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MERCHANDISING RULES FOR SHELF SPACE ALLOCATION WITH HORIZONTAL AND VERTICAL POSITIONS*

ZASADY PRZYDZIELANIA MIEJSCA W PIONIE I POZIOMIE PRODUKTOM NA PÓŁKACH SKLEPOWYCH

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Abstract: Retail visual merchandising techniques can maximize product attractiveness, create good store performance, attract more customers to the store, and as a result, they help to increase the retailer's profit. These strategies make it easier for category managers to differentiate their products from other competitors. This study aimed to investigate the practical visual merchandising methods that influence customer preference of visiting a store and making purchases there. It provides interesting insights into the techniques of how retailers could deploy visual merchandising into the daily tasks to increase profit. The author proposed the framework and the shelf space allocation model, which includes visual merchandising constraints including store layout and traffic, aisles with regard to traffic direction; different shelf levels (special attention is given to the most profitable eye-level shelf); and shelf segments where convenience and local products should be placed. The results of the study could be a part of strategic category management in the retail business.

Keywords: retailing, merchandising, store traffic, customer traffic flow, aisles, eye-level.

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Streszczenie: Techniki wizualnej prezentacji produktu na sklepowej półce mogą zmaksymalizować atrakcyjność produktu, zapewnić dobrą sprawność działania sklepu, przyciągnąć nowych klientów, a w konsekwencji zwiększyć dochody sprzedawcy. Różne techniki pozwalają łatwiej wyróżnić własny produkt na tle konkurencji. Opisane badania miały na celu sprawdzenie praktycznych metod wizualnej prezentacji produktu wpływających na preferencje klientów dotyczące odwiedzania sklepu i dokonywania w nim zakupów. Praca przedstawia wgląd w możliwości wdrożenia przez sprzedawców technik wizualnej prezentacji produktu w celu zwiększenia zysków. Autorka zaproponowała strukturę i model alokacji miejsca na sklepowych półkach, które obejmują ograniczenia wizualnej prezentacji produktu, w tym układ sklepu i ruch klientów w poszczególnych alejkach, różne poziomy półek (ze szczególnym uwzględnieniem półki na poziomie wzroku klienta) oraz segmenty półkowe, na których należy umieszczać produkty szybko zbywalne i regionalne. Wyniki badań mogą stanowić element strategicznego zarządzania kategorią produktów w handlu detalicznym.

Słowa kluczowe: sprzedaż detaliczna, ruch w sklepie, przepływ klientów, przejścia, poziom na wysokości wzroku.

1. Introduction

Retail is a critical industry for sectors of the economy and is characterized by intense competition, tight market share, and rising production capacity. The constant flow and transition in retail, combined with the availability of point-of-sale data, has driven a growing trend in analytics solutions and optimization that seeks new management directions to improve store operations and business efficiency.

Visual merchandising is a practice that encourages the selling of products, in particular by exhibiting them in retail outlets. This involves incorporating goods, experiences, and spaces into a stimulating and appealing presentation to promote the selling of a product or service. Visual merchandising covers window displays, signage, interior displays, beauty promotions, and all other special sales promotions that take place (Bhattacharjee, 2013). Generally speaking, shoppers make fast choices in supermarkets, thus visual product reach is important in a crowded store.

Visual merchandising and contact with the customer are assumed to be core components of retailing, the value of which is indicated by both academics and practitioners. Visual merchandising is also a practice that is of interest to retail outlets. In order to stay on the market and have a strategic advantage over its competitors, retailers integrate multiple competition tactics and techniques into their activities (Kerfoot, Davies, and Ward, 2003).

Ali Soomro, Abbas Kaimkhani, and Iqbal (2017) conducted a study to find out the impact of visual merchandising on customers' attention in a retail store. On the basis of different retail outlets, they analysed the impact of visual merchandising variables such as window display, store layout, colour, and lighting the store inside. They concluded that visual merchandising is a critical tool and has a strong effect on impulse buying and customer buying behaviour.

Matilla and Witz (2008) highlighted that visual merchandising is a selling strategy in which retailers improve both the outside and interior of their stores in order to attract their potential buyers. It helps retailers to develop a visual and successful reputation for their store, as well as generates the necessary level of interest and demand among customers. They also clarified that both the outside and the inside of the store must be in conjunction with each other, in order to have a major effect and must be planned with particular regard to the target demographic of the store. They further argued that this approach of visually making the brand appealing has proven to be highly effective in engaging the consumer market with the brand by visually emphasizing the distinctive and unique characteristics of the supermarket over the competitors.

Chandon et al. (Chandon, Hutchinson, Bradlow, and Young, 2009), suggested that visual merchandising is one of the store marketing strategies that really leads to unplanned purchasing among customers. In this strategy, retailers visually optimize their outlet by creating an aesthetic environment, acceptable shelf layout, appealing window display, orderliness, etc.

Very few studies investigated assigning products into some subcategories, blocks, or product families. One literature limitation concerns the understanding of retail merchandising tactics, while dividing products into categories, promoting less popular regional products, an appropriate definition of convenience products which results in the correct allocation of all mentioned product categories on a planogram. Moreover, there is no previously known model that simultaneously takes into account the possibilities of vertical shelf levels, horizontal on-shelf segmentation, and direction of customers' traffic flow. Another limitation of the existing literature is neglecting the adjustable size of the horizontal and vertical shelf segments dedicated for special products. Generally, the size of assortment range is very large, therefore some products must be allocated to special shelf segments, but it is difficult to estimate the size of the segment for special products and for popular products in advance that could form visually attractable rectangular (horizontal or vertical) shapes on a planogram.

