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MERCHANDISING RULES FOR SHELF SPACE ALLOCATION WITH PRODUCT CATEGORIZATION AND VERTICAL POSITIONING*

ZASADY PRZYDZIELANIA PRODUKTOM MIEJSCA NA PÓLKACH SKLEPOWYCH Z UWZGLĘDNIENIEM KATEGORYZACJI PRODUKTÓW I POZYCJONOWANIA PIONOWEGO

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Abstract: Visual merchandising is assumed to be the main component of retailing; the significance of it is highlighted by academics and practitioners. This research focused on the in-store merchandising strategy of product allocations and describes the relations between such tactics and customers' perception of store layout, traffic direction, brand awareness, and the appropriate assigning of products to shelf levels, based on their brand as well as price. For retailers, this study provides an overview of incorporating different merchandising tactics into a shelf space allocation model which is applicable at stores selling branded and popular

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fast-moving products. The authors carefully adapted the product allocation approach on the planogram, as well as the way in which products could be placed on different shelf levels. This model satisfies the retailers' goals and may have a significant effect on sales. Thus, the study provides essential insights into the influence of other products, such as complementary, substitutable and clustered ones, in the assortment range.

Keywords: retailing, decision making/process, merchandising, shelf levels, brand awareness.

Streszczenie: Wizualna prezentacja produktu na sklepowych półkach jest uważana za główny czynnik w handlu detalicznym; fakt ten podkreślają badacze akademicy, jak również praktycy handlu. Niniejsza praca koncentruje się na strategii przydzielania miejsca produktom na sklepowych półkach i opisuje wpływ na postrzeganie przez klientów zmian w układzie sklepu, kierunku ruchu, świadomości marki, a także właściwym przypisywaniem produktów do odpowiednich półek z uwzględnieniem ich marki i ceny. Praca zawiera przegląd różnych taktyk przydzielania miejsca produktom, które mają szczególnie zastosowanie w sklepach oferujących markowe i szybko zbywalne produkty. Autorzy starannie dopasowali sposób alokacji produktów na planogramie, jak również sposób ich rozmieszczenia na różnych poziomach półek. Zaproponowany model jest zgodny z potrzebami wskazywanymi przez handlowców, a jego zastosowanie może mieć istotne znaczenie na wielkość sprzedaży. Z tego względu, zaprezentowana praca dostarcza niezbędnych informacji na temat wpływu innych produktów, takich jak komplementarne, substytucyjne oraz zestawy produktów, w zakresie całego asortymentu.

Słowa kluczowe: sprzedaż detaliczna, proces decyzyjny, merchandising, miejsca na półkach, świadomość marki.

1. Introduction

Visual merchandising (VM) is the art of introducing practical concepts to boost store traffic and sales levels. VM is the art and science of showing goods to allow maximum selling. VM is a sales-and-target tool, a method to enhance products on the market, and a method to interact and affect the purchasing choice of the consumer. It uses season-based displays to add new arrivals to buyers and thereby maximize sales by a prepared and integrated way of displaying available stocks (Bhattacharjee, 2013).

VM is the basic aesthetics of science and is the cornerstone of the supermarket industry, and plays a significant role in the retail market. VM is a discrete distribution tactic that can minimize the workforce ratio and improve the return per square foot, and can further reduce campaign expenses (Randhawa and Saluja, 2017). VM is an art of product presentation and also has also a significant impact on online stores on e-retailing (Jakhar and Verma, 2020).

People are typically attracted to markets that look perfect and eye-catching. This often results in an impulsive purchase. The window display has a positive effect on customer focus, supplying customers with exclusive and recognizable images because a window display is the only way retailers can retain potential customers

(Ali Soomro, Abbas Kaimkhani, and Iqbal, 2017). Plenty of VM elements stimulate customers' interest in conservation, highlighting the product related to its application or material (Nominees for visual merchandising, 2020).

Shelf space allocation issues can become quite different. This is attributed to variations in the company's long-term approach, organizational style, product types, business climate, retailer-vendor partnership, store layout, business networking, fixture arrangement, etc.

Both academics and practitioners readily acknowledge that the architecture of the retail store influences the visual perception of the customer and, accordingly, the period spent in the store, navigation across the aisles, and the distribution of the resources through departments and categories.

If the store architecture is poor, it can have a negative effect on the overall experience of the customer. VM is one of the strategies used to gain a relative advantage. People are more likely to visit or buy something at the store that can catch their attention. Marketers use the VM tactic to attract more consumers to the shop than their competitors (Ali Soomro et al., 2017). Weber and Schütte (2019) provided numerous practical applications of AI analytics in retailing. They claimed that retailing forecasts are now applied in marketing and stock replenishment. Moreover, the use of AI is in great demand in the area of decision support and practical report analytics.

Various methods have been tried to maximize the amount of time and money that shoppers spend at store outlets. This includes the estimation of the scale of the store, cross-category management, the construction of efficient aisles and display fixtures, and the design of the store layout. Retailers deal with various shop sizes, like malls and hypermarkets (Gertin, 2012). Tasting the product at the point of sale results in a high degree of identification and stimulates customers to buy it (Kpossa and Lick, 2020).

To the best of the author's knowledge, no paper has considered merchandising rules based on the evidence of how fast products move, their brand, and price with regard to the vertical allocation of such products on dedicated shelf levels on a planogram. Yet in retail practice there are a number of concepts and branding principles that could be efficiently applied to the allocation of retailer brands and products, which highly differ by price. A model of organizing brand offerings is also missing so that the products could achieve their maximum sales while simultaneously being allocated on more than one vertical level.

These tasks suggest a number of research questions on grouping already-branded products, defining sub-brands under the given brand, and allocating them on better shelf positions on a planogram. Moreover, popular fast-moving products should also be carefully investigated and assigned to the shelves in a planogram as they could be allocated on the positions of low visibility as well as on better eye-levels. Therefore a retail maximization sales model with vertical shelf position

constraints which takes such brand strategy practices into account is needed to be designed and implemented.

This research paper will contribute to the visual merchandising literature with the important aspects that influence product on-shelf visibility, store traffic, and affect sales. The aim of this paper is to prepare a comprehensive overview of the retailer's conditions and consumer preferences and to create an amended shelf space allocation model with additional constraints based on the investigated merchandising rules. The model proposed is based on practical retail requirements and suggests new findings for academics and practitioners on gaining consumer attention, as it investigates not only the well-known collection of shelf space allocation constraints, but also the new elements. The basic shelf space allocation constraints include shelf length, product width, lower and upper bounds of facings, and product profit. In this research, the author proposed to use additional constraints which describe different shelf levels for products of different prices and brand recognition, product grouping because of their substitutability or competitiveness, creating visually attractive planograms and noticeable product categories while allocating the same products on multiple shelves.

The rest of the paper is organized as follows. Section 2 presents background and research motivation inspired by retailer requirements and customer prerequisites. Next, Section 3 introduces a shelf space allocation model with the constraints discussed in Section 2. Section 4 presents the conclusion and the recommendations for the retailers, while Section 5 provides ideas for future research.

2. Background and research motivation

2.1. Brands

Visual merchandising and retail brands

Visual merchandising information helps to create solid identities by differentiating products, creating loyalty, facilitating premium selling, and defending retailers against rivalry (Schmitt and Simonson, 1997). The allocation on the shelves of premium own (private) labels is an important factor in a relative impression of the retailer towards its competitors (Hoch, 1996).

