



Analyzing out-of-stock in independent grocery stores: an empirical study

Jesper Aastrup

*Department of Marketing, Copenhagen Business School,
Centre of Retail Studies, Frederiksberg, Denmark, and*

Herbert Kotzab

*Supply Chain Management Group, Department of Operations Management,
Copenhagen Business School, Frederiksberg, Denmark*

OOS in
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Abstract

Purpose – The purpose of this paper is to examine out-of-stock (OOS) challenges in the independent grocery sector with a special emphasis on in-store root causes. The analysis aims to assess the extent and root causes for OOS in the independently controlled retail sector and provide a comparison of these results with the centrally controlled chain sector in Denmark. The paper also seeks to examine the practices and challenges of store ordering and store replenishment processes in the independent sector and identify practical implications for store management and other members of the grocery channels.

Design/methodology/approach – The research design includes two studies. Study-I surveys and compares the extent and root causes of OOS of 42 stores from eight chains in the two sectors. Study-II identifies, based on qualitative interviews with 17 store managers/owners of independent stores, specific insights on store operations.

Findings – The quantitative study shows that the OOS rates in the independent sector are significantly higher than in the centrally organized sector. Furthermore, the independent grocery sector faces OOS challenges in more categories than the centrally controlled sector. The study also reveals a very large variation in the performance of independent stores. Contrary to the centrally controlled chain store sector, the major root cause for OOS in the independent sector is found in the store ordering process. The qualitative study shows that the main discriminating issues between stores with a low and a high OOS rate are: store management emphasis and commitment to OOS issues; the resulting priority and managerial guidance in store ordering and store replenishment tasks; the stability of staff and the proper planning for replenishment peaks; the store size and resulting space conditions; and the use of appropriate decision heuristics and use of inventory in store ordering.

Practical implications – The findings have practical implications for store management as it reveals practices to pursue and to avoid. Also, it is argued that the findings have implications for the other members of the grocery channels.

Originality/value – Empirically, this paper explores two issues not being dealt with in depth in previous research, i.e. the OOS challenge in the independent sector and the emphasis on store operations.

Keywords Stock control, Shelf space, Retail trade, Denmark

Paper type Research paper

1. Introduction

Product availability, defined as the probability of having a product in stock when a customer order arrives (Chopra and Meindl, 2007, p. 77), is one of the key performance



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components of customer service. The complement to product availability is out-of-stock (OOS) which can be defined as: “a product not found in the desired form, flavour or size, not found in saleable condition, or not shelved in the expected location” (Efficient Consumer Response – ECR Europe, 2003). European grocery shoppers rate OOS as the third most important issue after shorter queues and more promotions (ECR Europe, 2003). When facing an OOS, shoppers show different reactions ranging from switching store, brand or variant or to delaying or to even dropping the purchase (Kucuk, 2008). The consequences of OOS are loss in sales and shoppers for retailers as well as for manufacturers (Corsten and Gruen, 2003). Every year, the European grocery industry loses approx. €400 billion due to OOS (ECR Europe, 2003). The successful management of product availability by reducing OOS rates therefore represents a potential driver for increasing revenues (Corsten and Gruen, 2003).

OOS has been studied so far from two broad angles. One research stream has focused on the customer reactions to an OOS situation, representing consumer behavior. The second stream looks at the extent and root cause analysis of OOS situations and represents the logistics/supply chain operations perspective. Here, research shows that 70-90 percent of OOS situations originate from causes at store level (Corsten and Gruen, 2003; ECR Europe, 2003). Hence, a “deterioration of availability” seems to be a fact in today’s grocery supply chains, from suppliers over central warehouses to the grocery supply chain’s ultimate service level on the shelf.

This paper contributes to the second stream of OOS-research with an emphasis on the in-store operational causes as part of the logistics processes in independent grocery stores in Denmark. This study is a result of a research cooperation between the Copenhagen Business School and ECR Denmark where the particularities of the independent sector in terms of product availability have been studied. Existing studies have so far looked at OOS in centrally organized chain stores, so it would be interesting to see whether the independent sector shows differences in this area. Therefore, our study compares the Danish independent grocery sector with the centrally organized chain sector and analyses in depth the store-related practices in the independent sector. Consequently, we developed the following research questions:

- RQ1.* Is there a difference in the extent of OOS and its root causes between the independent grocery stores and centrally organized grocery stores?
- RQ2.* Do the two sectors differ on the OOS variability across stores?
- RQ3.* What are the particular challenges and practices of the independent grocery stores when it comes to the management of OOS?

Based on our analysis, we intend to suggest areas of managerial effort which can be used to reduce the OOS in the independent grocery sector.

Our methodological approach is a two-stage research design combining a quantitative examination of extent and root causes (= Study-I) with a qualitative examination on store-related practices and their influence on OOS situations (= Study-II). We compare the extent and root causes of OOS between centrally organized and independent sector stores by applying the methodology, which has been used in the majority of existing OOS studies (Gruen *et al.*, 2002), by physically auditing OOS situations in stores and tracking the root causes of these OOS situations afterwards

in administrative systems. These identified quantitative measures on extent and root causes are then linked to a qualitative analysis of store-related root causes in the independent sector. This will provide an in depth analysis of the relationship between store operations and created OOS situations.

The paper is structured as follows. In Section 2, literature on OOS is reviewed. Section 3 considers the methodological approaches and presents the Danish grocery retail context from an independent sector point of view. In Sections 4 and 5, the results of the empirical analysis is presented. This includes a comparison of the quantitative extent and root causes in the independent and centrally controlled chain sector and an elaboration on practices in independent stores based on qualitative interviews. The paper closes with a critical summary, a discussion on the managerial implications for store management, and an outlook for future research.

2. Literature and background

An OOS represents a situation where a product is not available when a customer order arrives. Kucuk (2008) calls the OOS situation the intersection between consumer behavior and distribution which has led to two different research streams since the late 1960s. Research stream-I can be labeled as “consumer behaviouralist approach” and deals with consumers responses to OOS situations (Sloot *et al.*, 2005; Kucuk, 2008). Research stream-II can be labeled as “logistics/supply chain operations approach” and addresses the logistics processes causing OOS situations (Corsten and Gruen, 2003; Grant and Fernie, 2008).

Early work in Research stream-I identified different consumer responses to OOS based on experimental research designs. The consumer responses to OOS have been presented in the form of decision trees and range from substituting the intended purchase with another size or switching brand or postponing the shopping action (Walter and Grabner, 1975; Schary and Christopher, 1979; Emmelhainz *et al.*, 1991b). In their global study, Corsten and Gruen (2003) applied the five responses of:

- (1) buy item at another store;
- (2) delay purchase;
- (3) substitute – same brand;
- (4) substitute – different brand; and
- (5) do not purchase item.

The results of the Corsten and Gruen (2003) study showed that 31 percent of the customers will buy the intended item at another store, while 15 percent delay the purchase, 19 percent substitute within the brand, 26 percent substitute to another brand, and 9 percent do not purchase the item. The same distinction has also been applied by ECR Europe (2003) and by the Institute of Grocery Distribution (IGD) in the UK (IGD, 2004, 2005, 2006, 2007). There, the ECR Europe (2003) study shows that 21 percent of the customers buy the item at another store, 17 percent delay the purchase, 16 percent substitute within the brand, 37 percent substitute to another brand, and 9 percent do not purchase item. However, these responses differ considerably across categories (Gruen *et al.*, 2002; Kucuk, 2008). In general, impulse items, less involvement, more substitutability and less brand loyalty increases the likelihood of substitution purchases (other variant or brand), whereas strong brand loyalty, more planned purchases,

and higher involvement increases the likelihood of store switching (ECR Europe, 2003). A detailed overview of these response patterns across different categories from previous studies are given in Kucuk (2008). Nevertheless, the results show that the majority of the behavioural patterns represent a lost sale for the retail store and a lost sale for the brand supplier.

