

**TOWARDS DETERMINING THE EXTENT OF INFORMATION AND COMMUNICATION
TECHNOLOGIES (ICT) USED IN THE MOROCCAN GENERAL RETAILERS' IN-
STORE LOGISTICS PROCESSES TO MINIMIZE STOCK-OUTS**

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Abstract:

With the evolution of the large general retail sector in Morocco, out-of-stocks (OOS) have become one of the major problems retailers have to resolve in order to retain their existing customers and attract new ones. This is particularly because the rate of OOS could indeed be considered as a performance indicator when the products and services offered by the competing retailers are relatively the same.

This paper provides a frame of reference in relation to the concept of “stock-out” in addition to the information and communication technologies used to improve some of the processes involved in the retail supply chain. We then present the results of a field study, which we have conducted in the large retail sector in Morocco in order to identify the scope of use of such technologies with the aim of reducing OOS situations at the store level.

Keywords: General Retail Sector; Stock-outs, Point of Sales; Electronic Data Interchange; Data Mining; RFID.

Résumé:

Avec l'évolution du secteur de la grande distribution généraliste (GDG) au Maroc, les ruptures de stock sont devenues l'un des principaux problèmes que les enseignes de GDG doivent résoudre afin de maintenir leurs clientèle actuelle et de recruter une nouvelle. Cela est dû en particulier au fait que le taux des ruptures de stock pourrait effectivement être considéré comme un indicateur de performance lorsque les produits et services offerts par les enseignes concurrentes sont relativement les mêmes.

Cet article fournit ainsi un cadre de référence relatif aux ruptures de stock ainsi que les technologies de l'information et de la communication (TIC) utilisées pour améliorer certains processus impliqués dans la chaîne d'approvisionnement de détail. Par la suite, nous présentons les résultats d'une étude de terrain que nous avons menée dans le secteur de la GDG au Maroc afin d'identifier la portée de l'utilisation de ces technologies dans le but de réduire les instances des ruptures de stock en magasin.

Mots-clés: Grande Distribution Généraliste; Ruptures de Stock ; POS; EDI; Data Mining; RFID.

I. Introduction

The large retail sector in Morocco has known an important development over the past decade following the evolution of the Moroccan consumers' behavior. Indeed, competitive pressures continue to increase between the different retailers available in the Moroccan market, which puts a wide range of attractive offers before the consumer. This leads the latter to adopt a loyalty behavior that might not be exclusive to only one retailer, which forces retailers to provide exceptional customer service in order to attract new customers and most importantly retain existing ones. The retention strategy can become noticeable through the size and diversification of the product assortment offered, product availability, inventory management quality, or the proximity to consumers, either physically, by having numerous outlets, or the adaptation to their needs.

As such, inventory management has become more and more difficult following the complexity of the consumers' expectations and demands in terms of products sold at such entities, which can therefore result in out-of-stocks situations. Moreover, since the desired products' availability is not always guaranteed, the consumer, when choosing a specific retailer, becomes sensitive to the quality of logistics services, more specifically, inventory management. Such sensitivity could be considered by the consumers as a key element in the evaluation of the logistics performance of the different retailers, which could, in turn, be influenced by numerous factors, namely stock-outs, delivery deadlines, or even the expirations dates of certain perishable products.

Indeed, the quality of logistics services plays a very important role in the consumers' perception of their favorite retail store. Indeed, one of the main logistics functions in the retail sector is to optimize the management of flows, whether physical flow of goods or data flow, in order to ensure optimal product availability at the store level and at the right time.

In this regard, Orsini (2008) adds that the quality of the logistics service plays an important role for the majority of the retail businesses, particularly in minimizing the rate of OOS instances. Furthermore, Bouzaâbia and Boumaiza (2013) emphasize the impact of stock-outs on how the customers actually perceived a given store, specifying that repeated OOS occurrences may negatively impact the store's image for customers, resulting thereafter in the risk of destabilization of the their loyalty to the store in question .

Furthermore, Lichte et al. (2000) specify, for their part, that when a large retail chain ensures good logistics management, supporting a reduction in stock-outs, it can indeed limit any possible customer losses. However, we should not overlook the fact that such losses can become permanent in the presence of competing stores in the market that offers similar products.

