise busy schedule to participate in our interviews and answering our questions. Lastly we would like to thank our friends and family for having an understanding for our mental and physical absence the past few weeks.

Kristianstad, 2013

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1. Introduction

1. 1 Background

Revenue Management, has its foundation in the airline industry (Cheraghi, Dadashzadeh, & Venkitachalam, 2010). The concept aims to (1) maximize capacity usage and (2) to increase company revenues (Cheraghi et al., 2010). Revenue management is about selling the right product to the right customer at the right place and at the right time (Pak & Piersma, 2002). For example, a plane ticket for a plane departing in 6 months might have one price today, but as closer it gets to the day it is scheduled to departure the price increases; But at a certain point, close to departure, the price starts to drop significantly and continues to drop the closer it gets (Talluri & Ryzin, 2005). This is an everyday example of revenue management.

The literature on Revenue Management states that additional sales, with reduced prices, would be preferable if the sale could generate revenues above its variable costs (Huefner, 2011). This is due to the fact that fixed cost would exist anyhow. As for the airline industry this means that the additional cost would only increase with a smaller margin of variable costs, such as beverages and increased fuel costs when adding another passenger on the flight. Other costs would, under the same circumstances, be the same. To be explicit, one could look at the consolidated income of the annual report of a company. It shows the annual income and the cost of sold goods. The cost of sold goods is the aggregated cost generated in relation to sales. For example if an airline company has a total earning of 1 million USD then this would be the aggregated sum of all sales. And lets assume the cost of goods sold were 0.5 million USD. It would reflect the fixed costs, the variable costs, and other sales related costs added. When applying Revenue Management a company is trying to reduce the cost of goods sold and to increase its annual income, at the same time.

1.1.1 The validity of revenue management in the manufacturing industry

Revenue Management is developed in the service industry, but has recently gained popularity among manufacturing companies. In the service industry, the products offered could be seen as perishable. For example, an empty hotel room in Paris could be seen as a product with an expiration time (Cheraghi et al., 2010), just like unused food will go out of date. However, in the manufacturing sector the products are tangible, and could be stored and used for later opportunities (Cheraghi et al., 2010). However, Huefner (2011) argues that goods stored

instead of being sold could be seen as perishable, since the company has lost a potential revenue and customer to a competitor. Furthermore, stored goods also lose value over a longer period of time. Therefore, Revenue Management is as relevant in the manufacturing industry as in the service industry. The production trigger in the manufacturing industry could either be make-to-order (MTO) or make-to-stock (MTS). An MTO company only starts to produce a product once they have received an order. Compared to an MTS company where demand forecasts controls the production and stock is used to cope with demand. According to Meyr (2004), there is a shift from make-to-stock to make-to-order in the German automobile industry. Meyr (2004) argues that in a make-to-stock company the budgeted sales could be seen as "orders". Therefore, all production in this sector can be seen as make-to-order. With this in consideration, Revenue Management is highly applicable in the manufacturing sector as well when focusing on production capacities rather than products and units.

1.2 Problem Formulation

When implementing Revenue Management in the service and hospitality industries, it should be implemented with company and industry specific modifications (Göksen, 2011). A company's strategy, vision and goal should be considered before the implementation in order to obtain an effective Revenue Management. Furthermore, it is important to identify the actual outcomes and results the Revenue Management is supposed to achieve (Göksen, 2011). An application of Revenue Management in a manufacturing company could be seen as transforming "know-how" between industries and could encounter definition- and "language" differences between the two sectors. The industry characteristics in the manufacturing industry might also differ compared to the characteristics of the service industry. Hence, when transferring know-how between these sectors one could encounter several characteristic differences that would give rise to a modified Revenue Management structure in the manufacturing industry (Cheraghi et al., 2010). With this in mind, it is rational to assume that there is a need for a modification of the concept of Revenue Management to better fit the manufacturing industry.

Most studies are conducted on companies in the service industry (Huefner, 2011; Kimms & Klein, 2006; Wang & Bowie, 2009). Thus, there is a research gap in the understandings of Revenue Management in the manufacturing sector. Previous articles about revenue management in the manufacturing industry have, for instance, been focusing on market

segmentation (Voigt, Saatmann, & Schorr, 2008) and demand management (deB Harris & Pinder, 1995). Although the studies are few the conclusions show important differences between the service and the manufacturing industry. For example, empirical studies in the manufacturing industry show a number of modified ways to segment the market (Voigt et al., 2008). Despite industry differences and modifications, the mechanisms such as market segmentation in the manufacturing sector are fully functional and serve their purposes. These researches, related to practical operations, fill some parts of the research gap of Revenue Management and its performance in this sector. Still, there are questions that need to be answered within Revenue Management.

In the service industriy, the price is based on the remaining capacity of a company. This capacity, such as numbers of hotel rooms, without considerations of outsourcing or contracting orders to other companies, is fixed on a short term but is flexible in long term. This is also true in the manufacturing industry where capacity is expendable, limited and is relatively fixed (Cheraghi et al., 2010). However, the capacity in manufacturing in short-term is more flexible compared to the airline industry. This flexibility is due to the possibility of over-time production in manufacturing and is the most distinguished difference between the two industries. On the other hand, the over-time capacity has a higher cost compared to standard shift-capacities (Holweg & Greenwood, 2001). Therefore, the over-time production capacity is not preferred unless necessary. In the long term the production capacity could be adjusted through an expansion of factories and increased employment rate or decreased through staff cuts and lowered production paces. In the service industry, the capacity is the final product. In contrast, in the manufacturing industry capacity is required in the production of the final products.

Despite several similarities between the service and manufacturing sector there are some differences. For example previous research claim that modified market segmentation is needed when implementing revenue management in the manufacturing sector because of industry differences (Voigt et al., 2008). This has led us to believe that there might be a need for a more industry specific modification when it comes to capacity control and pricing. We also think that existing research within this area lack a clear theoretical model for critical factors when implementing revenue management in a manufacturing company. The interesting aspect is how a pricing and capacity strategy in a manufacturing company could be constructed and managed over time.

1.3 Research Question

The purpose of this paper is to partially fill the research gap in revenue management in the manufacturing industry, and gain a deeper understanding of two of the main components in revenue management, which are pricing strategy and capacity management. Thus our research question is:

How do industry specific factors shape the capacity and pricing strategy when revenue management is implemented in a manufacturing company?

1.4 Limitations

Because of time limitation combined with the complexity and breadth of the revenue management topic this paper will only focus on pricing and capacity aspects. The capacity aspect will however be viewed through a make-to-order manufacturing production process since it could be generalized through the manufacturing industry. A complete coverage of all revenue management aspects would be too broad and take too much time when considering the timeframe of this thesis.

2. Scientific Approach

In this chapter we will present possible methodology choices, both research philosophy as well as research approach. We will also discuss, and argue for, our methodological choice.

2.1 Research Philosophy

The choice of research philosophy is of great importance, since the philosophy contains assumptions of how you see the world and how knowledge can be created. These assumptions are connected, and will act as a foundation and support your choice of research strategy and method (Saunders, Thornhill, & Lewis, 2009). According to Saunders et al (2009) there are four different philosophies: Pragmatism, Interpretivism, Realism and Positivism.

Since the purpose with this dissertation is to further explore revenue management in the manufacturing industry, which is a rather un-researched topic, it has been done with a realistic research philosophy. The reason for this is that this is an objective explorative study, and therefore ruling out interpretivism, since interpretivism would go in deeper at a personal level and analyze more of the people's social role. Furthermore, we explored a new research area and our aim was not to draw any "law-like generalizations" but to gain a deeper understanding of how revenue management is actually used in the manufacturing industry. We also believe, in concurrence with critical realism, that what is said in this paper is what we saw, in contrast to direct realism, which says what is said in this paper is how it is.

2.2 Research Approach

According to Saunders et al (2009), there are two different types of approaches, deductive and inductive. The difference between the two lies within how you approach existing theory and develop your hypothesis. If you have a deductive approach you would, initially, through existing theory develop hypothesis and then test these through data gathering and analyze the results later. An inductive approach, on the other hand, works in the opposite way; here you would first collect data and then derive theories from that data.

For this thesis we have been using a mixture of a deductive and an inductive approach. This is because this dissertation emphasizes on characteristics from both deductive and inductive approaches. For example, through existing theory on revenue management in the service

industry as well as general descriptive theories on the manufacturing industry itself we have created our own model and propositions (deductive). We then evaluated the validity of our models and propositions through interviews. We hoped that through these interviews we would gain a deeper understanding of how revenue management could be used in the manufacturing industry. However, it was not our aim to draw any law-like conclusions from this study, in coherence with an inductive approach.

2.3 Choice of theory

Since the majority of the articles on revenue management are about the service industry a combination of overarching revenue management literature (Huefner, 2011; Ingold, Yeoman, & McMahon-Beatti, 2000) have been used to provide a general description of revenue management and how capacity and pricing strategy are used. Furthermore, to be able to "translate" these theories to the manufacturing industry, more general articles about the manufacturing and especially MTO companies have been chosen. The reason is that the MTO production process is, according to Meyr (2004), valid for all manufacturing companies. This production process has also greater compatibility to the revenue management concept, which would facilitate the implementing process. The aim of this is to be able to grasp the characteristics of the manufacturing industry.

2.4 Choice of methodology

The aim of this dissertation is to fill a research gap within the field of revenue management. To the authors' knowledge there is no general model of revenue management in the manufacturing industry. There is also no existing theory on capacity and pricing strategy of revenue management in the manufacturing industry. Our interviews have provided us with a deeper understanding of how revenue management could be used. Furthermore, since there are no existing theory or model on revenue management in the manufacturing industry, we believe a qualitative study would be the most beneficial since it would provide a deeper understanding of the topic.

3. Literature Review

The purpose of this chapter is to further scrutinize revenue management in the service industry and to examine industry characteristics in the manufacturing industry. It will provide a more comprehensive and a more detailed description of existing revenue management operations in the service industry. To fully connect the concept of revenue management from the service industry to the manufacturing industry, this chapter will also provide a general description of the relevant areas in the manufacturing industry. Therefore, this chapter will be divided into three parts. Part I) consists of a short description of the history of revenue management as well as detailed information on revenue management in the service industry, with a focus on capacity management and pricing strategy. Part II) will focus on the characteristics of the manufacturing industry and the make-to-order sector. Part III) will present propositions derived from conclusions of part I) and II), where we focus on capacity management and pricing strategy in the manufacturing industry.

3.1 Revenue management in the service industry

The initial purpose of the revenue management concept was to allocate unused capacity and that way increase revenues (Dai, Chao, Fang, & Nuttle, 2005). The allocations of capacity should be done in co-ordinance with extensive market knowledge within a company. This facilitates the anticipations of market developments and reactions, which thereby enables the employment of the appropriate reactive measures (Cheraghi et al., 2010). The concept of revenue management originated in the airline industry and was developed by American Airlines. The reason was to compete with new upcoming low-fare airlines without becoming low-fare itself (Huefner, 2011). It was achieved through a higher capacity allocation, a differentiated pricing and a successful segmentation of the market. For example they would, closely to the flight departure, reduce the prices for the remaining seats, which would otherwise have been empty. The price reduction offers was restricted by “fences”, which made it possible to target selected segments while the offer was “prohibited” to other segments. The purpose of “fences” is to avoid losing full fare consumers to the reduced price offers. Thereby, the airline company could make use of its total capacity and, hence, increase revenues (Huefner, 2011). It also allowed the company to extend its segment groups by using available capacity and reduced price offerings to target consumers that would otherwise have chosen a substitute alternative. This was the beginning of revenue management.

