Food purchasing behaviour at automatic vending machines: the role of planograms and shopping time

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Received 10 February 2020
Revised 6 July 2020
27 October 2020
Accepted 19 November 2020

Abstract

Purpose – The purpose of this paper is to investigate the food and beverage automatic retail environment by analysing the impact of planograms, conceived as a visual merchandising practice and shopping time – the time spent making a purchase – as part of food consumer purchasing behaviour to further enrich the debate on the ability of companies to absorb customer knowledge.

Design/methodology/approach – A real-world experiment was conducted using a sample of 27,230 valid observations of consumer purchasing decision-making processes at automatic vending machines (AVMs). Data were collected by a shopper behaviour analytics system that allows for a better understanding of the AVM users' behaviour. Two sets of regressions were run to test the two hypotheses.

Findings – The experimental results demonstrated that planograms – the planned, systematic organisation of products in an AVM – positively impact food purchases. A planogram acts as a mediator in the relationship between shopping time and purchase, resulting in shorter shopping times and more purchases.

Originality/value – This work adds to the customer knowledge literature by focussing on customer behaviour in the food and beverage automated shopping environment. The shopper analytics technology adopted to collect real-time data leads to a better understanding of the purchasing behaviour of AVMs' users and provides new marketing and retail insights into AVMs' performance that retailers can use to improve their marketing strategies.

Keywords Customer knowledge, Vending machine, Purchasing behaviour, Planogram, Shopping time, Visual merchandising

Paper type Research paper

1. Introduction

Over the past few decades, understanding consumer purchasing behaviour and decision-making processes has become crucial both for researchers and retailers who are searching for innovative and stimulating ways to present products in order to increase shopping activity (Bäckström and Johansson, 2006; Grewal *et al.*, 2017). Retailers must therefore pay attention to technology-driven

British Food Journal
Vol. 123 No. 5, 2021
pp. 1821-1836
Emerald Publishing Limited
0007-070X
DOI 10.1108/BFJ-02-2020-0107

innovations (Inman and Nikolova, 2017; Bradlow *et al.*, 2017) and the new sources of data-driven marketing knowledge that are coming from increased diffusion of big data and real-time consumer information (Kawaguchi *et al.*, 2019). There is also increased consolidation of new shopping habits; consumers are more confident than ever about purchasing products in automated human–machine environments (Wenshan *et al.*, 2015). These new shopping trends combined with the consolidation of non-store retail channels, such as automatic vending machines (AVMs), present researchers and practitioners with new challenges in acquiring customer knowledge. In knowledge management, the analysis of customer behaviour leads to the proliferation of a heated and still lively debate (Wilhelm *et al.*, 2013; Gaviria-Marin *et al.*, 2018; Del Vecchio *et al.*, 2020); in light of current consumption trends, this strand of studies should deepen the interconnections between customer behaviour and the AVMs context.

