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"Going to vending machines is an archetypal situation, as camera café": an analysis of consumers' behaviour, food choice and nutritional interventions

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Introduction

Globally, about 2 billion adults are obese or overweight (WHO, 2024). Excessive body weight is a critical risk factor for different pathologies, such as cardiovascular disease, diabetes, and some types of cancer, accounting for more than 3 million deaths every year (NCD, 2016; Smith & Smith, 2016). Regarding eating habits, various environmental and socioeconomic factors have been identified as contributing to the obesity epidemic by shifting eating patterns toward unhealthy behavior.

Due to various socioeconomic factors such as social status, rapid income growth, and urbanization, the proportion of income spent on food prepared and consumed outside the home has been consistently increasing across the globe (Lachat et al., 2012; Blick et al., 2018; Patel et al., 2018). In contrast to the previous century, when food consumption was largely a home-based, family-centered activity, modern lifestyles have shifted food consumption patterns. Consumers are now spending more time at workplaces and on the move, leading to a growing reliance on convenient retail formats such as fast-food outlets, restaurants, and vending machines (VMs) (Vehmas et al.2019).

Vending machines (VMs), in this context, can be seen as one of the environmental elements increasing the availability of nutrient-poor and energy-dense food products, with healthy options rarely offered or absent (Grech & Allman-Farinelli, 2015; Matthews & Horacek, 2015). To control population obesity and promote consumer well-being, governments worldwide have initiated public campaigns to educate consumers on selecting healthier food products. An example of these initiatives is the traffic light system, which the UK voluntarily adopted in 2012 (Lobstein & Davies, 2009). Additionally, various popular nutrition interventions, like the 1–3 star and Nutri-score labels, are designed to help consumers choose healthier options within a given product category while shopping for groceries (Ittersum et al., 2024; D'hondt & Briers,

2024; Ma & Zhuang, 2021). Moreover, retailers are also adapting to the needs of consumers regarding health-conscious product alternatives for on-the-go (OTG) consumption (Sands et al., 2019).

On-the-go solutions, providing a single mini-meal, are an interesting category for developing personalized services and food products for healthy eating. Among the on-the-go solutions, vending machines are generally considered to offer unhealthy, nutrient-poor, energy-dense packaged food products with a long shelf life, while healthy options are very rare or not available at all.

VMs are widely used as they are available in many locations, such as schools, healthcare facilities, workplaces, and many public spaces (Matthews & Horacek, 2015). It was demonstrated that VMs are the primary and most readily available food source for people working long hours (Escoto et al., 2010), as they are used to buy main meals and snacks to save time. According to previous studies, most snacks and beverages sold in VMs are high in total calories, fat, sugars, and sodium while low in fiber (Byrd-Bredbenner et al., 2012; Raposo et al., 2016). Thus, the most popular, nutrient-poor snacks may negatively impact weight management (Hess et al., 2016). Due to the changing lifestyle of urban populations, the rising demand for drinks, food, and on-the-go snacks is a key factor in the market growth worldwide, and vending machines (VMs) play a strong role in it.

The retail vending machine market size has grown strongly in recent years. It will grow from $44.66 billion in 2023 to $48.72 billion in 2024 at a compound annual growth rate (CAGR) of 9.1%. The growth observed in the historical period can be attributed to factors such as the convenience culture, the demand for 24/7 accessibility, product diversification within vending machines, urbanization, high foot traffic areas, cost-effective retailing, and the appeal of on-the-go consumption (Research and Markets, 2024).

The literature distinguishes foods between vice (less healthy) and virtue (healthier) products. Vice food products are appealing and elicit strong positive affective reactions (Vosgerau et al., 2016). They are usually related to self-rewarding and seeking a positive mood rather than simply wanting to eat tasty foods (Ketron et al., 2021). Meanwhile, virtue food products are often consumed to pursue benefit-related desires such as health (Mishra & Mishra, 2011).

Moreover, choosing products from VMs is significantly different from selecting the same items for generic food consumption. Firstly, vending machines (VMs) offer a distinctive purchasing experience due to their automated, impersonal nature. Unlike traditional retail experiences, the absence of a cashier or human interaction can reduce the perception of judgment (Thorndike et al., 2012; Bucher et al., 2016. Secondly, the purchase is mostly unplanned (Benoit et al., 2019), the time spent on decision-making is minimized (French et al. 1999) and the consumers' involvement is generally low (Jebarajakirthy et al., 2020).

Despite extensive research on food choices and interventions in general retail environments, there is a noticeable gap in the literature regarding consumer behavior in vending machines (Stoyanov, 2021). Furthermore, past studies have not fully considered the potential of implementing new technologies in vending machines. This technological gap opens new opportunities for research on how such interventions could influence decisions in VM settings.

In my thesis, I aim to address these gaps, particularly by expanding the literature on consumers' behaviour in VM setting, vice/virtue food choice and nutritional interventions within the VM context.

Specifically, the thesis is developed as follows:

Chapter 1: To introduce readers to vending machine setting, I explore the evolution of retail, focusing on the evolution of retail format, showing how economic and cultural changes led to rising demand for ready-to-eat food and on-the-go retail settings. Then, I present the vending

setting, showing the novelty of the vending sector, in particular presenting a new vending machine, implemented with the latest technologies and new trends in retail expanding also on the vending sector (i.e sustainability)

Chapter 2: I chose the vice-virtue distinction as a theoretical lens for my thesis, because of its distinction in food marketing. As a result, I examined the research on food choices, specifically vice and virtue products, emphasising earlier studies that looked at the use of vending machines for nutritional interventions. This chapter's specific goal is to identify research gaps in the literature, which pave the way for my thesis' empirical section.

Chapter 3: This is the first empirical chapter. Because the vending environment has not been thoroughly studied in the marketing literature, and because past research has not taken into account how consumers behave in vending machines, I conducted in-depth interviews with consumers to examine their habits, the factors that influence their decisions, and possible implementations. The interviews' insights are examined, with particular attention paid to four pertinent subjects: consumes habits, technologies, communication strategies and sustainability.