Premium own labels have a public image positioning (national brand quality at a lower price) and play a significant role in positioning the store in comparison to its rivals (Hoch, 1996). On the one hand, the promotion of one category may attract buyers to the market. On the other hand, a retailer prefers to encourage a variety of other product categories within the store, fulfilling consumers' engagement for other brands (Russell and Kamakura, 1997). Lots of large and small retailers are offering their own private brands (both low-priced and premium versions of the products) in addition to well-established manufacturer brands (Anselmsson and Johansson, 2009).

Some categories can be influenced by premium brands, although others may be more value-driven. If a category consists primarily of luxury brands, most of the brands in that category segment should be very profitable. If the segment is mainly made up of prestige and own-label products, hence both the manufacturer and the seller would have a lower chance of achieving higher profit margins. There may be ways for retailers and manufacturers to collaborate together to increase the performance of such product segments through business models based on innovation and/or brand readjusting (Varley, 2001).

A study by Valenzuela and Raghbir (2009) found that consumers have shared shelf arrangement schemes for verticality and centrality in terms of market practice, but not for horizontality: premium brands are placed in the top rows, cheaper brands are in the bottom rows, promoted brands are at the ends of the aisles, and famous brands hold central planogram positions. Their research also showed that retail systems have an effect on product inferences: customers assume that goods placed on the top (and on the right) are more expensive and have higher quality than those put on the bottom (or on the left). Consequently, they choose locations in the middle of both directions since this reflects moderate price consistency.

Underhill (1999) indicated that there is a “reliable zone” from just above the level of the eye to around the level of the knee – products in this region are more likely to go unnoticed. He also addressed the “boomerang effect” in which the customer could not walk entirely down the aisle, thus goods found at the end of the aisle are usually more visible.

Brand awareness

Successful visual merchandising plays a major role for any retail sector to market participants or customers and raise brand awareness. Generally, retail enterprises attempt to develop the brand awareness of their products and assure logistics capabilities. Suppliers also work on proliferating brand awareness which allows for increasing retail prices on their products offered in the retail outlets. In addition, the objective of advertising is also to create brand awareness.

Brand awareness is a variable that can catch customers’ ability to easily remember a brand, i.e. the ability to identify a brand as an already recognized informational point, and thereby incorporate it for a conscious mental operation (Gabrielli and Cavazza, 2014).

Brand architecture means defining brand boundaries and brand relationships. The key comprehensive functions of the brand are:

- identifying all product and service solutions and the customer awareness of the brand;
- promoting consumer sales by improving the brand value of goods and services (Ailawadi and Keller, 2004).

Kucuk (2011) worked on new brand awareness conceptualization by extending the definition of push-brand by including available brand awareness with regard to

in-store merchandising. Brand awareness is potentially the major factor of repeating customers' purchase decisions.

Retail brands, like product brands, can be expanded to sell consumers something more than a core product or, in the case of supermarkets, a core range of products. A variety of retailers have been able to effectively add more and more product lines without affecting the sales of current product ranges. Superstore supermarket outlets have expanded product lines to both producer and proprietary products to many non-food areas, while many clothes retailers have shifted to shoes, toiletries, and gifts, and numerous supermarkets are moving to coffee shops and restaurants. This helps retailers to raise brand recognition, affirm brand values and create new markets (Varley, 2001).

Continuous increase in brand awareness by consumers often presents a challenge to small retailers to strengthen their assortments. Customer brand awareness is a very insignificant factor in preparing an assortment range for small retailers. The worthlessness of brand recognition in the case of small retailers may be due to the fact that consumers in the targeted area do not have a lot of brand trades. This is mainly due to a small retailer who gives more priority to profitability and demand than to retain new and promoted brands. However, retailers accept new products only if they are requested by customers (Koul and Jasrotia, 2019).

Furthermore, brand awareness is a dominant factor of store selection, where customers prefer to search for the product. Therefore increasing the visibility of the offered brands together with in-store merchandising activities can intensify store traffic on the defined store floor space (Kucuk, 2011).

2.2. Stores

Store layout

Store layout or floor layout signifies how the various parts and aisles of the store are arranged with the powerful and easy goal of getting shoppers to spend more time and purchase more (Davies and Tilley, 2004; Hubrechts and Kokturk, 2012). The number of customers in the shop is directly proportional to the buying action taken (Behera and Mishra, 2017). A well-planned retail outlet layout enables a retailer to optimize sales for every square foot of the store's available retail space. Store layouts typically display the scale and position of each department, any temporary facilities, positions of fixtures, and customer traffic patterns. Every floor plan and store layout relies on the category of offered products, the location of the shop, and the amount of company investment into the aesthetic design of the store. The purpose of the store layout is to optimize the interaction between customers and merchandise (Bhattacharjee, 2013).

The layout of a store is a major element in the maintenance of a successful industry. It improves revenue and profitability. A successful retail layout allows shoppers to go shopping around the store and across displays with a wide variety

of products. The most popular types of store layout include grid layout, racetrack layout, and free form layout. The grid structure is usually arranged in a rectangular format, enabling shoppers to look for the product easily and optimize floor space; it is suitable for supermarkets and hardware stores. The architecture of the racetrack means that the customer only takes one direction while going around the store. The advantage of such a structure is the sense that any commodity on the shelves can be reached by the customer. This might, however, irritate customers. Choosing a store layout depends on the particularity of the store and the type of products being sold (Randhawa and Saluja, 2017). The freeform architecture is a free-flowing and asymmetrical configuration of screens and aisles, utilizing a number of various sizes, shapes, and display types. It is used mainly for large department stores. The freeform style has been shown to maximize the time that customers are able to spend in the store; it has an easy-to-use structure, making it simpler for customers to search (Cil, 2012).

The layout of the store defines what feelings are invoked in the shopping experience. The purpose of the analysis by Behera and Mishra (2017) is to define the main aspects of the location and structure of stores that have a direct causal effect on customer buying behaviour in the integrated retail environment. Factors such as product location, fixture colours, and aisle space cause that a customer is loyal to the store and thus returns there. High visibility fixtures can trigger feelings of anxiety in customers, as they are required to traverse every aisle. Crowded store layouts where the fixtures are too close together also cause anxiety, rushing shoppers into their purchase. Open layouts where the product is noticeable can reduce stress, allowing people to continue to buy longer (Behera and Mishra, 2017).

A well-designed store layout may contribute to a stronger shopping environment that results in the kind of buying behaviour that a retailer needs to achieve (Choubey, 2017). The purpose of the analysis by Elbers (2016) was to demonstrate the most significant influence on customer behaviour within both store layout and shelf design. It seems extremely doubtful that any store layout could have a significant effect on the view of the product, but due to potential impractical layout designs, purchases may be affected by the type of layout that a certain seller gives to his/her store (Elbers, 2016).

A good shop layout encourages further traversing, and enables to easily find a route to a product (Baker, Parasuraman, Grewal, and Voss, 2002; Bitner, 1992; Botsali, 2016; Passini, Rainville, Marchand, and Joannette, 1998). Supermarket architecture attracts shoppers to the side and back walls of the shop, where the most sought-after and high-margin products are placed. On the way, shoppers must walk by and see a wide variety of slower-moving goods that raise the probability of purchasing products that are not included in their shopping list (Fernandez and Soriano, 2012).

Mowrey, Parikh, and Gue (2019) provided the analytical and algorithmic approaches on the customers' shopping paths with regard to the shelf orientations and

layout. Their results indicated that for unidirectional customers traffic, the shelves oriented 30 degrees from the main path's direction results in a nearly 250% increase in exposure comparing to the case with 90-degree-oriented shelves. For bidirectional customer traffic, this value results in 150% higher exposure.