AVMs may offer several products, including food, beverages, drugs, newspapers, cigarettes and other sundries. In this study, we consider the food and beverage categories, which are the most widespread in terms of market share [1]. However, despite the growing penetration of AVMs as a food retail channel, there is a lack of studies addressing purchasing behaviour (Lee, 2003). AVMs retailers therefore have almost no knowledge about what affects the purchasing decision-making process. With this in mind, this paper attempts to contribute to consumer behaviour research by looking at new aspects of customer knowledge in order to shed light on what factors impact the AVM food purchasing decision-making process. More precisely, the aim is to establish whether – and to what extent – planograms, that is a visual merchandising practice and shopping time, defined as the time spent making a purchase, affect food purchasing behaviour at an AVM. While there have been numerous research contributions that demonstrate the importance of factors such as visual merchandising (Bhalla and Anuraag, 2010; Levy and Weitz, 2012) and time spent in retail environments (Underhill, 1999; Spence *et al.*, 2014; Toldos *et al.*, 2019; Chen and Chi, 2017), there has been little discussion about these factors in the context of AVMs. Therefore, with a method consistent with the consolidated consumer decision-making process framework described by Blackwell *et al.* (2006), we conducted two real-world tests to shed light on (1) the effects of planograms, defined as the planned and systematic organisation of stock, on food purchases and (2) the relationship between a planogram and the time spent in front of an AVM. Data were collected and analysed through a new shopping behaviour analytics system (Allegrino *et al.*, 2019) that provides relevant insights into consumers' AVMs purchasing behaviour. This work provides both theoretical and practical insights. From a theoretical perspective, the paper contributes to shed light on the context of AVMs, which has never been studied from a purchasing behaviour perspective. In particular, with the aim of acquiring more in-depth knowledge of food purchasing behaviour, we analysed the role of visual merchandising and the time-spent metric. From a practical point of view, this study contributes by establishing the basis for a data-driven marketing culture that food and beverage retailers can adopt to develop new AVM strategies. The rest of the paper is structured as follows: Section 2 presents a review of relevant literature and hypothesis development, Section 3 describes the research design and methodology, Section 4 outlines the main results, and the implications, limitations and conclusions are presented in Sections 5, 6 and 7, respectively.

2. Literature review

2.1 Customer knowledge

The field of knowledge management (Armistead, 1999; Del Giudice and Maggioni, 2014; Del Giudice and Della Peruta, 2016; Giampaoli *et al.*, 2017; Papa *et al.*, 2018) emphasises the importance of intangible assets. Understanding shopping behaviour has become crucial, especially because of its direct impact on the overall performance of a business (Lancaster *et al.*, 2002; Monsuwé *et al.*, 2004; Kotler and Keller, 2012), and customer capital is embedded in the

knowledge (often implicit) of marketing channels and clients' relations (Chang and Tseng, 2005). Knowledge management solutions and approaches are part of the intangible and intellectual capital market (Nguyen *et al.*, 2015) and it is important to understand the structure of a customer base (and therefore customer capital) by identifying the most profitable customers in order to develop and consolidate relationships with them (Santoro *et al.*, 2017). Using a four-tier knowledge classification (customer knowledge, individual knowledge, collective knowledge and machine-readable forms), some scholars have sought to analyse the intersections between the components of knowledge and the process of obtaining customer capital (Cegarra-Navarro and Sánchez-Polo, 2008). From a cognitive viewpoint, new paths for innovation processes (Scuotto *et al.*, 2017; Vrontis *et al.*, 2016; Wu *et al.*, 2008; Usai *et al.*, 2018b) based on strategic knowledge management practices (Archer-Brown and Kietzmann, 2018; Cabrilo and Dahms, 2018; Ferreira *et al.*, 2018) require the capability to acquire the necessary information/knowledge from customer interactions (Santoro *et al.*, 2020). Firms are now more able to capture such knowledge thanks to new technologies (Taherparvar *et al.*, 2014; Del Giudice, 2016; Usai *et al.*, 2018a).