Chapter 4: What motivates customers to consume vice and virtue food products in a vending machine (VM) scenario has not been determined by previous study. Therefore, our goal is to investigate how various factors affect the vice/virtue selection of goods in a vending machine (VM) environment. It specifically assesses the variables that affect the choice of virtue (healthier) and vice (less healthy) products in vending machines.

Chapter 5: Food vending machines are frequently examined for contributing to overconsumption and unhealthy lifestyles, thus studies that look into how to improve nutrition interventions would be beneficial. The current study attempts to contribute to this stream. We utilized a between-subjects experimental design to adjust the product type (vice vs virtue) and

message type (prevention vs promotion-focused) to see whether strategy was more effective in raising (decreasing) the desire to buy healthier (unhealthier) products from vending machines.

1.1 From multichannel to omnichannel marketing

The term "retailer" originates from "tailor," meaning one who cuts into pieces, which historically referred to the breaking down of bulk goods in marketing channels. Today, the scope of retailing extends far beyond this function and is more broadly defined as the set of activities involved in selling products and services to end consumers, whether individuals or households. Retailing represents the final stage of the marketing process, serving as the point of contact between consumers and manufacturer products, marketing communications, and customer service (Mulhern, 1997). Retailers provide a range of services that are highly valued by consumers. These services can include facilitating access to information, offering product assortment, ensuring location accessibility, creating a desirable shopping ambience, and guaranteeing timely delivery of products in the preferred form and time frame. These services either offer direct value to the consumer (i.e. ambience) or reduce the cost of acquiring a market basket (i.e. easy accessibility to the store's location) (Betancourt et al. 2016).

Today, the retailing industry is transforming due to many processes driven by digitalization. One of the elements of digitalization refers to the interface between retailers and customers (Hagberg et al. 2016). Customers are increasingly engaging with retailers across multiple channels during the same shopping process (Sit et al., 2017; Rangaswamy & Van Bruggen, 2005; Neslin & Shankar, 2009). Examples of how customers interact with retailers are “showrooming” (i.e. discovering a product in a physical store but finishing the purchase online) and “webrooming” (i.e. discovering online but purchasing offline). These are contemporary examples of different shopper behaviours (Sit et al., 2018; Halibas et al., 2023; Sahu et al., 2021), but examples are also available of the functionalities that retailers have implemented following observed changes in customer behaviour, such as “click & collect” functionality, an

option to purchase online and pick up a product at a physical store (Gallino & Moreno, 2014; Nguyen et al., 2016).

Since online retailing has advantages in accessibility and assortment, while offline retailing has advantages in personal inspection and immediate delivery, retailers can combine the two channels to offer all types of services. Many retailers have done this, giving rise to multichannel retailing. (Rangaswamy & Van Bruggen, 2005; Wakolbinger & Stummer, 2013; Verhoef et al., 2010). The major question arisen was whether the benefits of synergy outweigh the potential costs of one channel cannibalizing the other. It was tested the effect of adding a brick-and-mortar store to a channel consisting of internet and catalogue options. In both cases, it was found that the added store increased sales, with a positive effect on the internet channel, while it was registered a negative effect of sales, through the catalogue channel (Pauwels & Neslin, 2015; Avery et al., 2012). The design, deployment, coordination, and evaluation of different channels through which the marketer acquires, develops, and retains customers is a strategy known multichannel (Neslin et al., 2006).

Three typical channels for making purchases are: (a) traditional or physical (i.e. brick and mortar), (b) web-based computer interaction and (c) mobile devices (Dennis et al. 2015; Mulhern, 1997). Several authors have also acknowledged social retailing via social media sites as a channel too (Levy et al., 2022; Jang et al., 2013; Goersch, 2002). Within each of these channels, multiple possibilities for interaction exist via the different touchpoints between a retailer and a customer (Baxendale et al., 2015; Straker et al., 2015; Larke et al. 2018). Achieving integration of the three channels (physical, online and mobile) and enabling customers to shop in a seamless manner across them has been described as the omni-channel retailing model (Hagberg et al., 2016; Asmare & Zewdie, 2022; Mishra et al., 2020). Management of such channel configuration has been defined as “the synergetic management of the numerous available channels and customer touchpoints, in such a way that the customer

experience across channels and the performance over channels is optimized" (Verhoef et al. 2015).

The reason for a company to have an omnichannel retailing model is to benefit from their existing multiple channels, through product consistency, integrated promotions, data-sharing across channels and the integration of logistic activities (Berman and Thelen, 2004; Kozlenkova et al., 2015). It is also inferred that the integration of channels increases customer satisfaction and loyalty (Frasquet & Miquel, 2017; Simone & Sabbadin, 2017) and that technology can be leveraged for data collection in an omnichannel environment (Grewal et al., 2017; Yang & Hu, 2024; Bèzes, 2018). The particular emphasis is on the opportunities that can arise from the integration of mobile (Perry et al., 2018; Taylor, 2016).

1.2 Technology and AI in retail

The world of retailing is changing rapidly due to changes in technology and consumer behavior. This dynamic retail marketplace is forcing retailers to strategize how to best position themselves to survive and flourish in this environment (Grewal et al., 2021). Even before COVID-19, retailing was changing dramatically spurred by new technologies (Grewal et al., 2017) that affected everything from in-store strategies to back-end operations (e.g., warehouses, supply chains) to communication (e.g., websites, social media platforms) and arrived to the promotion and display of merchandise. However, the speed of this transformation has been accelerated by the pandemic. Today, expanded applications of artificial intelligence (AI), machine learning, virtual reality, big data, and mobile apps have all contributed to front-end offerings that impact the retail interface with customers, as well as back-end technologies that facilitate retail operations (Roggeveen and Sethuraman 2020).