Further on, the concept gained popularity and was widely adopted in the airline industry. Due to its efficiency the concept of revenue management later began its movement into other industries as well, such as hotel, car rental, shipping, tour operator, television and radio broadcasters, energy transition companies, manufacturing and many more (Kimms & Klein, 2006; Talluri, van Ryzin, Karaesmen, & Vulcano, 2009).

According to Talluri and Ryzin (2005) revenue management consists of 3 major parts, structural decisions, quantity decisions, and price decisions (see figure 1). Structural decisions include areas such as customer segmentation, selling format and terms of trade. Quantity decisions (in this paper referred to as capacity management) consist of whether to accept/reject an order, capacity allocation and so forth. The part of price decisions (in this paper referred to as pricing strategy), are the two pricing steps, threshold pricing and dynamic pricing. Even though revenue management consists of 3 parts this paper will, as mentioned previously, only focus on capacity management and pricing strategy.

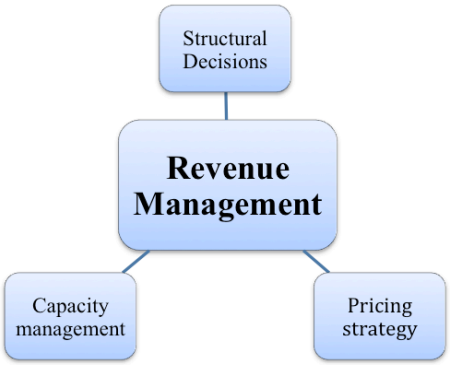

Figure 1 – Revenue management mechanisms
(Based on Talluri & Ryzin, *The theory and practice of revenue management.* p.3, 2005)

To be able to gain a deeper understanding of how revenue management works, existing theory on revenue management could be used. Since revenue management originated in the service industry most studies on revenue management has been focused to this area. Hence, this part will focus on the results of previous scholars and what is said about revenue management in the service industry. 3.1.1 is about *capacity management*, and will cover areas such as *booking limits* and *overbooking.* Section 3.1.2 will cover revenue management pricing strategies such as *threshold* and *dynamic pricing.*

3.1.1 Capacity Management

Relatively fixed capacity is one of the main fundamentals that indicate if an industry is suitable for revenue management. Hence, the ability to control the short-term fixed capacity could be a critical success factor. In the airline industry, Talluri and Ryzin (2005) identify several capacity management mechanisms. Some of these capacity management mechanisms could also applicable in the manufacturing industry due to a similar view on capacity itself. Furthermore, there are Two major capacity control systems, *"single-resource capacity control"* and the newer *"network capacity control"* which is an extension from single resource capacity control (Chiang, Chen, & Xu, 2007; Talluri & Ryzin, 2005). Single resource capacity control could be seen as one single resource line. For example in the airline industry single resource capacity control could be a direct flight route without transfers. Network capacity control on the other hand is several flight routes combined, which is in other words flight transfers. In this paper we will only focus on the *single-resource capacity control* and the types of controls used in it, such as booking limits and overbooking. The reason we have chosen not to include network capacity control due to the lack of research done on revenue management in the manufacturing industry. We believe that an understanding of single resource capacity control is needed before analyzing network capacity control, and due to time limitations both areas cannot be covered. The connection to the manufacturing industry will be explained further on in this paper.

3.1.1.1 Booking limits

Booking limits is for example when reserving a specific number of seats in an airplane in a specific pricing class. Hence, it is used to divide the total capacity amongst different classes. According to Talluri and Ryzin (2005) there are two different types of booking limits, which are partitioned and nested.

The first type of booking limit *partitioned*, also referred to as *static*, is the less sophisticated method of the two booking limitations. This method divides the capacity into different classes and once a class' capacity is consumed it will reject new bookings at that class price rate, even though there is available capacity in other classes (Talluri & Ryzin, 2005). Therefore, in the *partitioned* booking limitation capacity is not flexible and is restricted to its given class.

The second type of booking limit is *nesting*, also referred to as *dynamic*, on the other hand allows classes to overlap with each other. Parts of the capacity are double counted for, which

allows a flexible usage and allocates capacity in a *dynamic* manner. According to Chapuis (2008) the method of *nesting* itself contains two sub categories, *net nesting* and *threshold nesting*.

In the first category, *net nesting,* the capacity offered to the various classes is derived from both a forecasted demand and a stochastic demand. The demand forecasts are related to historical sales data. This information allows companies to divide capacity in a approximately manner to the different classes (Chapuis, 2008). There is, however, uncertainties considering actual demand coherency with the forecasted predictions. In other words, the demand is also stochastic. Therefore, an additional capacity margin has to be added in all classes. It is achieved through double counting capacities in some of the classes, usually the lower ones, which gives a capacity overlap. To a certain degree *net nesting* protects the higher fares and presents possiblities of allocating capacity from the lower fare to the higher fares.

An example to fully clarify *net nesting* could be; if an airplane has three classes and a total capacity of 10 seats and the division amongst the classes (C_i) are: $C_1 = 2$, $C_2 = 4$, and $C_3 = 4$, where C_3 is the highest fare, at time T = 0. Then the available capacity offered to the market that is available for booking in each class at T = 0 would be $C_1 = 2$, $C_2 = 4 + (2) = 6$, $C_3 = 4 + (4) + (2) = 10$. If the first received booking is in C_3 then it would reduce the initially given capacity in that class and hence $C_3 = 4 - 1 + (4) + (2)$. Therefore, initial bookings in the high-fare class in *net nesting* do not reduce capacity in other classes until it runs out of its initially given capacity. However, capacities in the lower fares normally have a higher demand and are therefore consumed before high-fare classes run out of capacity. Hence, when high fare classes run out of capacity and additional booking for that class is received then a company won't be able to allocate capacity from the low-fares to satisfy this demand. In other words, capacity has been sold to a lower price than what it could have been sold to. Therefore Chapuis (2008) argues that a sale in *net nesting* today could be considered as a loss of revenues tomorrow.

The second nesting method is called *threshold nesting,* also known as *theft nesting*. Like *net nesting it* "steals" capacity from other classes. However, *threshold nesting* has a "lack of memory" and favors the higher classes by stealing capacity from the lower classes in an aggressive manner (Chapuis, 2008; Talluri & Ryzin, 2005). The "lack of memory" derives

from not utilizing historical sales data. Hence, this nesting method is always trying to push bookings towards the high-fare class due to its profitability.

As an example, using the same condition as in *net nesting*, the airline would have a maximum capacity of 10 seats with 3 classes (C_i) and the capacity offered to the market would be $C_1 = 2$, $C_2 = 4 + (2) = 6$ and $C_3 = 4 + (4) + (2) = 10$. If there is a booking of 1 capacity in for example C_3, then *threshold nesting* will steal 1 capacity from the lowest class and, hence, reduce the capacity in C_1 and C_2 with one capacity. In other words it does not use the initial given capacity in the highest class. The current total available capacity, after the booking of 1 capacity in all classes will be $C_3 = 4 + (4) + (1) = 9$, $C_2 = 4 + (1) = 5$ and $C_3 = 2 - 1 = 1$ (Chapuis, 2008). Hence in *threshold nesting*, a higher ranking class, a class that provides a greater revenue, always uses a lower ranking class' capacity when a booking is received (Talluri & Ryzin, 2005). This control mechanism is also described by Chapuis (2008) where he refers to it as parallel nesting. The *threshold nesting* also brings some issues such as spill costs. According to Chapuis (2008) spill cost arises when capacity exceeds the demand. For example, if the low-fare class is always out of capacity on the medium/long-term then the market will start to look for low-fare capacities elsewhere. This will damage consumer relations on the long run and may lead to a decisive reduction of low-fare capacity demands.

Using booking limits is one way to maximize revenue through capacity control. However, it only focuses on the revenue part, which cannot guarantee a fully maximized capacity utilization. Hence, overbooking is a method used to ensure a maximized capacity usage.

3.1.1.2 Overbooking

Overbooking is a way to fully maximize capacity utilization, which is to sell in an excessive manner exceeding total capacity (Talluri & Ryzin, 2005). According to Bell (2012) *overbooking* is one of the fundamental concepts in the revenue management framework, and is applied to balance up the problem of people not collecting their ordered product. To reduce the risk of "no shows" airline companies began to have their customer pay for the full fare when making reservations and are not allowed to any refunds. Even though a seat on an airplane is already paid for an empty seat is still considered as a missed revenue opportunity (Bell, 2012). Hence, *overbooking* is used to ensure a maximum use of capacity, which could increase revenues. Historical data of "no shows" should be used when estimating the number of overbookings (Bell, 2012). However, Bell (2012) also stresses that if *overbooking* is

utilized then the company must also be prepared if the numbers of "no shows" are less than estimated.

One way to, fully or partially, protect yourself from the risk of cancelations, is to use some sort of cancelation or *no show penalty* (Talluri & Ryzin, 2005). According to Talluri and Ryzin (2005), both the passenger and the company are taking a risk when a reservation is made. For the passenger the future is almost always uncertain. She or he could get ill, change of plans or maybe even a substitute alternative might emerge. This creates a risk for the passenger if she or he has to commit to the reservation with no possibility to cancel. On the other hand, the company would have to deal with great uncertainties and great risks if free cancelations were allowed. The reason for this risk is due to a lack of passenger commitment if the passenger has nothing to lose. It is here the cancelation penalties have its role. The penalties allow the company and the customer to share the risk (Talluri & Ryzin, 2005).

Revenue management is used to maximize revenues in relation to existing capacity. Therefore, capacity management is one of two major components in the revenue management concept. The second major component is pricing, and it will be explained in the section below.

3.1.2 Pricing Strategy

3.1.2.1 Threshold pricing

The aim of revenue management is to maximize the occupation of capacity and to increase revenues through price flexibility. Therefore, revenue management consists of two major pricing steps. One of these pricing steps, identified by Talluri and Ryzin (2005), is *threshold prices*, also known as *bid-prices*, which is a costs-based pricing method. The usage of *threshold prices* is highly popular due to its simplicity (Volling, Eren Akyol, Wittek, & Spengler, 2012).

According to Bansal et al (2010), companies operates in either online or offline booking request processes. However, it is the online booking request process that is the reality of most companies. In the online mode the company would only have knowledge of booking requests that have been received. Hence, the future requests are unknown (Bansal et al., 2010). It is an imperfect information access where total demand and total supply could only be related to current and historical data. Therefore, it is important to know the lower boundaries when

reducing prices to maximize capacity. According to Han, Gupta, & Lehmann (2002), a threshold price could support managers in their decisions by identifying suitable price discounts in relation to costs. When using *threshold price* management in the airline industry a booking request will only be accepted if the offered price exceeds the *threshold price* (Talluri & Ryzin, 2005; Volling et al., 2012). It is because the opportunity cost of consuming capacity on a flight, which is the variable consumption costs, is reflected in the *threshold price*.

