Increasing On-Shelf Stock Availability of a Mexican Convenience Store Network: A Case Study

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Abstract

On-shelf availability (OSA) has been a major cause of concern to the Mexican convenience store sector. This has become an important issue to resolve during the last years for an international, and the leading Mexican convenience store company that is experiencing an aggressive growth level. Improving OSA level would increase cash flow to finance growth. The purpose of this work is to present a case study of how this major convenience store retailer tackled the low-level OSA issue. This study is carried out in the national store network. The product families that contributed the most to a low OSA index are grocery items, wine and liquors and water items. After an exhaustive analysis two major causes were identified: inadequate inventory management systems and highly imprecise forecasting procedures. The implementation of several initiatives is in process. However, results from pilot tests will be shown.

Keywords: Stock out, on-self availability, safety stock, lost sales, increasing on-shelf stock availability, forecasting procedures, inventory management systems

1. Introduction

The Mexican convenience store industry is rapidly growing along with the evolution of Mexican society. Mexican young families are changing customs, habits and roles. Now, both: husband and wife work and stay most of the day outside home. Time has become a very valuable asset to manage. This new environment has favored the emergence of the convenience stores. Location, fast response and 24/7 time availability have become key characteristics for the success of this format. According to Amador (2013), about 12,720 stores were installed in 2012. The company of concern in this paper (to be called The Company, hereafter), has 76% of the Mexican market share. The important factors for competing are product availability, price and customer service.

The project described in this document was borne by the need of the company to become more competitive in terms of product availability measured in terms of On Shelf Stock Availability (OSSA). Thus, The Company´s management determined that they require to improve this concept to support its aggressive growth goals of reaching 12,000 stores by year 2015 as described in Amador (2013). As of September 30, 2015, The Company had a total of 13,540 stores nationwide (http://www.femsa.com/en/press/femsa-announces-third-quarter-2015-results).

The problem of concern in this paper is the increase of the On Stock Availability index. This problem has been treated exhaustively in the academic literature. This report consists of five sections. The next section deals with a brief review of the literature on OSA causes and methodologies for its improvement. Then, a description of the general methodology utilized to improve OSSA is described in section 3. The application of this scheme is undertaken in section 4, and section 5 presents a summary of conclusions.

2. Previous Research

In an important study of retail out-of-stocks (OOS) provided in Corsten et al, (2003), the authors state that "availability of products is the new battleground in the fast moving consumer goods industry". The concept of stockouts in the retail sector is not new; Progressive Grocer (1968a,b) provide the first major study on how grocery customers reacted to stockouts. Research about this situation has been very intense. These studies identify five main reactions by consumers to a stockout in store:

(1) They buy the item at another store.
(2) They delay ordering or purchasing the item (postpone purchase at the same store).
(3) They do not purchase the item (a lost sale).
(4) They substitute the same brand (different size or type).
(5) They substitute for another brand (brand switching).

An excellent study of grocery customers in London (Schary et al., 1979) revealed that 48 percent of the customers select to shop in another place when faced with a stockout. According to studies developed by the Mexican leading convenience store company, 40% of the customers would switch to purchase a substitute item and the rest would shop in another place when face with the same condition. Research described by IGD (2003) shows that 65 percent of UK consumers looking for a specific grocery item will adopt one of the first three reactions, thus not buying in that particular store on that occasion if a stock-out occurs. In 1979, the figure from the study described in Aastrup et al., (2010) was 78 percent. Compared with the more general results provided by Corsten et al., (2003), the figure for the UK is high compared with other markets where the average is 31 percent.

2.1 The causes of retail out-of-stocks

An excellent retail reference model was developed by Aastrup et al., (2010) [7]. This is very useful to categorize main causes of stockouts. The works described in Gruen et al., (2008), McKinnon et al., (2007), Fernie et al., (2008) and Aastrup et al., (2009) are used to summarize the most significant causes. These can be classified as follows:

- Pre-store causes: These are related to direct suppliers or the retailer's distribution center. Some of the most important are: Deficient general planning and communications; Deficient warehousing procedures; forecasting problems; inaccurate inventory transaction recording; unreliable transportation and others.

