Alfred Angerer

The Impact of Automatic Store Replenishment on Retail

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The Impact of Automatic Store Replenishment on Retail

Technologies and Concepts for the Out-of-Stocks Problem

With a foreword by Prof. Dr. Daniel Corsten

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dedicado a las dos mujeres más importantes de mi vida:
mi madre y Anne

Foreword

Fast moving consumer goods retailing is a highly competitive market. European retailers are continuously aiming to improve customer loyalty by offering good service. At the same time, they are struggling to reduce costs in order to stay competitive. One technology that promises to decrease the number of out-of-stocks while simultaneously reducing store handling costs is automatic store replenishment (ASR). At the heart of ASR systems lies software that automatically places an order to replenish stocks. Many European grocery retailers have started to implement such decision support systems.

Surprisingly, although several retailers have automated their order process in the last few years, there is almost no academic source examining this topic at the level of the store. It is worth noting that other technologies in retail, such as RFID (Radio Frequency Identification) and the introduction of the barcode, have received far greater attention from the public and from researchers. Furthermore, while the topic of extent and root-causes of retail out-of-stock has received substantial interest over the course of the last years, the question to what extent existing and new practices remedy OOS is largely unanswered. In particular, there is a debate whether ASR improve or worsen OOS. Therefore, Dr. Alfred Angerer has well chosen a topic of both managerial and academic relevance.

Although there are many success stories from practitioners describing the enormous advantages of introducing automatic store replenishment systems there has been limited empirical proof of this. To the best of my knowledge no conceptual framework exits that can help practitioners to choose an adequate automatic replenishment system. In order to develop such a model research on relationship between replenishment performance (e.g. OOS rate, inventory levels) and contextual variables (such as store and product characteristics) is required. Finally, it is not clear how retailers have to adapt its organization and processes to best support the chosen ASR system.

Dr. Angerer confidently identifies and covers several research gaps and manages to give answers to this research gaps by a skilful combination of quantitative and qualitative research methodologies. In a first part an exhaustive data set of a European retailer is examined. With this data analysis the performance of replenishment system before and after the introduction of ASR systems is compared.

Dr. Angerer is able to statistically prove and quantify the positive impact of such systems on inventory levels and out-of-stock rates. In the second part, several case studies illustrate how ASR systems are implemented in practice. The given recommendations on store processes help retailers to benefit most from automatic replenishment systems.

Overall, this thesis makes an important contribution to the field of retail operations – in practice and theory. I personally wish Dr. Angerer's work wide attention in both academic and practitioner circles.

Prof. Dr. Daniel Corsten

Acknowledgment

Rarely is a doctoral thesis the contribution of a single person. Many people supported and consulted me during my three years of research at the University of St.Gallen. Therefore, I would like to express my thanks to everyone who supported me in finalising this work.

I am greatly indebted to my two advisors, Prof. Dr. Daniel Corsten and Prof. Dr. Fritz Fahrni. They guided me through the inevitable ups and downs that characterise such a long research project. I want to specially thank Daniel Corsten who supported my research from the very outset. Without his never ending striving for improvement, the present results would not have been gained. I also cordially thank my second adviser, Fritz Fahrni, who always helped me to look for the big picture in my work. Further, I am thankful to Prof. Dr. Frank Straube and Prof. Dr. Wolfgang Stölzle for their backup as directors of the KLOG.

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My time at the University of St.Gallen would only have been half the fun without my colleagues. I want to thank Gunther Kucza, Marion Peyinghaus, Jörg Hofstetter, Jan Felde, Jan Frohn, Elias Halsband, Florian Hofer, Petra Seeger, Dirk Voelz and all other colleagues at the Kuehne-Institute for Logistics and the Institute for Technology Management for being such good colleagues and for all the good moments we shared.

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Without the support from practitioners, this research would only have been a theoretical contribution. A very warm thank you to Roland S., who invested his time to provide me the data for the quantitative research. Further, I am very grateful to

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Finally, I want to thank my mother and father, Toni, Lydia, Nic and Anne for their never-ending moral support. Despite the distance, I always felt their affection throughout my education and career.