If retailer parties are involved in the sales process then the *threshold price* could also be supportive in the negotiations of a appropriate discount rate offered by retailers to end consumers (Han et al., 2002). Moreover, the *threshold price* could provides a cost structure awareness since the total variable costs of a product is reflected, which managers could monitor and strive to reduce (Han et al., 2002). A setting of individual bid or *threshold prices* on different products also supports information processing such as the identification of customer segments. This is because a varying customer price sensitivity gives possibilities of identification of existing segments (Han et al., 2002). Also, Volling et al (2012) argue for the development of specific bid price thresholds for each bottleneck in capacity and agree on the possible improvements in revenue management such as pricing strategies, and information processing. When a company achieves a small cost reduction it could reduce their *threshold prices* and thereby have a positive affect on consumers' willingness to buy. According to Han et al. (2002), a cost reduction will have greater impacts in companies with generally low discount rates.

Due to fluctuations and volatilities in demand *threshold prices* should be constructed with regards to received orders and historical sales data to forestall uncertainties in demand (Volling et al., 2012). According to Talluri and Ryzin (2005), to achieve maximum effect, prices must be updated after each sale and over time (Talluri & Ryzin, 2005).

3.1.2.2 Dynamic pricing

The second pricing step, *dynamic pricing*, was developed to support the revenue management concept. Due to dynamic capacity allocation and segmentation, *dynamic pricing* was necessary for an optimal functioning of the revenue management and has its purpose to maximize overall revenues (McAfee & Te Velde, 2006). It is quite the opposite of first come first served option usually conducted by companies. According to McAfee and Te Velde

(2006) *dynamic pricing* alone with yield or revenue management is one of the most advanced managerial systems existing. Moreover, *dynamic pricing* it self is a highly complex concept which has represented challenges to the modern economical analysis. It is because it aviates from the standardized pricing model where a product has a fixed price on the short/medium term (McAfee & Te Velde, 2006).

The concept of *dynamic pricing* is to markup or markdown prices for products in a dynamic manner simultaneously as a changing supply demand on the macro/micro level. It considers the total market situation such as own company capacity, competitors' capacities, total market demand, and historical data of market. Although prices are being marked up and down with a purpose to maximize profits for companies the concept of *dynamic pricing* brings a degree of fairness in pricing to various segment groups (Palamar & Edwars, 2007). It is because in a fluctuating demand environment a relatively static pricing strategy could result in a overpricing during periods of low demand and hence a overpricing of the market. Therefore, a *dynamic pricing* system would not only improve profits for a company but also adjust the price to current demand and hence an improved supply-demand model. A study conducted in 2003, presented by Palamar and Edwards (2007), shows of a significant difference in profit increases between reducing fixed costs and increasing prices. The result shows 1 % decrease of fixed costs would yield a 2.3 % increase in profits. Meanwhile, if prices would increase by 1 % it would yield an 11.1 % increase of profits.

However, when operating with revenue management companies will face decisions of either to accept or to reject offers. The risks related to this option are two sided. If the initial customer request is accepted the company might lose potential revenues since the product or service could have been sold to a higher bid (Spengler, Rehkopf, & Volling, 2005), which is therefore a spoilage cost to the company. On the other hand there are risks in rejecting the offer when hoping for a higher bidder that might not be realized and hence a revenue loss, which is a spill cost (Chapuis, 2008).

3.1.3 Summary

To manage capacity, revenue management utilizes *booking limits* and *overbooking*. Booking limits could either be *portioned* (static) or *nested* (dynamic), where the latter is considered to be the most sophisticated and consists of two methods, *net nesting* and *threshold nesting*.

Overbooking is used to cope with the problem of "no shows" to ensure a maximized capacity utilization and to maximize revenues.

Within revenue management the pricing strategy consists of two pricing methods, *threshold pricing* and *dynamic pricing. Threshold pricing* is an internal pricing method, and is based on opportunity costs while *dynamic pricing* on the other hand is based on external factors.

3.2 Industry specific characteristics in manufacturing

To be able to adapt the concept of revenue management from the service industry to the manufacturing industry a deeper understanding of the manufacturing industry is needed. Information of how capacity is managed and allocated, and how the pricing process looks like, in general, in the manufacturing industry is therefore required. There are, however, no (to the authors knowledge) generalizing descriptions of the manufacturing industry. It is probably also very difficult to give since characteristics can vary largely from sector to sector and from company to company. This section will however have a focus on capacity management with additional focus on MTO firms in the manufacturing industry.

This section will start to provide a general background of the manufacturing industry, such as how production is managed today and how the manufacturing industry could be divided. Processes such as sales, production-, and capacity planning, with focus on the make-to-order sector will also be presented. Due to the simply to relate, the automobile sector is used to present how the manufacturing industry is managed and the existing processes.

From a historical point of view, one characteristic for industrial manufacturers operating in stable markets is that "they tend to have narrow product lines, long production runs and process-oriented factory layouts" (Nahm, Vonderembse, Subba Rao, & Ragu-Nathan, 2006, p. 214). Both Ingold (2000) and Nahm (2006) claim that companies in the manufacturing industry can, and often, use inventory as a buffer to better cope with demand fluctuations. However, this is not quite the situation today. Today the markets where the post-industrialization manufacturers operate are much more turbulent. The product portfolio are much broader, the production runs are much shorter with quick changeovers between products types (Nahm et al., 2006). This development has been identified in the UK automobile industry where Holweg & Greenwood (2001) has observed a trend of decreasing product life cycle of platforms offered by manufacturers. It is due to the consumers' variety of

preference, which has given rise to an extended product portfolio among manufacturers to met market demand. This broad preference variety combined with intense market competition has also forced the automakers to decrease production of individual car platforms since demand is spread among different brands and their platforms. Furthermore, not only has the market development forced automakers to increase its product portfolio it has also increased the introduction pace of new platforms (Holweg & Greenwood, 2001).

Furthermore, to cope with fluctuations in demand Nahm (2006) claims that today's manufacturers act proactively and use flexibility to change both product mix and volume to be in line with current demand. However, the manufacturing industry is a broad industry and the capacity and pricing characteristics may differ tremendously from one company to another. Therefore, to be able to obtain a conclusion that is not too generalized the industry it self has to be divided and segmented into sectors. One way to divide the manufacturing industry is by dividing it into two parts where the "trigger for production" acts as a divider.

According to Meyr (2004) there are two different types of manufacturing companies, make-to-stock, MTS, and make-to-order, MTO, where the latter one have expanded into several sectors within the manufacturing industry. Furthermore, Barut, and Sridharan (in Chen, Mestry, Damodaran, & Wang, 2009) claim that today's MTO hold capacity to cope with demand fluctuations. This is in contrast to Ingold (2000) who claims that today's manufacturers still use inventory as buffers. Despite the different market approaches the factory layouts have over time changed from a process-orientation to a product-orientation. This means that factory layouts have gone from the idea of having similar machines etc. grouped together to the idea of letting the product being in the center (Nahm et al., 2006). Furthermore, Meyr (2004) claims that despite making a transition from more standardized products (make-to-stock) to more of a custom production (make-to-order) companies still try to shorten their lead-times by more than 50%.

3.2.1 The Selling process

One important factor that characterizes the manufacturing sector and plays an important role in the application of revenue management is how the products are sold. Using the automobile industry as an example, cars are being sold either via sales subsidiaries or via independent retailers (Meyr, 2004). The companies are seldom selling directly to the end customer in contrast to the service industry where the capacity is the final product and hence sold directly

to the end consumer. Normally in the automobile industry a retailer sends his request of cars to a manufacturer and this quota is then negotiated. At the negotiation stage it is only the "basic car" that is discussed. It is not until three to five weeks prior to the planned production the specification of the cars and models are decided (Meyr, 2004). Along with the transition from a make-to-stock production to a make-to-order production, premium producers are also trying to go around retailers to reach end consumers as attempts to increase their total incoming orders (Meyr, 2004). Hence, an increasing online ordering trend have been identified in the German automotive industry (Meyr, 2004). This can also contribute to a shortening of lead times since the order-placement process is reduced. In fact, according to Holweg and Jones (in Meyr, 2004) manufacturing and distribution only stands for 16% of the total lead-time, which is the time period from order placement to delivery. This means that if make-to-order companies want to shorten production time, the biggest time-consuming processes lie in pre-production.

3.2.2 Production planning process

In the car manufacturing sector Meyr (2004) identifies two different planning processes: forecast-driven and order-driver planning. The forecast-driven, is built on estimated market developments. Once an annual budget is set resourced are distributed over the company departments, and the production plants, for example, receive their goals and what is expected of them the following year. Furthermore, in this budget, capacity reservations can be made. Meyr (2004) argues that since lead times are long and a installation of a new assembly line is highly complex it is important to reserve your capacity in accordance to current demand. The input for this budget is the forecasted customer demand. These forecasts are built of historical sales data, retailers annual requests, as well as demand trends identified by sales organizations (Meyr, 2004). Usually in the manufacturing industry, the production forecasting is done from a centralized planning group (Nahm et al., 2006).

The second planning process is order-driven planning. Tasks belonging to this category are tasks exclusively triggered by fully specified orders (Meyr, 2004). Normally these fully specified orders are sent to, and handled by a central department who later on assigns production plans to the different production plants, and the plants get their production order (Meyr, 2004).

Hence in relation to production planning processes, capacity management in the manufacturing industry is therefore of great importance. Furthermore, capacity maximization is also one of the key factors to success in revenue management. Hence, general understandings of capacity management in the manufacturing industry are also necessary when developing revenue management based capacity allocation models for this industry.

3.2.3 Capacity planning

The capacity function in the manufacturing industry, and in the make-to-order sector specifically, could be described as a predefined time period of production. Hence, bookings are related to a given production period with a certain length, which could also be seen as a non-overlapping sequence period (Volling et al., 2012). The capacity in the manufacturing industry is much alike the service industry. However in the manufacturing industry the capacity is relatively fixed on the short-term instead of being fixed as in the service industry. Furthermore, in the make-to-order sector the capacity has also a close relation with placed orders. If a company fails to sell its products then it is also a loss of fixed capacity (Volling et al., 2012). Although there are similarities in assessing and valuing capacity there is a critical difference in the make-to-order manufacturing sector. It is the lack of possibilities to accept/reject incoming orders at later times. Therefore, the make-to-order companies are forced to make decisions on whether to accept or reject the order almost the second it arrives (Patterson, Balakrishnan, & Sridharan, 1997). This order receiving process is considered as the online mode, described previously, where the information access is limited.