In this study, we will focus primarily on the tools available to ensure good retail supply chain management, which will then enable the retailer to ensure good product availability to its customers and better response to their needs, therefore promoting customer loyalty. Indeed, through our study, we provide a frame of reference relative to the “stock-out” concept, along with the information and communication technologies used to improve some of the processes involved in the retail supply chain. Then, we will put forward the results of field study, which we have conducted in the large retail sector in Morocco to identify the scope of use of such technologies.

II. Frame of reference for the concept of Stock-out:

II.1 What constitutes an Out-Of-Stock situation?

Out-of-stock (OOS) situations or stock-outs have been defined by different authors and in slightly different manners over the years. According to Aastrup and Kotzab (2009), an out-of-stock situation refers to one where a product is not available in the desired form, flavor or size, not available in a saleable condition, or not available on the expected shelf. Similarly, Vasconcellos and Sampaio (2009) define a stock-out as a situation where a product that is generally sold at a given point of sale and made available to the customers through a specific place on the shelves, is not available to the consumer at the time of purchase.

Based on a study conducted by Progressive Grocer (1968), Ghesquiere and Yapo (2004) assert that “an item of any brand, size, format, flavor/perfume, color or type is out-of-stock if it is normally sold at a specified store but is not on the shelves at a given time.” It is therefore imperative to distinguish between the situation where a product is unavailable on the shelves and one where it is unavailable at the store. Zinn and Liu (2001) assert that in some (if not most) OOS situations, the OOS product is in fact available at the store (in the back room or stocking area for example) but not on the shelf, which is generally due to human negligence and/or error.

Consequently, for our study, we will take into account Ghesquiere and Yapo’s (2004) definition, considering then that an OOS situation is one where the product is unavailable on the shelf, regardless of its availability in the stocking area of the store. Our decision is rooted in the fact that, in general, customers do not ask department or aisle managers about every product they do not find on the shelves, they rather simply make their decision to substitute product, cancel purchase, delay purchase or go to a different store right away (Gobiraj & Nimalathan, 2011).

Bayle-Tourtoulou et al. (2006) describe OOS situations from another perspective; they suggest that such situations should be studied in each sales period separately, and therefore present two types of OOS situations: Partial OOS and Complete OOS. If a specific product is available during part of a given period, or if the store restocks during that same period, it is then

considered a partial OOS. On the contrary, if the desired product is unavailable at the beginning of the set period and the store does not restock [during that same period], then it is a complete OOS. In other words, as the authors explained the concepts in terms of sales, a partial OOS occurs if the sales for the set period are greater than zero, while a complete OOS occurs if there are no sales at all during that period (2006).

Other authors like Ghesquiere and Yapo (2004) and Sloot and Verhoef (2008) add in and highlight the difference between two categories of OOS situations: a “simple” out-of-stock situation and an assortment reduction. The first referring to an item being temporarily unavailable during a short period before the store restocks its shelves, and the second referring to a situation where a store completely discontinues the sale of a given product. This implies that the simple absence of a product from the shelves does not necessarily mean that it is an OOS situation; the possibility that it could in fact be an assortment reduction remains considerable.

II.2 Main causes of OOS situations:

OOS situations could occur due to numerous reasons, namely inadequate or late orders, stock-outs on the distributor or producer’s platform, overdue deliveries, inadequate shelf replenishment (absence of supervision), personnel unaware of high turnover products and, in some cases, inadequate shelving due to replacement of OOS products by others to avoid leaving empty shelf spaces.

Aastrup and Kotzab (2009) assert that the main causes of OOS can be found in in-store operations, not in the actual service levels between the suppliers and the warehouses, and between the warehouses and the retail stores. Furthermore, Gruen et al. (2002) note that the majority of previous studies placed most of the responsibility on the retailer’s ordering and forecasting operations. The responsibility is broken down as follows: store ordering with 34%, store shelving (products available at the store but not on the shelves) with 25%, manufacturer/supplier with 14%, store forecasting by 13%, distribution center by 10%, and other causes with 4%.