Emerging technologies as the Internet of Things (IoT), virtual reality (VR), augmented reality (AR), and mixed reality (MR) are now spreading and finding their space in the retail universe

(Shankar et al., 2021) and recent technological developments integrating virtual and real-world environments, such as virtual and augmented reality, have "embedded, embodied and extended" customer experiences (Hilken et al., 2018).The IoT is "a system of uniquely identifiable and connected constituents (termed "Internet-connected constituents") capable of virtual representation and virtual accessibility, leading an Internet-like structure for remote locating, sensing, and/or operating the constituents with real-time data/information flows between them" (Ng and Wakenshaw 2017). VR is a technology that offers an immersive experience where everything viewed is artificial. VR simulates the environment, shutting out the real world through a wearable device (typically a headset) to provide an immersive 3D environment (e.g., virtual videogames) (Wohlgenannt et al., 2020). AR creates an add-on and interactive experience of the areal-world environment through computer-generated displays, creating interactive, vivid and rich experiences (Yim, Chu, and Sauer 2017). MR combines AR and VR to produce visual environments in which physical and digital elements interact in real time (Milgram and Kishino 1994). Recently, also innovations in robotics have been registered. Specifically, home robots, store robots, delivery drones and warehouse robots. They have been changing retailing, offering new services and improving customer experiences.

Many of these technologies are powered by artificial intelligence (AI), adding another layer of change to the retail ecosystem (Shankar, 2021). Many retailers are excited about the implementation of artificial intelligence (AI), considering all the positive outcomes expected: (a) increase in-store sales, (b) increase in online sales and an increase in potential cross-sell/up-sell and (c) improvement of supply chain efficiency (Guha et al, 2021). Moreover, in the omnichannel and mobile shopping ecosystem, which is becoming more and more popular, AI helps these strategies to be more profitable, improving communication strategies and enhancing the positive effect these have on consumers (Adapa et al., 2020; Shankar et al., 2020; Willems et al., 2016). Specifically, AI can be used to analyze consumer's purchase data,

and can deliver real-time and personalized recommendations, both of which are significant value drivers for retailing. As an example, smart shelf technology, can give retailers the possibility to deliver customized product offers and pricing to every shopper, when they stop in front of a shelf (Marr, 2018). Moreover, retailers are developing their app, which consumers can use to create a shopping list and then, when in the shop, can guide them through the store (Bandoim, 2018).

1.3 New technologies shaping in-store experience

Moreover, technology shaped in-store consumers' experience, encouraging shoppers to use various technologies such as mobile phones or hand-held scanners (Grewal et al. 2018). The in-store experience is part of the customer journey and technology has multiplied the points of contact with customers. The technology endowment available to retailers enables them to enhance their strategies, acquiring data necessary to understand consumers to improve the shopping and consumer experience (Vadruccio et al., 2024). In parallel, as companies implement new technologies, their customers' expectations evolve. Today, for example, customers expect an integrated omnichannel experience where they can order online and pick up in shop (click and collect), or order in shop, if the product in the desired size/colour is not available, and have it delivered to their home (Knof et al., 2023). Another element that is becoming important for consumers is the presence of free Wi-Fi in the shop. A useful tool to be able to search for product information or compare prices with other retailers. At the same time, retailers can send notifications via SMS or using their own application, when the consumer is in or near the shop (Willems et al., 2017).

Innovative touchpoints such as self-service kiosks and mobile devices enable companies to connect with customers and offer experiences in a new way. Integration not only offers a sense of authenticity and realism to customers, but also reduces the gap between online and offline

channels (Hilken et al., 2018). These technology-permeated touchpoints help companies collect more precise and granular data on customers at a defined time and place, which helps deepen their understanding of customer behaviour and tailor offers in real time. Thanks to new in-store technologies, it is also possible to capture data that used to be the prerogative of e-commerce, such as path data and purchase intent data (adding a product to a shopping cart, cart abandonment rate, etc.). The information that can be obtained is much more accurate and the development of new technologies demonstrates how it is possible to build a 'bridge' between the online and offline worlds also about analysis metrics (Boone et al., 2019).

1.4 Evolution of store format

Retail formats have undergone significant changes over time. Up until the mid-19th century, small, family-owned general stores dominated the retail landscape. In these stores, customers would request goods from a clerk and often negotiate prices. The shift toward larger general and department stores began in 1852 with the founding of Marshall Field's, later acquired by Macy's. These stores featured a large assortment of products under one roof with fixed pricing. The rise of supermarkets, starting with Kroger in 1929, marked the next phase of retail development. This was soon followed by the opening of the first shopping mall in 1930, offering consumers access to multiple stores in a single location. In 1946, 7-Eleven introduced the first convenience store, offering extended hours (7 a.m. to 11 p.m.) for the first time. The era of discount retailing began in 1962 with the opening of Walmart, followed by Kmart and Target (Gauri et al., 2020).

When going shopping, consumers often seek specific store characteristics, such as product assortment, store atmosphere, and shopping convenience (Wagner, 2007), because these features are linked to terminal values like quality of life and happiness. It is generally assumed that retail experiences contribute to shoppers' overall life satisfaction, as retailers provide

products and services that solve a wide range of consumer needs (Grzeskowiak et al., 2016). Retailers play a role in enhancing their lives by helping consumers complete shopping tasks that vary in importance.

As consumer preferences vary, different store formats have emerged to address diverse needs. When purchasing groceries, consumers are presented with a wide range of physical store formats (Gauri et al., 2021; Shankar et al., 2021). Over recent decades, store-based retail formats have evolved, altering their market shares (Bronnenberg & Ellickson, 2015). Newer formats, such as discount stores, supercenters, and hypermarkets, such as Walmart, Aldi, Lidl, and Carrefour, have expanded consumer choices and disrupted traditional grocery retail models worldwide (Gauri et al., 2021)

Supermarkets	These stores feature medium- to large-sized selling spaces (varying by urban or non-urban location), are located near target markets, offer a mix of primarily food with some non-food items, have simple store designs, and place less emphasis on service. Examples include Albertsons (USA), Jewel (USA), Woolworths (Australia), and Albert Heijn (Netherlands) (Gauri et al., 2021; Shankar et al., 2021).
Hypermarkets	These stores are generally larger than supermarkets, offering a broader range of merchandise and relying on higher shopper volumes due to their suburban locations.