Chen et al (2009) claims that an efficient and effective use of capacity is a key factor for success for MTO companies, since unused capacity is a loss of revenue. Furthermore, Chen et al (2009) identify three major planning tiers, long-term, medium-term and short term. The long-term capacity planning focuses on facility locations and plant capacity, major supply chain planning, new production technology and principle operation modes and production methods. This planning is usually done on a yearly basis. Furthermore, Chen et al (2009) claim the long time capacity planning looks similar in both MTS and MTO firms.

The second tier of capacity planning, medium-term, focuses instead on labor-employment issues such as layoffs, vacations, hiring etc., Inventory policy, utility requirements, facility modifications, outsourcing and major material-supply contracts. The timeframe for medium-term planning is usually either a month or a quarter (Chen et al., 2009). Furthermore, Chen et

al (2009) claim it to be two different medium-term planning approaches, either matching demand or level capacity. By matching demand the capacity is alternated by hiring or layoffs, this to as exactly as possible match the aggregated demand. The Level capacity approach is somewhat the opposite. Here the capacity is constant and demand is matched through for example adjusting overtime/part time labor, inventory or subcontracting. According to Chen et al (2009) a mixture between "matching demand" and "level capacity" is used.

The last capacity-planning tier is short-term and plans the daily or weakly operations such as matching available resources with available capacity. For MTO firms this process is more complex since they have to plan for each individual order at a component level compared to MTS firms who can plan for bigger batches (Chen et al., 2009). Furthermore, Chen et al. (2009) claims that to meet the order deadline it is common for MTO companies to use outsourcing and overtime labor. An other difference that Chen et al (2009) stresses is that MTS firm often use so called "freeze periods" where production plans cannot be changed, which is to secure a smooth production process. This is however not used in MTO firms since they always have to be flexible when dealing with existing orders, but at the same time they have to decide what incoming orders to accept or decline.

3.2.4 Summary

The manufacturing industry is nowadays much more turbulent. This forces the companies to have a broader product portfolio and a faster and more flexible production. Administration of this planning process is of great importance. For MTO companies this process could be divided into long (year), medium (month-quarter) and short-term (day-week) tiers. Where the long-term tier focuses on facility location and plant capacity etc. Short-term focuses more on labor employment issues and facility modifications. Lastly the focus of the short-term tier lies on matching available resources with available capacity.

3.3 Conclusions and propositions

Previous scholars have both pointed out several industry characteristics necessary for a successful usage of revenue management as well as how revenue management is actually used in the service industry. Trends can also be seen that more and more manufacturing companies have started to adopt the concept of revenue management. Despite this, no general models of revenue management in the manufacturing industry exist. Therefore, in this section we will present our propositions and models of how we believe revenue management should be used in a manufacturing company most efficiently.

The figure below (Figure 2) visualizes important components of revenue management with additional focus on capacity management and pricing strategy. The purpose of the extra detailed model on capacity management and pricing strategy is to further illuminate how these two are connected. It is also because of the focus of this paper is to analyze how revenue management could be implemented in the manufacturing industry with specific regards to capacity management and pricing strategy.

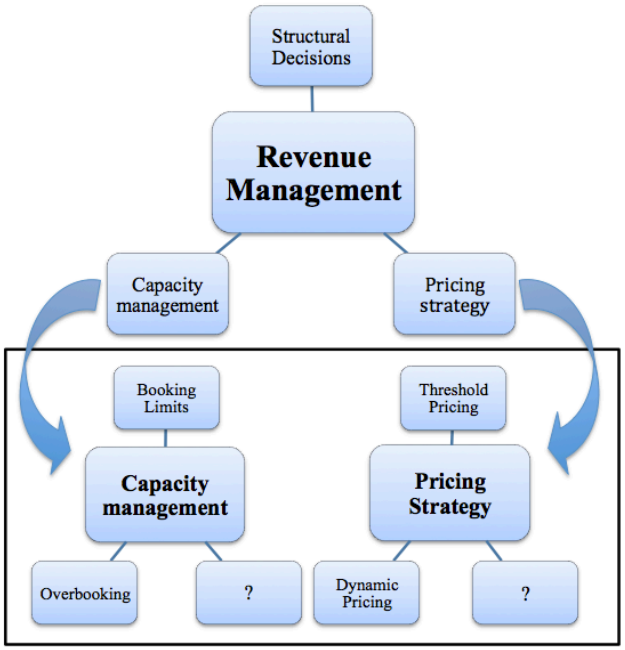

Figure 2 – Revenue management mechanisms; extended on capacity management and pricing strategy

As for capacity management two methods have been identified. One of the methods, booking limits, is used to maximize revenue based on the given capacity within a company. Hence, it does not guarantee a full capacity utilization. Therefore overbooking is used. When overbooking, a company is guaranteed a fully usage of its capacity, which would increase revenues at the same time. When implementing revenue management in the manufacturing industry there could be additional factors that are industry or company specific, which could affect the end result of capacity management. These factors are of interest because it could give rise to a modified capacity management in the manufacturing industry. Hence, a question mark for capacity management is formed as a reservation for these unknowable factors.

As for pricing the revenue management pricing strategy consists of *threshold-* and *dynamic pricing*. *Threshold pricing* considers internal costs and internal capacity availability. This pricing method should, according to previous researches, be updated over time and after each sale to be fully beneficial. *Threshold pricing* could also be seen as a reflection of opportunity costs of a sale. Therefore the end prices should exceed the *threshold prices* because it would otherwise be unprofitable. It has also been stated that each product should have its own *threshold price*, which could provide important information such as identification of customer segments and product cost awareness. *Dynamic pricing* considers external factors on market levels. It fluctuates depended on current demand of market and the total supply of market. Through this non-fixed pricing strategy in revenue management firms could therefor increase their chances of maximizing revenues, regardless to whether demand is high or low. When the pricing strategy is implemented in the manufacturing industry there could also be unidentified factors that has to be taken into account. Therefore, as with capacity management, a question mark is set as a reservation for these factors in pricing strategy as well.

3.3.1 Capacity Management

As shown in the literature review, todays' manufacturers have adapted their production to increasingly demanding and turbulent markets. It has forced manufacturers to increase their product portfolio and to shorten their product sequences. Therefore, manufacturers possess the flexibility of switchovers in production.

In the airline industry capacity is the end product, for example a seat on an airplane. In the manufacturing industry this is not the case. However if capacity is seen as the number of finished products, this view on capacity could be transferred from the service to the manufacturing industry.

In the three tiers in capacity planning, described by Chen et al. (2009), it is only the medium and short-term tiers that are directly affected by revenue management. On the long-term company objectives and goals are set based on forecasted demand. This process will not differ whether the company uses revenue management or not. It is not until the medium-term tier that revenue management plays an important role. It is here the company could adjust major operational factors such as employment issues, facility modifications and capacity allocation to better cope with the actual demand. Revenue management also operates on short-term,

which is a daily or weekly basis, to secure maximized capacity utilization through last minute bookings and matching available resources with available capacity.

3.3.1.1 Market nesting

The first possibility is capacity segmentation into markets, where different markets can "transfer" their production capacity amongst each other to better cope with demand differences on a global level. For example if demand is excessive in market A, then unused capacity in market B and market C could be allocated to satisfy this demand (see figure 3). Therefore it could utilize the two nesting possibilities, *net nesting* and *threshold nesting*, obtained from the service industry. These two method types are similar in nature but differ, however, in their operations, which are to either proactively protect or secure available capacity for a priority market, or to serve as a reactive measure to the dynamic developments of the markets. The aim of the two methods is to maximize revenues from the total capacity. Hence, both *net nesting* and *threshold nesting* could be used in the capacity segmentation into markets. This leads to our first proposition:

P1: Manufacturing companies can nest their capacity on a market level

3.3.1.2 Threshold nesting

Threshold nesting is the nesting method acting in a proactive manner. It allows a priority market to both reserve and "steal" capacity from a non-priority market as soon as orders are received. Hence the *threshold nesting* method could always secure a capacity availability in the priority market. This could be beneficial when penetrating a new market where the strategy is to rapidly increase market shares and establish a strong company presence. However, the *threshold nesting* strategy could generate spill costs for a company due to constant lack of supply. Furthermore, the long-term pricing strategy in the priority market might be difficult to manage when considering market demand and supply. According to traditional micro economical models, an increase in supply will lead to reductions of the product price (Perloff, 2010). These reduced prices might result in the fixation of a "false" preference price by the market. Hence, once the *threshold nesting* is cancelled the market might fail to accept the normal price rates. Thereby a well thought through strategy and operation plans, on long terms, is necessary when applying *threshold nesting*. Through this our second proposition is derived:

P2: Threshold nesting can be used proactively to serve "priority markets".

3.3.1.3 Net nesting

Capacity *net nesting* on the other hand is the method that acts in a reactive manner. It is reactive since it does not "steal" capacity from other markets until the capacity of a priority market has been expended whereas the demand remains unsatisfied. Thus a company can allocate production in plants in other markets with excessive capacity, if necessary and profitable, when the capacity in a priority market has been utilized (see figure 3). An application of *net nesting* would also reduce spill costs since the given capacity in non-priority markets are not consumed by the priority market right away. This leads to our third proposition:

P3: Net nesting can be used as a reactive tool to cope with demand

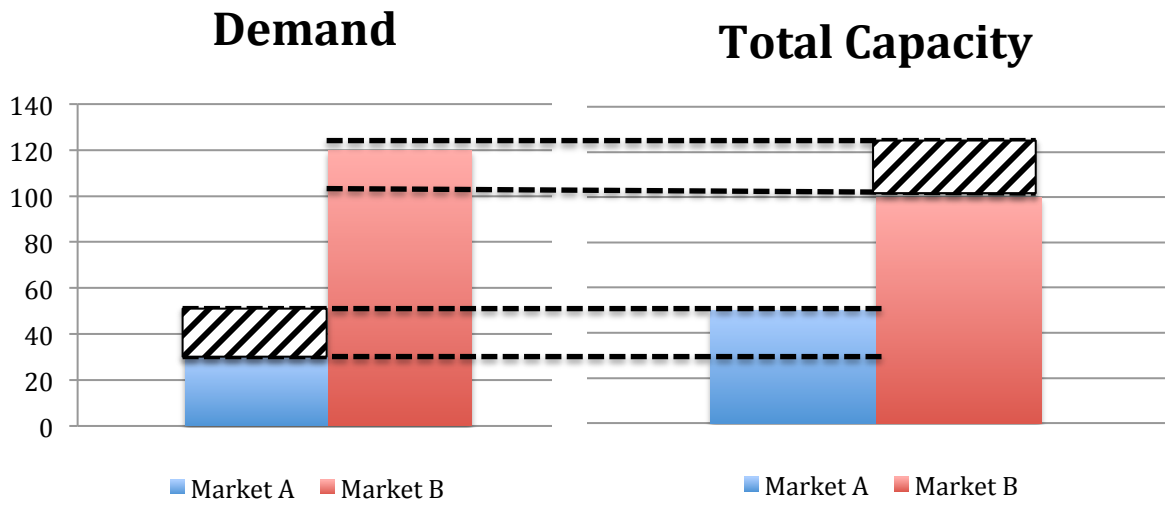

Figure 3 – Capacity allocation

3.3.1.4 Segment nesting

Used actively in the service industry, nesting on segment level has made it possible for service companies to "push" bookings toward fares with higher profits. Therefore, nesting of segments, if adopted carefully and modified, could also support manufacturing firms to obtain positive results.