Additional OOS research within Research stream-I looked at different consumer behaviour issues underlying the response patterns. Emmelhainz *et al.* (1991a) studied the effect of the perceived risk of switching to an alternative brand, the effect of urgency of purchase and the effect of the use occasion. Verbeke *et al.* (1998) examined the effect of the availability of competing stores, of whether OOS was a temporary or permanent change in assortment, of store loyalty and of the size of the shopping trip. Fitzsimons (2000) analysed consumers' decision satisfaction in OOS situations as a result of the commitment to the item OOS and the impact on decision difficulty. Campo *et al.* (2000) developed a model based on the consumer maximizing utility in terms of substitution cost (decreased utility of item switching), transaction costs (search and transport costs) and opportunity costs (cost of not consuming in the category). Their overall results, which are in line with other literature, show that loyalty towards OOS item lowers the probability of switching items, store loyalty and the availability of acceptable alternatives on the other hand increases the likelihood of item switching. Campo *et al.* (2003) extended the methodology to scanner panel data which allowed them to study quantity effects, switching effects and post-OOS purchase effects. Kucuk (2004) studied how in-store merchandising and store attractiveness factors affect consumers' brand and store loyalty in OOS situations. Sloot *et al.* (2005) analyzed the brand equity of the item OOS as well as the hedonic element of the shopping purpose. Recently, Kucuk (2008) examined double jeopardy patterns and showed how OOS rates, as part of the broader construct of distribution effectiveness, affect consumer penetration as well as consumer behavioural loyalty towards the brand.

In Research stream-II, the extent of OOS, the underlying logistical processes causing OOS situations and different managerial measures on how to deal with OOS were studied mainly in the grocery sector (Corsten and Gruen, 2003; ECR Europe, 2003; Fernie and Grant, 2008). Most of these studies indicate average OOS rates across categories in a range between 7 and 10 percent. Gruen *et al.* (2002) came up with a global OOS average at 8.3 percent, where the Northern and Western European countries performed slightly better with an average OOS rate at 7.2 percent. Similarly, ECR Europe (2003) arrived at a 7.1 percent for European countries, while British retailers showed an impressive 4 percent OOS rate (IGD, 2004, 2005, 2006, 2007).

The OOS-rate is caused by deficient distribution, bullwhip effects and retail store ineffectiveness (Kucuk, 2004, 2008; Corsten and Gruen, 2003; Fernie and Grant, 2008). This is presented in more detail in the ECR Europe (2003) study which sees the following logistics variables in relation to OOS:

- *Product availability deteriorates through the last metres.* While typical service levels between suppliers and central warehouses and from central warehouses to the stores range between 97 and 99 percent, the "shelf service level" in the store is around 92-93 percent. This indicates that a major part of the root causes can be found in in-store operations.
- *The extent of OOS depends on the characteristics of the category.* OOS rates clearly vary between categories, with the worst performing at about 15-16

percent, and the best performing at OOS rates as low as 1 percent (Gruen *et al.*, 2002). Logistics characteristics for “challenging” categories are many stock keeping units (SKUs), low demand predictability (impulse, season, campaign, etc.), and/or special issues such as shrinkage problems or requirements for facilities (coolers and freezers).

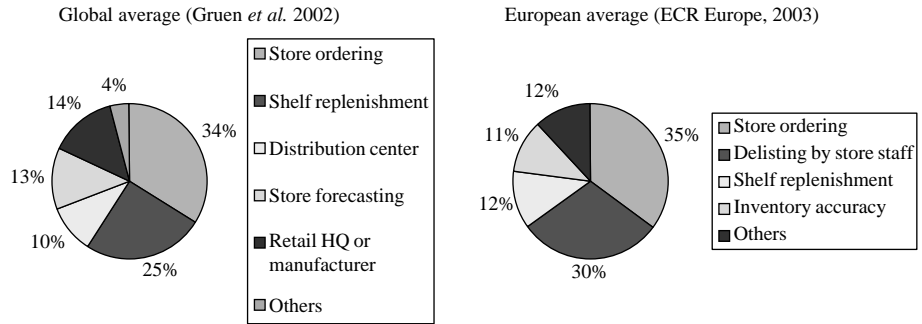
- *Promoted items have higher OOS than non-promoted items.* The studies show that promoted items have an up to 75-100 percent higher OOS than non-promoted items (Gruen *et al.*, 2002). But special attention towards promoted items in some cases result in lower OOS rates for promoted items (Fernie and Grant, 2008).
- *Significant differences exist between stores and formats.* The OOS rates of hypermarkets have been lower than the ones of supermarkets. Similarly, Fernie and Grant (2008) reported higher OOS in small convenience stores as compared to supermarkets. Hence, there seems to be an underlying issue of size effects. However, even more significant differences were found within store formats where the OOS rate was up to Factors 7-8 between the best and worst performing store (ECR Europe, 2003).
- *OOS is higher in the busy times of the week.* OOS rates vary over the week and at different times of the day. Gruen *et al.* (2002) identified lower OOS rates early at the day and higher OOS rates later at the day but also falling OOS rates over the week with a peak at sunday/monday and lowest rates at saturdays, while the European experiences show the highest OOS rates at the beginning of the week and over the weekend sales (Friday/Saturday) whereas in the mid week, OOS rates were the lowest.
- *High stock can result in higher OOS rates.* Lower stock through the supply chain increases transparency and efficiency resulting in both lower OOS rates and lower inventory (Scott, 2006).
- *No significant differences exist between direct and indirect delivered items.* The OOS rate of items which have been delivered directly from the supplier to the store does not differ to the OOS rate of items which have been delivered to the store via a central warehouse.

However, the ECR Europe (2003) study did not systematically compare the independent stores with the centrally controlled chain stores.

Figure 1 shows the identified root causes to OOS situations as studied by Gruen *et al.* (2002) and Corsten and Gruen (2003) on a global level and by ECR Europe (2003) on a European level.

OOS root causes are categorized slightly differently across these two studies. However, the root causes can be grouped into in-store causes and out-of-store causes. In-store causes can further be divided into store ordering (including store forecasting) and store replenishment. We can see that store ordering is the central root cause for OOS representing 35 percent in the European study and 47 percent (store forecasting included) in the global study. Another significant factor is store replenishment that makes up 12 percent in the European study and 25 percent in the global study. The European analysis has also looked at the root cause “delisting by store staff” that accounts for 30 percent of the European numbers. The global study shows that

Figure 1.
OOS root causes
world-wide and in Europe



28 percent of the root causes (distribution center, retail headquarter (HQ) or manufacturer, and others) were tracked to out-of-store causes, while ECR Europe (2003) classified only 12 percent as out-of-store causes (inventory (in)accuracy however can occur in stores as well as in the rest of the supply chain). All-in-all, both studies show in-store causes as significant parts of the OOS-root causes.