St. Gallen, November 2005 Alfred Angerer

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List of Abbreviations and Acronyms

ANOVA	Analysis Of Variance
ARP	Automatic Replenishment Programme
ASR	Automatic Store Replenishment
ASRx	Automatic Store Replenishment System level x
CD	Cross-Docking
CU	Consumer Unit
CU/TU	Consumer Unit per Trading Unit (=case pack size)
CRP	Continuous Replenishment Planning
CPFR	Collaborative Planning Forecasting and Replenishment
EAN	European Article Numbering
ECR	Efficient Consumer Response
EDI	Electronic Data Interchange
ERP	Enterprise Resource Planning
DC	Distribution Centre
DSD	Direct Store Delivery
DSS	Decision Support System
HQ	Headquarters
IS	Information System
IT	Information Technology
ITEM	Institute for Technology Management
KLOG	Kuehne-Institute for Logistics
KPI	Key Performance Indicator
MAD	Mean Absolute Deviation
MAPE	Mean Absolute Percent Error
OOS	Out-Of-Stock
OR	Operations Research
OSA	On-Shelf Availability
PC	Personal Computer
PDA	Personal Digital Assistant (handhelds)
POS	Point Of Sales
QR	Quick Response
SC	Supply Chain
SCM	Supply Chain Management
SKU	Stock Keeping Unit
TU	Trading Unit
VMI	Vendor Managed Inventory

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Abstract

European fast moving consumer goods retailers face a mature market with low margins and high competition. To improve their situation, retailers are looking for technologies and concepts to increase consumer satisfaction while at the same time reducing costs. One technology that promises to increase the availability of the products on the shelf while simultaneously reducing store handling costs is automatic store replenishment (ASR). At the heart of ASR systems lies software that automatically places an order to replenish stocks of a certain product. A majority of European grocery retailers have implemented such decision support systems. Yet research in this area is practically non-existent. Therefore, this thesis aims to investigate the impact of this technology on retail, taking into account financial, organizational and personnel aspects.

To answer this main research question, a quantitative and a qualitative methodology was chosen. First of all, based on theoretical sources and more than 50 interviews, a descriptive model and an ASR classification system is developed. Next, an explanatory model is developed with a view to enabling identification of the characteristics of products, stores and replenishment systems that influence the replenishment performance of retail stores. To be able to test the hypothesis derived from this explanatory model, exhaustive data from a grocery retailer is examined. The quantitative analysis clearly shows that even simple automatic replenishment systems are able to dramatically reduce the average shelf out-of-stock rate and at the same time lower inventory level. In addition, a major advantage of automatic systems over manual ones is that they show constant results, independently of product characteristics. Yet the analysis also shows that badly-parameterised automatic systems will fail to deliver the desired results. In order to better understand how ASR systems are best implemented in practice, four major grocery retailers are analysed in detail. These case studies illustrate the necessary technological and organizational changes and highlight the influence of ASR systems on the working behaviour of employees.

Overall, this thesis makes contributions to both practice and theory. On the one hand, the results presented are a first stepping stone towards the creation of a basic theory of ASR systems. A descriptive model enables further researchers to make differentiated statements on the impact of ASR based on the classification developed. Another contribution is the explanatory model which tests existing and demonstrates new relationships hypothesised in inventory and operations management research. On the other hand, practitioners receive an overview of the

existent systems by which they may automate store replenishment. The determination of ASR benefits and necessary requirements help them to make a cost-benefit analysis. In addition, the several implications of the automation of their replenishment system for the organization and for human working patterns are illustrated. Practical recommendations on store processes help retailers to benefit most from automatic replenishment systems. And finally, a decision tree helps practitioners to identify the best-suited ASR system for each product category.