In order to contribute to filling these gaps, the objective of this paper was to identify the most important visual merchandising factors that influence customer awareness and, as a result, retailer's profit. Based on experience, it was observed that sometimes the store planograms include numerous products, but it is very difficult to find those which are not popular enough. For retailers, it is very difficult to manage planograms that contain products of various categories. This paper provides a detailed description of retailer requirements and customer expectations, which later results in the new shelf-space allocation model with the proposed value and constraints criteria. This model is based on practical retail evidence and provides new insights for academics as it investigates not only the basic set of shelf space allocation constraints, but also more sophisticated ones taken from retail requirements. The basic constraints are shelf capacity, product width, lower and upper bounds, and

product profit. The study proposes additional constraints which illustrate different shelf levels (children-level, eye-level, touch-level, etc.), different product types (general, local, convenience products), different type of shelves for heavy, packaged or fast-moving products (general shelves, pallets), and different shelf segments dedicated for special products. The proposed framework helps to systematize the merchandising tactics and better understand the shelf space allocation model.

The rest of the paper is organized as follows. Section 2 provides a literature background and research motivation based on retailer requirements and customer expectations. Section 3 proposes a shelf space allocation model with appropriate constraints. Next, Section 4 summarizes recommendations for the retailers, while Section 5 suggests directions for future research. The paper concludes with Section 6.

2. Background and research motivation

This section provides an overview of published research results in the domains of interest to this paper. Given the interest in optimal shelf space allocation, especially for constraints usage in the model, an overview of the relevant store space allocation practices is collected from the literature. Figure 1. presents the framework of the impact of visual merchandising management on the model of shelf space allocation proposed and discussed in this paper.

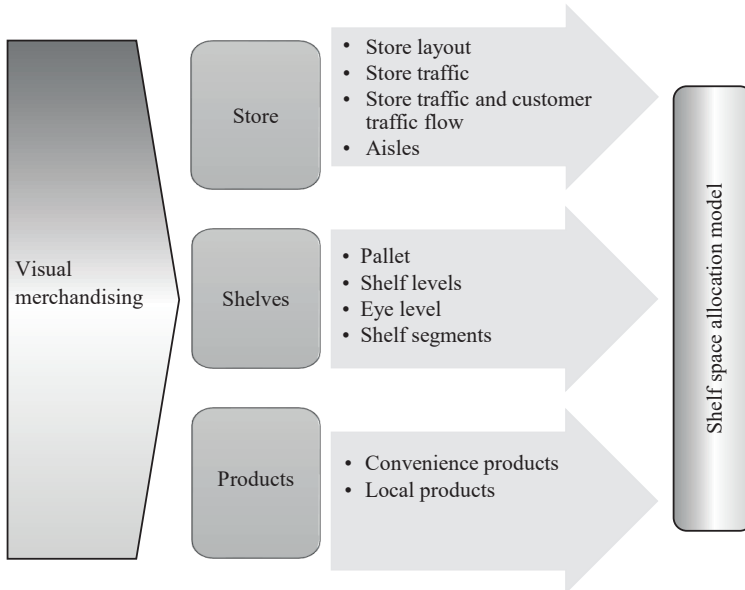


Fig. 1. A framework of the impact of visual merchandising management to the shelf space allocation model

Source: own elaboration.

2.1. Store

Store layout

The store layout practice is extremely complex. Store layout and space planning concentrate on enhancing the visual impact of the retail experience and space efficiency. Merchandising tactics play an important role in store performance. The physical store layout is a key factor of what the customer selects and buys. The various store layouts have a similar goal: to make the customer shop longer and buy more.

The store layout is the location of shelves or other areas of product types on the market (shelf space management at the level of retail stores). Store layout or the organization of departments and categories of products should be arranged in order to promote the flow of customers through the store, and to ensure optimum visibility and the appealing presentation of products. The unique characteristic of the layout of category management is expressed in the arrangement of store spaces by product categories (Dujak, Kresoja, and Franjković, 2017).

Various approaches have been utilized to maximize the amount of time and money that shoppers invest in retail stores. This includes the estimation of the scale of the store, cross-category management, the construction of efficient aisles and display management techniques, and the design of the store layout. Retailers focus on designing store layouts with the goal of maximizing the time that customers spend in the retail store (Gertin, 2012).

Store layout and interior space design rely on improving the visual impact of the retail experience and the productivity of space. Planograms are used to display exactly how many facings of what product can be physically positioned on the store shelf (Bai and Kendall, 2005). It is also essential to plan a store layout that can have a positive effect on the customer's choices. Retailers today benefit from computer tools to design their layout more effectively and increase their profitability (Hubrechts and Kokturk, 2012).

A number of studies on the subject of store layout address attractiveness of the different shelf segments based on traffic density in a grocery store (Flamand, Ghoniem, and Maddah, 2016; Flamand, Ghoniem, Haouari, and Maddah, 2018; Ghoniem, Flamand, and Haouari, 2016; Hui, Bradlow, and Fader, 2011).

Flamand et al. (Flamand et al., 2018) investigated maximizing overall store profit in the problems of retail assortment planning dealing with the shelf segments of different attractiveness, which depends on the store layout. Their case study was performed on a mid-sized grocery store. Prime shelf segments are designated for fast-moving products that have the advantage of increasing in-store demand and maximizing buying experience. The leftover attractive shelf segments are assigned to high-profit product lines, making them more accessible to customers and raising the probability of unplanned transactions.

Botsali (2016) introduced an empirical model to estimate the visibility of shelf positions along the travel path in order to optimally design a layout of store categories with the aim of maximizing the exposure of the shelves within it.

The layout of the store is considered to be a strong factor in the purchasing process, and can have a direct effect on the mood and behaviour of customers. The effective (or ineffective) design of the store layout can affect the process, the time spent in the store, and eventually sales (Behera and Mishra, 2017; Bitner, 1992; Botsali, 2016; Burke, 2006; Choubey, 2017; Desrochers and Nelson, 2006; Elbers, 2016; Hui et al., 2011; Lu and Seo, 2015; Shankar, Inman, Mantrala, Kelley, and Rizley, 2011; Turley and Millian, 2000).