There is, however, a requirement needed of a manufacturing firm to fulfill. It is distinct market segmentation where customers groups are identified. This is necessary because it would otherwise be impossible to divide capacity and perform *nesting* methods. Segmenting per se could, however, instead of customer groups be based on product classes. The

segmenting of products could, for example, be based on price range where products are sorted into a certain class dependent on its end price. These methods could be compared to the service industry with different segments and fare classes. Therefore, when this requirement is fulfilled then the two nesting methods on segment level, identified in the service industry, would theoretically be applicable in the manufacturing industry.

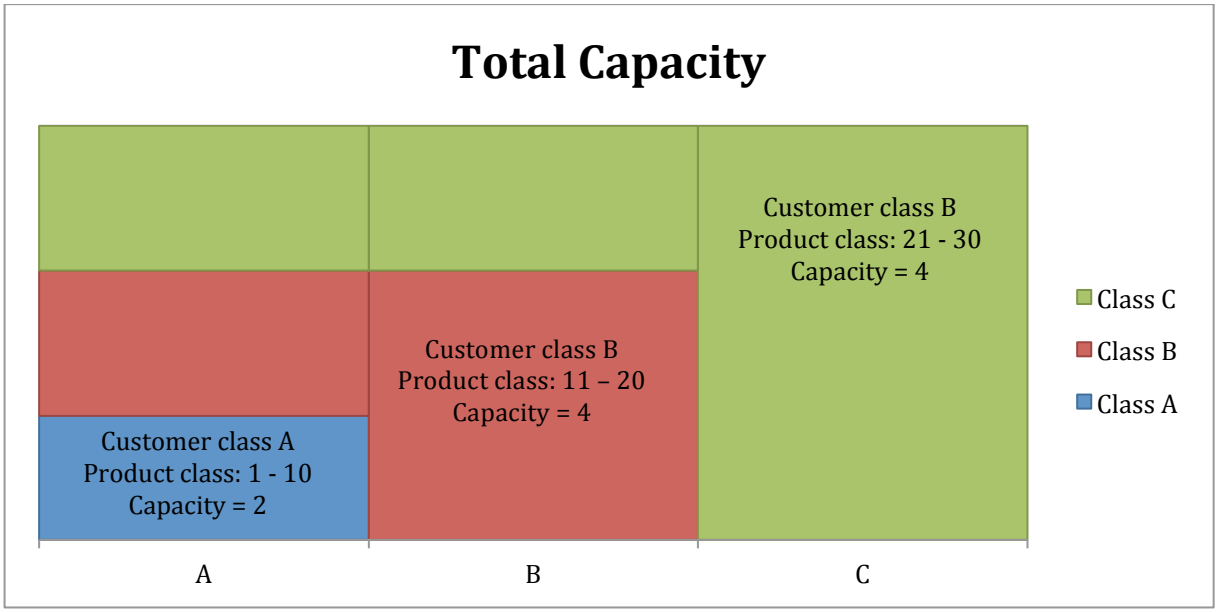

Figure 4 – Capacity nesting

(Based on: Chapuis, *Nesting Booking Limits in Revenue Management: The Good, the Bad and the Ugly,* p.10, 2008)

Theoretically, nesting should provide the same benefits for a manufacturing firm, with segmentations of customers, as for the service industry. For example if there are thee classes A, B and C, where Class A have a price range of 1 – 10, Class B have 11 – 20, and Class C, the most exclusive class, have 21 – 30 (see figure 4). Then the capacity division should, on the forehand, divide capacity among the classes. Simply, it is estimations of how much capacity each class will require to meet market demand. This would allow a controlled capacity allocation between the classes when nesting on segment levels. This results in our 4th proposition:

> *P4: Nesting on segment level is possible when a manufacturer has predefined segment groups. A manufacturer could then divide its total capacity on beforehand based on estimations. This would make it possible to steal, protect, and reserve capacity for more profitable orders instead of first come first served.*

3.3.1.5 Segment net nesting

In the service industry, *net nesting* is the nesting method that steals capacity from lower classes only when a higher class runs out of capacity. Therefore, *net nesting* adjusts and allocates capacity in a reactive manner. Since *net nesting* is less aggressive in capacity allocation it could on the other hand generate spoilage costs to the company. It is due to the fact that capacity in lower classes are usually more attractive compared to the higher classes. Therefore, if the capacity in the lower classes are completely consumed then a manufacturer would be unable to allocate capacity to the higher classes if it is demand. Considering this our 5th propositon is:

> *P5: Because of a passive capacity allocation net nesting could generate a revenue loss to a manufacturer since capacity could have been sold to a higher bid.*

Eventhough it could generate spoilage costs to a manufacturing firm, *net nesting* on segment levels is prefereble if the firm has an equal focus on all its segments. A less aggressive capacity allocation gives the lower and medium classes a greater opportunities of being booked, which does not damage customer relations in these segments. It leads therefore to our 6th proposition:

> *P6: Net nesting on a segment level would reduce the risks of damaging customer relations with lower classes due to a less aggressive capacity allocation to the higher classes.*

3.3.1.6 Threshold nesting of segments

The second nesting method, *threshold nesting*, on the other hand protects and steals capacity more aggressively. It is because a received booking in a higher class always consum capacity of lower class instead of its own. Compared to *net nesting*, *threshold nesting* gives lower classes a smaller oppurtinity of being booked. On the other hand, *threshold nesting* would reduce the spoilage costs as capacity, to a greater extent, could be allocated to the higher classes and sold to a higher price. This leads to our 7th propistion:

P7: Because of an aggressive capacity allocation threshold nesting could reduce spoilage costs and generate greater revenues.

This capacity allocation method would be preferable and more beneficial if a firm has a greater focus on higher classes. For example if the firm has a differentiated strategy then it would only focus on customers with a higher ability to pay. Hence, the recieved booking requests would be greater in the higher classes. With this in consideration an utlitization of *threshold nesting* could, therefore, always secure available capacity for the higher classes if demand exceeds estimations.

3.3.1.7 Overbooking

One of the most fundamental concepts, according to Bell (2012), is *overbooking*, which is another way to secure a fully utilized capacity and is widely used in the service industry. If a manufacturing firm's incoming orders do not exceed the total capacity then this capacity will only be a cost without generating revenues. The difference between MTO and MTS is that the latter have the possibility to control the degree of their capacity utilization. The capacity utilization in MTO firms is on the other hand controlled by order backlog. This leads to our 8th proposition:

P8: Overbooking could be used as a security measure to maximize the capacity usage within a MTO firm.

3.3.2 Pricing Strategy

Revenue management operates with a pricing strategy, which consists of two parts that are *threshold pricing* and *dynamic pricing* (see figure 5). *Threshold pricing* is based on in-firm factors such as costs and capacity availability while *dynamic pricing* considers current market situation. This provides the benefits of a pricing flexibility that changes dynamically. As for manufacturing firms, this pricing strategy is possible to conduct since each order is treated independently and could therefore differ from each other. Since each order could differ from one another, the *threshold price* part has to be considered anyhow when evaluating order profits. As for *dynamic pricing* it could be considered as a pricing method that is benchmarked on competitors and hence, expected market price.

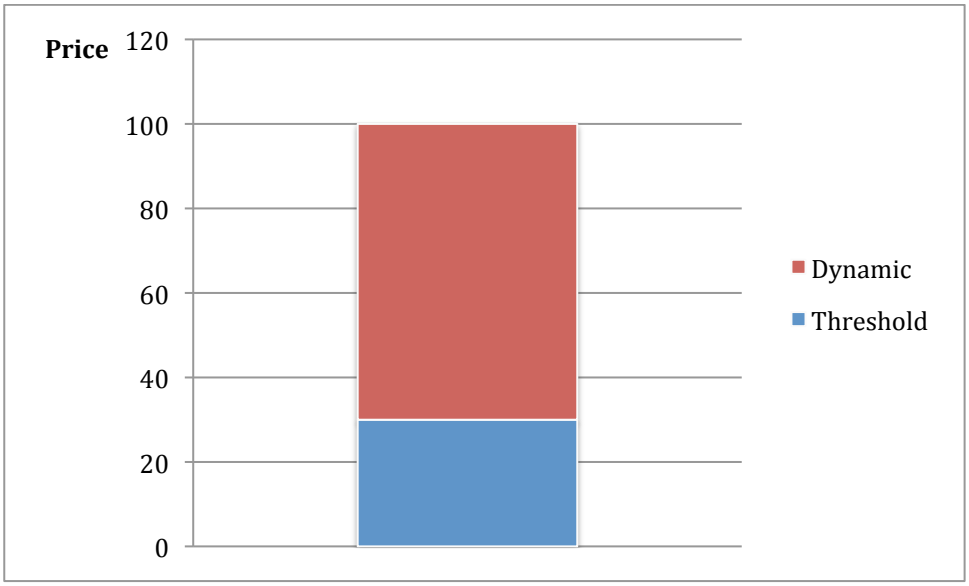

Figure 5 – Revenue management pricing

(Based on: Chenavaz, 2012; Dai et al., 2005; Levin & McGill, 2009; Luo & Peng, 2007; McAfee & Te Velde, 2006)

Through this our 9th proposition is derived:

> *P9: The pricing strategy used in revenue management is conductible in a manufacturing firm as well because both threshold price (opportunity costs) and dynamic price (market price) are knowable.*

This pricing strategy could always generate higher revenues compared to a standardized pricing strategy. For example when demand is low then the prices could be reduced to the *threshold price* level to obtain continuous sales. And when demand is high then the *dynamic pricing* could increase prices and maximize revenues by serving the highest bidder. This results in our 10th proposition:

> *P10: The pricing strategy is more beneficial and profitable, which could therefore generate higher revenues compared to a standardized pricing strategy.*

4. Empirical Method

4.1 Research strategy

Once identifying the research philosophy and approach one can move further down and identify research strategy, research choice and time horizon. According to Saunders et al. (2009) there are 7 different research strategies, experiment, survey, case study, action research, grounded theory, ethnography and archival research.

For this dissertation a case study have been used with interviews as a data collection technique. This is because the aim of this paper is to gain a deeper understanding of how capacity and pricing strategies could be used in a manufacturing company when using revenue management. Furthermore a single case has been used, since it provided an opportunity to analyze this rather un-researched area in a deeper perspective.

4.2 Time Horizon

Saunders et al (2009) claim that a research can either be done as a "snap-shot" (cross-sectional) or over a longer timeframe (longitudinal). This dissertation has been done with a cross-sectional time horizon. The reasons for this is that first of all the overall timeframe for this dissertation we considered being to short for a longitudinal study. Second of all, since this research aims to identify how certain mechanisms in revenue management differs between two industries; we believe time would have limited, if any, effect on the result.

4.3 Data collection

According to Saunders et al (2009) there are two different types of data, primary and secondary data. Primary data is when new data is collected, whilst secondary data is data collected by others for a previous research.