The flow of the store layout regulates how consumers buy and how long they shop (Behera and Mishra, 2017). The research by Hui, Bradlow and Fader (2011) was the first effort to explain the in-store purchasing paths of shoppers and their transactions through an applied mathematical model. Using a series of latent variables representing the "attraction" of each commodity category and zone, their model combines three facets of grocery shopping: (1) where customers visit and their zone-to-zone transitions; (2) whether (and for how long) they stay and spend money in each zone, and (3) what types of products they buy (Hui, Bradlow, and Fader, 2011).

Store traffic

The influence of the retailer on the store traffic is usually imperfect and always relies on the general layout of the store, such as entrances and exits positioning, the shape of the shopping area, and the width of the aisle. For instance, in a department store, customers who have just visited the makeup department or the electronics department can access the clothing department from various directions. The traffic management of a retail store can also be investigated in a longer strategic period than the decisions to arrange a shelf or set prices in a specific department (Gu and Liu, 2013).

Eventually, retailers must find a balance between two methods: creating store traffic and enhancing consumer traffic flow. As both of these strategies is expensive and the costs involved with either approach are not equally efficient, the main managerial question here is whether retailers should direct their efforts to either enhancing store traffic or optimizing consumer traffic flow (Anic, Radas, and Lim, 2010; Underhill, 1999).

Retailers are encouraged to use a variety of merchandising tactics, service, product selection, and quality improvement strategies to attract customers to the store (Anic et al., 2010; Yue and Zinkhan, 2006).

Moreover, a lot of retailers invest in advertising, branding, and in-store promotions with the goal of generating incremental store traffic and maximizing store revenues (Anic et al., 2010; Blattberg, Briesch, Peacock, and Fox, 1995; Gijsbrechts, Campo, and Goossens, 2003; Ilfeld and Winer, 2002). Promoting one product category could attract customers to the store. The increased store traffic, for this reason, may then increase the sales of other products displayed at the store (Russell and Kamakura, 1997).

The direction of consumers in stores is one of the main factors that affect shopping purchasing decisions since they can only buy the products they can find. The consumer orientation mechanisms in retail stores and the store design (anti-

clockwise or clockwise) are extremely powerful in helping consumers to identify the desired products and to guide them around the store. Many stores lead customers around the store in an anti-clockwise direction because most people are right-handed. Others guide customers in such a way that they always look inside the store in a clockwise-oriented environment. If customers are directed at stores in a clockwise direction, they would have a more detailed comprehensive chart and could rate the store better in terms of the relative ease of navigation and value for money compared to the anti-clockwise direction (Bhattacharjee, 2013).

2.3. Shelves

Shelf levels

Vertical shelf levels in retail stores have a definitely greater influence on sales than horizontal product positioning (Ebster and Garaus, 2011; Elbers, 2016; Hansen, Raut, and Swami, 2010; Valenzuela and Raghurir, 2009; Wongkitrungrueng, Valenzuela, and Sen, 2018). Ebster and Garaus (2011) defined four vertical shelf levels: stretch-level, eye-level, touch-level, and stoop-level.

The merchandise shown at eye level is more visible and allows the retailer to sell more (Wright, 2013), therefore in order to achieve higher revenue, retailers should place products at eye-level.

Eye-level is the most profitable location in buying (Bhattacharjee, 2013; Elbers, 2016; Van Nierop, Fok, and Franses, 2008). This means that products placed on lower shelves are expected to be cheap; products placed on high shelves are supposed to be expensive (Bhattacharjee, 2013; Elbers, 2016).

Wongkitrungrueng, Valenzuela, and Sen (2018) performed experiments with shelves allocated on three levels: high, low, and eye-level. Their research extends the general interpretation of customer reactions to retail product displays by exploring the interplay between the vertical role of product placements and the customers' perceptions in making choices and the preference options. Experiments indicated that when customers select from locations put in a low shelf position, forcing them to lower their heads, those higher (vs. lower) position more likely stimulates an indulgent choice than its lower equivalent. However, when selecting from the locations on a high shelf, forcing customers to raise their heads, those lower (vs. higher) in a personal power position are more likely to stimulate an indulgent choice. This influence is due to the discrepancy (vs. match) between the customer's personal sense of control and that caused by the market role of the products, causing their emotional distress and directing them.

Customer patterns at store layouts depend on the scale of the brands:

- price level: expensive brands are at the top; inexpensive brands are at the bottom;
- sales volume: popular brands are in the middle; slow-moving brands are at the aisle;

- promotional strategy: promoted brands are at horizontal aisles; own store brands are positioned next to popular and promoted brands (Valenzuela, Raghbir, and Martins, 2013).

The retailer should always focus product locations exactly at eye level – higher in adult areas, lower in children’s areas – or the locations which are noticeable from the aisles. Merchandising on very high or low shelves should be discouraged (*Visual merchandising guidelines*, 2013).

Shelf segments

The horizontal position of the product means how far from the aisle the product is positioned, and which products are placed next to each other. Shelf segments can be differentiated not only vertically but also in horizontal order.

The most appealing shelf segments are usually found in the vicinity of entrances/exits and shelf-end caps, which achieve heavy customer traffic (Ghoniem, Flamand, and Haouari, 2016). Flamand, Ghoniem, and Maddah (2016) also implemented a tactical, store-wide shelf-space management issue where shelves are made up of smaller, neighbouring parts that differ in attractiveness. The type of commodity (e.g. tea or oil) is presented at the aggregate level. The benefit arising from the assignment of a product category to a market shelf depends on the attractiveness of the shelf segments to which it is allocated and its overall size. Kim and Moon (2021) conducted research on product selection and replenishment considering two-dimensional shelves and the factors of customer demand for products such as space and cross-space elasticities and positioning effects.

Ghoniem, Flamand, and Haouari (2016), employed in their study estimated traffic densities which correspond to the relative attractiveness of shelf segments. Traffic densities were modelled by the likelihood that a customer spends time in front of a particular shelf segment at the store planogram. Higher values were assigned to shelf segments allocated near the end of aisles, entrances, or peripheral passages in the store.

Düsterhöft, Hübner, and Schaal (2020) investigated the problem of whether a specific shelf area (e.g. the horizontal shelf centre, the beginning or end of an aisle) is a more attractive location regarding sales and more visible to customers. They provided a viable approach to shelf-segment-dependent demand with the help of the shelf attractiveness factor, which means the increase in base demand if the product is located on a certain shelf segment compared to a situation where it is positioned in the least attractive shelf segment.

Specific regions of the shop and separate shelf segments are not equally accessed by the customer and are not equally available to them. Each shelf covers a set of contiguous segments whose attractiveness determines the customers’ loyalty to the store.

Aisles

Retailers typically have a classification order for products within the category, e.g. principal category at the beginning of the aisle, and discount products are allocated at the end of the aisle (Düsterhöft, Hübner, and Schaal, 2020).

If customers tend to see promoted products at the end of the aisle and popular products in the center, they could expect retailers to put own-label goods in a position that encourages consumers to clearly equate pricing to the prominent and well-promoted brands – that is, between them (Caruso et al., 2018). Huang, Yao, Chang, Tsai and Kuo (2019), in their experiment, used a typical store layout, which includes cabinets (i.e. several cells where the space of one cell is used to exhibit one product) and aisles in a real retail store.