Customer purchasing behaviour is an important factor when designing shop layouts. The goals of the layout and design of the stores are so follows:

- They are supposed to attract buyers.
- Customers are being helped to find required products effortlessly.
- They can make shoppers spend longer time in the shop.
- They can inspire the customer to perform unexpected, impulsive transactions.
- They can affect the purchasing behaviour of the customers (*Retail management*, 2015).

The purchasing decisions in actual stores are affected by store layout, which stimulates impulse buying (Hubrechts and Kakturk, 2012; Kacen, Hess, and Walker, 2012; Kaltcheva and Weitz, 2006; Liu, Melara, and Arangarasan, 2007; Massara and Pelloso, 2006; Mattila and Wirtz, 2008; Weber and Schütte, 2019). Unplanned (impulse) purchases are very common.

Customers make their purchases with regard to the visual influences of the store layout and merchandize type (Ali Soomro et al., 2017; Baker, Grewal, and Parasuraman, 1994; Behera and Mishra, 2017; Cil, 2012; Davies and Tilley, 2004; Elbers, 2016; Liu et al., 2007).

Randhawa and Saluja (2017) concluded that a good layout decreases the rate of information, i.e. a good layout allows customers to locate products and services quickly, as opposed to a bad layout. Good interactions occur if the shop makes it easier for customers to locate the product they are searching for by having a logical store interface and offering an appropriate quantity and signage.

Store traffic

A variety of studies elaborated on the value of a well-organized customer traffic flow, indicating that building store traffic does not always create additional sales (Anic, Radas, and Lim, 2010; Beemer, 2003; Gijsbrechts, Campo, and Goossens, 2003; Lam, Vandenbosch, and Pearce, 1998). This is because retailers do not usually manage the store traffic correctly (Elbers, 2016).

Store layout has a strong impact on in-store traffic patterns, shopping impressions, shopping atmosphere, and efficiency of retail operations. The store layout is also a critical factor in the creation of store image (Anic et al., 2010; Behera

and Mishra, 2017; Vrechopoulos, O’Keefe, Doukidis, and Siomkos, 2004; Wu, Kim, and Koo, 2015). The success of store traffic management relies on the placement of supermarket brands within the retail market (Russell and Kamakura, 1997).

Store traffic is one of the factors of the retailers’ decisions about the materials that must be used at the stores. Although a wide entrance mat is necessary in every shop, the flooring must not become slippery when wet and must be easy to clean, and this is why department stores incorporate wood blocks or tiles in the main walking paths and prohibit the use of carpets in the departmental display section (Varley, 2001).

Retailers may also use music to affect the actions of the consumer and to regulate store traffic. Music can monitor the speed of traffic in the store, create an impression and draw or guide the interest of the customer (various practices of visual merchandising – their impact on the store image and customer perspective).

Visual merchandising, involving window displays and lighting arrangements, ensures that retailers can attract a different class of customers to their stores, raise customer perception and increase store traffic and revenue (Kerfoot, Davies, and Ward 2003; Saeed, 2015).

Store areas characterized by high store traffic, i.e. areas where a large number of shoppers walk and reach, and by visibility of front entrances, end-caps (parts of the planograms near the aisles), promotional aisles, and check-out areas (Caruso et al., 2018; Dapin, 2007; Inman, Winer and Ferraro, 2009; Suher and Sorenson, 2010).

Store traffic and customer traffic flow

Analyses of retailing in the past showed that store traffic and customer traffic flow are significant store performance drivers. In order to distribute their particular resources in an optimized manner, retailers need to consider the potential strength of the store traffic and the flow of customer traffic.

Store intensity levels can also be defined in terms of store traffic and consumer traffic. The distinction between these two definitions is that retail traffic includes the number of shoppers who enter the store at a given point in time, whereas the flow of customer traffic is determined by the movement of customers inside the store (Anic et al., 2010; Elbers, 2016).

Anic et al. (2010), attempted to create a link between store traffic and customer traffic flow in consumer spending in supermarkets. They reported that a mixture of these two factors had a positive effect on the amount of money consumers spent. Nevertheless, they argued that while the traffic of stores and the flow of consumer traffic has a positive effect on product revenue, other influences have the largest impact on sales. If retailers decide to achieve a greater impact on merchandise sales, they should perform a close analysis of the style of store layout to be used in their outlets. In other words, they would have to ensure that customers pass as many aisles as possible during their store walk, but also make purchases in more specific aisles.

Many studies highlight the value of building store traffic to increase sales in retail (Anic et al., 2010; Gijsbrechts, Campo, and Goossens, 2003; Lam et al., 1998; Walters and MacKenzie, 1988).

Some studies deal with the problem of customer traffic flow, which can be explained in terms of shopping paths or location passed. Customer traffic flow means customers' movement inside a store. Therefore, retailers tend to optimize merchandising and store layout design, creating more convenient shopping paths (Anic et al., 2010; Gertin, 2012; Hui et al., 2011; Larson, Bradlow, and Fader, 2005; Uotila and Skogster, 2007).

Aisles

Many retailers have a well-established pattern of buying activity in the supermarket – the average buyer is supposed to walk up and down the store aisles. They stop at different category locations, decide on the range of factors, select the best (utility-maximizing) alternative, and then move on in a similar way until the path is complete.

Planograms are physically constructed from segments that are stacked together to create convenient aisles for customers (Bianchi-Aguiar, 2015; Bianchi-Aguiar et al., 2016). The aisles are essential because most people implicitly believe that most of the shopping takes place there (Larson et al., 2005).