2.2 Consumer behaviour and the purchasing decision-making process

Consumer behaviour theory involves several research fields, including marketing, psychology, economics, engineering, computer science and artificial intelligence (Zhang and Zhang, 2007; Allegrino *et al.*, 2019). According to Schiffman and Kanuk (2000), consumer behaviour concerns how consumers make decisions about products based on their available resources, such as money, time and effort, while Blackwell *et al.* (2006) defines consumer behaviour as those activities involved in obtaining, consuming and disposing of products and services, which includes the consumer decision-making process. The customer's purchasing behaviour could also be incorporated into the environmental management system (EMS) and related knowledge management mechanisms (Biscotti *et al.*, 2018). Thus, achieving a greater understanding of the purchase decision-making process is amongst the main purposes of consumer behaviour theory. One of the most commonly adopted models of the consumer decision-making process was described by Blackwell *et al.* (2006) and based on studies by Peter and Olson (1994) and Engel *et al.* (1995). According to these authors, the five stages of the consumer decision-making process are recognition of needs, information search, pre-purchase evaluation of alternatives, purchase and post–purchase evaluation. While this decision-making process model has been widely adopted in the in-store retailing literature, there are no studies that apply it to the AVM scenario. Park and Mittal (1985) found that the type of process is dependent on the level of the customer's involvement and therefore different types of decision-making processes emerge, of which Assael (1995) identified four: complex decision-making, brand loyalty, limited decision-making and inertia. In order to analyse the context of AVMs, which are characterised by a limited shopping experience, we decided to focus on the limited decision-making process that, according to Engel *et al.* (1995), is characterised by little information searching or evaluation prior to purchase. One example of this kind of purchase is a weekly shop for groceries (Foxall, 1993; Beharrell and Denison, 1995), in which the consumer wants to simplify the decision-making process by limiting the number and variety of information sources, alternatives and evaluation criteria (Engel *et al.*, 1995). In this context, understanding what factors affect buying behaviours has taken on particular relevance for both researchers and marketers (Kotler *et al.*, 2005; Bäckström and Johansson, 2006; Inman *et al.*, 2009) and there are several factors that should be considered in order to influence buying behaviour. Of these, external factors, such as communication activities – or the marketing mix more generally (Kotler, 1988; Kotler and Armstrong, 2008) – can play an important role in the decision-making process. The external knowledge search can be considered to be a physiological part of knowledge marketing (Cruz-González *et al.*, 2014; Diehr and Wilhelm, 2017). This issue has been studied in the food industry (Bresciani, 2017); Vohra and Soni (2016) examined the impact of food promotional strategies on children's food shopping behaviour, and Silayoi and Speece (2004) analysed the role of packaging in food purchasing

decision-making. In this paper, we focus on two factors – planograms and shopping time – and argue that these affect the AVM food purchasing decision-making process.

2.2.1 Visual merchandising: the planogram. Academics have long considered visual stimulation and communication to be important aspects of the retail store environment (Kotler, 1974; Kerfoot *et al.*, 2003; Chandon *et al.*, 2009; Lea-Greenwood, 1998). According to Bhalla and Anuraag (2010), visual merchandising is the presentation of any kind of product in the best possible way, and it allows retailers to gain consumers' attention through a store display (Levy and Weitz, 2012). Visual merchandising is thus a key aspect to increasing store traffic and sales (Bhalla and Anuraag, 2010). Numerous studies have analysed the positive relationship between visual merchandising techniques and consumers' purchasing behaviour (Morrin and Chebat, 2005; Cant and Hefer, 2013; Thomas *et al.*, 2018; Widyastuti, 2018; Ferraris *et al.*, 2019). Cant and Hefer (2013) examined the influence that visual merchandising has on the shopping experience in a retail store and found that visual merchandising displays guide consumers' decisions, and Thomas *et al.* (2018) noted that the clear organisation of shelving racks helps consumers to find a product and then make a purchase. While retail sectors such as fashion (Jang *et al.*, 2018) and apparel (Law *et al.*, 2012; Cant and Hefer, 2013; Wanniachchi and Kumara, 2016) have been studied, there is a lack of focus on the food industry. According to Stulec *et al.* (2016), food retailers have never paid much attention to visual merchandising practices because they have low margins and therefore must strictly control costs. They are unwilling to allocate resources to visual merchandising; consumers tend to perceive the purchase of food as a task rather than an experience and so retailers have little incentive to invest in visual merchandising (Stulec *et al.*, 2016). We believe that visual merchandising can play a relevant role in the purchasing decision-making process of the food AVM environment specifically because of the absence of a human presence. In the AVM scenario, retailers can initially approach visual merchandising by referring to planograms (Chandon *et al.*, 2009), which represent the systematic organisation of products (Bhalla and Anuraag, 2010). A planogram allows AVMs retailers to present products in a neat and organised manner, which can increase sales through correct placement of product categories. In a limited shopping experience like the AVM one, better organisation of products by product categories should facilitate the purchasing decision-making process, particularly by favouring the information search, the pre-purchase evaluation of alternatives and then the purchase. This is consistent with a study by Orth and Crouch (2014), who stated that, in the presence of utilitarian shopping goals, a lower visual complexity improves the attractiveness of products and then guides consumer behaviour. Based on the literature and considering that store layout factors like planograms have a strong impact on traditional retail (Singh *et al.*, 2014), we aim to determine in this paper whether the adoption of planograms positively affects purchases in the food AVM context. Thus, the first research hypothesis can be summarised by the following statement:

H1. The planned and systematic organisation of products (planogram) positively impacts food purchases.

2.3 Shopping time and visual merchandising

Considering the time consumers spend on shopping (Underhill, 1999; Del Giudice and Della Peruta, 2017) is extremely important for understanding consumer behaviour (Donovan and Rossiter, 1982; Donovan *et al.*, 1994). Previous studies have suggested that in-store shopping time is generally positively related to purchases (Toldos *et al.*, 2019) and retailers therefore want their consumers to spend as much time as possible in their stores to maximise purchasing outcomes. According to Spence *et al.* (2014) consumers who decide to spend more time in a store evaluating products have a higher propensity to buy and Chen and Chi (2017) and Chi and Chen (2020) found that when purchasing apparel consumers tend to spend more

time in certain retail conditions and then more money on shopping. There are several external factors that may impact shopping time and scholars have identified visual merchandising as one of these. Visual merchandising practices may affect the time spent by guiding and simplifying consumers' shopping activity (Cant and Hefer, 2013) or by acting as a "silent salesperson" that provides information to customers (Bhalla and Anuraag, 2010). In the context of consumer food goods, such as those available in AVMs, consumers look for utilitarian and time-saving shopping experiences (Bhalla and Anuraag, 2010; Wenshan *et al.*, 2015) that are characterised by a low level of involvement (Lee, 2003; Fernandes *et al.*, 2016). Thus, while traditional retailers tend to want to extend shopping time, we believe that AVM retailers should understand the potential effects of reducing it and actions that could be taken in this regard. However, despite the important role of time in automatic retail environments (Kawaguchi *et al.*, 2019), there has been little discussion about this topic in relation to purchasing behaviour. In this work, we attempt to demonstrate that streamlining the consumer decision-making process by the adoption of a planogram at an AVM has a mediating effect on the purchasing time. We therefore hypothesise that

H2. When a planogram is in place, the actual shopping time decreases and the number of purchases increases.

Supporting this hypothesis could lead us to conclude that the consumer takes more time to observe the range of products present and then decide what to purchase when a planogram is not in place, which means that the planned and systematic organisation of the products affects the consumer decision-making process (Blackwell *et al.*, 2006). Based on the literature review, a framework for the study was constructed, as shown in Figure 1.

3. Methodology

This work aims to enrich the literature concerning customer behaviour in a real-world food and beverage automated shopping environment. The model used is based on the one suggested by Blackwell *et al.* (2006) and further developed by adding other variables: the planogram, defined as the planned and the systematic organisation of the products in stock; time spent, understood as the time taken by consumers to purchase at an AVM and "number of purchases". A careful review of the literature informed our decision to classify each relevant construct as either a latent exogenous or endogenous variable. The main variable of interest is the planogram – a dummy variable with the value 1 when the goods within the AVM are displayed according to a planned layout, essentially a product category. This allowed us to develop a multi-group analysis method. L_time – the natural logarithm of the time spent at the AVM – was defined as an exogenous variable and correlated with sell-out. Purchases were considered an exogenous variable, defined as the number of food products bought by customers. As control variables, we used "age", which measures the age range for each customer; "gender", a dichotomous variable which takes the value 1 for women and 0 for men; "time of day", which measures the moment of the day at which the purchase occurs, expressed in hours and minutes; and "day of the week", a variable indicating the day of the week that the consumer makes the purchase. To analyse the time spent at the AVM, we