1. Introduction

Grocery retailing is a highly competitive market (e.g. Keh and Park 1997). European retailers are continuously aiming to improve customer loyalty by offering good service. At the same time, they are struggling to reduce costs in order to stay competitive. The effort to achieve customer service excellence has only been partly successful, as the low average product shelf availability rates of 92–95% (Gruen, Corsten et al. 2002; Roland Berger 2003b) and a sunk store loyalty underline. The major part of retailer costs are personnel costs, and in particular it is the operations in the store that require intensive staff dedication (Broekmeulen, van Donselaar et al. 2004a). The German retailer Globus has calculated that the logistics costs of the last 50 meters in the store, i.e. from the backroom to the shelf, are three times as expensive as the first 250 kilometres from the producer to the store gate (Shalla 2005). A technique that promises to reduce the out-of-stock (OOS) rate by simultaneously reducing the store handling costs are so-called automatic store replenishment (ASR) systems, the main research subject of this thesis.

This chapter provides an introduction to the business challenges faced by retailers and the valuable role of logistics in retail, followed by a short introduction to ASR systems. Later, research deficits in the literature are identified and the research questions of this thesis are derived. Finally, an overview of the structure of this research study is given.

1.1. Logistics Contribution to Retail Excellence

The major market developments that make retail challenging started in the 1990s and still are prevalent today, namely high cost pressure, shorter innovation cycles, increasing consumer expectations and globalization (Baumgarten and Wolf 1993; Lee 2001). The common response of retailers has been a so-called quantity strategy: They introduced more product variants, invested in new channels of distribution, diversified store formats and expanded into new countries. However, the benefits harvested from such a strategy seem to have come to an end, as the market has become saturated. The fraction of private consumption that flows into food and near-food retail has decreased continuously in the last two decades. In Germany, for example, it sank from 44.2% in 1990 to 29.3% in 2004 (Körber 2003), and this trend is typical for many developed countries. Nevertheless, a small group of retailers was able to defy this trend and outperformed the market. As a study by Accenture (2000) reports, approximately one-third of 63 examined retailers outperformed the other two-thirds by far and showed a yearly revenue increase of at least 10% coupled with

a higher-than-average increase in stock price. According to the study, this group had developed the right strategy by focusing their investments in areas where the most efficiency potentials were located.

One of the areas with such potential is without doubt logistics, as effective and efficient logistics is the fundamental to successful retailing. Hans Joachim Körber (2003), CEO of Metro AG, describes logistics as "the physical accomplishment of the concern strategy."

Figure 1 depicts the great importance of logistics for retail and various industry sectors under the aspects "differentiation" (i.e. logistics as a marketing tool) and "rationalisation" (i.e. logistics as a method of saving costs).

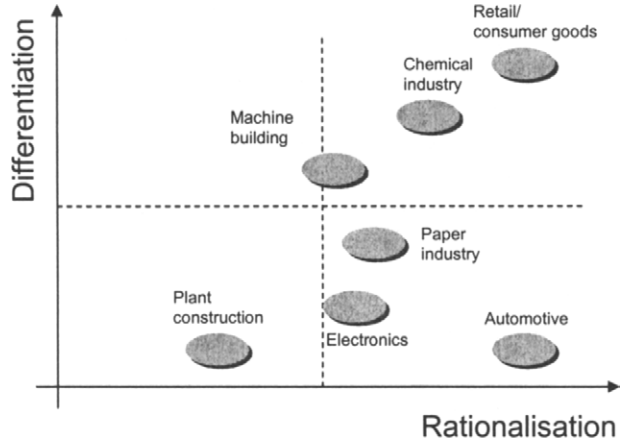

Figure 1: The importance of logistics for different industries[1]

The importance of logistics for the retail sector is based on the nature of the products sold. Most consumer goods, for example daily food items, are relatively cheap and the consumer generally buys without lengthy quality or price comparisons. Nevertheless, the importance of logistics in other sectors is increasing as well, as Pfohl (2004) stresses.

[1] Source: Kowalski (1992).

A precise estimation of the logistics costs is rather difficult. Pfohl compared studies measuring the logistics costs as a percentage of turnover. The large differences in the results can often be explained by geographical differences between countries and their infrastructure levels. Yet even within a single country like Germany, there are several studies with significantly divergent figures. This is the result of the varying definition of logistics costs. One of the most cited studies is that by Baumgarten and Thoms (2002). They estimate the retailers' logistics costs at up to 27% of total costs (see Figure 2).