The revenue obtained by a department is defined as a function of its area of operation and its exposure to the aisle market network. The aisle network consists of two components: the race track, which acts as the customer's primary path, and the entrance/exit aisle. The racetrack aisle itself is viewed as a department of field distribution and subsequent production of revenue (Yapicioglu and Smith, 2011).

Yapicioglu and Smith (2011) suggest a model and solution method for selecting a department store layout with a racetrack layout with a single entrance. The standard of the layout is measured on the basis of two criteria: (1) degree of customers' satisfaction within departments and (2) the revenue generated.

Several fascinating observations into the behaviour of shoppers can be found. First, on average, shoppers spend a substantial amount of time in the immediate vicinity of the entrance, where the goods (fruits and vegetables) are displayed. Second, shoppers tend to travel very rapidly through the aisles. Third, a shopper who performs the 'typical' counter-clockwise movement through the store spends less and less time in the area as his/her trip progresses (Hui et al., 2011).

Some researches highlight the fact that the products which are placed near to aisles can affect sales (Asghar, 2011; Avais and Yaqoob, 2010). Moreover, numerous studies on shelf space management address the maximizing sales near the aisles (Caruso et al., 2018; Flamand et al., 2018; Grewal, Levy, Mehrotra, and Sharma, 1999; Harris, 2012; Hubrechts and Kokturk, 2012; Hui et al., 2011; Larson et al., 2005; Mowrey, Parikh, and Gue, 2019; Valenzuela and Raghubir, 2009).

Smith and Burns (1996) discuss the use of a “power aisle” in retail stores, namely an aisle that shows comparatively large amounts of a relatively limited number of consumer goods (i.e. fewer products but the same number of items), usually at a discount. The authors found that the effect of the power aisle is not only increased exposure and reduced-price perception of products but also reduced expectations of the prestige of the shop. Since the ‘massed-out’ appearance of the power aisle emulates the layout of a warehouse grocery store, which customers equate with discount rates and lower prestige, it indicates that the retailer has vast stocks of goods and is thus able to sell them at a reduced price.

Botsali (2016) emphasized the quantifying exposure by the optimum positioning of racks along the direction of the shopper. At macro level, the exposure section was split into three levels: entrance, main aisle, and cross aisle. They created a model with bidirectional customer traffic within an aisle.

Regions with high store traffic include the following (Ozcan and Esnaf, 2013):

- Areas at the store entrance, in particular the first shelf or other display areas that customers face directly after entering the store.
- End-caps of aisles are usually highly noticeable to people who do not enter the aisle.
- Check-out location, where all consumers have to go through the preferred area for impulse purchases.

On routes that feature lengthy aisle travel, shoppers appear to make short trips through and out of the aisle rather than across the full length of the aisle. For instance, as shoppers walk through the aisles, they may or may not buy products in all aisles. In some aisles, shoppers stop and buy something, while in others, they are just looking at products or merely going around the store to get to another department (Anic et al., 2010).

Larson (2006) explored the possible advantages of aisle management and examined some of the concepts of aisle management analysis that can help many grocery retailers boost their store efficiency. The length of the aisle was also defined as a significant variable. Shoppers could stop walking down aisles that are either too long or too short. The experiment showed that spotlights at the end of the aisles increased the time spent looking at the items in the final aisle displays and improved sales.

Beginning of the aisle

It is expected that placing more profitable products next to the beginning of the shelf would result in higher revenues (Larson et al., 2005; Rodrigues, Lim, and Qian, 2002; Van Nierop, Fok, and Franses, 2008).

Generally, at the beginning of the aisle, products appear to sell better than those in the middle of the aisle. When customers are looking for a specific product, they will probably pick up the first product they see as they reach the aisle (Rodrigues, Lim, and Qian, 2002).

Van Nierop et al. (2008) concluded that it is beneficial to place highly profitable products close to the beginning of the aisle, because customers do not always travel through the entire aisle. Generally, they enter the aisle for a very short time rather than traversing its entire length. This may lead to increased purchases at the beginning of the aisle than from the middle part.

As Larson et al. (2005) demonstrated that this is because customers do not often walk along the whole aisle. In reality, as soon as they reach the aisle, customers hurry to the other end. Instead, they go on brief trips in and out of the aisle, which can encourage them to buy more from the beginning of the aisle than from the centre.

Middle of the aisle

Dréze, Hoch, and Purk (1994) model the problem flexibly enough, introducing the case where the best shelf position is in the middle of the aisle, and the most profitable position is on one or both edges of the aisle. They concluded that multiple product locations (e.g. end-of-aisle promotional displays) undoubtedly result in increased sales.

Cross-over aisles, where a shopper can switch from one aisle to the next, save the consumer time and resources, but reduce the retailer's ability to monitor traffic and visibility. The end-display situated at the end of the planogram, is also a positive thing. The area of impulse purchases and cross-over escapes expands the amount of end-to-display opportunities (Harris, 2012).

It is clear that high-traffic environments need wider aisles. High-traffic areas are typically synonymous with 'demand' queues such as flour, cereals and milk, seasonal promotion items, holiday items such as Christmas decorations and specific routines such as the check-out or elevator lobby. In order to stimulate consumers to buy on both sides of the aisle, many stores follow a strategy of finding at least one demand segment in each gondola. The aim is to create a "bounce pattern" in which the customer is exposed to much more than one side of the aisle (Harris, 2012).

End of aisle

Products nearer the end of the aisle may be subject to more shopping traffic than products located in the middle of the aisle, and therefore an increase in sales on those products occurs due to their proximity to the end of the aisle (Hansen, Raut, and Swami, 2010). Dréze, Hoch, and Purk (1994) found that the majority of the sales categories improved at the end of the aisles. Furthermore, the end-of-aisle displays, because of their larger total shelf space having strong effect on brand sales (Bemmaor and Mouchoux, 1991; Chandon, Hutchinson, Bradlow, and Young, 2009; Nedungadi, 1990).