Despite most root causes being tracked to in-store causes, Corsten and Gruen (2003) also argue for a supply chain approach which includes the linkage between decisions in stores, in distribution centres, at wholesaler/retail headquarter and at suppliers. When improving OOS-rates at the store level, improvement measures and initiatives must look across these stages of the supply chain too. This view has been supported by Kucuk (2008, Table 2). Corsten and Gruen (2003) suggest thereby to:

- improve processes (such as assortment planning and space allocations, automatic ordering systems, electronic data interchange, internet and real-time ordering, inventory control, and flow replenishment);
- improve the operational accuracy (by automatic availability measurement, inventory record accuracy and automatic identification); and
- install incentive alignments (by offering ordering incentives, incentive systems, roles and responsibilities, flexible staffing and changing culture).

This is in line with Lee *et al.* (1997) when eliminating the bullwhip effect from a supply chain.

Similarly, ECR Europe (2003) developed seven “levers” to improve OOS which refer to two prerequisite levers, and five logistics process levers, i.e.:

- (1) measurement of OOS;
- (2) management attention;
- (3) replenishment system;
- (4) merchandising;
- (5) inventory accuracy;
- (6) promotion management; and
- (7) ordering system.

This can help to reduce the bullwhip effect between store level and supplier (Kucuk, 2008; Lee *et al.*, 1997).

We can summarize the existing discussion from both research streams as follows. The performance drivers for product availability are the interaction between the distribution systems of suppliers and retailers and retail store operations. The OOS occurs then at the meeting point (= shelf of a store) between the “controlled” supply of manufacturers and retailers and the “uncontrolled” demand of ultimate customers, who behave differently when not receiving the required product.

3. Methodology and context

Our project refers to the Research stream-II where we examine the extent and root causes in the Danish independent grocery sector compared to the centrally controlled chain store sector. Thereby, we apply in our study a three-stage methodology in two studies. Study-I consists of the quantitative two-stage approach of extent measurement and root cause tracking (Gruen *et al.*, 2002). Study-II represents the third stage of OOS-analysis based on a qualitative approach where we address in-store causes affecting an OOS. Our findings will also be compared with the findings as presented in the relevant literature.

Study-I: quantitative study of OOS extent and root causes

In the quantitative part of our study, we followed the notions of Corsten and Gruen (2003) and conducted physical audits in the stores and tracked root causes via the retailers' IT systems. We departed from OOS in line with the traditional definitions as: not available for the customer on the fixed shelf. This was measured first of all in relation to the assortment defined for the chain. However, we pursued in our analysis the OOS in relation to the assortment carried by the store, i.e. we did not consider in our analysis the OOS situations of products that were delisted by store staff. Therefore, the OOS situation in our analysis is defined as: item in store assortment that is not available for the customer on the fixed shelf.

The survey was set up in collaboration with ECR Denmark. The physical audits were accomplished by a third party in 42 stores covering most of the Danish market. The 42 stores represent eight chains, four centrally controlled and four chains of independent stores. The store formats include 13 hypermarkets, 16 large supermarkets and 13 smaller supermarkets. Discounters were not represented in the sample. Over a period of three weeks, each store was visited four times systematically (with one early visit on a busy day, one late visit on a busy day, one early visit on a slow day and one late visit on a slow day). This ensured avoiding a systematic bias when comparing store OOS rates. Comparable assortment lists were developed for each chain covering 12 categories with a total of about 110 products. In sum, the physical audit resulted in a total sample of 19.054 observations.

The first part of the root cause audit was carried out during the store visits. Whenever facing an OOS situation, auditors asked store personnel about the product, whether it was in store assortment, and whether it was available at another place in the store (e.g. a campaign display) or in the back room storage. Products that were not in the store or back room storage were then tracked in the retailers' inventory and ordering systems (see Appendix 1 for the root cause system pursued). All in all, 917 OOS situations were analysed for their root cause.

The resulting data measures of OOS extent from the physical audits are dichotomous, in the sense that a given item at a given store visit was either not on the shelf or available on the shelf. The resulting data measures on root causes are categorical as each OOS situation is tracked to a specific classification (see Appendix 1 for the classifications). Both, the dichotomous extent measures and the categorical root cause measures are nominal scales (Hair *et al.*, 1998) as no relative positions can be determined between the categories. For these measures inferential tests of column-row independence based on χ^2 statistics are permissible (Hair *et al.*, 1998) and will be applied in the analysis.

Study-II: qualitative study of in-store root causes

Owing to a large part of root causes being classified as in-store causes (store replenishment or store ordering), and due to a large variation within the group of independent stores, we were interested in the particularities of those. Based on a qualitative approach (Kvale, 1996), we were able to analyse in more depth the strengths and “challenges” of particular independent stores and link this analysis to store-specific knowledge of OOS rates, problematic categories and root causes from Study-I. Furthermore, this approach allowed an identification of possible patterns between high and low performers on the OOS matter, which would not have been possible if we did not know the store performance from Study-I.

We interviewed a total of 17 store managers/owners from the four independent chains. The respondents represented both large supermarkets as well as smaller supermarkets (no hypermarkets though as only centrally controlled hypermarket chains exist in Denmark); and they represent high, low and middle range performances from Study-I. The investigated stores were located in most major regions of Denmark. The interviews lasted between 45 minutes and about two hours with the most typical interview length of about 75-90 minutes. The interview guide was set up as shown in Appendix 2 (Table AI) starting with the interviewees “off the top of their head” responses, attitudes and store efforts in relation to the OOS topic; then moving on to “revealing” the store specific performance and root causes as measured in Study-I; and finally, based on pre-fixed issues of store operations and management inspired from the different OOS management levers (ECR Europe, 2003; Corsten and Gruen, 2003), the interview dealt with each store operation element and its possible effect on OOS.

The analytical approach can be classified as a mixture of condensing meaning and categorizing meaning (Kvale, 1996). Condensing meaning, as a phenomenological approach of moving from holistically reading the interview transcripts into breaking it down into crucial units of meaning and dominating themes (Kvale, 1996), has been the approach in the interpretation of the single case store. Categorizing meaning aims for comparison across the 17 stores where the units identified are structured into simple categories in order to compare, weigh, or rank across cases (Kvale, 1996).

The Danish grocery retail context from an independent sector point of view

The Danish grocery sector is dominated by two retail groups, Coop and Dansk Supermarked, each consisting of several centrally controlled retail chains. The third dominating factor is the independent sector. The total market is divided as follows (Knudsen, 2008):

- *Coop Denmark* – 36.3 (%)
- *Dansk Supermarked* – 29.9 (%)
- *Independent sector* – 29.3 (%)
- *Aldi/Lidl* – 4.5 (%)

The independent sector as a whole represents a significant, though not dominating, part of the Danish grocery sector. However, the independent sector is in decline and its market share is estimated to be 23 percent in 2010 (Bjerre and Bahr, 2006). Recently, 86 percent of the independent sector's turnover, which equals a total market share of about 24 percent, is controlled by the Dagrofa group including the wholesaler SuperGros, the supermarket chain SuperBest (large supermarket), the Spar chains which are smaller supermarkets, and the discounter Kiwi (Bahr, 2006). The second actor is the Edeka-group including the large supermarket AktivSuper, the smaller supermarket chains Merko and Focus and the discounter Rema 1000. Edeka represents 11 percent of the independent sector's turnover or 3 percent of the total market (Bahr, 2006).

The differences between the independent sector and the centrally controlled chain sector refer to smaller store formats and its variety of store sizes within the sector. Large store formats such as hypermarkets and low price warehouses are only operated by Coop and Dansk Supermarked. The largest store formats in the independent sector are represented by SuperBest and AktivSuper with average store sizes at 893 and 1,051 square meter, respectively, (Bahr, 2006). The other store formats in the independent sector are smaller. Another important characteristic of the independent sector is the heterogeneous store sizes within the single retail chain, and the resulting challenges for store concepts/layout and category management (Bjerre and Bahr, 2006).