Promotional products are usually placed in racks situated in the store's high-visibility zones. However, aisle areas were also used to handle a variety of overlapping promotions. With delivery from suppliers, the tradition of the chain was for the drivers of the suppliers or their assistants to position the stock inside the shop, in the aisle(s) where it would be placed. The shop employees would then replenish supplies in their respective locations, i.e. on the display shelves and/or storage areas above the display shelves. Narrow aisles affected replenishment. Larger stores offered a larger aisle space; shoppers had a more convenient shopping atmosphere and enjoyed a wider variety of goods and services relative to the other two smaller stores (Hooi, 2013).

According to Hu and Jasper (2007), the interior of the store is the overall impact that the store leaves in the minds of its customers. The authors noted that the best approach is to create aisles that are small enough to make consumers slow down, leaving them more than enough time to notice the items shown (Hu and Jasper, 2006).

Valenzuela and Raghurir (2009) demonstrated that shoppers expect retailers to put the most common item in the centre of the aisle, prompting them to select the core item when they choose it.

Flamand, Ghoniem, and Maddah (2016) considered the problem of allocating grouped product categories and placing them in shelves and aisles with the objective of maximizing the impulse buying profit. They concluded that, on the one hand, shelf segments allocated close to the end-of-aisles/entrances near busy walkways generally have a higher customer traffic density, while on the other, shelf segments located in the middle of aisles usually tend to have low customer traffic (Flamand, Ghoniem, and Maddah, 2016).

Underhill (1999) noticed that products at the end of aisles are more accessible and recognizable to customers, so they do not usually walk the whole aisle in order to make a decision. This phenomenon was termed the “boomerang effect”. As the whole aisle is not usually visited, thus the revenues at the end of the aisles are increased (Underhill, 1999).

2.4. Products

Clusters

Space management in the retail industry has two main priorities.

- to maximize both short-term and long-term returns on invested costs in the retail area;
- to provide a rational, simple, and motivating design between the offered assortment and the customer (Varley, 2001).

Products in the assortment range may be grouped, and such groups of other products have a strong influence on the main assortment range. Cluster products are product groups based on their similarity of usage, style, taste, type, etc.

Retail space gains as it grows per square foot, and this can be done by the use of a retail layout. Store layouts can easily assemble product groups together so that shoppers can locate different products they are searching for in one location (Behera and Mishra, 2017).

The visual impact of product adjacency can stimulate the impulse purchases over 70% of buying decisions in a supermarket (Armata, 1996; Cil, 2012). Allocating the related products close to each other strongly impacts on the retailer's profitability. On the one hand, allocating certain products in close proximity can lead to an increase in sales. On the other hand, placing the adjacent products away from each can lead to a decrease in overall sales (Batty, 2003; Cil, 2012; Larson, Bradlow, and Fader, 2005).

Grouping cluster products in threes or fives; odd numbers ensure an aesthetic window display, which is most pleasing to look at (Taskiran, 2012). The next goal of grouping some products into clusters on the same shelf is the goal of the supermarket to facilitate customers with one-stop shopping. Customers could buy both products when they stop in front of the shelf useful for them (Cil, 2012).

The following strategy helps supermarkets cluster products around relevant purchase options related to the purchasing association: instead of placing coffee in the beverages department, cheese in fresh cheeses, ham in the meats department, and cornflakes in the cereals department, one might find all these items in the breakfast section (Cil, 2012).

Other departments, such as the baby products department or the tableware department, suggest the same scheme for clustering various product groups (Borges, 2003), namely to put products that have a good buying 'relationship' close together and take advantage of the natural product association. To be specific, association rule mining can help companies design store layouts. In one technique, products that are commonly bought together can be put in close proximity in order to further promote the selling of those products together (Cil, 2012).

Some of the common principles used by retailers in store layout design suggest locating coffee and sugar together, or shampoo and hair conditioner together; showing

some product matches side by side improves shoppers' unplanned transactions (Abratt and Goodey, 1990).

Specific tactics for manipulating purchasing decisions may be implemented in retail stores. For example, if the retailer offers two products of the same purpose at different price-quality levels, and suppose that the more expensive product is more profitable, then the total sales can be enhanced by putting on the same shelf another product that is significantly more expensive than the given expensive one (Simonson, 1999).

To find the logical complementary categories, econometricians have developed cross-elasticity, which measures the sales change of one category from a price change in another. It claims to capture the use association among categories, because the products are allocated together (Cil, 2012).

Cross-product effects, including certain product substitution or complementarity effects, occur when consumers usually focus on a few retail stores due to time limitations or neighbouring allocation (Burke, 2006). In fact, certain groups have been put side by side in their logically rational pairs. This basic principle has been strengthened with the use of cross-elasticity, which can be calculated by an association between the products (Walters, 1991).

In order to improve store performance, the retailer could make some improvements in highly sensitive shelf areas, grouping products in clusters and allocating them in close to each other on the shelf.

Complementary products

One of the key functions of the retailer when defining a category is to determine the complementary product categories based on the deep understanding of customer's habits as well as different product forms, flavours, usage, price options, sizes, etc. (Desrochers and Nelson, 2006) Equally significant is the potential of the layout to hold complementary goods or related labels in close proximity so that the buyer is more likely to purchase products linked to the one they are looking for (Behera and Mishra, 2017).

The assortment range is linked to purchasing decisions in a particular product segment, where the customer has to determine one of the products available to choose from. However, customers typically buy more than one product or service at the same time of purchase. The dilemma that inevitably arises is how the merchandise assortment range influences the purchasing of similar products. Obviously, the purchase of one product increases the likelihood of choosing a complementary one and decreases the likelihood of choosing a substitute product (Abratt and Goodey, 1990).

Providing consumers with a wide variety of complementary products in a single retail store decreases the strength of market rivalry between retailers. This can clarify the emergence of supermarket campaigns intended to encourage cross-category sales, such as setting up potato displays in the meat aisle, selling salad dressings in

the produce aisle, or targeting loss-leader discounts of products that are easy to use so that they stimulate complementary purchases on a single shopping trip (Richards, Hamilton, and Yonezawa, 2018).

The position where the products are displayed has a direct effect on the sales of the product. Almost immediately, the display of complementary products placed side by side raises the likelihood of cross-selling products (Ozcan and Esnaf, 2013).

Many product categories are complementary. For such product types as seasonal goods, the same product type in different physical size and weight options are complementary ones. Thus, retailers should define appropriate fixture types for them and allocate products in close proximity to each other. In boutique-type shops, mannequins are often used for displaying complementary clothing products (Bhattacharjee, 2013).

The next examples of mixed merchandise complementary product categories include products in active sports department which offer sports equipment is both men's and women's activewear (Hart and Rafiq, 2006). Other examples of complementary products are coffee and tea, coffee and sugar or cream, fruit smoothies and frozen yogurt, shampoo and conditioner, sausages and ketchup.

Complementary vs. substitutable products

Category managers must define complementary products in such a way that they satisfy basic customers' needs and match the main product in the defined purchasing situation. In achieving this, more precise definitions that differentiate product categories based on their specific features could be suggested. As a result, the retailer could obtain a higher purchase per customer.

The overall product category's attraction depends on its intrinsic attractiveness with regard to the category itself; store and trading area features; shelf space allocation in the store; the amount of space assigned to other complementary or substitutable products (Campo, Gijsbrechts, Goossens, and Verhetsel, 2000).