The end-of-aisle and check-out counter stimulate purchasing decisions to buy a product by around 3% compared to being located in the middle of the aisle (Inman et al., 2009; Kacen et al., 2012). A shopper can, for example, visit the cereal aisle and

remember that his/her own home cereal supply is limited and needs to be re-stocked. This is an unplanned purchase (Kacen et al., 2012).

Bemmaor and Mouchoux (1991) also found that promotional end-of-aisle presentations are more successful for low-market share brands than for high-market share brands. This is explained by such factors: irrespective of the particular brand-consumer preferences, as more market share labels results in the better promotion and memorizing, and therefore less disturbance of the additional in-store visual salience.

End-caps are any displays for offered products found at the end of the shelf or shelving row in a store. They are a standard part of merchandising deals since they are assumed to attract more of shoppers' attention (Suher and Sorenson, 2010). Products on the end-caps are likely to be quickly noticed by the moving customer, although those products further in the cross-aisle can be barely seen. This knowledge can help managers when deciding on optimum product positioning (Botsali, 2016).

Impact of the pandemic on the retail store

The challenges caused by the Covid-19 pandemic and the economic crisis require retail stores to adjust to the new circumstances. The pandemic is still a critical factor in store performance.

Retailers must have a mechanism in place to guarantee customer and employee safety while continuing to perform business as usual. Beyond the corporate retail strategy, retailers should consider how they can direct their employees in a variety of situations.

Previously, people-counting technology such as cameras or traffic sensors were implemented in retail stores in order to optimize customer traffic management. But in the times of the pandemic, such solutions are used to ensure optimum social distancing control in retail stores.

Earlier, methods of faster product finding and selection were used for ensuring customer satisfaction, but during the pandemic, such methods help the customer to spend less time inside the store. Among the ways to achieve such goals by the retailers there are:

- using appropriate store marketing and the correct highlighting words on banners;
- promoting the products based on the customers' interest regarding store locality.

Appropriate store layout secures the customers' direction at the store, and it ensures how customers interact with the store space, the main factors of which are counter-clockwise and clockwise direction. Many retailers prefer to fill their store space with as many products as possible, and in recent years such a strategy proved effective, however during the pandemic, creating narrow aisles is forbidden. People need to be protected, the social distance between people should be big enough, as well as personal space in the store must be enlarged in order to make them feel comfortable. Another aspect of having wide aisles is giving the customer the

possibility to pick up products both from the lower and upper shelves. This results in a larger shopping basket.

The aspect of how frequently customers go shopping has changed too. Previously, smaller shopping trips a few times during a week were the usual way, but during the pandemic many customers prefer weekly shopping trips. Therefore a factor which retailers should consider is the convenience of direct traffic to the store and enough parking places in front of it. Some retail chains provide customers with different mobile solutions to find and book parking places.

Retailers will feel the effect of the pandemic, regardless of how long the current health crisis lasts. Therefore there is no need to wait until the business returns to normality, a better solution is to adapt to new retail requirements.

2.2. Shelves

Pallet

Planograms consist of not only shelves, but also other types of fixtures. Some of them include more than one fixture type. Therefore, in stores one can find chests, pallets, and pegboards (these are vertical bars with steel rods sticking out to display peggable products like rulers, pens, and pencils) (Bianchi-Aguiar, 2015; Bianchi-Aguiar et al., 2016), while heavy and bulky materials are generally effectively displayed on pallets. Pallet shelves are helpful when potentially unstable stacks of bulky materials are displayed within store space, and they could be used to hold exactly the right load of products in a stable, safe manner.

A big advantage of such types of shelves is that they can maximize scarce store shelf space, and allow obtaining more vertical space as well as more floor space. The next advantage of pallets is the safety factor for customers and store employees, as are made of high-quality materials able to hold heavy goods.

A variety of organizational factors must be taken into account in the placement of the product categories. Products shipped already priced in cage pallets and ready for display would need to be placed near the entrances so that they can be wheeled in with minimal disturbance (Buttle, 1984). Moreover, a pallet shelf is a very convenient solution as they are reusable and can be moved to other locations for better accessibility in the store (Hübner and Schaal, 2017).

Stores that offer low-cost, and often high-quantity products, can also use pallets for product presentation (Chandra, 2014). Sometimes customers take products directly from the pallet, thereby removing the need for the retailer to position the products on the shelf (Supply Chain Management and Advanced Planning, 2005).

It can be observed in real stores that pallets help to create the direction of shoppers' traffic. It became apparent that the existence of pallets in the middle of the main aisle essentially created one-way traffic on either side, where shoppers went 'up' to the right of the pallets, and 'down' to the left of the pallets (Botsali, 2016; Mowrey, Parikh, and Gue, 2019).

Shelf levels

There are several considerations that should be included in the design of successful visual merchandising in retail stores. The usual construction involves floors, partitions, furniture, art, graphics, and display products. Eye-level designs include product placement, props, point of sale, countertop assembly, and graphics. The ground-level architecture consists of fixtures, benches, layouts, densities, product placement, flooring, and lighting. Windows includes roofline, front desk, and entry (Benjamapornkul, Rakthin, and Punnakitikashem, 2016). Vertical product placement has a much influence on sales than horizontal positioning (Elbers, 2016; Hansen, Raut, and Swami, 2010; Valenzuela and Raghurir, 2009; Wongkitrungrueng, Valenzuela, and Sen, 2018).