Furthermore, a major difference between the two sectors, being of high importance in the context of OOS, is the replenishment processes and the number of weekly deliveries to stores. While most stores in the independent sector have one or two weekly deliveries of dry groceries, their centrally organized competitors have more frequent, up to daily, deliveries.

4. Study-I: quantitative analysis of OOS extent and root causes

The extent of OOS

Table I shows the OOS of the total sample and for the independent and centrally controlled chain sector in particular.

The hypothesis of equal OOS rates between the two sectors must clearly be rejected on the basis of χ^2 test for independence. Hence, we see a significantly higher level of OOS in the independent sector, almost twice as high.

As compared to international studies (Gruen *et al.*, 2002 or ECR Europe, 2003), the Danish OOS rates of 4.98 percent are quite low. This number, however, does not include the OOS situations due to delisting by store staff, which in Europe covers about a third of the total OOS-rate (ECR Europe, 2003). Extracting this number from the average

	Independent sector (<i>N</i> = 10,777)	Centrally controlled chain sector (<i>N</i> = 7,661)	Total sample (<i>N</i> = 18,438)	Pearson χ^2		
				Value	df	Sig.
OOS	6.24%	3.20%	4.98%	87.861	1	0.000

Table I.
OOS in the independent and centrally controlled chain store sector

European OOS rates (ECR Europe, 2003), we are able to receive a relevant benchmark of about 5 percent which makes Denmark an “average” European OOS-performer.

OOS rates by categories

When looking at different categories, we are able to see large variations in OOS rates across categories (Table II).

The independent sector holds lower OOS rates in fresh meat and breakfast cereal (the latter difference not significant though). For the remaining categories, the independent sector holds higher OOS rates. Most of the identified differences (with exception of breakfast cereals, cleaning/hygiene and partly dairy) are significant in the χ^2 tests. The problematic categories for the independent sector are frozen foods, juice, bread, and personal care. The impulse/variety seeking categories of confectionary and cakes and cookies also show OOS rates above 4 percent. All of these categories have one or more of the following characteristics: perishability, large number of variants, impulse and variety seeking behavior, and/or requirement for expensive freezing capacity which largely is in line with reviewed research (Corsten and Gruen, 2003; ECR Europe, 2003). The centrally controlled chain store sector, on the contrary, seems to have narrowed the problems to three categories, i.e. fresh meat, frozen foods, and personal care.

OOS rates by stores

Figure 2 shows the distribution of OOS rates for the individual stores of the two sector.

The figure shows lower average values of OOS rates in the centrally controlled chain sector as well as a large variance between store performances (the latter being in line with international experiences). The figures also visualise a remarkable difference in store performance variance between the independent and centrally controlled chain sector on the OOS matter. All stores with a measured OOS rate above 7 percent belong to the independent sector. However, more unexpected, the two best performing stores of the entire sample were also independent stores (both with impressive OOS rates below 1 percent). The range for independent stores between 1 and 16 percent (Factor 16) compared to the range for centrally controlled stores going from 1.5 percent to

Category	OOS – independent sector (%)	OOS – centrally controlled chain sector (%)	Pearson χ^2		
			value	df	sig.
Fresh meat	3.6	6.8	6.432	1	0.011
Frozen foods	19.2	9.0	26.489	1	0.000
Diary	2.9	0.7	3.898	1	0.048
Juice	9.5	1.6	43.487	1	0.000
Coffee/tea	3.9	2.1	5.521	1	0.019
Breakfast cereals	1.9	2.4	0.428	1	0.513
Bouillon/sauce	3.2	1.7	2.805	1	0.094
Cakes/cookies	4.8	2.1	5.728	1	0.017
Bread	6.6	3.0	12.828	1	0.000
Confectionary	6.0	2.5	11.326	1	0.001
Personal care	8.4	4.5	12.649	1	0.000
Cleaning/hygiene	2.6	2.4	0.096	1	0.757
Total	6.2	3.2	87.861	1	0.000

Table II.
Variance in OOS by category and sector

about 6 percent (Factor 4), as well as the very different standard deviations also illustrate the large variation between stores in the independent sector.

Root causes of OOS

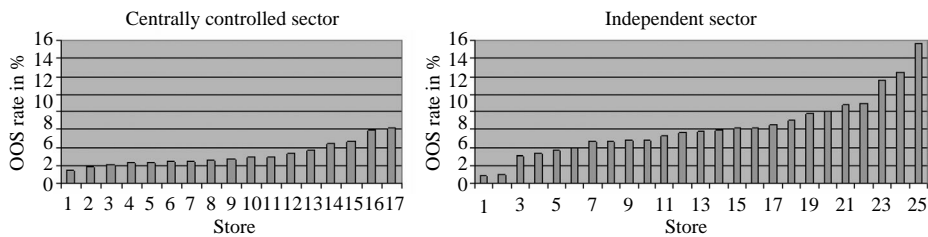
The root causes tracked have been grouped into the following four categories of OOS causes, based on the scheme in Appendix 1:

- (1) In-store causes:
 - *Store replenishment causes.* The paper is somewhere in the store or back room facilities, just not on the shelves.
 - *Store ordering causes.* The item is not in the store, but the store ordered it too late or too little of it (store order is made and delivered to store as ordered).
- (2) Out-of-store causes:
 - *Wholesale or central warehouse-causes.* The paper was ordered by the store but not delivered to the store (in adequate quality or volume), and the root cause is tracked to problems in warehousing, warehouse to store distribution or wholesale ordering practices.
 - *Supplier-causes.* The paper was ordered by the store but not delivered to store (in adequate quality or volume) due to causes within the supplier controlled part of the ordering and replenishment system.

Table III shows the distribution of root causes with χ^2 measures on independence between rows and columns.

In-store-related root causes were expected to dominate the distribution based on the reviewed research (Corsten and Gruen, 2003; ECR Europe, 2003), however, not as strongly as the results of the analysis shows. Between 98 and 99 percent of the root causes, in both independent and centrally controlled chain store sector, were tracked to store ordering or store replenishment, with comparable international figures of out-of-store causes at 12 and 28 percent, respectively, (ECR Europe, 2003; Gruen *et al.*, 2002).

A significant difference exists between the independent and centrally controlled chain store sector. Whereas the independent sector has a 25/75 division between store replenishment and store ordering, it is more or less reversed with a 64/36 division in the centrally controlled chain store sector. The main challenge of the independent sector therefore lies in the routines and practices concerning store ordering, whereas store replenishment seems to be the major challenge in the centrally controlled chain store



Notes: Range = 1.47% - 6.13%, Std dev. = 1.36; Range = 0.87% - 15.67%, Std dev. = 3.38

Figure 2. Store performance in centrally controlled and independent sector

Table III.
Root causes in
independent sector and
centrally controlled chain
store sector

Root cause	Independent sector (N = 616) (%)	Centrally controlled chain sector (N = 300) (%)	Total sample (N = 916) (%)
<i>In-store causes</i>			
Store replenishment	24.4	63.0	37.0
Store ordering	74.0	35.7	61.5
<i>Out-of-store causes</i>			
Wholesaler/central warehouse	1.5	1.0	1.3
Suppliers	0.2	0.3	0.2
Total	100	100	100

Notes: Pearson χ^2 : value = 1.303E2, df = 3, sig. = 0.000 (three cells with expected count below five); fisher's exact test: value = 129.285, sig. = 0.000

sector. Explanations can be found in the larger (use of) back room facilities and more frequent deliveries of many categories in the centrally controlled chain store sector.