	Notable brands include Tesco and Carrefour (Burt, 1984; Sumner & Davies, 1978)
Discounters	These stores, like Aldi and Lidl, are similar in size and location to supermarkets but offer less customer service, a smaller product assortment, and minimal merchandising. They emphasize private labels and consistently follow a low-price strategy (Fornari et al. 2020; Van Der Plas et al. 2024)
Convenience stores	Typically owned and operated by retail chains like 7-Eleven, convenience stores often include "forecourt" retailers co-located with gas stations. These small stores offer a limited selection of food and essential non-food items and are located near high-density urban and suburban areas (Goić et al. 2021; Gibson et al., 2022)
Cashier-less stores	Amazon introduced cashier-less stores in the U.S. with its "Go" convenience store concept in 2018. These stores, ranging from 450 to over 2,000 square feet, use advanced camera technology. Shoppers simply pick up items and walk out, with AI and predictive

	analytics distinguishing individual customers and purchases (Ives et al., 2019; Polacco & Backes, 2018). Their Amazon accounts are automatically charged via the retailer's smartphone app, aiming to offer a faster, more convenient shopping experience (Herrera & Tilley, 2020; Szabó-Szentgróti et al., 2023).
Pop-up stores	Pop-up stores stay open only for a defined period, ranging from a few days to a few months. They don't generate a huge sales volume or cater to the broader demographics of the geo-graphic market. Their main objective is to offer their customers tangible experience and sensory information that they cannot find online (Boustani, 2021; Henkel & Toporowski, 2020; Ye et al. 2023)

Table 1.1 – summary of different retail format

Food to go and convenience are ubiquitous trends in food and beverage consumption, as evidenced by the variety of channels, such as convenience stores, food service restaurants, and coffee shops found in all major Western metropolitan areas (Ipsos, 2018; Statista, 2024). Accordingly, the market share of small-format retailers, such as convenience stores, continues to grow due to their appeal to consumers who shop "little and often" and need "food/beverages on the go," often at the expense of larger formats such as hypermarkets (IGD, 2018; Nielsen, 2015; PMA, 2017). One primary factor contributing to such changes is the increasing pace of

consumers' lifestyles (Jebarajakirthy et al. 2021; Rosa et al., 2017; de Sena, 2018). Therefore, food consumption is less confined to in-home settings and is increasingly occurring out-of-home and, more specifically, while on-the-go (Lachat et al., 2011; Benoit et al., 2016).

The OTG consumption activity involves the consumption of food or beverages while consumers are in transit or conducting other activities, such as picking up a family member, travelling to the office, going to a meeting, etc. (Gibson et al. 2022; Benoit et al., 2016). Besides, OTG consumption can occur at any time during the day and is often associated with a sense of urgency driven by situational factors (Benoit et al., 2016; Nago et al., 2013; Sands et al., 2019). OTG consumption purchasing can occur at various locations (e.g. convenience and fast-food stores, cafés, vending machines), across a range of occasions (e.g. main meal, snack) and times of day (e.g. morning, afternoon, evening) (Benoit et al., 2016; Binkley, 2006; Heider and Moeller, 2012; Nago et al., 2013).

1.5 An example of OTG retailer: vending machine

Vending machines can be categorized into product-oriented and service-oriented machines. Product-oriented vending machines are machines that offer both cold and hot food as well as nonfood goods. This category includes packaging refund machines where the customer gets the bottle deposit back. Service-oriented vending machines offer different kinds of services, entertainment (e.g. jukeboxes, slot machines) and non-entertainment (e.g. telephone or scales) (Gruber et al., 2005). Selling cold and hot drinks was the predominant business in the past, but at present, the variety of goods and services marketed with vending machines is steadily increasing (Grech & Allman-Farinelli, 2015; Matthews & Horacek, 2015). Additionally, vending machines can be designed for the sale of large quantities of various products, for example in Japan, it's possible to buy ten-kilo bags of rice from a vending machine.

VMs are widely used as they are available in a multitude of locations, such as schools, healthcare facilities, workplace, and many public spaces (Evans et al., 2023; Matthews & Horacek, 2015; Utter et al., 2021; Grivois-Shah et al. 2017). They are the primary and most readily available source of foods for people working long hours (Escoto et al., 2010; Lillehoj et al., 2015; Onufrak et al., 2019), as they are used to buy main meals and snacks to save time (Ali et al., 2015; Klapheke, 2012).

1.5.1 Historical evolution of VMs

Historically speaking, the evolution of vending channels started in ancient times with the first coin-operated dispenser of holy water to worshippers. These machines would be usually located at the entrance of the temple. The first model was created by Hero of Alexandria, an Ancient Greek mathematician and engineer, in 219 B.C. In his books, he describes and illustrate this device. It was completely automatic: first, you would insert a coin into the machine. Then, the coin would land onto a pan connected to a lever, which would be heavy enough to pull the lever and dispense a small amount of holy water. Once the coin slid off the pan, the water would stop flowing. The system was very simple: inside the machine, there was a scale that, upon detecting the weight of the coin, caused it to drop and opened the water valve. The coin would fall completely, and the scale would return to its original position, closing the valve (Segrave, 2003).

After that, next to nothing happened in the industry, until the 17th century, when snuff and tobacco automatic boxes started to spread in England, around 1615. In 1882, instead, booksellers used a vending machine to sell banned books. By the second half of the 19th century, fully automatic vending machines hit the scene. They dispensed postcards, gum, and chocolate using a similar mechanism to Hero’s ancient design. Some machines operated on the honor system, with a coin allowing buyers to open a drawer and take a single item. These

newspaper-style vending machines only worked if no one took more than their share (Segrave, 2003; O'Brien, 1962).

In the early 20th century, the automat took vending machines to a new level. These restaurants dispensed food through vending machines. Diners would slide coins into the machine and open a window to receive their food. It was not until the 1930's that bottled soft drinks could be sold through drinks vending machines. Coca-Cola was one of the first drinks brands to sell bottled drinks through vending machines, with Pepsi soon following suit. Later, the technology for drinks vending machines developed to allow people to sell canned soft drinks (Wilson, 2024; O'Brien, 1962; Springboard, 2024).