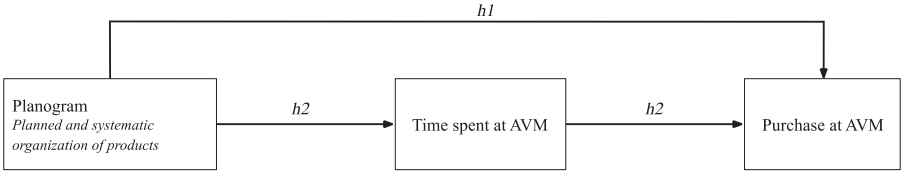

Figure 1.
Proposed conceptual model

applied the customer decision-making process described by Blackwell *et al.* (2006) to the context of an AVM. The coding of this script identified three stages of the decision-making process in the AVM environment (Table 1). We assumed that the needs recognition stage is represented by the moment at which the consumer stops in front of the AVM – the phase in which face detection occurs. The information search and the pre-purchase alternative evaluation stages can be compared with the phase in which the consumer interacts with the AVM. Finally, we equated the purchase at the AVM with the purchase stage. The interactions and purchases were analysed during data integration, which is discussed in Section 3.1. Based on this framework, three different interaction scenarios can occur:

(1) No interaction: when people transit around the AVM area, they are only detected during the people detection step and therefore neither stop in front of the AVM nor buy from it.

(2) Negative interaction: when the person stops in front of the AVM, face detection and gender and age identification occur but there is no purchase.

(3) Positive interaction: when the person stops in front of the AVM, face detection and gender and age identification occur and a purchase is made.

3.1 Sample and data collection

This research is based on a real-world experiment conducted to test the conceptual framework. The final sample is composed of 27,230 valid observations of the consumer decision-making process. We analysed the interactions between individuals and the AVM; in this work, we consider customers to be those who interacted with the AVM. We collected and analysed data from an AVM placed in a public location in Italy, the passage of customers at the AVM was recorded during the months of May and June 2019. Data were collected by a system based on an RGB-D [2] camera that was mounted above the AVM keypad and connected to a dedicated elaboration unit (Paolanti *et al.*, 2018). Data from different sources, such as the camera and the actual AVM, are collected by the elaboration unit and subsequently integrated. This system allows for a better understanding of the AVM users' behaviour by detecting people in the AVM area and the ways that they interact with the AVM. This technology can be installed on any type of AVM. A variety of machine learning and feature-based approaches could be used effectively (Paolanti *et al.*, 2018), and detection consists of four steps. The first step is "people detection", which quantifies the people passing around the AVM area. The second step is "face detection"; face analysis is relevant for the identification of the actual AVM customers and is therefore based on a frontal face detector that scans the people that actually approach the AVM. A subsequent face processing step is "age and gender classification", which is based on the work of Levi and Hassner (2015). Eight

Table 1.
The automatic vending machine consumer decision-making stages

The consumer decision-making process Peter and Olson (1994), Engel *et al.* (1995), Blackwell *et al.* (2006)	AVM consumer decision-making stages	Interaction types with AVM
	People passing by the AVM area	No interaction
Need recognition	Stage 1. Stop in front of the AVM (Face detection, age and gender classification)	Interaction (negative or positive)
Information search	Stage 2. Interact with AVM (Data integration)	
Pre-purchase alternative evaluation		
Purchase	Stage 3. Purchase at AVM (Data integration)	Positive interaction

different classes were defined for the age range (0–2, 4–6, 8–13, 15–20, 25–32, 38–43, 48–53 and 60+) and two for gender (male and female). The final step is "data integration", which creates a comprehensive view of the customer, with age and gender estimates, behaviours and interactions with the AVM's keypad or display. This innovative detection method allows more efficient and effective compliance with the requirements of naturalistic observation, which is characterised by a low level of constriction; an observer must be non-intrusive and not alter the subject being observed in any way.