In a nutshell, the independent grocery sector experiences on average an OOS rate of 6.2 percent which can be divided into following parts: 1.5 percent (24 percent of the total rate) can be tracked to store replenishment. About 4.6 percent (or 74 percent of the total OOS) refer to store ordering causes and only 0.1 percent (remaining 1 percent of the total OOS rate) was tracked to out-of-store causes (i.e. wholesale, central warehouse, and/or supplier). Independent stores face challenges in more categories than the centrally controlled chain sector and they have a remarkable variation in store performance (unlike the centrally controlled chain store sector). Furthermore, the independent sector faces severe problems with store ordering root causes. This is different from the centrally controlled chain sector in which store replenishment is the major root cause.

5. Study-II: qualitative analysis of in-store causes in independent stores

This section addresses the issues of in-store causes (store replenishment and store ordering) based on the 17 qualitative interviews. Store size will be dealt with first followed by an analysis of the activities of store replenishment and store ordering that directly affect OOS. Finally, the factors affecting the store replenishment and store ordering activities (thereby indirectly affecting OOS) will be explored. Emphasis will be:

- practices that seem to create or lower OOS; and
- seemingly discriminating factors between better and worse performing stores.

Store size and OOS

Figure 3 shows the results for each store in the qualitative sample split into smaller and larger stores. The figure decomposes the overall OOS rate of the interviewed stores into the contribution of the different root causes[1].

The figure clearly illustrates that the smaller stores face the largest challenge as regards OOS in the independent sector. The best performing stores by far in the entire sample are larger independent stores; similarly the few stores with more than 10 percent in OOS rate are smaller independent stores. Organizationally, the smaller

stores are typically very reliant on one person/owner, whereas the larger stores typically have a more formal hierarchy and division of task responsibility. Second, larger stores have better possibilities to allocate space, to give more facings to products with high turnover, and to take in products with lower turnover without heavily affecting other space requirements, whereas smaller stores have a challenge in simply finding space for centrally defined assortments, new products and items on campaign. Third, being “bigger” also gives advantages in terms of turnover. Higher turnover at a given SKU gives lower relative demand uncertainty per period, thus improving the conditions for forecasting.

Shelf replenishment

One important direct cause of OOS lies in the shelf replenishment from the back inventory of the stores. Store replenishment in the independent sector represents 1.5 percent of the overall 6.2 percent OOS rate as compared with the 2 percent share of the centrally controlled chain store sector. Speaking in isolation, the independent sector has an advantage on this issue. But since stores in the centrally controlled chain sector make much more use of back store facilities for inventory, the isolated comparison of the sector is problematic. As shown in Figure 3, most stores in the interview sample lie between 0 and 2 percent for the contribution of store replenishment to the overall OOS rate, with one exception (shelf replenishment contribution = 6 percent).

Shelf replenishment in the independent sector is typically performed by employees from permanent staff being responsible for store replenishment in the single department or category. In some smaller stores, this responsibility is centered on the store owner. But most stores, even the smaller stores, have allocated store replenishment responsibility to some degree to employees. In categories with daily deliveries such as dairy, fruit and vegetables and bread, it is part of the daily routines whereas “replenishment peaks” at the specific delivery days were created in dry grocery categories and frozen categories which have only one or two deliveries a week.

Many respondents view the daily replenishment from back store inventory to be a task to be done in-between other tasks. All respondents indicated ambitions of replenishment from back room storage and generally trimming shelves on a daily basis (depending on the category). Numbers do not indicate major differences between the stores (besides the one store with a store replenishment contribution well above 6 percent). But what seems to discriminate the stores is the attention or focus on this task, where some of the better performing stores indicate a larger managerial commitment towards replenishment (and generally nice looking shelves).

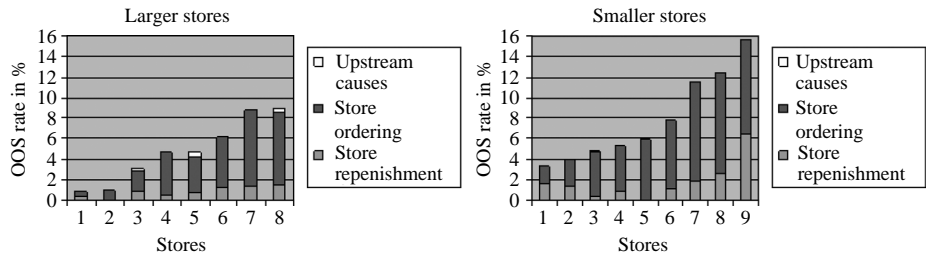


Figure 3. Contribution of root causes to overall OOS rate in larger and smaller stores

In relation to the replenishment peaks regarding, e.g. dry groceries and frozen food, the task is done mainly by planning employee working hours. In one store (OOS = 9 percent), some of the dry grocery goods from main weekly deliveries were not on the shelves until three days after delivery, even though it was stated that store management planned staff in relation to these replenishment peaks. The lowest performing store (OOS = 16 percent) had difficulties over their busy weekend with the store being “emptied” Monday morning and was planning in future to have people meet several hours before opening to replenish shelves. Some of the better performing stores (OOS = 3 percent; OOS = 5 percent) on the other hand used the possibility to have employees meet in due time before opening hours on the replenishment day whereby the major replenishment tasks could be done without shoppers in the store.

Hence, interviews revealed some obvious practices of outsourcing responsibility, having ambitions of replenishing shelves on a daily basis and planning employees based on replenishment peaks. There are no clear discriminating factors, besides to some extent the managerial attitude and the employee situation that distinguish the better from the worse performing stores.

Store ordering and forecast

The by far major part of OOS situations in the independent sector originate directly from store ordering practices. Ordering too late or too few stands for 4.6 percent of the 6.2 percent OOS rate in the independent sector (Figure 3). The benchmark from the centrally controlled chain sector is 1.1 percent, so this is where the major disadvantage of the independent sector lies. The range on the contribution from store ordering root causes goes from the best ones with a contribution rate at about a 0.5 to 1 percent, over the “good performers” at about 2-3 percent, the “below average performers” with an OOS contribution from store ordering at about 6-7 percent, to the worst performances with store ordering contributions at about 10 percent (Figure 3).

Generally, employees from permanent staff are made responsible for store ordering in the single department or category. In smaller stores this responsibility is often centered around the store owner, but also smaller stores have to some degree allocated store ordering responsibility to employees. The stores have fixed time windows for placing orders, typically two workdays before delivery of non-promoted goods. Goods on campaign (some to be ordered four weeks in advance) are also normally the responsibility of this same employee. Hence, the organization of the task seems important but is not something that discriminates the better from the worse performing stores. However, a discriminating factor from interviews is the stability of the employees. Some stores have had great difficulties in finding store educated employees and have generally suffered from a high turnover rate of employees. This has in many interviews been stated as one reason for not doing better on the OOS issue. Also, one of the best performing stores of the interview sample (0.9 percent OOS) uses this as a reason: “[. . .] but we must also acknowledge that we have gained from a quite permanent and loyal group of core employees.”