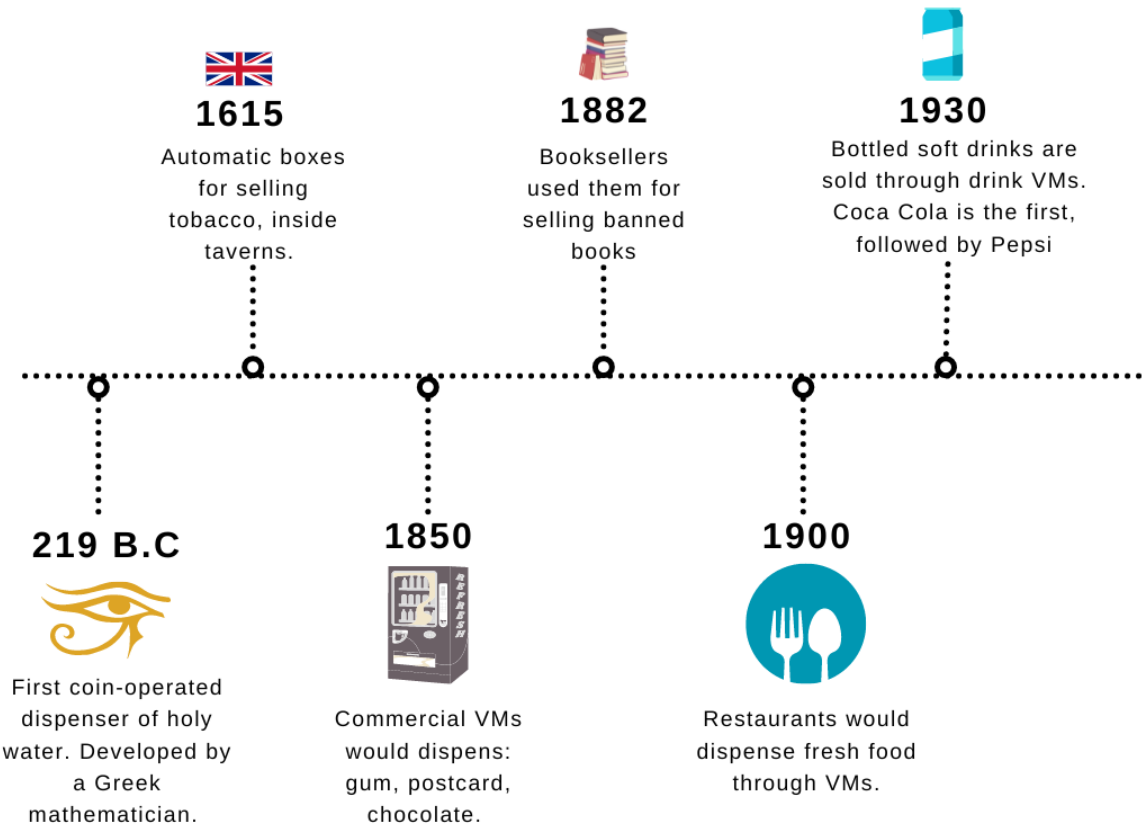

Figure 1.1 - Timeline of VM evolution

1.5.2 The VM market

The global vending machine market size reached US$ 20.5 Billion in 2023. Looking forward, the market is expected to reach US$ 30.3 Billion by 2032, exhibiting a growth rate (CAGR) of 4.4% during 2023-2032 (Statista, 2024). The changing consumer lifestyles, rapid technological advancements, easy availability of a diverse product range, cost-effectiveness, rising concerns about sustainability, increasing health consciousness, the convenience offered by the product, and increasing profitability are some of the major factors propelling the market (Statista, 2024). The vending sector in 2023 recorded a turnover of more than 1.6-billion-euro (+2.6% vs. 2022) to which must be added the more than 397 million euro of the OCS (Office Coffee Service) sector for a total of more than 2 billion euro.

Italy has the largest automatic food distribution network in Europe with more than 830 thousand vending machines installed that, in 2023, dispensed almost 4 billion consumptions (3,974,040,247) to which must be added 1.1 billion in capsules and pods for a total of more than 5 billion consumptions in the year just ended. Coffee is at the center of Italian consumptions at vending machines: in 2023, in fact, almost 2.3 billion (+0.95%) were drunk in front of a vending machine, a good 57% of total consumptions; followed by snacks, which represent 16% of total consumptions (626,251. 484); but there was also a significant increase in savoury snacks (+7%) and confectionery (+26%) in 2023, also due to the partial reopening of schools in the first months of 2023; cold drinks, on the other hand, due to a cool summer with frequent rainfall, recorded a drop of -2.56% (Confida, 2024)

1.6 Innovation in VM sector

The vending market is going through a period of strong growth and innovation, fueled by major technological transformations. The future is increasingly cashless now and international

internet of things companies are focusing on digital payment models and integrated systems that only allow transactions with a smartphone or other mobile device (Solano, 2016; Confida, 2024).

Everything you can find at the machines can now be purchased without inserting notes and coins, and even without a key. An Italian example of digital payments system is Matipay. The operation is very simple. It is a 4.0 version of the keys used for vending machines. By installing an electronic module that can be adapted to any vending machine, Matipay [1]allows you to pay for your coffee, snacks or any other product via the app downloaded to your smartphone and by bringing your phone close to the module. Moreover, Satispay [2]presented a new service that implements its app. It allows you to pay at VMs simply with your mobile phone. Some apps already allow payments at VMs, but few VMs have them and they mostly run on private circuits. Instead, Satispay, can be used also for payment in other settings (i.e. cafés, shops, grocery stores).

Another trend already well-known abroad, which is also finding a space in Italy, is the super-automatics: machines that are aesthetically appealing, with rather large screens, integrated with touch screens that also offer the possibility of buying ready-to-eat food. Compared to a 'traditional' vending machine, it gives consumers the possibility of exploiting the 'coffee corner', mainly in companies, as a space for socializing and conviviality with colleagues. It is the ideal tool to create a coffee break more like the experience one has at the bar counter (Mezzapenna, 2024; Bangkar et al., 2020)

1 https://www.matipay.com/it/sistemi-di-pagamento-tutti-i-trend-nel-vending/

2 https://www.satispay.com/it-it/

1.6.1 Sustainability in VM setting

Although for many companies in the retail sector, the last few years have been times of crisis, for vending companies, they have turned into an unmissable opportunity to rethink their production models in a more sustainable key and develop new systems to ensure greater respect for the environment and quality in the delivery of services and products. This transition towards a more eco-friendly and technological idea of vending has involved food producers, but also those involved in packaging, transport, distribution services and, in general, the revitalisation of the entire sector (Argante, 2022; Il Sole 24 ore, 2021)

For some years now, the energy-saving mode has been an established reality on most sustainable vending machines installed in public and private places (Manzano et al., 2023). A feature imposed by the market, but also by the growing need to keep energy and water consumption under control in all day-to-day areas. More and more often in company break areas and public places, where sustainable vending machines are installed, efforts are being made to inform consumers to encourage the proper sorting of materials and set up efficient and truly environmentally friendly collection and disposal processes (Harnan 2013; Il Sole 24 ore, 2021; Wu et al., 2024).