4. Main results

We first present some descriptive evidence regarding the distribution of our dependent variables and their relationship to the independent variables. Regarding gender, men and women bought approximately the same number of items at the AVM – 50.45% of items were purchased by men and 49.55% by women. Most purchases happened between 7 a.m. and 7 p.m., with a peak at around 1 p.m., when almost 10% of the items were bought. The table below summarises the statistics related to the variables in this study (See Table 2).

This study examined 27,230 records of potential customers who approached the AVM and spent at least enough time to decide whether they wanted to buy. On average, 0.121 items were bought each time a person approached the AVM, reflecting the very high number of people who approached the AVM without buying an item. The items available were organised according to a planogram about 10% of the time. It took, on average, 23 s for a potential customer to make a decision regarding a purchase and the logarithm of milliseconds spent in front of the AVM was 8,885. Of the people who approached the AVM, 42% were women, with very few instances in which the gender could not be determined by the camera (−1 in the summary statistics table). In the multivariate analyses which follow, we correct this by introducing a dummy variable for missing gender. The next step in the research consisted of an assessment of the hypotheses – that is, an evaluation of the relationships between the constructs shown in Figure 1. Logistic regressions and count data regressions were employed, particularly negative binomial regressions, to accommodate the skewness of the dependent variable, i.e. the large number of zeros as compared to other observations. To test our two hypotheses, two sets of regressions were performed. In the first set, the probability of purchasing from the AVM and the number of goods purchased were regressed against the presence of the planogram and a set of control variables, as described in the section above. In the second set of regressions, the association between the number of products purchased at the AVM and the time spent there was analysed, paying particular attention to whether this association differed according to the presence of the planogram. The results show that the planned and systematic organisation of the products (planogram) positively impacted the food purchases (H1). Table 3 reports the results of the logistic regression that estimates the changes in the probability of purchasing at least one item from the AVM based on the presence of the planogram as well as a battery of control variables.

Variable	Obs	Mean	Std. Dev	Min	Max
Purchased	27,230	0.121	0.384	0	5
L_time	27,230	8.885	11.844	5	14
Plano	27,230	0.103	0.303	0	1
Age	27,230	4.353	0.788	3	7
Gender	27,230	0.422	0.585	−1	1
Time of the day	27,230	13.215	38.613	0.010	24
Day of the week	27,230	3	2	1	7

Table 2.
The set of variables

Purchased (0/1)	Coef	Std. err	*z*	*P*>|*z*|
Planogram	1.408	0.052	27.300	0.000
Age	−0.335	0.026	−12.680	0.000
Gender	−0.190	0.041	−4.600	0.000
Time of the day	0.022	0.005	4.200	0.000
Day of the week				
2	0.072	0.070	1.030	0.301
3	0.115	0.069	1.660	0.096
4	−0.137	0.073	−1.880	0.060
5	0.039	0.071	0.550	0.581
6	−0.110	0.090	−1.230	0.220
7	−0.005	0.095	−0.050	0.958
Constant	−1.081	0.149	−7.240	0.000
LR χ^2 (11)				953.29
Prob > χ^2				0

Table 3.
Probability to purchase from the AVM

The coefficient of the planogram variable is positive and statistically significant, indicating that the presence of the planogram increases the probability of buying at least one item from the AVM. Younger customers were less likely to buy and women were less likely to buy than men. As seen in the descriptive statistics above, most purchases occurred later in the day, which is reflected in the coefficient of the time of the day, which is positive and significant. The probability of making a purchase was highest on Tuesdays and lowest on Wednesdays. Table 4 shows the results of the negative binomial regression estimating the changes in the number of items purchased from the AVM based on the presence of the planogram and a battery of control variables.