Categories with a strong local interest can reflect a greater portion of store sales as well as their complementary products, while their substitutable products are predicted to be sold relatively less. For example, some customers are interested in fresh fish. In this case, complementary categories like fresh produce also have a higher popularity, whereas substitutable product categories like prepared meals (groceries) capture fewer sales (Campo et al., 2000).

In addition, substitutability within the category indicates a standard, more reliable category grouping, whereas departments are willing to undertake greater change due to the complementary essence of the products. For example, the baby boots section also offers large items such as prams and cots instead of concentrating on the fast-movers such as profitable lines of baby and nursery products. Therefore, in each category a number of product categories were defined as related to the complementary ones (Hart and Rafiq, 2006).

In a situation where a store is focused on two opposite goals, for example, offering healthy food and tasty cookies (or pizza and fresh salads), the customer needs to balance the choices of two products during the same shopping trip, choosing a less healthy dessert (or pizza) after choosing fresh fruit or vegetables (or salads).

One should emphasize the situation in which customers perform their choices. Depending on the situation, the customer may select different products from the category, based on their personal goal, for example, maximizing pleasure or minimizing money. This means that for holidays such as Christmas, the customer may prefer the higher price sweets from among various types of similar sweets. Otherwise, the customer would usually prefer the cheaper ones (Varley, 2001).

Another example concerns the situation when a customer hesitates between two products on the same occasion. If the consumer smokes two cigarettes per day and has a higher-price high-quality one and a reduced-price lower-quality one to select, in this case, he/she can choose both items and smoke one of them before dinner and the other one after dinner (Simonson, 1999).

Generally, products within a category should be defined in a way that allows replacing one with another. The differences could be applied to features such as brand, producer, flavour, colour variation, size, product quality, and price level. Moreover, products within some categories may have only an element related to another one. For example, a category of exotic foods could have refried beans, taco shells, and salsa as complementary products. Therefore it is better and logical for consumers to display such products together (Varley, 2001). Furthermore, promotions in one product category affect sales in other complementary product categories.

2.5. Research motivation

There is an underlying motivation to conduct research investigating customer requirements and retailers' goals. There is an increasing interest on the part of scientists and practitioners in qualitative methods to examine the customers' purchasing behaviour and to increase sales. The primary motivation for this paper was to identify visual merchandising factors that influence customer attitude to the retail store and the willingness to make purchases there. Figure 1 presents the examined visual merchandising components. This paper focuses on brand loyalty, store layout, positioning on the shelf, and product adjacencies. The proposed shelf space allocation model helps to understand the current challenges faced by retailers as in the competitive retail environment they strive for operational efficiency and customer satisfaction.

In addition, customers have varying requirements in different retail conditions. For example, they want to be able to purchase simple consumer products (e.g. food and household goods) at a low cost. When dealing with more complicated requirements such as the installation of a deck or the redecoration of space, retailers are searching for a complete solution including resources and details in combination

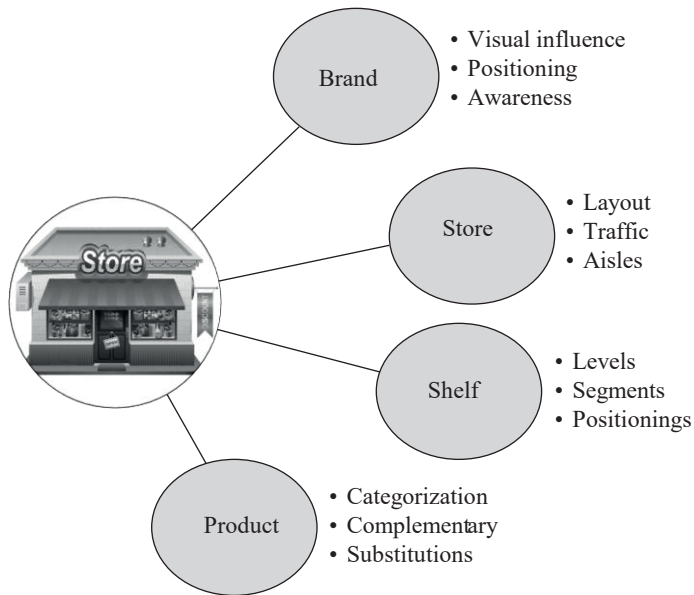


Fig. 1. Retail visual merchandising components

Source: own elaboration.

with additional items required. Then, at all times, shopping is guided by preferences rather than by needs. This consciousness shopping mode is both ego-intensive and emotional. These diverse purchasing conditions and motivations result in a the growth in cross-shopping – the trend of purchasing both high and low-priced items or encouraging expensive, region stores and price-oriented retailers (Burke, 2006).

3. Conceptual development

3.1. Criterion value proposition

On the basis of the previous section's analysis of store layout, customer requirements, purchasing behaviour, products grouping possibilities as well as the retailer's goals to increase sales, to reduce expenses, and to renew the assortment range due to the increasing movement of products, the value of criteria values for the issue of shelf space allocation can be proposed:

1. Maximize the total product profit presented on the planogram.
2. Maximize the total sales received after selling the products presented on the planogram.
3. Maximize the total movement of product units presented on the planogram.

The model constraints are introduced in the further parts of this paper. Figure 2 and Table 1 summarize the findings.

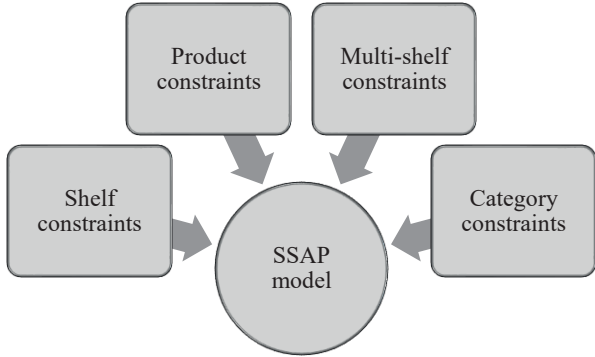


Fig. 2. Components of the shelf space allocation model

Source: own elaboration.

Table 1. Constraints of the shelf space allocation model

Constraints type	Definition
Shelf	Width Height Weight Depth
Product	Allocation Duplication Supply limit Lower bounds Upper bounds
Multi-shelf allocation	Other shelf orientations Orientation type Orientation possibility Continuous rectangular blocks allocation Cluster group products
Category	Category size Category width tolerance Shelf level

Source: own elaboration.

3.2. Presentation of constraints

Shelf constraints:

- For each shelf, the total product width does not exceed the shelf width.
- For each shelf and each product, the product height does not exceed the available shelf height.
- For each shelf, the total product weight does not exceed the shelf weight.
- For each shelf and each product, the product depth does not exceed the available shelf depth.

Product constraints:

- Each product must be placed at least on one shelf of a planogram.
- The same products must be duplicated on no more than the defined number other shelves.
- The total number of product facings on all shelves must not exceed the available supply limit for a product.
- For each product, the number of facings on each shelf must satisfy the lower and upper bounds.

Multi-shelf constraints:

- If the product is repeated on multiple shelves, the requirement is to place it in the same orientation on all shelves, in order to make it aesthetically noticeable on all shelves.
- Only one orientation (front, right, left, top, back, base) must be available for each product on all shelves.
- For each product, its possible orientations on the shelf must be defined and respected during allocation.
- If the product is repeated on multiple shelves, they must be placed on continuous rectangular blocks (shelves without this product, between the shelves on which this product is placed, are not allowed).
- The products of the same cluster group (because of their substitutability or complementarity) must be placed together on the same shelf.