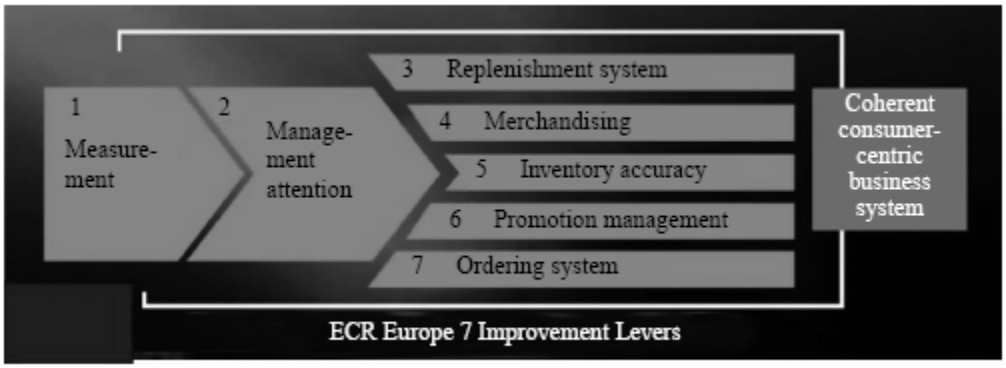
- Instore causes: These occur after the inbound replenishment process to the store has finished. Among the most common are: store ordering problems; deficient manual inventory adjustments; items damage; problems in the process of moving items from the back-store to the correct space on the retail shelf and; promotion-caused stockouts in the stores.

Most OOS situations occur at the store level according to Corsten et al., (2003), primarily through ordering and replenishment practices. According to the authors, 35 percent of OOS problems occur with shelf replenishment in the store, 30 percent occur during the inbound delivery to the distribution center of the company, 15 percent from the regional distribution center (RDC) to the store and 15 percent is due to inventory accuracy problems.

2.2 Approaches to improve on-shelf availability

Two of the main approaches suggested for improving OSA are provided by Corsten et al., (2003) and by the ECR UK (2004). Corsten et al., (2003) developed an approach to address the causes of OOS. This is based upon the achievement of an improvement of process responsiveness, operational accuracy and incentive alignment. Process response improvements were related to assortment planning and space allocation; ordering systems, inventory control and store flow replenishment. Operational accuracy initiatives are focused upon the accuracy of inventory levels and the ability to measure and identify OSA. Finally, incentive alignment, is about scheduling staff to improve shelf filling in addition to optimizing overall management objectives.

In their report, the ECR UK (2004) recommended a combination of processes and approaches to increase the level of OSA. The study identified seven "levers" that can be used to improve OSA. Figure 1 illustrates the reference model. The seven levers are: measurement "levers" which need "managerial attention" (levers 1 and 2); replenishment and in store execution, namely merchandising (levers 3 and 4); inventory accuracy (lever 5); promotional management and ordering systems (levels 6 and 7).



Source: ECR UK (2004)

Figure 1 Reference model of levers to increase the level of OSA

These levers have subsequently formed the basis for several OSA improvement strategies. After reviewing both approaches previously described, the team responsible for the initiative decided to follow the ECR UK model as a broad conceptual guideline for identifying the most important areas for improving potential lost sales.

3. Implementation and Results

The scheme is applied to the distribution and retail operations of the leading Mexican convenience store company. The project was borne by the need of The Company to become more competitive in terms of product availability measured in terms of On Shelf Stock Availability (OSSA). Thus, The Company´s management determined that they require to improve this concept to support its aggressive growth goals.

The supply chain structure of the company is shown in Figure 2. The supply to the stores consists of two stages decoupled by inventory at the DC. Inventory replenishment at the stores and the DC is done utilizing periodic review models with parameters updated dynamically by demand forecasts.

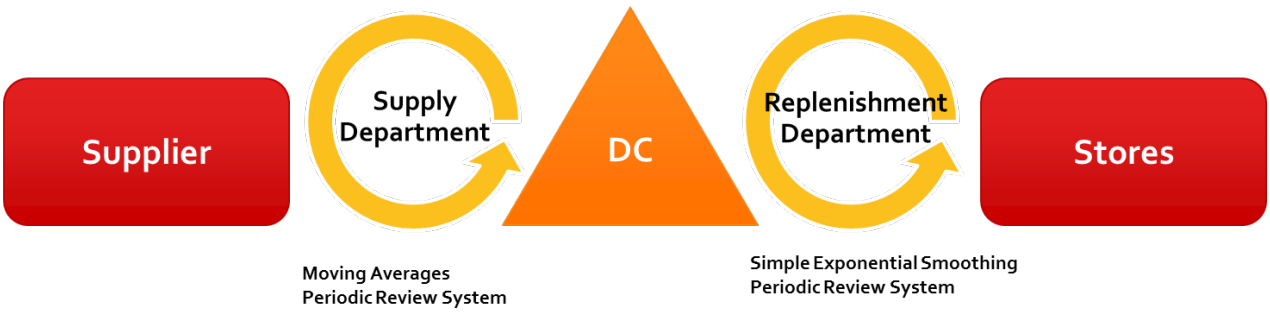


Figure 2 Supply Chain Structure

The initial step of the analysis taken was to focus on the product categories or families that had the greatest level of lost sales. Figure 3 shows that the grocery and wine and liquor families were the most important.