II.3 Consequences of OOS:

In order to respond to the unavailability of a given product or an OOS situation the consumers find themselves in a way forced to adopt some behaviors that could entail additional costs for the store, which in turn could have a negative impact on both the producers’ and the distributors’ financial records (Campo et al., 2000; Sloot et al., 2005; Walter & Grabner, 1975; Zinn & Liu, 2001).

Moreover, when confronted with an OOS situation, the customer is indirectly encouraged to experiment and try a different brand or a different retailer. Gruen et al. (2002) then deduct that

OOS situation could indeed facilitate the possibility of permanent brand switching or even permanent retailer/store switching.

Based on the literature (Bensa, 2006; Ghesquiere, 2005; Zinn & Liu, 2001), the consumers generally adopt one of five different behaviors, namely substitution of the brand, substitution of the product, delay of the purchase, cancellation of the purchase and substitution of the store altogether. These different behaviors can be influenced by numerous factors that we will try to cover in the following section.

II.4 General measures taken by retailers to monitor OOS situations:

Retail companies now use different methods to monitor stock-out situations. Per Grünblatt (2006), the technique mostly used consists of manual recordings, which is considered relatively reliable; such technique involves the use of hand-held scanners, which requires time in addition to high employee involvement. Scanner data is another technique used by retailers to keep track of OOS situations. However, since it consists of relying on the data collected at the points of sale, it does not enable distributors and suppliers to distinguish between “real” OOS situations (the OOS product is not available at all at the store) and the unavailability of products on the shelves. Finally, Grünblatt (2006) identifies a less common method used: customer surveys. This method however cannot be relied upon solely, as the customers are rarely collaborative.

III. Functionalities of the Information Technologies used in retail:

III.1. Point of Sales (POS):

The POS are used to facilitate the purchasing process for customers. POS terminals consist typically of a computer, a cash register, and other equipment or software used to sell goods or services¹. It is commonly used in store-level transactions, including, but not limited to, price look ups; sales tax calculations; inventory tracking; credit card or check cashing authorization, returns and exchanges and dynamic accounts receivable updating .

Although one of the main features of POS is reducing checkout times, its utility is not limited to that. Indeed, the information gathered through POS can help retailers improve inventory management by minimizing stock-outs, shrinkages, overstocks and forced discounts . In fact, POS enable retailers to gather information regarding the items sold, the ones that are out-of-stock, the most popular sales, etc... This then enables them to make realistic sales forecasts . Some retailers even opt for sharing POS data with the other participants in the SC. For instance, by sharing such information with their suppliers, they are able to reduce lead times, therefore providing better service for their customers .

¹Investopedia, "Point of sale terminal", Investopedia <http://www.investopedia.com/terms/p/point-of-sale-terminal.asp> (accessed 25 November 2014).

III.2. Electronic Data Interchange (EDI):

According to , EDI refers to a systems that enables the transmission of standardized and structured data between two or more computers. Basically, an EDI helps create a linkage between a company and its environment. Also, it is considered a tool, which could be used to generate inter-organization logistics dialog in a multitude of sectors, namely the industrial, the commercial, the financial, the retail and distribution, and the transportation sectors .

The utilization of an EDI, through its automation, helps avoid possible deadlocks for the parties involved in the retail SC or even the simple omissions of submitting a receipt acknowledgement or any other document. It also helps create more structure in the relationships between partners since it require a standardization of some work procedures .

The implantation of an EDI system by a retailers helps reduce errors, enables a better management of financial flows, a better inventory management, and most importantly a better traceability of all the business transactions with the different partners, which in turn facilitates tracking irregularities .

III.3. Data Mining (DM):

define data mining as extracting or “mining” knowledge from large amounts of data, which allows companies to build predictive models for management decisions making. then specifies that data mining plays a considerable role in retail, particularly in customer relationship management (CRM) as it allows retailers to gather customer-related information, through loyalty card systems for instance, which helps them develop a better understanding of their customers’ behaviors. This makes it possible for retailers to readapt their product offering or promotional material to better serve and satisfy customer .

Furthermore, in addition to its use in CRM, data mining can assist customers in improving inventory management and replenishment scheduling in order to minimize both stock-outs and overstocks . Also, by exploiting and analyzing the loads of information through DM, retailers can also optimize their marketing strategies either to better serve existing customers or targeting new segments². Indeed, DM utilization helps retailers predict potential future trends, which allows them to make knowledge-driven decisions .