Category constraints:

- If the product category is placed on the shelf, the minimum category size, i.e. the total widths of the products of the defined category, must be at least the one defined by the retailer in order to make it visible enough.
- If the product category is placed on multiple shelves, the total category width tolerance between different shelves must not exceed the defined limit in order to form a strict enough border between neighbour categories and to form rectangular blocks. On each shelf different product in the same category may be placed. Therefore, an attempt to create accurate rectangular blocks could not succeed. A better solution is to define tolerance for category width.
- Based on the product price, functions and movement, the product must be placed no lower than the level defined for it (stretch-level, eye-level, touch-level, and stoop-level).

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.

4. Conclusion and recommendations for retailers

Both academics and practitioners readily acknowledge that depending on the shelf levels and different positions on the shelves, products are not equally visible to customers, which therefore results in different traffic flows in some store locations. Factors like brand awareness, number of stores in a retail chain, the size and location of each store, product supply strategies, discount or promotion policies have a significant impact on a retailer's profits.

While the assortment range generally refers to the collection of individual goods sold, suppliers and distributors increasingly sell to customers branded merchandise, and offer prizes or gifts with purchases. Such strategies help retailers to distinguish between their popular product offerings and to use one product to support another.

The wrong allocation on the shelves of a low-price and higher-price product could lower sales. By changing the location of a product on a shelf, adding some complementary or substitutable products in the nearest proximity might potentially significantly increase the expected sales. From a managerial point of view, such tactics may help the company to increase its profits and have a positive influence on customer store loyalty.

This study aimed to provide explanations for some useful retail practices and to incorporate them into a real shelf space allocation model with vertical shelf levels, grouping products into categories and subcategories based on their branded or fast-movement opportunity, as well as allocating some complementary, substitutable, or clustered products near each other. The analysis focused on the impact of such strategies in the real retail environment, providing general theoretical insights into retail practices and customer perception.

The suggested model shows a direct relation between the use of merchandising rules and satisfying customer expectations. The allocation of products on different vertical levels, and horizontally grouping them in categories, as well as grouping complementary or substitutable products near each other on a shelf, is expected to affect sales. Generally, central locations are dedicated to popular products, while the aisle display is used for promoted products.

Retailers, as well as other category leaders, should insist on the integration of visual merchandising components into their operational practices. This should be included in their sales tactics, as a very unique and innovative method to attract customers to the stores. The author recommends that retail category managers and researchers develop shelf space allocation models with regard to the merchandising

rules which are specific to the given store, because it is impossible to create an ideal model which could be applied in any store of any layout.

Table 1 presents a critical analysis of the state-of-the-artw in recent merchandising literature from which retailers could find theoretical, practical, and managerial applications.

Table 2. Critical analysis

Authors	Year	Direction of investigation	Key features	Implication study
1	2	3	4	5
Simonson	1999	Analysis and integration of the results on the impact of product preference and prepared assortment purchasing decisions.	Factors that influenced purchase decisions: adding options presentation of a product, compromise options of products, number of quality levels in assortment, multiple attractive products which increase shopping time, complementary assortment categories, assortment presentation.	The product usage in the assortment influence customer purchase decisions, focusing on evaluating the product groups in order to encourage high margin purchases; the manner of product displaying; assortment preference influenced by the marketing mix variables (sales promotions).
Destrochers and Nelson	2006	The implementation of customer behaviour analysis to complement the perspectives obtained from point-of-sale scanner data.	The influential factors during and after the customer enters the store (consumer-related goals, consumer decision-making, perception processes, product class and brand choice involvement).	The strategical and tactical decisions about the category in the retail store including assortment selection, pricing, shelf merchandising, shelf space allocation, product presentation, promotion, supply, and marketing.
Anselmsson and Johansson	2009	Investigation of the reasons for introducing own labels to grow profits and consumer perceived brand confidence, interaction with industry leading brands, and improving the store image.	Investigation of the customer expectations, preferences, and behaviour to determine whether manufacturers' reasons to promote own label brands are really realized. Analysis of the brand loyalty, store image, store loyalty.	Guidance to retailers on achieving their goals in own label merchandise; the relation between the customer price-conscious and own label purchases for which they are willing to pay; the correlation between the quality of retailer's own label products and customer loyalty towards them.
Anic, Radas, and Ljim	2010	The relative effects of retail traffic and consumer in-store traffic flow on shopper spending in a single analysis. Variables that better influence the shopper spending.	Control variables: demographic characteristics, shopping trip type, time spent shopping. Five regression models to analyse the impacts of store traffic and customer traffic flow factors on shopper spending. The impact of the number of aisles passed, relative to the number of aisles with purchases made.	Both store traffic and customer traffic flows have a positive effect on shopper purchases in supermarkets. Store traffic and customer traffic flow allow retailers to estimate expenditure on branding, advertising, and in-store promotions.

Table 2, cont.

1	2	3	4	5
Kucuk	2011	Investigating the role of push-based brand awareness in the creation of the brand image as an alternative approach.	Introducing conceptualisation of the brand awareness; 'push-based brand awareness' in the field of retail field, distribution, and branding. Analysis of the customer decision dynamics or in-store merchandising effectiveness and efforts.	Recommendations to retailers on maximizing push-based brand awareness or productivity with regard to hidden out-of-stock costs.
Gabrielli and Cavazza	2014	Investigation of the efficiency of in-store marketing factors consisting of allocation of products on an end-of-aisle planogram and their influence on customers' evaluation and attitude to the product and purchase intention.	Comparison of the different product in-store allocations (unique product, shelf, and display stand) with their location at the end of an aisle. Analysis of the number of product facings, presentation and overall visual aspect, colours, logo, packaging.	Suggestions for the practitioners on the allocation of products on display stands, as this has a major effect on customers attitude and purchasing intention; they trigger product positive evaluations in contrast to the same product allocated in isolation or on the shelf. Moreover, the display stands can be useful and powerful for unfamiliar products or products with low brand awareness.
Randhawa and Saluja	2017	Analysis of the efficacy of visual merchandising through various approaches on customer impulse buying behaviour in retail apparel stores.	Factor analysis on the store form/mannequin display, shelf presentation and product display, store layout, the window display of contemporary designs, atmospherics, promotional schemes and discount offers.	Guidance for the apparel retailers on the relation between the store layout impact and the customer's willingness to impulse buy. Suggestions on the relation between the impact of in-store form/mannequin displays and the customer's willingness to impulse buy.
Caruso et al.	2018	Investigation of the foot traffic and visual reach of endcaps depending on its location (front, back store).	The exploration of how customers go across the supermarket, their foot traffic. Identification of the endcaps that could generate the most visual reach of the brand. The analysis of the locations that customers walk past and when they visit endcaps.	Guidance for marketers, retailers and manufacturers on how to maximize the visual reach of customers in different endcap locations in the retail supermarket, which store locations create higher merchandising investment.
Wongkitrungrueng, Valenzuela, Sen	2018	Survey on customer reactions to retail product exposition by exploring the relationship between the vertical shelf position of products and customers' personal sense of control in making their decisions on product preference or impulse purchases.	Investigating the effect of consumers' movement-induced sense of control which impacts on product selection. Suggestion the product choices. Presenting the awareness of customer reactions to retail shelf position by involving the customer to be a central moderator of the shelf position. Analysis of the interactive effect of shelf position and customer's personal intention to make impulse purchases.	Suggestions to marketers on investment on "First Moment of Truth" opportunity, interactions with target markets, specific implications on retail atmospherics, product displays, embodied cognition, effective in-store management.