Certainly, no less important are the food products with which vending machines are stocked, the quality of which has increased considerably in recent times, providing healthier drinks and snacks made with ingredients and raw materials from controlled and certified organic supply chains (Bertossi, 2024,2022)

1.6.2 Smart VMs

Smart Products are cyber-physical products/systems which additionally use and integrate internet-based services to perform a required functionality (Abramovici, 2015). Smart products

can communicate in different dimensions of their operation with other smart devices, systems and users, through the use of a variety of communication channels, but mainly through the Internet (McGehee, 2024; Solano et al., 2016).

Thus, smart vending machines are products that are simultaneously connected through different communication channels to other systems. Also, they are devices that can collect and process for different purposes information from the environment in which they are located and from the users they serve, as well as interact with other smart machines or products applying the concept of Internet-of-things (Hashi et al. 2024; Li et al. 2024). This turns them into technological solutions that are context-aware, pro-active and self-organized (Greftegreff, 2017). In this way, smart vending machines expand the applied aspects of their operation and to the greatest extent provide the economic process with appropriate and timely information (Park & Park, 2015). It allows making optimal business decisions to make the device itself, its positioning, product offering, price level, etc. more fully tailored to the requirements and needs of specific users (Stoyanov, 2021).

Smart vending machines can also collect information on various climate features (i.e. humidity, air temperature, fogginess, and sun exposure) and recommend to consumers the most relevant hydration or nutrition options available (Stoyanov, 2021). Moreover, through artificial intelligence, product recommendations can be based on biometric data (i.e age, gender, weight, height, nationality) to estimate the approximate body-mass index of the consumers or health-related risks and propose products accordingly. With the advent of 5G, smart vending machines can become even more interactive and socially responsible if they adopt videoconference features and therefore provide consumers with real-time advice from public health nutritionists. Furthermore, several recent studies showed that when anthropomorphized attributes are assigned to non-human objects, consumers tend to behave more responsibly (Han et al., 2019; Wang and Basso, 2019).

2. Literature review

2.1 Vice and virtue products

Food marketing research has long highlighted that consumers perceive food products in distinct ways. Some foods are viewed as nutritious and beneficial for health, while others are seen as indulgent and delicious (Drugova & Curtis, 2024; Wertenbroch, 1998). Foods that promote health are often referred to as virtues, whereas those that provide immediate pleasure but are unhealthy are labeled as vices (Dhar & Wertenbroch, 2000). Vice foods are consumed for enjoyment and pleasure, but often contribute to long-term health problems, such as weight gain, cardiac issues and other negative outcomes. Indeed, they are usually associated with sin (Fitzsimons et al., 2007; Goldsmith et al., 2012) and consequently, with post-purchase or post-consumption guilt (Mishra & Mishra, 2011). By contrast, "virtue foods" are less gratifying and appealing in short-term, but have fewer negative consequences in long-term and therefore represent a more prudent choice for consumers (Milkman, Rogers, & Bazerman, 2008, 2010; Okada, 2005; Wertenbroch, 1998). Moreover, virtue products, promise future benefits and, at the same time, carry immediate and ongoing usage costs (Wertenbroch, 1998; Read et al., 1999). These costs include not only purchase costs, which are common to all products but also psychological, physical and emotional costs that are experienced during consumption and that lead many people to consume virtue products less often than they should (Della Vigna & Malmendier, 2006; Wichstrøm, 1994). Considering that the benefits gained are not experienced immediately, the consumption of virtue products could be perceived in some cases as unpleasant too (Ein-Gar, 2012). Furthermore, many consumers operate under the assumption that food cannot be both tasty and nutritious (Raghunathan et al., 2006). As a result, they tend to apply a heuristic that categorizes virtuous foods as "healthy but not tasty" and vice foods as "unhealthy but tasty" (Chernev & Gal, 2010; Rozin et al., 1996; Wertenbroch, 1998). Accordingly, healthy

foods are classified as virtue products, while unhealthy foods fall into the vice category (Kivetz & Keinan, 2006; Thomas et al., 2011).

In literature, vice and virtue products are also classified as hedonic and utilitarian, considering the value perceived by consumers (Dhar and Wertenbroch, 2000). Specifically, hedonic foods (i.e. ice cream, chocolate bar, chips) primarily provide sensory pleasure, while utilitarian foods (i.e. bread, dried fruit, fresh fruit) mainly fulfil functional purposes (Otterbring et al., 2022). Considering that indulgence is hedonic in nature (Salerno et al., 2014), it is likely that sensory information, especially imagery, have a strong impact on forming product judgements and decisions in this domain (Muñoz-Vilches et al. 2018). For example, it was shown that hedonic message appeals enhance visualization, demonstrating that clarity of imagery is a vital component of hedonic vice-related consumption (Phillips, Olson, & Baumgartner, 1995; Shiv & Huber, 2000).

Although the difference between vice and virtue might seem clear and well defined, the perception of vice/virtue product can be influenced by the processing of the product too. As an example, when consumers tasted labelled organic products (i.e. cookies, chips, and yoghurt), they perceived them as healthier. Specifically, these products were considered lower in fat, calories and having more fiber and micronutrients overall, compared to their non-organic counterparts (Lee et al., 2017; Ellen et al., 2015). Then, it was found that the "organic = healthy" association holds even for vice products (i.e. chocolate chip cookies and ice cream). Participants to a study found it more acceptable to skip exercise, thus indulging themselves after eating an organic dessert, compared to a non-organic dessert (Schuldt and Schwarz, 2010).