A crucial consideration in the decision-making process may be the option that the customer, as a result, selects the product. After attracting the customer closer to the shelf, four vertical shelf areas can be identified (Drexler and Souček, 2017; Wright, 2013;). They are:

- Stretch-level – above 6 ft. (over 180 cm), represents one of the least valuable zones in the store. Shelves in this zone typically get very little customer focus. Some modern shops avoid this area, but it is still commonly used. Lighter items are put on shorter racks (Ebster and Garaus, 2011).
- Eye-level – 4-5 ft., represents a region of the greatest attention of the client. It is a position where the most valuable goods can be put. Items in this field will raise the customer's interest by 35% (Ebster and Garaus, 2011).
- Touch-level – 3-4 ft., this field is an integral part of the body of the customer. This is the zone which draws more interest than the stretch and the stoop levels, but is less used than the eye-level one. Items with higher profits are also found in this zone (Ebster and Garaus, 2011).
- Stoop-level – below 3 ft. (90 cm), is an unpopular place that does not draw too much consumer interest. Consumers do not want to bend down to this zone. Items with a low benefit or heavy materials are usually put there (Ebster and Garaus, 2011).

Eye-level

Product placement at eye-level is perhaps the most successful product positioning in terms of product revenue and exposure (Aghazadeh, 2005; Bhattacharjee, 2013; Cant and Hefer, 2013; Hansen et al., 2010; How to revamp your visual merchandising, 2007; *Retail management*, 2015; Van Nierop et al., 2008; *Visual merchandising guidelines*, 2013; Wright, 2013).

Previous experiments by Van Nierop et al. (2008) found that eye-level is the most successful position for product positioning when identifying the right vertical location for the product. Aghazadeh (2005) claimed that product placement at or just below eye-level had the most marketing success, because the eye-level products are

seen with less effort than those positioned at vertical points of the shelf (Sigurdsson, Saevarsson, and Foxall, 2009).

Therefore, retailers should place the displays at eye-level to achieve the best results. In addition to a sensible floor plan, the height of the store displays and fixtures should be considered. Children and women are generally shorter than male adults, so retailers should lower the displays if this issue is essential (Bhattacharjee, 2013). Furthermore, store customers deserve to see the finest assortment stock at eye-level. The easiest way to deal with height is to level it out by making a pyramid or a stepped exposure, which encourages the eye to move down naturally (White, 2012).

Retailers generally agree that product exposure affects commodity unit revenues, meaning that market space distribution is regularly manipulated to maximize revenues and earnings. For example, products with high-profit margins are often placed in eye-level, high-traffic locations and with multi-facings at vertical points of the supermarkets shelves (Elbers, 2016; Sigurdsson et al., 2009). Undoubtedly, it is difficult to position all products at eye-level, but it is vital for retailers to distribute products on those shelves in such a manner that the retailer finds to be the most relevant in fulfilling the business priorities of the store (Elbers, 2016).

Shelf segments

Different parts of a store and different shelf segments are not equally visited by customers and are not equally visible to customers. Each shelf contains a number of contiguous segments, the attractiveness of which depends on the design of the store.

Some researchers proposed dividing a shelf into smaller neighbouring segments that differ in attractiveness (Düsterhöft, Hübner, and Schaal, 2020; Flamand, Ghoniem, and Maddah, 2016; Flamand et al., 2018; Ghoniem et al., 2016; Hui et al., 2011).

Flamand et al. (2018), recommended assigning the most attractive shelf segments and their maximum space for fast-movers (e.g. milk, meat, ice-cream, cookies) included in the assortment. Düsterhöft et al. (Düsterhöft et al., 2020) investigated different shelf segments in different shelf positions with the goal of the optimal assigning of shelf space to products and the optimal performance of replenishment decisions.

Shelf segments that are closest to the end of the aisles, exits, or cashiers appear to be more prominent, better visited, and thus more appealing than shelf segments situated in the centre of the aisles. The middle shelf segments are comparatively less appealing than the other segments, as shelf segments that are closest to the end of the aisle are more attractive in a shop department (Flamand et al., 2018; Ghoniem et al., 2016;).

Flamand et al. (2016), proposed a model based on product position in the store layout, where each shelf is divided into adjacent shelf segments of separate ones based on expected buyer traffic densities. The retailer assigns a shelf to each category

of product categories, to decide the relative position of the product categories within their specified shelf, and to define their designated overall shelf space within the lower/upper bounds. Based on the relative profitability and the desirability of the product categories, they intend to maximize profits from impulse-buying.

2.3. Products

Convenience products

Convenience products have become increasingly important in retail chains. The appropriate allocation of such products provides convenience and efficiency for the customers, as well as a higher density of customers attracted to the store.

The growth in pre-prepared convenience foods over the past decade shows the degree of which social trends affect the grocery market. Social movements have certainly influenced the food industry. Examples of convenience products are pre-washed salads, vacuum-packed chilli, frozen pizza, ready-to-eat chicken tikka masala, snacks, salad bars, and even ready-made sausages and mash are sold in supermarkets. Longer working days result in less free time for most people, therefore they prefer to 'buy time', which results in more frequent purchasing of the pre-prepared convenience foods. Thus retailers selling convenience and basic grocery products must carefully select the positioning of such products on a planogram close to the main purchased products (Varley, 2001).

Convenience products need easy access, allowing the customer to make a purchase rapidly. Therefore, the shopping centre may not have been a suitable place for convenience products. This form of commodity is inexpensive and bought by a wide variety of buyers. Specialty items are often more unique than most products, and consumers usually do not like going out of the way to buy them (Behera and Mishra, 2017).

Convenience-orientated products such as snacks and cleaning supplies require a somewhat different range of management methods compared to service products, e.g. hair styling and travel. For example, the post office should provide local people with not only the usual postal and state payment services, but also a carefully chosen range of vital grocery and convenience goods (Varley, 2001). All the chain drugstores sell many convenience products (Warren, 2005).