1	2	3	4	5
Mowrey, Parikh, Gue	2019	Modelling a customer travel through an aisle at the store with racks of products arranged on either side, considering such components as exposure, intensity, space aspect ratio.	Providing a series of visual-spatial statistics of visual measures (exposition and intensity) and spatial measures (space and aspect ratio) that can be used to calculate the impact of a retail arrangement on a customers' visual experience. The analytical and algorithmic approaches of the analysis of customers' travel dynamics considering a static rack layout.	Recommendations to retailers on the relation between store layouts and customers attention to the products; on focusing on minimizing travel time or material handling costs in addition to maximizing sales goals.
Kpossa and Lick	2020	The exploration of the ways of most effectively visual presentation of pastries in retailing, such as the influence of the colour of the surface, flavour expectations and perceptions.	The analysis of the visual merchandising of the pastries, the influence of the color of the surface (black vs. white), customers' expectations (sensory and hedonic), tasting possibilities, perceptions of flavour on purchase intentions.	Recommendations to retail bakeries, pastry shops, catering firms, restaurants about serving pastries based on their sensory attributes (colour, crunchiness, greasiness, sweetness, and creaminess).
Jakhar and Verma	2020	Creating a fuzzy evaluation model which prioritizes the relative weights of visual merchandising components of an online fashion apparel store.	Identification of the measurements of online digital merchandising. Prioritization and evaluation of the aspects of online visual merchandising. Sensitivity analysis to ensure the accuracy of the prioritized dimensions.	Guidance for retailers and web designers in identifying and reflecting on certain measurements that are perceived more appropriate for making purchasing decisions.

Source: own elaboration.

5. Future research

The current research highlights several insights that investigate some retailer branding and fast-moving product considerations. However, much work still needs to be done.

Future research could expand this study using other variables which were not examined so far, such as promotions displays, creating special segments on a shelf for regional products offered at one store and not at all stores of a retail chain, selling products directly from the pallets without placing them on shelves, etc. Therefore such retail requirements and customers' expectations need to be transformed into a new shelf space allocation model.

Furthermore, this model can be applied in real retail stores, however nowadays many retailers are transferring their business to omnichannel distribution. Therefore, they could achieve higher competitiveness values by also selling their products online.

Optimization techniques are widely used to solve such kinds of allocation problems. There are numerous opportunities to create complex iterative heuristics

and metaheuristics to solve the proposed model, such as tabu search, simulated annealing, and genetic algorithms.

Moreover, in particular, if the problem is investigated using the parameters obtained through history or different retail estimation methods, as this allows getting more realistic solutions to practical requirements. Yet generally, such parameters are very difficult to estimate, therefore a method that can be applied in the estimation of product demand could be based on artificial neural networks. This provides a new research direction of integrating artificial intelligence and machine learning into the tasks of forecasting the demand or revenue.

References

- Abratt, R., and Goodey, S. D. (1990). Unplanned buying and in-store stimuli in supermarkets. *Managerial and Decision Economics*, 11(2), 111-121.
- Ailawadi, K. L., and Keller, K. L. (2004). Understanding retail branding: Conceptual insights and research priorities. *Journal of Retailing*, 80(4), 331-342.
- Ali Soomro, Dr. Y., Abbas Kaimkhani, S., and Iqbal, J. (2017). Effect of visual merchandising elements of retail stores on consumer attention. *Journal of Business Strategies*, 11(1), 21-40.
- Anic, I.-D., Radas, S., and Lim, L. K. S. (2010). Relative effects of store traffic and customer traffic flow on shopper spending. *The International Review of Retail, Distribution and Consumer Research*, 20(2), 237-250.
- Anselmsson, J., and Johansson, U. (2009). Third generation of retailer brands – Retailer expectations and consumer response. *British Food Journal*, 111(7), 717-34.
- Armata, K. (1996). Signs that sell. *Progressive Grocer*, 75(10).
- Baker, J., Parasuraman, A., Grewal, D., and Voss, G. B. (2002). The influence of multiple store environment cues on perceived merchandise value and patronage intentions. *Journal of Marketing*, 66(2), 120-141.
- Batty, M. (2003). Agent-based pedestrian modelling (Working paper. CASA Working Papers No. 61). London, UK: Centre for Advanced Spatial Analysis (UCL).
- Behera, M. P., and Mishra, V. (2017). Impact of store location and layout on consumer purchase behavior in organized retail. *Anvesha*, 10(1), 10-21.
- Bhattacharjee, C. (2013). *Visual merchandising*. Phagwara: Lovely Professional University. Retrieved from http://ebooks.lpude.in/management/mba/term_4/DMGT552_VISUAL_MERCHANDISING.pdf
- Bitner, M. J. (1992). Servicescapes: The impact of physical surroundings on customers and employees. *Journal of Marketing*, 56(2), 57-71.
- Blattberg, R. C., Briesch, R., Peacock, P., and Fox, E. J. (2010). How promotions work. In *Perspectives on promotion and database marketing: The collected works of Robert C Blattberg* (pp. 170-180).
- Borges, A. (2003). Toward a new supermarket layout: From industrial categories to one stop shopping organization through a data mining approach (Proceedings of the 2003 Society for Marketing Advances Annual Symposium on Retail Patronage and Strategy, November 4-5). Montreal.
- Botsali, A. R. (2016). *Retail facility design considering product exposure* (Ph.D. dissertation). Wright State University.
- Burke, R. R. (2006). The third wave of marketing intelligence. In *Retailing in the 21st century: Current and future trends* (pp. 113-125). Berlin–Heidelberg: Springer.