2.2 Vice and virtue bundle

Consumers often face situations in which they can consume both vices and virtues together rather than trading off between them (Jiang & Lei, 2013; Liu et al., 2015). When consumers are

facing these situations, they tend to perceive differently products (i.e. combined/isolated). Specifically, it was demonstrated that when vice and virtue foods are evaluated as a “whole” (i.e. yogurt plus a cookie), consumers estimate the overall calorie content of the combination of vice and virtue foods as even lower than that of the vice foods alone (Chernev & Gal, 2010). Furthermore, when vice-virtue elements are combined into the same product, such as yogurt with M&M’s or ice cream with fruit toppings, consumers tend to evaluate the cost-benefit balance differently and this shift in perception often influences their purchasing decisions (Milkman et al., 2013; Liu et al., 2015).

That considered, researchers introduced the "vice-virtue bundles" paradigm (Liu et al., 2015). This paradigm involves presenting consumers with options that vary in the relative proportions of unhealthy (vice) and healthy (virtue) components while keeping the overall portion size constant (Liu et al., 2015; Kahn & Rafieian, 2021) For example, a vice-virtue bundle may contain more virtue (i.e., three apple slices and one cookie), an equal proportion of vice and virtue (i.e., two apple slices and two cookies), or more vice (i.e., one apple slice and three cookies) (Kirgios et al., 2020; Read et al., 1999). Important to notice is that implementing this strategy does not imply offering two separate snacks. Still, the total quantity provided is visually and volumetrically equivalent to a single snack, ensuring portion control (Schuldt et al., 2012). This approach addresses consumers’ desire to reap health benefits without sacrificing pleasure and taste (Kristensen et al., 2013).

In line with this, food and beverage companies have already started presenting products, blurred bundling vice and virtue ingredients, as Oreo cookies in Yocrunch Yogurt. Another example, Pepsi and Coca-Cola introduced vitamin-fortified sodas, aiming for consumers to perceive them as healthier options that offer both taste and health benefits (Coca-Cola, 2018; Miranda, 2022). Although this may seem like a novel approach, the fortification of foods with vitamins and micronutrients has been a long-standing practice (Didar, 2020).

Finally, fiven that better health outcomes can be achieved by both limiting the intake of vice foods (Schwartz et al., 2012; Wertenbroch, 1998) and increasing the consumption of healthy foods (Redden & Haws, 2013), vice-virtue bundles may help consumers pursue both strategies simultaneously. These bundles offer a multifunctional solution, allowing consumers to satisfy both taste and health goals (Kopetz et al., 2011; Dhar & Simonson, 1999; Liu et al., 2015). Moreover, the vice-virtue bundling paradigm can motivate consumers to commit to their utilitarian goals (i.e. health) and persist in engaging it (Kahn & Rafieian, 2021).

2.3 The consumption of vice and virtue

The consumption of vice and virtue products often stems from different motivations. When choosing vice, consumers tend to be indulgent (Drugova & Curtis, 2024), which can be linked to self-reward (Chernev, 2010; Chernev & Gal, 2010), mood maintenance (Gardner et al., 2014; Gao & Mattila, 2017), a stress-relief strategy (Lunardo et al., 2022) or a simple desire for tastier option (Mishra & Mishra, 2011; Siddiqui et al., 2016). In contrast, purchasing virtue products tend to be more mindful, planned, and deliberative and is often tied to personal goals (Ittersum et al., 2024; Ramanathan & Menon, 2006; Thomas et al., 2010). Specifically, choosing healthy products often activates a health-related goal. Thus, the individual prioritizes long-term benefits (e.g., a healthy life), becoming more motivated to make decisions that align with these goals (Fishbach & Dhar, 2005; Fishbach et al., 2006).

Moreover, prior research has identified various product-related factors influencing consumer choice between vice and virtue products. These include the size of in-store assortments pointing out that choosing from larger assortment is often more difficult (Berger et al., 2007; Iyengar & Lepper 2000), leading consumers to select options easier to justify, thus switching from vice to virtue (Sela et al., 2008; Okada, 2005; Simonson 1989). Then, it was considered the physical

distance from the product, explaining how access to specific kind of food could affect choice (Gao et al., 2016),

Additionally, elements such as package size affect calorie perception regardless of whether the product is a vice or virtue (Scott et al., 2008). Other relevant factors include perceived product quality, environmental impact, and the fit with specific promotional strategies (Ellison et al., 2015). Finally, a wide research focused on the effect of nutritional labeling (Ketron et al., 2022; Ikonen et al., 2019; Cabrera et al. 2017; Bialkova et al., 2015).

2.4 Self-regulation dilemma and product choice strategies

When choosing food products, consumers often make trade-offs between health and indulgence (Januszewska et al., 2011; Steptoe et al., 1995). Thus, consumers face a self-regulation dilemma: unhealthy food is perceived to be tastier, and consequently often triggers an impulsive, short-term indulgence goal, whereas healthy food contributes more to a long-term health goal (Dhar & Simonson 1999; Laran 2010; Muraven & Baumeister 2000). This self-regulation dilemma could explain why many consumers continue to overconsume calories, even though they have become more health conscious compared to previous generations (Prasad et al. 2008). Most food choices are not made in isolation but are part of "consumption episodes" (Dhar and Simonson 1999), a sequence of related decisions in terms of temporal proximity. In the context of a grocery shopping trip, sequential choices are also related in terms of a common self-regulation dilemma (health vs. indulgence). At the most basic level, there are two possibilities in terms of how consumers navigate this dilemma across sequential choices (Huber et al., 2008; Kim and Rao., 2023): reinforcement and balancing.

Reinforcement: When first choosing a healthy (unhealthy) product, it is more likely, subsequently to choose a healthy (unhealthy) product, due to bolstering or highlighting a health goal (indulgence) goal. Past literature termed these acts reinforcement (Dhar & Simonson 1999;

Huber et al. 2008). When an activated goal (i.e. health or indulgence) has not been yet satisfied and consumers might make only one subsequent choice, it is more likely they enhance their first choice (Wight et al. 2023; Laran & Janiszewski, 2009). Moreover, if consumers feel that the following choice might help advance the initial goal achievement, they will choose the same product (i.e healthy/unhealthy), even if they are choosing from different category of products (Akamatsu & Fukuda, 2022).