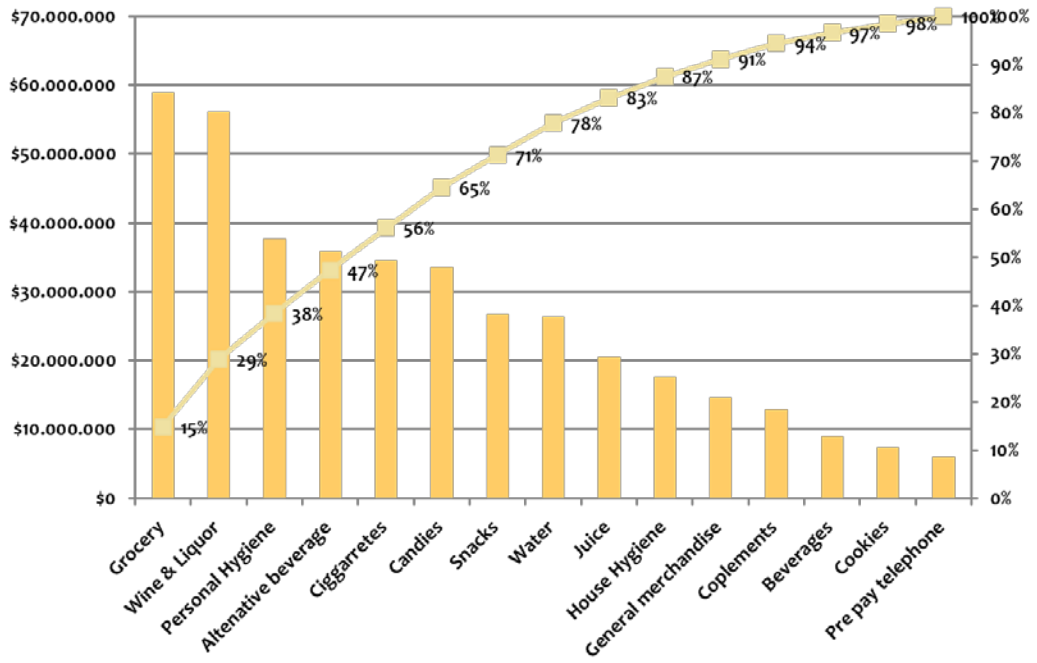


Figure 3 Pareto of product families with lost sales

In addition, the team responsible for the initiative considered important to analyze conceptually the levers of the ECR UK reference model. This task was carried out with the help of DC management and the responsible for the store inventory replenishment and outbound transportation areas of the company. This exercise consisted on assessing the level of performance for each of the levers suggested by the ECR UK model. As illustrated in Table 1, the management of the company perceived an excellent level of performance for the measurement and control and promotional management levers. However, even though the forecasting and inventory management systems for the Distribution Centers (DCs) and stores are designed for dynamic updates according to changes in demand, they considered that there was some room for improving OSA & Lost sales through an adjustment of the models or procedures used.

Table 1 Conceptual assessment of lever performance for The Company

OSA & Lost Sale measurement and control	Replenishment and store execution	Inventory accuracy and ordering systems	Promotional management
- OSA & Lost sales measurement in excellent level. These are estimated for every sku, per store at a national level.	- Dynamic forecasting & inventory management systems are in place. - Potential improvement of inventory mgt systems for B items.	- Dynamic forecasting & inventory management systems are in place. - Potential improvement in forecasting procedures for seasonal items.	- Promotional management is rated as excellent. - Very high OSA level values for all items during promotional campaigns.

3.1. Lost sale analysis for grocery and wine and liquor items

The team responsible for the project considered as the following step the analysis of every store replenishment order related to an event of lost sale. This was realized for grocery and wine and liquor items during the period of February – October of 2015 at a national level. This study concluded that 78% of the lost sale was due to an In-store cause and the rest to a cause occurring at the DC.

The In-store cause consisted of a deficient design of the inventory management system for B products. This conclusion supported the results obtained from the conceptual assessment of lever performance provided in Table 1. Even though the demand for these items had a significant variability, the inventory model did not consider the use of safety stock. In particular, the value of M, the maximum up-to quantity to order did not included safety stock. With respect to the DC cause, in this case, two situations were identified as the relevant causes: the estimation of safety stock was done very subjectively, and; the forecasting procedure of simple exponential smoothing did not cover demand seasonality of several product families such as the water items family. Again, this finding supported the result gathered in the conceptual assessment of lever performance of the company.