- Campo, K., Gijsbrechts, E., Goossens, T., and Verhetsel, A. (2000). The impact of location factors on the attractiveness and optimal space shares of product categories. *International Journal of Research in Marketing*, 17(4), 255-279.
- Caruso, W., Corsi, A. M., Bogomolova, S., Cohen, J., Sharp, A., Lockshin, L., and Tan, P. J. (2018). The real estate value of supermarket endcaps: Why location in-store matters. *Journal of Advertising Research*, 58(2), 177-188.
- Choubey, N. (2017). Floor layout optimization using genetic algorithm. *International Journal of Current Research*, 9(07), 53529-53533.
- Cil, I. (2012). Consumption universes based supermarket layout through association rule mining and multidimensional scaling. *Expert Systems with Applications*, 39(10), 8611-8625.
- Davies, J., and Tilley, N. (2004). Interior design: Using the management services approach in retail premises. *Managing Services*, 48(7), 10-13.
- Desrochers, D., and Nelson, P. (2006). Adding consumer behavior insights to category management: Improving item placement decisions. *Journal of Retailing*, 82(4), 357-365.
- Düsterhöft, T., Hübner, A., and Schaal, K. (2020). A practical approach to the shelf-space allocation and replenishment problem with heterogeneously sized shelves. *European Journal of Operational Research*, 282(1), 252-266.
- Ebster, C., and Garaus, M. (2011). *Store design and visual merchandising: Creating store space that encourages buying* (1st edition). New York, NY: Business Expert Press.
- Elbers, T. (2016). *The effects of in-store layout-and shelf designs on consumer behavior*. Retrieved from <http://edepot.wur.nl/369091>
- Fernandez, B. S., and Soriano, P. L. (2012). *Determination of factors affecting shelf space layout and allocation of bread & bakery products and its effects in consumer buying decisions in selected small standalone grocery stores in Laguna, Philippines* (Research report). Mapúa Institute of Technology.
- Flamand, T., Ghoniem, A., and Maddah, B. (2016). Promoting impulse buying by allocating retail shelf space to grouped product categories. *Journal of the Operational Research Society*, 67(7), 953-969.
- Gabrielli, V., and Cavazza, N. (2014). The influence of in-store product holders on orientation towards the product and on purchase intention. *The International Review of Retail, Distribution and Consumer Research*, 24(3), 311-327.
- Gertin, T. (2012). *Maximizing the cost of shortest paths between facilities through optimal product category locations*. Diss.
- Ghoniem, A., Flamand, T., and Haouari, M. (2016). Optimization-based very large-scale neighborhood search for generalized assignment problems with location/allocation considerations. *Informs Journal on Computing*, 28(3), 575-588.
- Gijsbrechts, E., Campo, K., and Goossens, T. (2003). The impact of store flyers on store traffic and store sales: A geo-marketing approach. *Journal of Retailing*, 79(1), 1-16.
- Gu, Z. J., and Liu, Y. (2013). Consumer fit search, retailer shelf layout, and channel interaction. *Marketing Science*, 32(4), 652-668.
- Hansen, J. M., Raut, S., and Swami, S. (2010). Retail shelf allocation: A comparative analysis of heuristic and meta-heuristic approaches. *Journal of Retailing*, 86(1), 94-105.
- Hart, C., and Rafiq, M. (2006). The dimensions of assortment: A proposed hierarchy of assortment decision making. *International Review of Retail, Distribution and Consumer Research*, 16(3), 333-351.
- Hoch, S. J. (1996). How should national brands think about private labels? *Sloan Management Review*, 38(Winter), 89-102.
- Hooi, L. (2013). *Managing out-of-stock and over-stock occurrences in supermarket stores: A case study in Singapore*. RMIT University.
- Hu, H., and Jasper, C. R. (2007). A qualitative study of mall shopping behaviors of mature consumers. *Journal of Shopping Center Research*, 14(1), 17-38.

- Huang, H., Yao, L., Chang, J. S., Tsai, C. Y., and Kuo, R. J. (2019). Using product network analysis to optimize product-to-shelf assignment problems. *Applied Sciences (Switzerland)*, 9(8). Retrieved from <https://doi.org/10.3390/app9081581>
- Hubrechts, L., and Kokturk, B. (2012). Effects of visual merchandising on young consumers' impulse buying behaviour. *Journal of Consumer Research*, 5(2), 23-34.
- Hui, S. K., Bradlow, E., and Fader, P. (2011). An integrated model of grocery store shopping path and purchase behavior. *SSRN Electronic Journal*. Retrieved from <https://doi.org/10.2139/ssrn.960960>
- Ilfeld, J. S., and Winer, R. S. (2002). Generating website traffic. *Journal of Advertising Research*, 42(5), 49-61.
- Jakhar, R., and Verma, D. (2020). Prioritization of dimensions of visual merchandising for apparel retailers using FAHP. *An International Journal*, 27(10), 2759-2784.
- Kim, G., and Moon, I. (2021). Integrated planning for product selection, shelf-space allocation, and replenishment decision with elasticity and positioning effects. *Journal of Retailing and Consumer Services*, 58, 102274.
- Koul, S., and Jasrotia, S. S. (2019). Product adoption by small retailers in India. *International Journal of Retail & Distribution Management*, 47(11), 1163-1180.
- Kpossa, M. R., and Lick, E. (2020). Visual merchandising of pastries in foodscapes: The influence of plate colours on consumers' flavour expectations and perceptions. *Journal of Retailing and Consumer Services*, 52, 101684.
- Kucuk, S. U. (2011). Push-based brand awareness: The role of product availability and in-store merchandising. *International Review of Retail, Distribution and Consumer Research*, 21(3), 201-213.
- Larson, J. S., Bradlow, E. T., and Fader, P. S. (2005). An exploratory look at supermarket shopping paths. *International Journal of Research in Marketing*, 22(4), 395-414.
- Mowrey, C. H., Parikh, P. J., and Gue, K. R. (2019). The impact of rack layout on visual experience in a retail store. *INFOR*, 57(1), 75-98.
- Nominees for visual merchandising. (2020). *Gifts & Decorative Accessories*, 121(6), 44.
- Ozcan, T., and Esnaf, S. (2013). A discrete constrained optimization using genetic algorithms for a bookstore layout. *International Journal of Computational Intelligence Systems*, 6(2), 261-278.
- Pan, Y., and Zinkhan, G. M. (2006). Determinants of retail patronage: A meta-analytical perspective. *Journal of Retailing*, 82(3), 229-243.
- Passini, R., Rainville, C., Marchand, N., and Joannette, Y. (1998). Wayfinding and dementia: Some research findings and a new look at design. *Journal of Architectural and Planning Research*, 15(2), 133-151.
- Randhawa, K., and Saluja, R. (2017). Does visual merchandising have an effect on consumer impulse buying behavior? *Journal of General Management Research*, 4(2), 58-71.
- Richards, T. J., Hamilton, S. F., and Yonezawa, K. (2018). Retail market power in a shopping basket model of supermarket competition. *Journal of Retailing*, 94(3), 328-342.
- Russell, G. J., and Kamakura, W. A. (1997). Modeling multiple category brand preference with household basket data. *Journal of Retailing*, 73(4), 439-461.
- Schmitt, B. H., and Simonson, A. (1997). *Marketing aesthetics*. New York: The Free Press.
- Simonson, I. (1999). The effect of product assortment on buyer preferences. *Journal of Retailing*, 75(3), 347-370.
- Taskiran, Z. (2012). *The elements of visual merchandising*. Retrieved from http://www.as8.it/edu/writing/GD494_taskiran.pdf
- Underhill, P. (1999). *Why we buy: The science of shopping*. New York: Simon & Schuster.
- Valenzuela, A., and Raghurib, P. (2009). Center of orientation: Effect of vertical and horizontal shelf space product position. *ACR North American Advances*, 36, 100-103.
- Valenzuela, A., Raghurib, P., and Martins, C. (2013). Shelf space schemas: Myth or reality? *Journal of Business Research*, 66, 881-888.

- Van Nierop, E., Fok, E. D., and Franses, P. H. (2008). Interaction between shelf layout and marketing effectiveness and its impact on optimizing shelf arrangements. *Marketing Science*, 27(6), 1065-1082.
- Varley, R. (2001). *Retail product management: Buying and merchandising*. Retrieved from <https://epdf.pub/retail-product-management-buying-and-merchandising.html>
- Visual merchandising guidelines*. (2013). Retrieved from https://www.anythinklibraries.org/sites/default/files/imce_uploads/anythink_merchandising_guidelines_final_100113.pdf
- Walters, R. G. (1991). Assessing the impact of retail price promotions on product substitution, complementary purchase, and interstore sales displacement. *Journal of Marketing*, 55, 17-28.
- Weber, F. D., and Schütte, R. (2019). State-of-the-art and adoption of artificial intelligence in retailing. *Digital Policy, Regulation and Governance*, 21(3), 264-279.
- Wongkitrungrueng, A., Valenzuela, A., and Sen, S. (2018). The cake looks yummy on the shelf up there: The interactive effect of retail shelf position and consumers' personal sense of power on indulgent choice. *Journal of Retailing*, 94(3), 280-295.
- Wright, B. L. (2013). The elements of visual merchandising. *20/20*, 40(13), 105-108.