In almost any store, the identified ordering routines were rather non-data based. A total of 14 of the stores interviewed directly stated that normal order procedures are based on the single employees’ “intuition” (OOS = 0.9 percent), “gefühl [German for a good sense of something]” (OOS = 6 percent), “experience” (OOS = 16 percent) rather than relying on POS data analysis in decision making. The category responsible

employees use their experience and “from the top of their head” knowledge to guess or predict the sales of next period and thereby to decide on how much to order. Only in rare occasions sales data are used (the sale of cream up to Christmas was often mentioned as such an example). This non-data-based approach goes for almost all stores, performing from below 1 percent to about 16 percent OOS rate. The exception, on the other hand, relies on the philosophy that “numbers don’t tell lies” (OOS = 3.3 percent) and is the best performing smaller store in the interview sample. Furthermore, OOS data (directly or indirectly measured) were not used in any of the stores. About half of the stores (and generally the better performing ones) were generally positive towards using OOS statistics if they were made available to them, while the other half were very reluctant towards “more numbers” (OOS = 16 percent). Hence, more data-based approaches do not discriminate high performing from low performing stores in this sample.

Whereas all stores in the centrally controlled chain sector use automatic store ordering systems, only four of the stores in the interview sample of independent stores apply automatic store ordering fully or partly. The performance of these stores is broadly distributed. One of the best performing stores with OOS at about 1 percent used automatic store ordering on a few categories; another applied it on most categories with a “good” OOS performance on 3.3 percent; two other stores however also used automatic store ordering on most categories but performed worse with OOS rates at 8 and 12 percent, respectively, and these two stores both had more than 80 percent of their OOS situations that was tracked to store ordering. Hence, automatic store ordering is no guarantee for a well functioning store ordering routine. What characterises the use of automatic store ordering in the two low performing stores is that the automatically generated order is not questioned in relation to sales data or experience. This is the case in the two well performing stores; they used the automatic order to support store order decisions rather than “blindly” determining the orders.

It is difficult to take out one winning model from the above but one clearly discriminating element is the priority of the store ordering tasks. The best performing stores tend to claim the importance of store ordering activities, and this translates into the necessity to allocate the necessary resources (= time spend) to do this properly. On the contrary, the typical attitude towards store ordering in lower performing stores is that “you have to fit in the task [of store ordering] somehow before the window closes” (OOS = 8 percent) or “it doesn’t take a long time, you scan the items and order a colli, that’s it, it is no problem” (OOS = 16 percent) as some respondents with relative high-OOS rates (see brackets) pointed out. Also, the necessity and importance of clear guidance and communication to the employees responsible for ordering seems to characterise the better performing stores. One quote of the interviews reflects this quite well, where one respondent (OOS = 3.1 percent) states: “I require that store ordering is done at the shelf by taking one product at a time, shelf by shelf, going from left to right. If you do that it is very difficult to miss a product.” Viewing the full section at one time to quickly detecting the visual holes was on the other hand identified as the practice in some of the lower performing stores (e.g. OOS = 16 percent). Also, specific guidance to employees about identifying and being extra aware of the most important SKUs is an example of how prioritising the store ordering activities turns into specific guidance. Thus, time priority and specific managerial guidance in store ordering tasks discriminate stores with higher OOS performance from those with lower performance.

Earlier it was stated that experience and non-data-based approaches were the basis of store ordering in most stores, also in the well performing stores. But how are these ordering decisions taken? And which applied decision heuristics and rules-of-thumbs constitute these non-data-based routines? Some of the low performing stores indicate using some problematic rules-of-thumbs. One is a practice of ordering that does not take into account expected demand, e.g. when there is a visual hole in the shelf (OOS = 16 percent) or when a package fits into the shelf (OOS = 12 percent), which obviously puts heavy requirements on the amount of space allocated to a certain item and how this allocated space relates to expected demand. Another applied procedure is ordering for expected sale of next period (OOS = 6 percent) which is problematic as the store then must expect to go OOS in about every second period (assuming normally distributed demand uncertainty). The better performing stores generally emphasise procedures that are based on expected sales plus a buffer: "We order home for expected sales + one extra day + 20 percent" (OOS = 1 percent). Another *modus operandi* is that the better performing stores allow, or even encourage, using inventory as buffer towards demand uncertainties. One respondent (OOS = 0.9 percent) explains: "we can almost only order to few." A manager of a lower performing store (OOS = 9 percent) specifically addressed an explicit politics of being very careful of not ordering too much. Also the worst performing store (OOS = 16 percent) showed a tendency to emphasise cost of products thrown out and cost of lowering price, i.e. both being examples of the relative visibility of the cost of overstocking vs the cost of understocking (Chopra and Meindl, 2007; Corsten and Gruen, 2003). Hence, it is indicated that the identified procedures of better performing stores explicitly rely on expected sales plus some buffer. Related to this is the use of back room facilities for inventory. Most stores make very limited use of inventory besides the inventory held at shelves (which is a major difference from stores in the centrally controlled chain store sector). Managers of some of the best performing stores, however, have an explicit strategy of using back room inventory as this quote shows: "We must allow ourselves to order for inventory" (OOS = 3.1 percent), whereas a respondent of a lower performing store (OOS = 12 percent) stated that plenty of back room facilities for inventory were available but the store relied explicitly on only using the store's sales area. The exception from this pattern was the earlier mentioned smaller store using automatic store ordering, who had succeeded in operating with very high inventory turnover while maintaining a low-OOS rate (3.3 percent). This exception is more in line with the observation from existing research that lower inventory can lead to lower OOS rates (ECR Europe, 2003).

In Table IV, the indications of the importance of different factors and their discriminating effects are summarized.

Managerial attention and emphasis

Our study showed that the managerial focus and priority of OOS at store level is the most clearly discriminating element between the better and worse performing stores. The emphasis and priority was very strongly accentuated in the four best performing stores (before revealing their performance in the interviews) as this quote of a respondent (OOS = 3.1 percent) shows: "We use very much energy on this [OOS]. As we are in an urban area in which the customer can switch between many stores, shelves filled up become a competitive factor." Others ascribed less importance to the OOS issue,

	Importance for managing OOS in store	Discriminating effect of better and worse performing stores
Fixed responsibilities for store ordering in categories	Yes	No
Stability and loyalty of staff	Yes	Yes
“Intuition” vs data-based approaches in store ordering	No clear indication	No clear indication
Automatic store ordering	No clear indication	No clear indication
Priority given to store ordering task	Yes	Yes
Management guidance on how to perform task	Yes	Yes
Decision heuristics and rules-of-thumb applied in store ordering	Yes	Yes
Use of inventory to buffer against demand uncertainties	Yes	Yes

Table IV.
Importance and discriminating effect of store ordering practices

e.g. “This issue [OOS] doesn’t cause any problems in daily life” (OOS = 9 percent), or they mention that they emphasise the issue but have difficulties understanding their measured performance, e.g. “We have done much to have the items at home, so we feel that we don’t have any OOS situations, so I am quite fuzzled about the numbers [. . .] but it must be as you say, we cannot see it” (OOS = 16 percent).

For the three best performing stores the emphasis is not as much a concern for the immediate effect of lost sale. It is more a matter of seeing it as a competitive factor for the store and a shopper orientation in which it is believed that OOS situation irritates shoppers and affects the store loyalty negatively. Hence, in the words of Corsten and Gruen (2003) the concern is shopper loss, not sales loss. This manifests itself in doing “something extra” for the shopper facing an OOS. This could be same SKU the following week at the same low campaign price; it could be a substitute SKU at a lower price; it could be making an effort to get the SKU and deliver it to the customer.

This managerial attention at store level also manifests itself in both the store ordering and shelf replenishment tasks. Most importantly, the emphasis on OOS situations result in priority given to the store ordering tasks as well as clear guidance from store management on how to perform store ordering and what heuristics or decision rules to follow. Further, a characteristic about these three best performing stores as a result of their OOS emphasis is that they deliberately pursue a store ordering practice of ordering for inventory, thus indirectly emphasising cost of understocking relative to cost of overstocking.