The coefficient associated with the presence of the planogram is positive and significant, indicating that a larger number of items were bought at the AVM when the items were presented according to a planogram. Coupled with the results above, they suggest that the planogram was associated both with a larger number of items being purchased and with a higher probability of an item being purchased at all. The sign and significance of the other variables are similar to those of the logistic regression: younger customers and women bought fewer items, more purchases occurred later in the day, with the coefficient of the time

Purchased	Coef	St. err	*Z*	*P* > |*z*|
Planogram	1.129	0.047	24.210	0.000
Age	−0.278	0.024	−11.600	0.000
Gender	−0.152	0.038	−3.990	0.000
Time of the day	0.022	0.005	4.600	0.000
Day of the week				
2	0.096	0.064	1.510	0.132
3	0.135	0.063	2.140	0.032
4	−0.139	0.067	−2.060	0.039
5	0.001	0.065	0.020	0.988
6	−0.099	0.082	−1.200	0.229
7	−0.039	0.087	−0.450	0.651
Constant	−1.280	0.137	−9.370	0.000
LR χ^2				1072.360
Prob > χ^2				0

Table 4.
Number of items purchased from the AVM

of day being positive and significant, and more purchases occurred on Tuesdays and fewer on Wednesdays than on the other days of the week. To test whether H2 is supported, we analysed whether the shopping time was negatively correlated with the number of items purchased and whether the planogram had a mediating effect on this relationship. Two sets of regressions were performed – one for the sample of transactions at the AVM when no planogram was in place and one for the sample when one was. The coefficients related to the duration of the transactions were then compared to determine whether they were statistically different. Table 5 presents the results of negative binomial regressions of the number of purchases. The main independent variable is the shopping time.

The first striking result is that the coefficient of the duration of the shopping time (L_time) is statistically larger for the sample without the planogram than for the sample with the planogram (Prob > χ^2 = 0.00). Knowing that the average number of goods bought with the planogram was larger than without it, this result suggests that the planogram leads to faster decisions regarding purchases. Customers decided more quickly which goods to buy when the planogram was in place and spent more time in front of the AVM deciding when it was not. For the control variables, the results resemble those found for the previous sets of regressions: younger customers bought fewer goods, and, although gender had no statistically significant effect on the number of goods bought without the planogram, it was statistically significant when the planogram in place – negatively and positively, respectively (that is, men bought more goods when the planogram is in place). As seen in the descriptive statistics above, more goods were bought later in the day and the coefficient of the time of day was positive and statistically significant.

5. Theoretical and managerial implications

This article enriches the debate on customer behaviour analysis that is developing within the knowledge management research stream (Wilhelm *et al.*, 2013; Gaviria-Marin *et al.*, 2018; Del Vecchio *et al.*, 2020). The work highlights the relevance of an approach focussed on the acquisition of knowledge about customers, especially in a constantly evolving technology-driven context such as retail (Grewal *et al.*, 2017). This paper offers two theoretical implications: the first is consistent with the traditional retail literature and concerns the positive impact that visual merchandising has on purchasing behaviour. This is connected to the second theoretical contribution that contrasts with the retail literature: in the specific context of AVMs, shopping time is negatively correlated with purchases in the presence of a better visual organisation of products in stock. This work is intended to lay the foundation for a more customer knowledge-oriented approach to AVM management, which today is characterised by an absence of planning and focusses mainly on filling AVMs with products for sale. In our analysis, advanced big data analytics techniques generating real-time data about customers were introduced in the AVM context. We believe that in the next future the adoption of shopper behaviour analytics systems will be able to provide food AVMs retailer with a deep customer knowledge, allowing them to undertake targeted communication and promotion actions, which can affect both individual product categories and vending machines as a whole. Moreover, this analytical approach will allow AVMs retailers to lead real-world tests aimed to determine the effectiveness of their initiatives even before making actual large-scale investments. The results of our work also offer initial advice in regards to category management; as a matter of fact, visual merchandising practices are effective if oriented to simplify the decision-making processes and reduce purchase times. In practice, we found that a better display of products which, instead of being presented without a clear logic at the AVM, are organised by product categories, allow customers both a more rapid identification of the desired product and a more rapid evaluation of alternatives.