Since the research on revenue management in the manufacturing industry is rather limited and we aimed to provide a deeper understanding primary data have been used. A case study has been used and the primary data collection was done through one interview, and one e-mail conversation. Saunders et al (2009) claim there to be three types of interviews, structured, semi-structured and un structured. This study have been done through semi-structured interviews, this because this study is an explorative study and a semi-structured interview would provide us with more in depth answers.

4.4 Reliability

LeCompte and Goetz (in Bryman, 2011) identify two types of reliability for qualitative research, external and internal reliability. The external reliability concerns the problem standardization, which can result in a lack of reliability since other scholars might not be able to replicate. This is a problem that is hard to go around since it is not possible to freeze the current conditions and circumstances. This is always a problem, however since this paper aims to explore a concept where the time factor has little effect, and we believe that we would have gotten more or less the same results whether this paper was done this or last year.

The internal reliability concerns problems regarding subjectivity. For example the researchers may interpret the answers to a question in a subjective manner, unintentional or not, but still it creates a problem of reliability. However, this research is done with a critical realistic philosophy, so we believe that what is said in this paper is what we saw, we do not claim what is said in this paper is how it is.

Furthermore Saunders et al (2009) stress the concern of bias when conducting interviews, both from the interviewer and from the respondent. Interviewer bias concerns comments, tone and non-verbal behavior done by the interviewer and that these shall affect the answers of the respondent. Respondent bias, on the other hand, is for example that the respondent may not be answering honestly, or only gives you a part of the answer. This is because the respondent might give answers that that is "expected of him" or that only shows the positive sides of a company.

4.5 Validity

Also regarding validity LeCompte and Goetz (in Bryman, 2011) identify two different types of validity concerns for qualitative studies, internal and external. Internal validity is whether or not the observations match the theoretical ideas of the researchers. However LeCompte and Goetz (in 2011) argue that the internal validity can also be one of the biggest strengths of a qualitative research since qualitative research allows the scholars to show a strong connection between model and empirical findings.

The external validity regards the problem of generalization. Which is a big "problem" for qualitative research since they often tend to study cases or only have small samples (Bryman, 2011). However, since the purpose of this research not is to generalize but to explore and gain

a deeper understanding of a rather unexplored research area, this validity problem is less relevant. The aim is to modify revenue management for the manufacturing industry and provide a foundation for future research; it is then up to future scholars to do generalizing studies.

4.6 Interview guide

Market nesting

Q1. Please describe how the production of your company is divided

Q2. Do you use production sequences? If so, how is the production sequence divided in your company? Are there any differences between any markets?

Q3. Is overtime counted as a part of the estimated total capacity? Or is it left out to serve as an available and flexible capacity?

Q4. Is the total capacity viewed as static or dynamic? And why? (Explanation)

Q5. Is it possible to steal capacity from one market to satisfy the demand of a more profitable market? If so, to what extent?

Q6. If this is possible, is this preferable?

Justification: Q1-Q3 are asked to gain an understanding of how the specific company production looks like to be able to further analyze the capacity allocation possibilities. Q4 is asked to see if the company views its capacity as static between different production plants or if it is more dynamic where some sort of capacity allocation is possible. Q5 and Q6 are questions to determine if nesting methods are possible and preferable.

Net nesting

Q7. Is it preferable to allow a more profitable market to steal capacity from other markets once its given capacity is consumed?

Q8. If so, would it be preferable to double count the capacity to allow a dynamic capacity allocation?

Q9. Is this type of strategy something you use today? If not, would you consider it as a profitable strategy?

Q10. If used, how do you think it would affect the product pricing in the affected markets on both short and long-term?

Justification: The aim of Q7 and Q8 is, in a more hypothetical way, see if net-nesting methods could be considered as a valid strategy in the manufacturing industry. Furthermore Q9 is asked to obtain a more company specific perception on net nesting methods. The purpose of Q10 is to see how that specific company thinks net nesting would affect the product pricing.

Threshold nesting

Q11. If an order were received in a priority market, would it then be preferable to use the capacity of a lower priority market first, to secure available capacity in the priority market?

Q12. Is this type of strategy something you use today? If bot, would you consider it as a profitable strategy?

Q13. If used, how do you think it would affect the product pricing in the affected markets on both short and long-term?

Justification: The aim of Q11 is, in a more hypothetical way, see if threshold nesting methods could be considered as a valid strategy in the manufacturing industry. Furthermore Q12 is asked to obtain a more company specific perception on threshold nesting methods. The purpose of Q13 is to see how that specific company thinks threshold nesting would affect the product pricing.

Overbooking

Q14. Please describe your company's order selection strategy?

Q15. Does overbooking occur? Why does it/not?

Q16. What is you policy to cancelation?

Q17. How do manage production and delivery when overbooked?

Q18. If capacity is overbooked, how do you respond to a late arrived highly profitable order?

Q19. Would it be preferable to allocate available capacity from other markets to deal with overbooking?

Justification: The aim of Q14 is to see how the company assesses which orders to accept. Q15 is asked to see if the company uses overbooking as well as their argument of why or why not they use it. Q16-18 aims to see how the company deals with the different problems of overbooking. Q19 aims to connect overbooking to capacity allocation.

Pricing

Q20. Please describe your pricing strategy

Q21. How does the cost structure differ between markets?

Q22. How does the pricing strategy differ between markets?

Q23. How does the profitability differ between markets?

Q24. What are the major factors that affect the price?

Q25. Does the price offered for the same product differ between customers and segments?

Justification: The aim of this chapter is to find out if the company uses dynamic or threshold pricing. This is done by a combination of open and more precise questions to see patterns that could be liked to either dynamic or threshold pricing.

4.6.1 Additional Questions

In addition to the questions in the interview guide, following supplementary questions have been asked via e-mail:

Q26. Is there a distinct customer segmenting? If yes, are any of these prioritized?

Q27. Are the products divided in classes based on their price?

Q28. Are there any clear differences in gross margin between the models?

4.7 Case

For this study a large multinational manufacturing company have been used as a case, with production/assembly plants in different countries. The company has begun to use a revenue management approach to the daily operations. However, according to R1, all the revenue management mechanisms are not in use in this particular company.

We have chosen to only work with this case since first of all, the inspiration for this thesis came from this company, where they had an interest in knowing more on this matter. Second of all, due to time limitations and difficulties to find a company suitable for this dissertation we chose to only work with this company.

4.8 Respondents

Two respondents have been chosen for the data collection, both of them having key positions within the company with good insight to the affected areas of revenue management.

4.8.1 Respondent 1 (R1)

The first respondent has the position of Revenue Manager and is in charge of strategy and target setting of revenue management within the company. For R1 a semi structured interview was conducted.

4.8.2 Respondent 2 (R2)

The second respondent is Process Manager within the sales department. Due to a busy schedule questions to R2 where sent and answered via e-mail.

5. Empirical Findings and Analysis

The analysis is based on transcripts from the interview with R1 as well as e-mail from R2. This data have then been compared with our propositions and theory in chapter 3. The answers from both R1 and R2 have been summarized and compiled in Table 1 below. The analyses are presented in order of the propositions with a presentation the results first followed by the analysis of the respective proposition.

Table 1 – Respondent Summary

Respondent	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10
R1	Yes	Yes	Yes (to a certain extent)	Could not validate	Could not validate	Could not validate	Could not validate	No/modified	Yes, but modified	Yes, but modified
R2	Yes	Yes	Yes	Could not validate	Could not validate	Could not validate	Could not validate	No	Yes, but modified	Yes, but modified

5.1 Capacity management

5.1.1 P1 – Market nesting

P1: Manufacturing companies can nest their capacity on a market level

R1 states that the company's production planning is forecast driven. Sales forecast planning is used as a foundation for the development of the production plans. Already at this stage the company tries to allocate capacity, in accordance to forecasted demand, to the more prioritized markets. Furthermore, R1 stresses that the company uses capacity allocation frequently and have a special department tasked with these issues regarding "business and volume optimization". R2 also agrees on the possibilities on allocating volume/capacity. In addition, R2 states that the company uses production sequences of 4 weeks, where the latter two are fixed. Hence, capacity allocation is possible if it is done within the first two weeks of a production sequence.

According to R1 the company mainly uses retailer to sell its products, and have its markets in Europe, China, as well as North and South America. From the view of the company it is the retailers and not the end consumers that are considered as customers. Furthermore, this manufacturing company has three production plants. Two of them are located in Europe, however in different countries, and one in China. The production capacities of the European plants are used to satisfy demand in all markets. The production plant in China, on the other

hand, only needs to focus on the Chinese market due to higher profitability of earnings and a higher degree of demand, and there are no plans of sharing its capacity with other markets. Furthermore, R1 also states that the Swedish and the Chinese markets are approached as home markets, where both receive extra attention within the company. Although both China and Sweden are considered as home markets, R1 stresses that China is both the single largest market considering sales volume and degree of profitability.

Hence, when considering this information it would be compatible with the proposed model of priority-based market nesting where markets receive different focus and production volume. It is because one of the production plants is located in China and two are located in Europe, where capacities of the European plants are shared by all markets. One could therefore argue of a priority-based model with three classes. Our interpretation is that the American markets are of low priority, since there are no local plants because of a too low demand. Hence, the capacity consumed by the American markets has to be allocated from other regions. The European market could be considered as medium priority because it consists of two production plants and a home market, Sweden. The Chinese market, which is the last market, could be considered as a high priority market due to the high degree of focus towards it. Therefore, the interesting aspect is how market nesting is performed within this company.

5.1.2 P2 – Market threshold nesting

P2: Threshold nesting can be used proactively on "priority markets"

On the question on *threshold nesting*, R1 responds that for example, capacity from the European markets could be allocated proactively to the Chinese market if the Chinese market could sell the products with a higher profit margin. This is regardless to if there is existing demand in the European markets. Different from the service industry this manufacturing firm uses *threshold nesting* with a high degree of sales forecasting. Hence, *threshold nesting* is only used when the company is certain of that the allocated capacity could generate additional sales in the priority market. According to R2 if a priority order were received then the company would allocate capacity by postponing a lower priority order to a later production sequence and/or by reducing the products that are produced to stock.

This aggressive capacity allocation with a high focus on priority markets is therefore in concurrence with our proposition on the proactive *threshold nesting*. Furthermore, our theory was also that this strategy would lead to a decrease in prices, which is in accordance to the classical supply/demand model when supply increases. However, according to R1 this is not the case. It is because the company has a policy of price positioning, and would never allocate capacity if it would lead to a lower sales price. Moreover, responses from R1 showed that our original theories derived from the supply/demand model contain two errors. The first error lay in a too simplified price theory. It is because there are several additional factors, beyond the supply/demand model, that affect prices. The second error is our theory of price decreases, which according to R1 only reflected half of the reality. This is because our theory on supply/demand model solely focused on supply increases with no regards to changes in demand first (Se figure 6). However, in the analysis and the explanation of *threshold nesting* we will still use the supply/demand model. Hence, we will overlook the first error and its complexity due to otherwise a too complex pricing model and would be incoherent with the purpose of this paper.