3.2 Brief Description of design and implementation of improvement Initiatives

Table 1 presents a summary of the improvement strategy. The first initiative to implement is the estimation of safety stock for B items. The value of safety stock should be considered in the calculation of the parameter M for every B item as follows:

$$M = d\,(T + LT) + \text{Safety Stock}, \qquad (1)$$

Where;

T represents de review period in days.
LT stands for the response time of the supplier.
d is the daily demand

This parameter represents the maximum amount of inventory in the warehouse. Every time you order would be up to this quantity. The value of safety stock required was established after its estimation for various values of the probability of not stocking out α. Namely, 0.90, 0.95 and 0.99. Safety stock is calculated as follows.

$$\text{Safety Stock} = Z_{\alpha}\,\sigma_{d(T+LT)} \qquad (2)$$

Where

Za represents de value of standard normal variable for a given probability of no stocking out a
$\sigma_{d(T+LT)}$ stands for the standard deviation of the demand during the review period plus the supplier response time.

Table 2 Summary of Improvement Strategy

Location of Cause	Cause Description	Initiative Description
In-store	Safety stock for B items not considered.	Include safety stock in M estimation
Distribution Center	Deficient safety stock estimation	Develop and include a statistical manner of safety stock calculation
	Inadequate forecasting procedures	Adjust simple smoothing forecasting by seasonality

The implementation at the national level of the initiative described is under way. The first step taken was a simulation of the impact of using safety stock in the calculation of the M parameter on the lost sale during the period of January – October of 2015. The second step was a pilot test of all the B items of the grocery and the wine and liquor families for a one month period in all the stores located in Toluca and Mexicali cities. The excellent results obtained from both efforts convinced management to continue its implementation to the rest of the product families and stores of the company.

The initiatives considered for reducing lost sale due to deficient safety stock estimation and inadequate forecasting procedures in the DC are also in the process of implementation. However, for these two cases, the simulation phase has already been finished and the pilot test is under way.

4. Conclusions and Results

The problem of concern in this paper is to reduce the level of lost sales of the leading Mexican convenience store company. This objective is intended to be achieved by increasing the on-shelf stock availability level. This work provides a brief description of the application of the improvement strategy in–store and distribution center of a Mexican convenience store

chain. The company is experiencing an On-shelf availability (OSA) problem. This has been a major cause of worry since is experiencing an aggressive growth level.

Even though the forecasting and inventory management systems for the Distribution Centers (DCs) and stores of The Company are designed for dynamic updates according to changes in demand, they considered that there was some room for improving OSA & Lost sales through an adjustment of the models or procedures used. The approach to the inventory and replenishment management is a key element to increase the on-shelf availability due to the right forecasting method for each type of product according to their classification adding stock.

During the implementation, the convenience store increase 7% on-shelf stock availability with 25%, from one week to another, for wine and liquor and 11% for grocery. On the other hand, with the simulation of the changes for the category of water items, the company will increase 71% on-shelf stock availability. Due to the results, the implementation in all the stores and all categories of the Mexican Convenience store is expected to increase 8%.

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Biography

Ana-Sofia Villarreal-Navarro is an Industrial Engineer just graduated from Universidad de Monterrey (UDEM). She has participated on several projects such as the Improvement of several assembly lines for a subsidiary Japanese company that produces speed reducers. She also participated on the improvement of administrative procedures of a non-profit institution. She has applied data analysis in the commercial department in the largest and most important convenience store chain of Latin America for several fast food categories. Nowadays, she works in the beer category of the retail company. Ana Sofía is a member of the IIE and APICS Societies.

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Lilian Camacho-Alcala is an Industrial Engineer just graduated from Universidad de Monterrey (UDEM). She has participated on several projects such as the Improvement of two assembly lines for a Japanese Company producer of speed motors. She also applied Lean Thinking principles for improving the productivity of several procedures in a private transportation company in Mexico as well as Quality principles for reducing waste and non-conformances in the automobile

industry. At the moment, she initiated working in a retail Mexican Company in the department of Supply Chain. Lilian is a member of the IIE, ASQ and APICS Societies.

Bernardo Villarreal is a full professor of the Department of Engineering of the Universidad de Monterrey. He holds a PhD and an MSc of Industrial Engineering from SUNY at Buffalo. He has 20 years of professional experience in strategic planning in several Mexican companies. He has taught for 20 years courses on industrial engineering and logistics in the Universidad de Monterrey, ITESM and Universidad Autónoma de Nuevo León. He has made several publications in journals such as Mathematical Programming, JOTA, JMMA, European Journal of Industrial Engineering, International Journal of Industrial Engineering, Production Planning and Control, International Journal of Logistics Research and Applications, Industrial Management and Data Systems and the Transportation Journal. He is currently a member of the IIE, INFORMS, POMS and the Council of Logistics Management.