III.4. Radio Frequency Identification (RFID):

Radio frequency identification is a data collection technology that uses electronic tags or chips that consist of three main components: An antenna, and transceiver, and a transponder. The antenna and transceiver are intended to transfer information to a processing device (i.e. decoder,

²A. Kusiak, "Data mining in design of products and production systems," in *12th IFAC/IFIP/IFORS/IEEE Synposium on Control Problems in Manufacturing* (Saint-Etienne, France: 2006).

reader or scanner), while the transponder is the tag itself, which is an integrated circuit carrying information related to the item to which it is attached . There are two main types of RFID tags; *passive* and *active*. Passive tags do not have autonomy when it comes to electric power; they receive energy from the electromagnetic field created by the reader and remain energized only while within that range . Active tags, on the other hand, consist of an embedded battery from which they draw their operating power. This allows superior communication range, higher data transmission rates and larger data storage capacity than passive tags³ .

Based on the literature, RFID technology can represent an extremely valuable tool throughout the retail supply chain as it provides more accurate, comprehensive and up-to-date information . further add that the quality of the information gathered through RFID technology enables retailers to increase on-shelf availability particularly since such technology offers efficient merchandize tracking all through the retail supply chain (transportation; warehousing; distribution, etc.). Moreover, the implementation of RFID tags helps optimize inventory stocking and management by enabling retailers to reduce inventory levels and promoting higher inventory visibility and better space exploitation in warehouses and of course easy tracking⁴.

IV. Case of the Moroccan Large Consumer Products Retailers

The sector of large retail has experienced an important expansion in the past decade due to the change in the Moroccan consumer's behavior. Nevertheless, the retail (large and medium stores) sector in Morocco still cannot be considered as important since it represents only 13% of the domestic trade⁵. This results from the Moroccan consumer's behavior of still relying on traditional commerce (mom & pop stores) to purchase everyday consumption products, such as milk, bread, sugar, etc.

In fact, considering the fierce competition in this sector, retailers have to maintain high level service in order to keep existing customers and attract new ones, particularly since the main performance indicator used by retailers or supermarkets is the rate of shelf stock-outs . Hence, the importance of the logistics function within any retail outlet to ensure proper inventory

³Dursun Delen, Bill C. Hardgrave, et Romesh Sharda, "Rfid for better supply-chain management through enhanced information visibility," *Production and Operations Management* 16, no. 5 (2007); André Marchal, *Logistique globale supply chain management* 1st ed., Gestion (Paris, France: Ellipses Marketing, 2006); Bo Rundh, "Radio frequency identification (rfid)," *Marketing Intelligence & Planning* 26, no. 1 (2008); Samuel Fosso Wamba, "Les impacts de la technologie rfid et du reseau epc sur la gestion de la chaine d'approvisionnement: Le cas de l'industrie du commerce de detail" (Ecole Polytechnique de Montréal, 2009).

⁴P. Jones et al., "Radio frequency identification and food retailing in the uk," *British Food Journal* 107, no. 6 (2005).

⁵ According to a study conducted by the Competition Council in 2011.

management, thereby making all the products carried by the store available of its clients at the right time. Furthermore, Aurifeille (1999)⁶ adds that a "good logistics function" is one that is not noticed; in other words, the first thing that pops out to the consumers' attention is generally a negative aspect of their shopping experience (stock-outs; close expiration dates on perishable products, etc.), so if they do not notice anything in particular, it means that everything is fine.

As stated previously, in our study we focus primarily on the inventory management aspect of logistics in retail stores in Morocco, more specifically, which IT tools are used in the Moroccan context to improve such processes and how. The purpose of this study was to shed some light on the actual scope of IT use in the Moroccan retail supply chain. Indeed, considering the lack of literature in this field of study in Morocco, we conducted an exploratory qualitative field study in the form of interviews with the directors some of the stores of the four major large retailers in Morocco, namely Marjane, Aswak Assalam, Carrefour and Atacadao.

* For discretion purposes, the names of retailers will be left out in the next sections. Please note the retailers will not be listed in the same order as above.