Table 5.
Results of hypotheses testing

	Without planogram				With planogram			
	Coef	Std. err	*Z*	*P*>|*z*|	Coef	Std. err	*z*	*P*>|*z*|
L_time	0.560	0.022	25.620	0.000	0.378	0.034	11.250	0.000
Age	−0.209	0.033	−6.350	0.000	−0.224	0.033	−6.760	0.000
Gender	0.008	0.046	0.180	0.856	−0.200	0.072	−2.770	0.006
Time of the day	0.025	0.006	4.180	0.000	0.029	0.008	3.750	0.000
Day of the week								
Tuesday	0.121	0.077	1.570	0.117	0.094	0.115	0.820	0.415
Wednesday	0.193	0.075	2.570	0.010	−0.066	0.124	−0.530	0.596
Thursday	−0.125	0.080	−1.550	0.120	−0.032	0.126	−0.260	0.797
Friday	0.006	0.079	0.080	0.940	0.076	0.118	0.640	0.520
Saturday	−0.123	0.104	−1.180	0.237	−0.022	0.132	−0.170	0.866
Sunday	−0.164	0.124	−1.320	0.186	0.180	0.121	1.490	0.138
Constant	−6.939	0.282	−24.650	0.000	−4.383	0.398	−11.020	0.000
No. obs.				24,437				2,793

6. Research limitations and future directions

The study has some limitations; since it is a first series of tests on this topic, the results do not allow us to introduce a new theory. Data were collected from an AVM placed in a public location and for a limited period of time. Therefore, to enrich knowledge on food purchasing behaviour in the context of AVMs, further studies are needed. Subsequent research will address the validation of the presented construct through a longitudinal analysis in which more AVMs in different locations will be involved. New experiments will be launched in parallel with the aim of introducing additional elements of analysis such as the impact of communication and promotion activities on AVMs, the role of product packaging and the different configurations of product assortment. We believe that this approach could increase the robustness of the current results.

7. Conclusions

This study explores the food and beverage automatic retail environment and analyses the role that planograms, conceived as a visual merchandising practice and shopping time have in food purchasing behaviour. The two hypotheses have been supported by the results of the presented experiments. The presence of a planogram, defined as the planned and systematic organisation of products in stock, has a positive impact on food purchases at AVMs, and also has a mediating effect on the relationship between time and purchasing, that is, when a planogram is in place, there is a negative correlation between time and purchasing. With this in mind, it appears that the planogram acts as a facilitator in the purchasing decision-making process (Cant and Hefer, 2013), helping consumers to find products in an AVM more easily (Kahn, 2017) and complete their purchases more rapidly. Our findings, shown above, are consistent with the existing literature. Considering the first experiment, we demonstrated the role that planograms play in the context of AVMs, in which retailers have limited space for marketing efforts. Since a planogram can be considered a visual merchandising tactic, AVM retailers can leverage it to increase the number of purchases (Singh *et al.*, 2014). We found confirmation of what Grewal *et al.* (2017) stated: visual merchandising is a key area that should be included in retail strategies. The results of the second analysis are also consistent; we found that consumers prefer a quicker purchasing process and so if they are supported by AVM retailers at a visual merchandising level, they make more purchases more quickly. Purchasing decision-making processes at AVMs seem more like a mere task (Stulec *et al.*, 2016) than a sophisticated shopping experience, such as this might occur in a more articulated retail scenario. Finally, with this study, we hope to advance the scientific debate about the AVM retail format. CB Insights (2018) considers AVMs to be an emerging channel for physical retailers who, needing to identify new options that can integrate with online channels, are considering AVMs as a possibility for omnichannel shopping experiences (Pondel and Korczak, 2017). However, this option can only be implemented if AVMs are equipped with a real-time analytics system capable of generating better data (Bradlow *et al.*, 2017).

Notes

1. According to the *2017 State of the Industry Report – Vending and Micro Markets*, the food and beverages product categories' share of sales was 97% in 2016.
2. Red Green Blue Depth

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