Gabrielli and Cavazza (2014) conducted their research in order to evaluate the communicative effectiveness of an in-store marketing operation comprising of placing products on a show stand at the end of the in-store. For their studies, they choose two convenience products, a very familiar and a less familiar one.

The location of the product on a planogram has a huge effect on the customer's attitude and, implicitly, the buying intention, in comparison with the same product on the same shelf or in isolation. This proves that a product on the planogram location is an authentic informational indicator, and a cause for positive product evaluation by customers. They observed that the informational role of a planogram is powerful

for unknown categories of products, and for products with a low level of brand recognition (Gabrielli and Cavazza, 2014).

For stores selling convenience goods, traffic intensity is most important as customers often purchase convenience products on impulse from easily accessible stores. Ease of traffic flow and store accessibility are key factors in retail businesses, more important than others. Thus retailers offering convenience products must draw business from the existing flow of traffic. Here attention must be paid on-street widths, one-way streets, and parking possibilities (Bhattacharjee, 2013).

Local products

There is increasing consumer demand for goods of regional origin. For consumers, the region of origin of fresh food products is an essential criterion in forming an attitude towards the store and deciding to make a purchase there. Moreover, many regional producers encourage customers to support their national producers and to buy products from their own region.

The uniqueness of the culture, customs, processes, and geographical and natural factors, results in the popularity of local products in the specific geographic area. The mixture of individual, economic and productive factors related to a particular area, distinguishes regional products from the other ones which are sold in the retail stores (Lombart, Labbé-Pinlon, Filser, Antébliau, and Louis, 2018).

Obviously, highly regional products, such as local journals, newspapers, and souvenir gifts, are offered in retail stores locally. Moreover, fresh produce such as fish and meat is often purchased on a local or regional based on the need to minimize shipment and storage times (Varley, 2001).

The allocation of local products on the planogram must be logical and convenient for the customer. Allowing the retail outlet to adapt quickly and efficiently to local product preferences is a means to enhance the consumer experience, customer service, and store productivity (Varley, 2001).

The study conducted by Lombart et al. (2018) specifically showed that consumers' loyalty to regional product assortment and visual merchandising significantly influence the retailer's local image and consumers' attitude toward these products. They also highlighted the indirect impact on their customers' attitude towards the store.

The effective recognition of the psychographic features of these products, such as lifestyle, moral values, and religious diversity of customers, will enable marketers and merchandisers to create and promote local products (Katrandjiev and Velinov, 2014).

In addition, local products are common for unorganized retail. Independent retailing is a small retail business managed by an owner or manager of the store without any technological and accounting aids. Compared to organized retail, independent retail provides only a range of local products (*Retail management*, 2015).

3. Conceptual development

3.1. Criterion value proposition

All retailers have the same goal to achieve success. In order to improve store operations profitability, they tend to increase profits and sales, and reduce their expenses. Therefore, the criterion values for the issue of shelf space management may be following:

1. Maximize the total profit of all products placed on all shelves.
 2. Maximize the total sales gained after selling the products placed on all shelves.
 3. Maximize the total unit movement of all products placed on all shelves.
- The following sections address the model's constraints.

3.2. The constraints of the model

Shelf constraints:

- The total product width on each shelf is not greater than the shelf width limit.
- For each product on each shelf, the product height is not greater than the given shelf height limit.
- The total product weight on each shelf is not greater than the feasible shelf weight.
- For each product on each shelf, the product depth is not greater than the available shelf depth.

Product constraints:

- All products must be allocated at least on one shelf of a planogram.
- The same product can be repeated maximum on the defined number of shelves.
- The total number of facings of each product on all shelves mustn't exceed the feasible supply limit for a product.
- For each product on all shelves, the number of facings must satisfy the defined minimum and maximum number of facings.

Multi-shelf constraints:

- Due to the product similarity or competitiveness by taste, characteristics, functions, some products are grouped in clusters and must be placed together on the same shelf.
- If the product is repeated on multiple shelves, it must be placed in the same orientation on all shelves, in order to make it visible in the same manner on all shelves.
- Only one orientation among the possible ones (front, side) must be selected for each product on all shelves.
- For each product, the feasible facings orientation are defined by the retailer and must be respected when allocating products on a planogram.

- If the products are repeated on multiple shelves, they must be placed only on the next shelf, creating visible rectangular blocks of the same product on several shelves.

Shelf segment constraints:

- Products for which shelf levels are defined must be placed on the appropriate shelf levels (pallet, low-level dedicated for children, stretch-level, eye-level, touch-level, stoop-level).
- Products for which their types are defined must be placed on the appropriate shelf segments (segment for local, convenience products).
- Based on the store traffic, some products must be placed near the beginning or end of the aisle of a planogram.
- Due to the popularity of the centre position of a planogram among customers, some products must be placed on the center segments (and not near the aisle segments) and can be placed on all shelf levels of a planogram.
- The size of the shelf segments (local, convenience, aisle, centre) must be adjustable according to the defined maximum, reducing and enlarging sizes based on the products which must be placed on that segment and the products which could be allocated on any segment of a planogram.

Decision variables:

- Binary value – if the product is placed on the shelf.
- Positive integer value – the number of facings of the product.
- Binary values – if the product is placed on the shelf on the defined orientation.
- Binary values – if the product is assigned to the special shelf segment.

3.3. Data collection and conducting experiments

An important part of conducting experiments with the proposed models is gathering retail data. There are numerous methods of data collecting available for the retailer, some such techniques are more complicated and expensive than others. Most of retailers can collect data using in-store technology. Due to the fact that innovative information technologies become cheaper, affordable and compact, many retailers have decided to include digital tools in their stores.