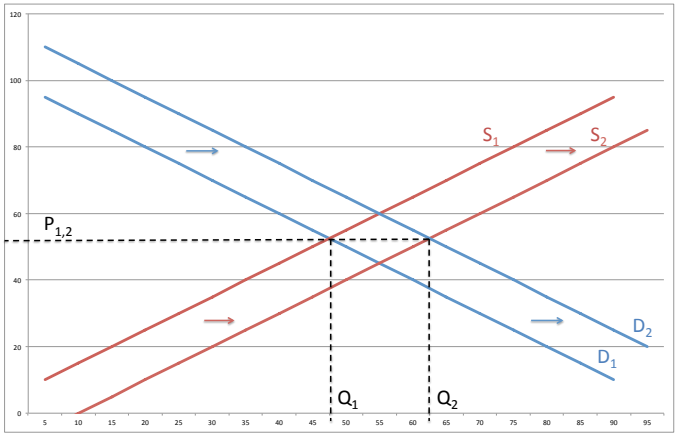

Figure 6 – Supply/Demand

(Based on: Perloff, Microeconomics: Theory and Applications with Calculus, 2nd Edition, 2010)

As for the service industry *threshold nesting* allocates capacity regardless to historical sales data and sales estimations. This is quite the opposite compared to the answers of R1 where sales estimations based on historical sales data and sales forecasts are of grave importance in the utilization of *threshold nesting*. According to R1, this sort of aggressive capacity allocation occur regularly but only when forecast estimates of an excessive demand in the priority market. Hence, in the supply/demand model this estimated increase of demand would shift the current demand curve, D_1, to further right to D_2, which symbolizes an increase in

demand (see figure 6). In response the company proactively allocates capacity, which leads to an increase of supply. This is visualized through a change in the supply curve where S_1 shifts to S_2. Regarding to the statements of R2 the increased supply is derived by postponing lower priority order and by reducing the number of products that are produced to stock. A reduction in produce to stock could lead to a decreased ability to meet unexpected demand. However, it is more beneficial that the capacity and the produced goods instead of being stored will generate revenues instead. Another information obtained from R1 was that capacity allocation should not lead to a decrease in prices. Hence, the capacity allocation, the shift of the s-curve, has to be managed with this regard. Therefore, in the supply/demand model (see figure 6) one could see a shift in the supply/demand curves but the price per unit remains at the same level.

Since the price is not reduced, the market preference price of the company products will be unaffected by this capacity allocation. However, the question is how this excessive demand, which affects the lower and priority market/markets, should be managed over time. A long-term usage of this nesting method could generate spill costs in lower prioritized markets. It is realized when capacity is allocated proactively from lower prioritized markets and could, because of it, not meet demand in the lower markets. In the company's case, where retailers are the main customers, a long-term usage of *threshold nesting* could then damage retailers' structure and relations in lower priority markets. According to R1 the retailers have to be able to do business in sales and in aftermarkets to be able to be profitable. But as R1 stated, *threshold nesting* does not only allocate capacity, it also allocates business opportunities from the lower priority markets. If this were recurrent in the long-term it would be of difficulties for retailers. Therefore, R1 argues for a long-term reflection when utilizing *threshold nesting*. If the excessive demand on the priority market remains then the company should consider expanding its capacity. The decision should be based on current market situation and the expected market developments. For example it would be unprofitable to expand the capacity in the priority market, which requires capital intense investments, whilst demand in the lower priority markets is expected to decrease. Hence, the negative aspects of *threshold nesting* are recognized and considered in this company. Additional information from R1 also shows that *threshold nesting* is not the only nesting method utilized by the company.

5.1.3 P3 – Market net nesting

P3: Net nesting can be used as a reactive tool to cope with demand

R1 states that if capacity is consumed in a priority market the company will use the production capacity from a plant in a lower priority market to cope with the high demand in the higher prioritized market. Both R1 and R2 also state that the business and volume optimization department works with these types of allocation questions on a daily basis. Furthermore R1 states that the profit margin is the most interesting aspect, which decides where capacity should be allocated. Meanwhile R2 agrees on the importance of profit margin but argues for other objectives in the decision-making when allocating capacity. Nonetheless, profit margin is one of the main factors to allocate capacity but there are also other underlying factors that would trigger an capacity allocation, which vary and depend on what goals are the most important at the time; it could be profit, revenue, retailer structure or where a certain product is located on the market lifecycle.

Based on the statements of R1, it is rather clear that this company uses *net nesting* reactively, hence, validating our proposition (P3). Furthermore, the "Business and volume optimization" department works daily with these types of issues, which is another evidence of the existence of *net nesting* in this company. However, as R1 states several times during the interview, the company uses forecasting as a fundamental tool in the overall production planning. Thus one could argue that the majority of the nesting is done proactively, but *net nesting* is used as precision a tool to fine-tune the production.

5.1.4 P4-P7 – Segment nesting

P4: Nesting on segment level is possible when a manufacturer has predefined segment groups. A manufacturer could then divide its total capacity on beforehand based on estimations. This would make it possible to steal, protect, and reserve capacity for more profitable orders instead of first come first served.

As proposed a manufacturing company should have distinct market segmentations or product groups divided in classes with price as base. It is then possible to divide capacity and enable nesting methods on segment levels. A usage of segment nesting in capacity instead of a static

capacity division could allow a manufacturing company to allocate capacity in dynamic manners, which increase revenues.

According to R2 the customer segments are only involved at the development stage of a product. At this stage the product only consists of the basic platform without additional add-on components. Once the product is introduced to the market the customer segments are of a less importance, which is of two reasons. The first reason is that many end consumers consider the company's products as investments. Our perception is that the customer perceived and demanded values together with product life expectancy, rather than price, are the important factors of purchase. Hence, prejudices on customer segment purchase behavior may contribute with inaccurate information and result in distorted demand forecasts. The second reason is that the majority of sales to end consumers are mediated through retailers. With this knowledge our interpretation is that the customer segments are of less importance for the company since segmenting cannot provide any useful information.

Instead of customer based segmenting our proposition suggested a product price based segmenting. According to R2 this form of segmentation does not exist within the company. Furthermore, it would also be difficult to establish since each product type could be configured with a range of additional add-on components and features. A basic product could for example have a starting price of 200 000 SEK. Depending on additional components the final price could be well above 400 000 SEK. Hence, a product price based segmenting would also be useless.

When considering the way of operations in the case of this company, segment nesting is therefore not implementable. Hence, this automatically invalidates the propositions on *segment net nesting* (P5 and P6) and *segment threshold nesting* (P7).

5.1.5 P8 – Overbooking

> *P8: Overbooking could be used as a security measure to maximize the capacity usage within a MTO firm.*

When it comes to *overbooking*, both R1 and R2 claim that this is not possible to do in this company. They cannot produce more than they have capacity for; therefore, they cannot book

for a larger production than they have capacity for. However, R1 continues by describing a, for the manufacturing industry and this company, modified way to overbook; R1 argues that in their production planning they can plan to manufacture more units than they know they can sell. Then these excessive products are either put on stock or a buyer is found during the production process. Furthermore, R1 is well familiar with revenue management theory and compares their situation to the hotel and airline industry. According to R1, when *overbooking* in the service industry a company could have a hard time providing their overbooked customer with a "product" (a hotel room the same night) whilst in the manufacturing industry they can just assemble the product tomorrow instead.

This shows an important difference between the service and the manufacturing industry, and this goes against our proposition on *overbooking*. *Overbooking* was described in the service industry literature as one of the fundamental mechanisms of revenue management. It is however, according to R1, not possible in the manufacturing industry. Again it comes down to the planning process in the manufacturing industry. The production planning is based on a high degree of forecasting and this can be reflected in *overbooking* as well, since the type of *overbooking* that is used in this company is not *overbooking* of capacity but *overbooking* of predicted sales. Furthermore one other important factor have been identified, according to R1 the company uses stock, which could be considered as a buffer. This argues against Nahm's (2006) statement of inventory buffers being "outdated", but for Ingold et al. (2000). However concluding evidence can be shown supporting Nahm's (2006) theory that todays manufacturing companies use flexibility to cope with demand. This is since this company is a hybrid between MTO and MTS who uses revenue management and, hence, the usage of both inventory and production flexibility.

5.2 Pricing strategy

5.2.1 P9 and P10 – Pricing

> *P9: The pricing strategy used in revenue management is conductible in a manufacturing firm as well because both threshold price (opportunity costs) and dynamic price (market price) are knowable.*

> *P10: The pricing strategy is more beneficial and profitable, which could therefore generate higher revenues compared to a standardized pricing strategy.*

According to the theory of revenue management the pricing strategy consists of two dynamic parts. On one side there is *threshold pricing*, which is cost-based pricing reflecting opportunity costs. On the other side there is *dynamic pricing*, which considers the current market situation and levy the product price to market price. Our proposition of the revenue management pricing strategy is that it is fully adoptable in the manufacturing industry since both the *threshold price* and the *dynamic price* are knowable. Furthermore, when demand is low a company could reduce its prices as long as revenue of each sale exceeds the *threshold price*. Hence, this flexible pricing strategy could always generate higher revenue compared to a standardized pricing.

According to R1, the company mainly uses price positioning for each model. It is composed by conducting market surveys on company products and by using reference prices, which consists of competitor prices. Furthermore, R1 states that their product price structure could be seen through a revenue management pricing perspective with *threshold*- and *dynamic prices*.

Statements made by R1 suggest that each and every product type has its own *threshold price*, which reflects the opportunity costs. Moreover, the *threshold price* is divided into two parts, which consists of pure costs and content costs. According to R1, the pure costs are the fundamental material costs of a product model type. However a product could always be equipped with additional add-on components. The costs derived from these additional components are the content costs. Hence, two final products of the same model type could therefore cost differently due to different equipment content. According to R2, the end price of product could differ tremendously dependent on what additional contents a product consists of and to what extend the product is equipped.

The *dynamic price* of a product considers how the product is approached on the market and how equal products produced by competitors are priced. Hence, the *dynamic price* part could provide knowledge of how much the company should charge for a model. Furthermore according to R1 the *dynamic price* together with the *threshold price* also allows the company to assume a price position for each product.

Answers from R1 also validate our proposition of that prices could, although unusual in this company, be reduced to the threshold price at the most, since it would otherwise be unprofitable. However, according to R1 it does occur in other companies operating in the same sector where prices are reduced beyond threshold prices. One of the reasons is the potential earnings over time from serving the aftermarket, which would be profitable on an overall view.

As for the *dynamic prices*, this manufacturing company does not fully utilize its flexibilities, which is due to each model's price position. It is because each product type has a price position the company is unwilling to compromise. According to R1, the reductions in prices are disguised through an increase of components in the product types but remain on the same price position. This would lead to an increase of content costs, which reduces the profit margin of a sale. Hence, in this manufacturing company, when reducing prices, it is the *threshold price*, and the content price to be specific, which is changed in a dynamic manner to increase demand. Therefore, price reductions are not connected to the *dynamic prices* at all. Our modified pricing model of how content cost increases/decreases but total price remains static is illustrated in Figure 7 below.