V. *Research Methodology*

Over the past few years, the large retail sector in Morocco has seen a relatively steady growth of approximately 15% yearly during the past 5 years⁷. The modern retail sector in Morocco consists of several retail entities, including those that qualify as supermarkets and those as hypermarkets. For the purpose of our study we considered only the four that are classified as hypermarkets.

Our study consisted of semi-directive interviews conducted in a face-to-face manner with some of the top managers at the four hypermarkets in Morocco during a period of three months. The composition of our sample is described in the following table:

Table1: Composition of the exploratory field study sample

Retailer	Respondent (s)
Retailer 1	<ul style="list-style-type: none"> - General manager - Director of purchasing - Logistics manager
Retailer 2	<ul style="list-style-type: none"> - General manager - Purchasing manager

⁶ As cited in Marie Christine Lichtlé, Myriam Manzano, et Véronique Plichon, "La sensibilité du consommateur à la logistique - mise en évidence des variables déterminantes," in *The Third International Meeting for Research in Logistics* (Trois-Rivières, Canada: 2000).

⁷ According to the 2014 report conducted by the French Chamber of Commerce and Industry in Morocco.
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Retailer 3	<ul style="list-style-type: none"> - Logistics manager - Director of purchasing
Retailer 4	<ul style="list-style-type: none"> - Purchasing manager

Considering the size of our sample, we used classical content analysis to analyze the information gathered.

VI. Results and discussion

Among the four different ICT tools discussed in this paper, we found that POS is the one that has become somewhat mandatory in any large retailer and is in fact used by all such retailers in Morocco. Indeed, POS not only enables retailers to manage all the information they have pertaining to the products sold, but it also gives them the possibility to become more knowledgeable of the customers' preferences in terms of purchases, which products are more popular, which ones need more promotion, etc. Furthermore, it provides retailers with enough information to constitute databases, which are then used for data mining purposes in order to better satisfy the customers' needs.

Additionally, based on our interviews, retailer 3, which holds a considerable market share, and although with only a minority of its suppliers complying to the use of such system, has started using EDI in the past couple of years, unlike its counterparts, which are still in the process of adopting a more information-technology-oriented approach towards improving their retail supply chain. In fact, according to the majority of the parties interviewed, most suppliers are reluctant to using such systems as EDI for technical reasons and due to the costs involved. In other cases, the retailers sometimes do not trust the system and are therefore unwilling to share access to their databases, and the same for manufacturers/suppliers, which sometimes refuse to share information with their clients, the retailers. Abbad et al. (2012) state in this context that withholding information by manufacturers/suppliers in the Moroccan context is increased by a certain climate of suspicion in trade.

Finally, the parties interviewed expressed unanimously that RFID systems are not used at all because of the costs involved in implanting them, particularly since these require the construction of a whole infrastructure that supports the capabilities and the technicalities involved.

VII. Conclusion

Inventory management is indeed a very complex component of any company's supply chain management processes, especially for larger retail stores. As more stores are introduced into the

market, customers' demands and expectations increase in terms of the quality of the products and the services offered, the variety, the availability, among other factors.

In the case of Morocco, although large retailers currently represent only a small portion of the overall domestic trade, more and more people are switching their purchasing habits and are leaning towards more convenient one-stop-shops such as Marjane, Asswak Assalam, Carrefour, etc. With this, large general retail stores should adopt more efficient inventory management techniques in order to avoid respond better to OOS situations.

In this regard, the four information technologies discussed in our literature review – POS, EDI, DM and RFID — are considered as the prevailing tools used throughout the retail supply chain to collect and store data, communicate with the organization's environment, facilitate data transfer, exploit data to improve business processes, enhance inventory management, etc. Indeed, our research findings have enabled us to conclude that these tools are used for different purposes at the different levels of the supply chain, the main ones being POS and DM. EDI, on the other hand, was only implemented by one of the four retailers studied.

The implementation of one or more of these tools of course is not always simple. For instance, in the case of RFID technology, a whole structure will have to be put in place to ensure its operations and that represented the one of the main reasons retailers have not opted for implanting them. Additionally, the use of information systems and/or technologies always involves some privacy and security risk, so the necessary measures will need to be taken into account to avoid possible threats.

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