Among the most useful ways of using information technology to gather store data, and better understanding of customers preferences and behaviour are:

- Customer surveys with the help of mobile apps installed in the customers' tablets or phones.
- RFID tagging which helps to collect the data about selected products and customer paths inside the store.
- Touch-screens which help customers to locate the required product and to find out what products are most popular and difficult to find.
- Installing traffic-sensors to control the distance between customers instore during the pandemic.

- Sales data which reports on the fast-moving, over-priced, popular and unattractive products at each store of the retail chain.

Appropriate retail data collection helps to improve store performance and creates a better shopping experience for customers.

It is known that the problem of size is the main factor in the results of the experiments. Due to this the process of preparing test instances must take into account different problem sizes with regard to different product categories, shelf lengths, number of products in the tested category, and the linear measures of the products.

The experiment should be conducted according to the following steps.

- Creating a template planogram that includes the product assortment of the selected category.
- Performing non-standard adjustments of the planogram if needed and required at the selected store.
- Adjusting the designed template planogram to the real circumstances of the store, such as available floor and shelf space, the width of the aisles, the customer traffic flow, etc.
- Model testing using the sales data from the given store of the retail chain.
- Obtaining the number of facings of the product and other useful results based on the data collected from the given store.
- Repeating the experiments on the basis of other stores.

4. Recommendations for the retailers

Nowadays customer expectations are higher than ever, therefore retailers must know what products the customer may be interested in. Obviously, different recommendations are suitable for different retail stores, which vary for the product types being offered, the size of the store, regional customer's preferences, etc..

Retailers and other category managers should focus on the implementation of visual merchandising elements. This should be included in their business practices as it is a very special and creative way of engaging with consumers in this growing area of shopping in supermarkets.

In terms of shelf merchandising, retailers must ensure that local and convenience products are easily accessible with enough shelf space assigned for them. Next, retailers must make such products noticeable to store customers, defining the appropriate shelf position for them or allocating them near the main or well-known branded product. Consequently, the customers can instantly find, access, and decide to choose them.

At stores where heavy stock capacity must be offered, pallet racking is the best solution. Furthermore, the retailer can achieve higher profits because of having more space on the ordinary shelves to display more products. The correct product allocation on different levels must satisfy the following requirements: the eye-level

shelves must be reserved for top brands or the most profitable products, while lower shelves dedicated to cheaper or fast-moving products.

Regarding the allocation of products near the aisles, there is still a clear reason for brand managers to place goods on end-caps, as these places are free of aisle-based competition, even if they are at the front or the back of the shop. End-cap places differ in terms of the number of customers passing by and looking at them. The awareness of where there are more shoppers lies in the interest of both retailers and brand managers (Caruso et al., 2018).

The layout of the supermarket should be planned in an orderly manner with a good interior, as it helps shoppers to make purchases for a longer time in the store. The architecture must enable the customer visiting the supermarket to easily recognize all the products he/she wants.

Management teams should also continue to invest in improving store layouts, as it encourages shoppers to spend more time in shops and explore the products, which could result in impulsive demand (Randhawa and Saluja, 2017). Understanding the improved revenue-generating impact of in-store traffic flow, retailers must properly plan their store layout and merchandising strategies to maximize traffic flow and improve store efficiency.

5. Future research

This study shows the obvious need for the proper implementation of the practical shelf space allocation models, and transforms customers' expectations into a new model.

In this research, the items commonly used in stores such as shelves and pallets were considered. In stores, some planograms may include more than one fixture types, or represent irregular planograms which consist of shelf placements of various orientations. Future research should consider different fixture types such as chests and pegboards to be used in the model for effective visual merchandising. Additional investigations of pallets should also be considered if a pallet is allocated in the aisle and not as the lowest shelf of the planogram, because in this case, it would require an empty space to allow customer traffic on both sides of the pallet. Finally, the influence of visual merchandising cognition of local and convenience product displays need to be explored if they are allocated on different planograms on other main product categories.

Future research also may benefit from the development of the optimization techniques to test the proposed model. This approach could be valuable for retailers interested in practical solutions that are appropriate to solving retail problems, enabling them to maximize profit, minimize lost revenue, and increase customer satisfaction.

6. Conclusion

Retailers are interested in efficient shelf space allocation, which reflects the elements of visual merchandising. Examining how visual merchandising on the store shelves impacts on customer awareness in retail stores is very important. Understanding the most appropriate location of a shelf allows the category managers to present products on store shelves correctly and effectively.

Control of visual merchandising can help to optimize product attractiveness and stimulate consumer interest in it. In addition, it also allows consumers to buy more of their desired products. Eventually the retail store can build up an efficient display system that can help them to gain competitive advantage over their competitors.

This research contributes to the retail literature by introducing a new practical shelf space allocation model, which includes practical merchandising tactics resulting in the store, shelf, and product constraints. Store layout and customer traffic are the main factors that influence the time spent by customers in stores. The additional role of aisles is also explained in detail by the author. The advantages and importance of shelf level differentiation were also discussed. Finally, the role of pallets in maximizing the vertical space on regular shelves, is presented.

Prior research on regional products was based primarily on consumer motivations to buy these products with regard to tangible product characteristics such as quality, size, colour, weight, variety, smell, taste, touch, quantity, or material. Market attributes such as regional segmentation, trends, size, and target customers are also very important. From a practical point of view, this research is the first study that pays attention to different types of products and includes in the shelf space allocation model regional and convenience products.

Moreover, both store traffic and customer traffic flows are key determinants of the overall store performance. The author included such concepts in this model, identifying the shelf segments at the beginning, in the middle, and at the end of the aisles.

Inclusion of the proposed merchandising constraints into the space shelf allocation model can bring very interesting and useful findings for the retail industry. The study also created a retail framework that illustrates the proposed approach.

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