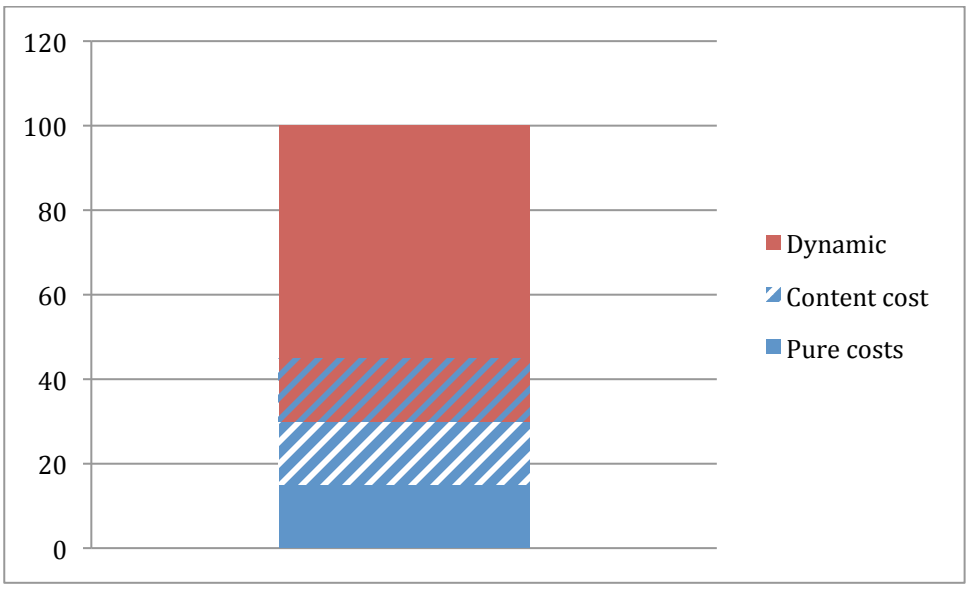

Figure 7 – Modified company specific revenue management pricing

The study on this company has shown that the *threshold prices* could be divided into sub categories and used as tools, which could affect the purchasing behaviors of the market. Our initial theory on the revenue management pricing was that it is only the *dynamic part* that is

used when trying to increase sales. Evidently there are other ways of "reducing" prices than just reducing *dynamic prices*. This leads to a reflection of other alternative ways to "increase" and manage prices. Our perception of the respondents' answers is that the *dynamic prices* are not used when "reducing" prices, which is to avoid compromising price positions.

On the other hand, when demand exceeds supply and a company could increase prices, the *dynamic price* could be flexible and used in accordance to the traditional revenue management theory. An alternative way to increase prices could be to decrease the number of add-on components of a product and still charge the same price. Hence, this method could conceal the changes in ways as its counterpart does in price reduction.

Another possible aspect of an inflexible *dynamic price* could be the difference between the service industry and the manufacturing industry. In the service industry the supply on short-term is limited. The current supply could be known, which would allow an automated pricing through computerized systems. For example the number of hotel rooms of all hotels in Paris during a weekend is limited. With existing technology and information access, such as Internet, the available rooms at a certain time would always be knowable. Hence, all hotels could utilize an automated *dynamic pricing* that is flexible and considers the current market situation. This is however not the case in the manufacturing industry since the production volume and the output of each manufacturer are not accessible. Moreover, some manufacturers use the MTO market approach while some others uses MTS. Hence, a fully automated flexible *dynamic pricing* would be unmanageable. Therefore, the manufacturers have to manually manage prices, which usually comprise the end price of a product type. This leads to our perception that the revenue management pricing strategy in the manufacturing industry is only flexible to a certain degree and has to be managed manually.

5.3 Summary of the Analysis

5.3.1 Capacity Management

One of the biggest differences between our original model on capacity management and the results was that "booking limits" was rather modified. In this company nesting methods was utilized, but only on the global level and capacity is allocated to prioritized markets. Furthermore, this is done in close relation with a modified type of *overbooking*, and the difference between the two could be hard to distinguish. The company can overbook its production in relation to the estimated sales, and through this maximize capacity allocation.

Another difference between the original model and the new one (Figure 8) is that we have added capacity singularity. By this we mean that it is of rather high importance for a manufacturing company to see its capacity as a singular unit. This will allow the company to easier plan, nest and allocate its capacity according to demand and market priority.

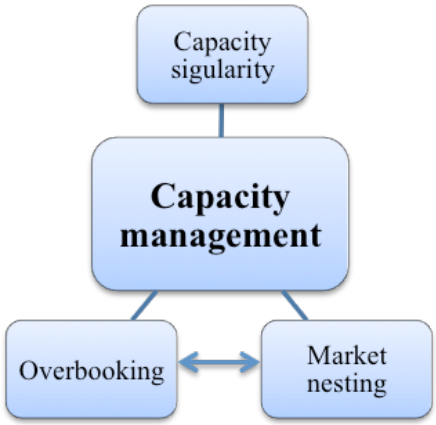

Figure 8 – Modified company specific capacity management

5.3.2 Pricing Strategy

One of the findings in pricing was that a *threshold price* is divided into two parts (see figure 9). A product in this manufacturing company could be equipped with additional add-on components. Hence, such a division of the *threshold price* of a product could improve the product's cost awareness since it separates the fundamental costs of a product and its add-on component costs. This division could also, as we have discovered, used as a flexible tool to affect the market. The other finding in pricing was the importance of reference prices. The reference prices are utilized as support when levying the *dynamic price* to market price. Moreover, the reference prices, derived from how competitor has priced a product that is indifferent to own firm product, also supports this manufacturing firm the identifications a product's price positioning and could justify this price position. Hence, the reference prices are used greatly and improve the overall pricing policy of a product.

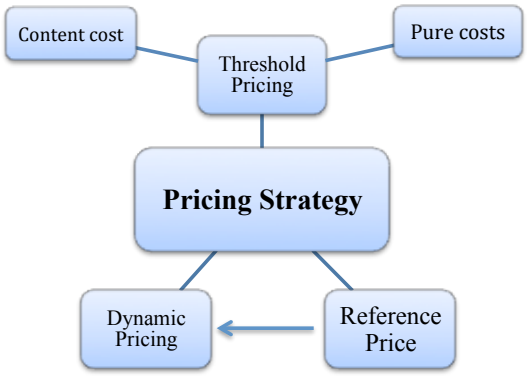

Figure 9 – Modified company specific pricing strategy

6. Conclusion

Revenue management has been, and still is, an interesting concept, and is therefore well studied. Much of the existing theories on revenue management have been focused on the service industry. However, little has been done on the manufacturing industry despite the fact that several manufacturing companies have adopted the concept. Therefore, the purpose of this paper is to better understand the pricing and capacity components in revenue management and their compatibility in the manufacturing industry.

6.1 Conclusion

This paper has, in our opinion, contributed with several interesting results, such as how the revenue management pricing strategy functions in a manufacturing company, and its difference from the traditional service industry model.

However, the most important conclusion drawn from this study is that this manufacturing company only utilizes nesting methods at a market level. This is a big contrast to the traditional revenue management nesting theories, where nesting methods are applied on a customer segment level. We base this conclusion on two major aspects.

The first important aspect is based on the company product and prices. For example, the products sold by this manufacturing company are highly expensive. The products are also built with a long life expectancy, and are therefore used over a longer period of time. Hence, from the consumers' point of view the products are considered to be more of an investment, where price is of less importance, while individual customer perceived value is. Therefore, segmenting the market would be irrelevant, since it is hard to categorize the market and anticipate their purchase behavior.

The second important aspect is that capacity in all markets in an manufacturing company can be seen as unitary, which is not the case in the service industry, such as an airline company consisting of several airplanes with their own individual capacities. A plane going from New York to Berlin cannot use the capacity of a plane flying from Beijing to Tokyo. Therefore, on this level and without reassigning airplanes between the different locations, the capacity of this airline company cannot be seen as singular and unitary. On the other hand, the company we have studied has three production plants with individual production capabilities. If aggregating the individual capacity of all plants into one it could then be viewed as a unitary

production capacity. In this way capacity could be allocated between the markets to meet current and forecasted demand on a global level. For example, when one market has excessive demand that exceeds supply, the company could use nesting methods and allocate capacity to cope with this situation.

6.2 Ethical and societal contributions

Revenue management as a concept currently exists in several sectors within the service industry. The concept contributes to a more flexible pricing strategy that is adjusted faster and more precise to current demand. For example with an revenue management pricing strategy the prices set by companies could be justified by a lower price when demand is low and a higher price when demand is high. Therefore, it could allocate capital more efficiently compared to fixed price strategies. For example, a flight ticket during peak season costs SEK1000 and during low season SEK500. Hence, during off-season a customer would only need to pay SEK500, and therefore save SEK500. These SEK500 could then be used to purchase other products. In this way, the customers' welfare, from a total of SEK1000, increase from only one flight ticket to one flight ticket plus additional products. Furthermore, this also leads to that several other companies could gain revenues from this spillover.

Evidently our research has shown that revenue management is, with modifications, applicable in the manufacturing industry. Hence, this efficient capital allocation is therefore not limited to the service industry. With revenue management in the manufacturing industry as well the gains in society would be greater as well.

6.3 Critical review

The purpose of this dissertation was to gain a deeper understanding of how revenue management can be used in a manufacturing company. Hence, a qualitative research method was chosen. However, this means that no generalizing convolutions can be made. Therefore, we cannot know if the results from this paper are the reality throughout the manufacturing industry or if it is just an anomaly.

Furthermore, only one case has been used in this dissertation. The usage of several cases could help to stronger validate our propositions. The same goes for a larger number of respondents who had insight in different areas of the company and the aspect affected by revenue management.

6.4 Future research possibilities

We believe that the process required when implementing nesting methods on this level is beneficial itself. To be able to implement capacity nesting on this level, a company has to identify its higher and lower priority markets. This would require reflections on current market situations and the forecasted development of the markets. Such a reflection could generate deepened understandings of the markets, but also facilitate the capacity nesting itself. Hence, it could provide information of where capacity should be allocated from and to which markets. Moreover, such reflection would also force a company to consider the opportunity costs of capacity nesting contra the potential increase in revenues. However, this implementing-process and all its sub-processes and activities are unknown to us. Therefore, it could be an interesting research area for future studies.

Furthermore, this paper, due to time limitations, has not studied all aspects of revenue management from a manufacturing company's point of view. Only capacity management and pricing strategies have been discussed. There are still other aspects to cover. For example, the, third major part of revenue management described by Talluri and Ryzin (2005), "structural decisions", have not been the focus of this paper. Hence, this could be a future research possibility as well.

As mentioned before, this paper was a qualitative study with the aim to lay some of the first bricks of revenue management in the manufacturing industry. This means, however, that no "law-like generalizations" could be made from this paper, but only show how the concept of revenue management have been shaped when implemented in one company. Furthermore, this paper was a qualitative study with the aim to lay an introducing path of revenue management in the manufacturing industry research area. Therefore a quantitative study would be interesting to see if the finding of this paper is true for the entire manufacturing industry or just an anomaly.

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