Allocating space and deciding on assortment and new products

The most limited factor for stores is space. For many stores in the independent sector, the size of centrally defined assortment makes the efforts related to OOS difficult. Categories and space are centrally designed for chains with stores of different sizes. Considerations taken centrally are variety for shoppers and maximizing allowances from suppliers, and to a lesser degree the effect that space has on the tasks in store operations. One respondent (OOS = 16 percent) felt that “the assortment is too deep, too many variants, and the weekly promotions pushes us into situations with too many items.”

Most independent stores do not use back room storage to any significant degree and thereby the space on the shelf is a limiting factor on the ordering process. Especially, in the problematic frozen food category this is considered a major problem. Freezer facilities are quite expensive and therefore relatively limited space in many stores. On the other hand the products are quite voluminous and many series come in quite many variants, e.g. pizzas and ready-to-eat meals.

The main principle of spacing based on turnover is pursued by most stores. It is the department responsible person who is supposed to secure a proper allocation of space on the shelves, often based on centrally developed space suggestions. However, this is perceived (especially by smaller stores) as quite a resource demanding task. These stores often work with only one or very few facings per SKU which gives very little freedom in relation to new products and campaign activities, compared to larger stores with, e.g. three or four facings on the same SKUs. Some of the larger and well performing stores emphasise having flexibility in space. This covers the situation in which the shelves are spaced so that the number of faces can easily be increased or reduced for individual SKUs in relation to necessary new products and other activities.

This issue of allocation of space is to some extent common across all the stores. Some of the best performing stores have intentions of having some flexibility on their shelves, however this is not a possibility that smaller stores can apply. Wrong spaces will come out as OOS situations resulting from store ordering or replenishment root cause, however the allocation of space and the sizing of the assortment must be seen as an underlying reason or limiting factor indirectly affecting OOS.

Managing store employees

The employee situation has for many stores been emphasised as a problematic area (and excuse of having too high-OOS rates). It has generally in the sector been difficult to recruit qualified people to work in stores. Some of the better performing stores seem to have gained from relatively stable employee situations, whereas worse performing stores explain their higher OOS rates with a lack of people.

Most stores have described fixed responsibilities regarding store ordering and replenishment in the different departments. In the smaller stores it is often the store owner who is central in these processes, whereas larger stores have a more clear division of responsibility. Planning employees' work hours in accordance to replenishment peaks has also shown to be a factor affecting OOS. A characteristic about the best performing stores (with low-OOS rates) is that there is a more intense dialogue or mutual coaching within the group of managers in daily operations, or a much clearer coaching in the principles and guidelines for carrying through the store operation tasks. Hence, strong leadership or organizational surplus seems to characterise the better performing stores.

6. Summary and managerial implications

The average OOS rate and its decomposition into root cause contributions as identified in our quantitative Study-I are shown in the right part of Figure 4. The left part of Figure 4 shows the inductively based insights from the qualitative Study-II.

The in-store causes (store replenishment and store ordering) directly affect OOS situations, whereas managerial attention, organizational issues, and allocation of space affect the store ordering and store replenishment tasks and thereby indirectly causing

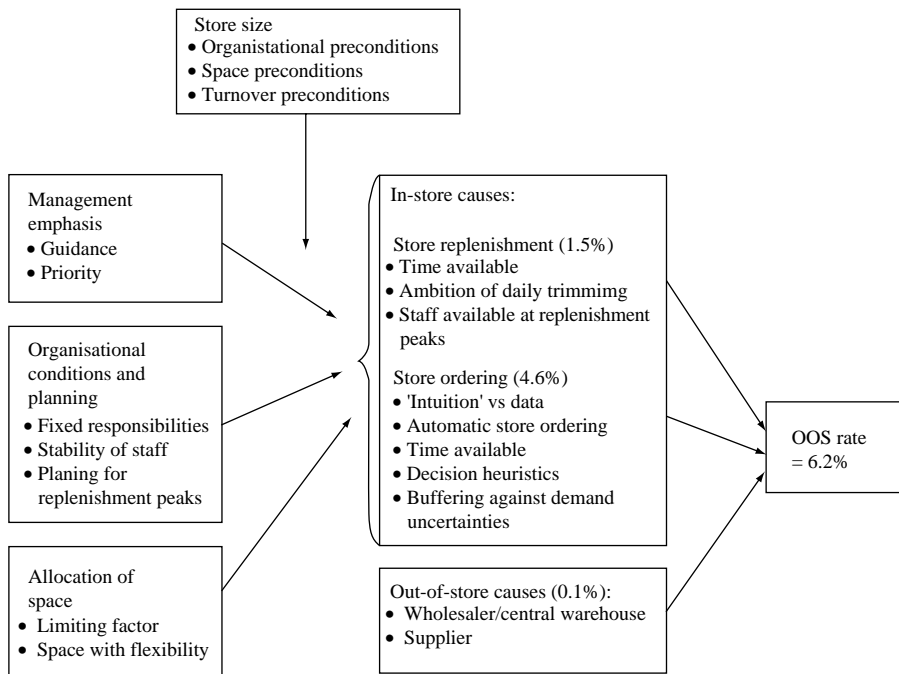


Figure 4. OOS, root cause contributions and underlying store operations

OOS situations. Aspects of store size are also seen as conditioning factors. The best performing stores are characterised by a management emphasis and commitment to OOS issues, thereby giving priority and managerial guidance to the store ordering and store replenishment tasks. All stores indicate fixed responsibilities of employees to the tasks, but what seems to characterise better performing stores is the stability of staff and the proper planning for replenishment peaks. Space is a limiting factor. The best performing stores are generally larger stores with better space conditions. Also, creating shelves with flexibility is indicated as a feature of stores with low-OOS rates. Store replenishment on average contributes with 1.5 percent points (of the total 6.2 percent OOS rate) and does not show clearly discriminating practices across the stores (neither large variance). Store ordering is the single most important task to deal with as it on average contributes with 4.6 percent points (of the total 6.2 percent OOS rate). Store ordering in the independent stores to a large degree make use of “experience” non-data-based approaches rather than data driven decision supported procedures across high- and low-performing stores. No clear conclusions regarding the use of automatic store ordering procedures can be given as both high and lower performing stores apply automatic store ordering. The major discriminating effects between high- and low-performing stores in store ordering can be found in the managerial emphasis on the issue, as well as in the appropriate decision heuristics and use of inventory to buffer against demand uncertainties.

The exception, or unique case, compared to these general patterns is a smaller store making comprehensive use of automatic store ordering, systematically applying numbers in store ordering and deliberately working with low inventories. The store

has a good OOS rate at 3.3 percent and still runs with a low inventory policy, thus supporting the ideal ECR business model of data-intensive, automatic-store-ordering, low-inventory based approach (ECR Europe, 2003). But this store is in this sample of independent stores the exception, or unique case, and further more traditional approaches from the sample have shown to produce just as good and even better OOS performances than more “advanced” stores in the centrally controlled chain store sector.

Based on our analysis, we can answer our research questions as follows.

We were able to identify significant differences in the extent and the root causes of OOS between the independent and the centrally controlled sector. The quantitative Study-I demonstrated larger variability of OOS-performance across stores within the independent sector as compared to the centrally controlled sector. Finally, in Study-II we were able to see that the challenges of independent grocery stores can be found in in-store causes. Thereby we could identify different practices in in-store operations which can be used to explain the differences in OOS-rates.