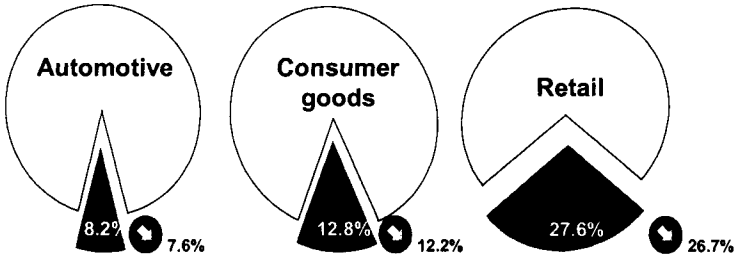

Figure 2: Percentage of logistics costs on total costs by industry (in %)[2]

Even if other researchers have clearly lower estimations (e.g. Klaus 2003), there is a common agreement that there exists a large savings potential. Two studies from the year 1999 estimate the savings potentials at about 12–25% (Baumgarten and Wolf 1993; European Logistics Association and A.T. Kearney 1999).

In order to achieve these savings, new advanced logistics-technology is employed. But logistics should never be reduced to its cost-reducing effect, as logistics concepts can also be utilized to improve service and consequently increase sales (Angerer and Corsten 2004). The next section deals with one of the most important measures used to quantify customer-service levels: the on-shelf availability rate.[3]

1.2. Excellence in Store Operations

A high availability rate of products on the shelves is of utmost importance for retailers. All the efforts made to improve the supply chain are futile if, in the end, the consumer is unable to buy the product because it is not available on the shelf. There

[2] Source: Baumgarten and Thoms (2002).

[3] The on-shelf availability rate is the percentage of products that are available for purchasing on the store's shelves at a particular moment in time.

exist studies that show that out-of-stocks (OOS) in stores are the most frequently mentioned cause of frustration for dissatisfied customers in retail (Sterns, Unger et al. 1981). Interviews with practitioners confirm the importance of high shelf availability:

> *"The three criteria that decide the success of a product are the right price, the right forms of advertisement and high on-shelf availability. (...) In particular, if there is a promotion, there is nothing more important than having the goods on the shelf!"*[4]

Obviously, the impact of an OOS depends on the reaction of the customer:

> *"The reaction of customers [on OOS] differs a great deal. If the customer buys a different brand, we are happy. If he or she does not buy anything at all, then we are not content. And if the customer buys the product in a competitor's store, that is a catastrophe! Seventy percent of customers change to the competition for good if they experience repeated OOS; and that is a complete catastrophe!"*[5]

Furthermore, there is a strategic component to high shelf availability, as it ensures an advantage in increasingly competitive markets:

> *"If we want to compete with new aggressive retailers such as LIDL which are planning to enter the Swiss market, we have to increase the turnover per square meter. For that, we need to increase the on-shelf availability (...) to make our stores more interesting for customers."*[6]

The importance of a high availability is underlined by the research of Drèze, Hoch et al. (1994) among others. They show that the total amount of money spent on any store visit is an elastic quantity and is highly dependent on product presentation and quantity on the shelf. Although the on-shelf availability rate plays such an important role in the business of retailers, it seems that only a minority of European grocery retailers systematically measures this important KPI (key performance indicator). A case study of 12 leading European grocery retailers has shown that only four companies have established a process for daily availability check (Småros, Angerer et al. 2004a). Only one retailer had implemented an electronic-based system for automatic checks. The magnitude of the OOS problem still appears not to have been identified by many retailers. They tend to derive the availability rate in their stores

[4] Source: Arthur Mathys, Director Logistics, Denner, 04.08.2003.
[5] Source: Wolfgang Mähr, Director IT, Spar Switzerland, 16.02.2004.
[6] Source: Wolfgang Mähr, Director IT, Spar Switzerland, 16.02.2004.