Managerial implications – for store operations and remaining channel members

These results have implications for management in stores as well as for other members of the grocery channels. The implications for managers in stores are straight forward. This study provides the following suggestions for store management:

- put managerial emphasis on the issue in store operations;
- give priority to and very specific guidance especially on ordering tasks;
- plan staff in relation to replenishment peaks;
- allocate (if possible) space so that there is some flexibility on shelves;
- adjust and explicate the decision heuristics to be used in store ordering; and
- allow for certain items to have buffer inventory.

Since the emphasis here has been in-store causes, other channel members are not directly involved in these tasks. However, several types of contributions by chains, wholesalers, and suppliers can help improve in-store causes:

- Managers in the remaining channels can help induce awareness and attention to the OOS challenge (ECR Europe, 2003). Central management can thereby put emphasis on the issue. From quantitative and qualitative studies, management attention was one of the most visible discriminating effects. By informing stores in an independent chain about the losses caused by OOS, presenting the statistics, some of the best practice cases, etc. central management can create “a culture with a passion for availability” (Corsten and Gruen, 2003), or at least better informed store managers which should result in more managerial attention to OOS in the stores.
- Central management can indirectly affect the issue by providing a measurement infrastructure (ECR Europe, 2003). OOS is a highly invisible cost element compared to inventory and waste, for stores as well as for wholesalers, chains and suppliers. Physical audits can be carried out periodically so that stores can see their performance and potential economic benefits. Indirect measurement based on sales data (Hausrückinger, 2004; Corsten and Gruen, 2003) could be

built into the systems used by the stores so that it can be reported to the store which products and which categories that should have special attention. Further, measuring OOS will positively affect the store attention to the problem, and thereby measurement can be seen as a prerequisite for the above mentioned managerial attention.

- Central management needs to be aware of how wholesale, chain and supplier decisions affect store operations, and how they make the OOS task more challenging in the store. Centrally defined assortment and merchandising decisions affect store operations; so do space set-ups and planograms created centrally to cover a variety of store sizes; decisions regarding new products and a variety of promotional activities decided by chain, wholesaler and suppliers similarly affect store operations. Even though not affecting OOS directly, these issues have a large effect on the possibilities and challenges of working with store ordering and store replenishment.
- Central management can have a task in “educating” store employees regarding operational issues. OOS situations are created based on operational practices especially related to store ordering. Inexpedient ordering heuristics and problematic use of automatic ordering systems seems to exist in the independent sector, and there can be a potential in offering educational efforts on these issues.

Contributions to theory and future research

OOS originate at store level. Corsten and Gruen (2003) track 72 percent of OOS situations to in-store causes, ECR Europe (2003) tracks 88 percent of OOS situations to in-store causes and this study tracks 98 percent of OOS situations to in-store causes. Therefore, we find it important that future OOS studies in Research stream-II takes up the in-store challenges and in-store root causes of product availability as an issue.

This study has contributed to OOS Research stream-II by analyzing the independent sector, a perspective to OOS studies that has not been taken previously, and equally important by analyzing in-depth the in-store causes. Hence, we have made a first contribution to the question: what is it about store operations that cause OOS situations? Also, by methodologically extending the two stage approach of Corsten and Gruen (2003) with the in-store operational analysis we have demonstrated, on an explorative level, how performance measures (OOS extent) and behavioural measures (in-store practices) as well as attitudinal measures (e.g. management attention) can reveal patterns and linkages between these elements (see Aastrup *et al.*, 2008, for a discussion of measures in ECR-related research).

The limitation of this papers Study-II is the qualitative and explorative nature. This has been appropriate for this first step, however further research is needed. Further qualitative studies can verify, add to and specify the insights gained from this paper; it can take the study subject into other contexts, e.g. discount stores or centrally controlled stores. Also, further research should move towards quantitative studies examining and generalizing the linkages between store practices and OOS extent. Behavioural and attitudinal measures on store operations can be defined and standardized, and hypotheses on the relation to OOS extent can be developed and nuanced departing from the exploratory results of this paper.

An underlying premise of OOS Research stream-II, as well as in this study, is that OOS should be minimized. OOS is a service-level measure which, according to logistics

management literature (Grant *et al.*, 2006), needs to be traded off against or analyzed in relation to other logistics performance measures, e.g. inventory levels. Similarly, economic order quantity models (Chopra and Meindl, 2007) present this as different cost elements being traded off against each other, in the case of product availability a balance between costs of overstocking vs cost of understocking should be optimized. Based on these views it can be stated that OOS should be optimized, not necessarily minimized. Hence, future OOS research should also explicitly consider the trade-off between inventory levels and OOS.

In addition, a combination of the two OOS-research streams can also be a rewarding research effort by taking into account an accepted OOS-level from a consumer point of view when optimizing in-store operations.

Note

1. The contributions of different root causes measured for specific stores should be seen as only indicative due to the relatively low number of root causes tracked per store.

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(Appendices follow overleaf.)

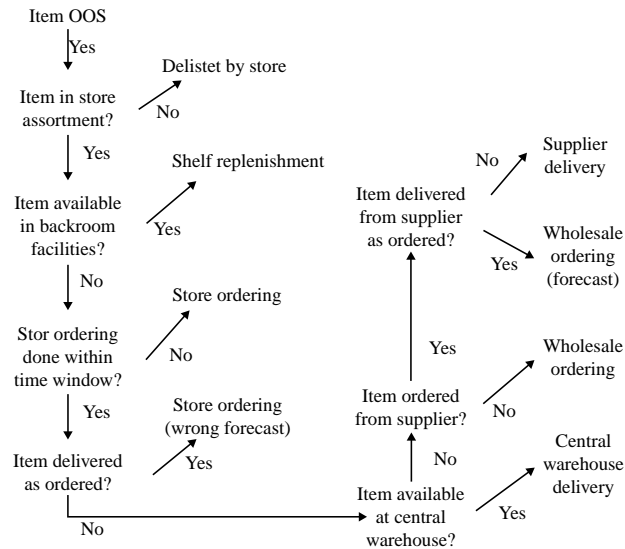


Figure A1.
Root cause tracking

Appendix 2. Interview guide

1. Presentation of store (tour in store and back room facilities)
2. Background information
 - ECR Denmark
 - Purpose of research
 - Anonymous examination
 - Shortly of overall results from quantitative study
3. Top of mind on OOS
 - What do you experience as the challenges and causes in relation to OOS situations?
 - Why is exactly those categories challenging?
 - How do you organize your work with availability?
 - How do you see the role of sales consultants and chain headquarter?
 - Open dialogue during which interviewer shows store's performance on extent and root causes with further dialogue based on quantitative results
4. Specific issues of store operations
 - How do you organize work with/apply?
 - Shelf replenishment
 - Organization of store ordering
 - Assortment and space
 - Use of automatic store ordering, sales numbers, other tools?
 - Use of automatic store ordering, sales numbers, other tools?
 - Forecasts at normal and campaign items
 - Employees and organization
 - Other factors influencing OOS
 - How can wholesaler/chain and supplier support these issues?
5. Closing

Table A1.
Interview with store XX

About the authors

Jesper Aastrup is an Assistant Professor at the Department of Marketing, Copenhagen Business School, Denmark. His research deals with retail marketing and retail logistics, retailer-supplier relationships, category management, and efficient consumer response emphasising the grocery sector.

Herbert Kotzab is a Professor in the Department of Operations Management at Copenhagen Business School, Denmark. His research focuses on supply chain management theory and practice, marketing and logistics, category management, and efficient consumer response.

OOS in
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