Balancing: Instead of making reinforcing choices, consumers may employ a balancing strategy, such that a healthier (unhealthier) initial choice is followed by an unhealthier (healthier) subsequent choice. Balancing is defined as the scenario where "the first choice satisfies the goal, allowing an alternative goal to drive the later choice" (Huber et al., 2008; Dhar & Simonson, 1999; Laran et al., 2019). Balancing is a compensatory strategy, which help consumers maximize both enjoyment and good health (Dhar & Simonson, 1999).

2.5 Nutrional intervention in VMs

For decades, policymakers aimed to encourage healthier eating habits by providing general dietary advice and refraining from highlighting "healthy" or "unhealthy" foods to prevent diet-related diseas. They instead invested in health education (Lobstein & Davies, 2008). However, people's perceptions of healthy eating are multifaceted and deeply intertwined with personal experiences and societal influences. These beliefs may diverge from expert recommendations, reflecting a complex interplay of cultural norms, personal preferences, and practical considerations (Bisogni et al., 2012). Individuals also interpret healthy foods differently based on their age, psychosocial experiences, and cultural background (Matthews & Horacek, 2015). Therefore, nutrition guidelines and recommendations are constantly evolving and changing.

Furthermore, eating outside home and snacking occasions are more frequent, food portion sizes are increasing, and the availability of high fat, energy-dense foods and sugar-sweetened drinks

is larger (Rosi et al., 2017; Pechey et al., 2018; Stämpfli et al. 2016). Then, the increasing contribution of packaged foods to population diets has prompted the development of tools to assist consumers in the identification of foods that are more or less likely to be part of healthy or unhealthy diets (Scarborough et al., 2007). An example is the nutrient profiling, the categorization of foods according to their nutritional composition (Rayner, 2017; Drewnowski & Fulgoni, 2008; Arambepola et al. 2007)

In this context, the widespread availability of vending machines has been viewed as a problematic environmental factor contributing to the high consumption of food and drinks of minimum nutritional value (Wiecha et al., 2006; Thompson et al., 2010; Callaghan et al., 2015; O'Hara and Haynes- Maslow, 2015; Cisse-Egbuonye et al., 2016; Raposo et al., 2018). These patterns contribute to the increasing number of obese or overweight adults and chronic diseases like diabetes (WHO 2023, 2024). However, considering that consumers' food choices and interests in leading a healthy lifestyle have continuously increased in recent years (Steinhauser and Hamm, 2018), VM interventions on VMs emerge as an opportunity. Since environmental interventions have been proved to be effective in influencing consumers behaviour and eating habits, they could lead users to better food choices (Matthews & Horacek, 2015; Story et al., 2007; Swinburn et al., 1999).

Because of the widespread presence of VMs in schools and the critical period of childhood and adolescence for eating habits acquisition, several behavioral and educational interventions have been conducted in school settings (Adachi-Mejia et al., 2013; Alaimo et al., 2013; Bucher, Collins, Diem, & Siegrist, 2016; Han-Markey et al., 2012; Kocken et al., 2012). Then, during the transition between adolescence and adulthood, young people face severe lifestyle changes, typically associated with moving away from home, which has a direct effect on food choice (Winpenny et al., 2020; Maillet & Grouzet, 2021). They tend to eat less nutritious food, more take away and ready-to-eat meal (Park & Papadaki, 2015; Dunford et al., 2021; Trapp et al.,

2021). Thus, considering that VMs in university setting are an available retailer for students living in campuses, interventions took place also there (Kirchoff et al., 2021; Arnett, 2000; Sparling, 2007; Lambert et al., 2021; Roy & Liu, 2020). Moreover, it was considered the location of hospitals, to explore how well vending machine are meeting the needs of health-care organization, staff and visitors (Utter et al., 2021; Rozman et al., 2020; Winston et al., 2013; Kibblewhite et al., 2010; Grivois-Shah et al. 2017). Considering also the relevance of the location, which should be an outstanding example for health even if sometimes the assortment is incongruent with the setting, considering the assortment of unhealthy food (Utter et al., 2021; Van Hulst et al., 2013; Champ et al., 2019; Pechey et al., 2019; Carrillo-Alvarez et al., 2020). Finally, related to health lifestyle, there are sport activities and recreational centers, which usually have VMs too (Evans et al., 2023; Olstad et al., 2015). And, finally, worksite locations, where it is common to spend an important part of the day and often eating breakfast and lunch there (French et al., 2010; Lillehoj et al., 2015; Onufrak et al., 2019).

Interventions tested in the past involved first, the manipulation of assortment, with the partial introduction of lower fat and calorie products in the VMs (Kovacs et al., 2020; Hartstein et al., 2011; Grivois-Shah et al., 2017) and the restricting access to vending machines before and during lunch times (Kakarala et al., 2010; Phillips et al., 2010; Woodruff et al., 2010). Recently were introduced “healthy vending machines” that provide, according to the different nutritional frameworks, healthier products compared to the traditional vending machines (Carrillo-Alvarez et al., 2020; Mason et al., 2014; Grivois-Shah et al., 2017; Mann et al., 2020). However, merely offering healthy food items is unlikely to trigger consumers’ intention to eat healthy items (Dunn et al.,2020). Then, pricing or promotion interventions have been considered, however results are mixed. It was demonstrated that they tend to be effective to address and improve consumer choices among VM products (French, 2003; French et al., 2001; Voss et al., 2012; Yan et al., 2017). In the Chicago Park District's, indeed, was introduced a 100% Healthier Snack

Vending Initiative. Every item's price remained at $1, and consumers positively reacted to these healthful changes, with both adults and children driving sales (Mason et al., 2014). Then, a study conducted in worksites (i.e. bus garages), with the combination of price reduction and the increase of healthy items availability, enhanced the sales of these snacks, significantly (French et al. 2010). However, in another studies, price reductions alone had no effect (Hua et al., 2017; Ng et al., 2018; Gibson). Moreover, price is a potential barrier to buying healthy products (Callaghan et al., 2010) and when the price is higher than the unhealthy counterpart, the sales are not increasing (French et al., 1997).So, a long-term reduction of the selling price of healthy products might not appear as a viable strategy for VM companies hence, other intervention strategies have been developed and have been tested (Grech & Allman-Farinelli, 2015).

Furthermore, the health-related benefits of food products, with the aim of a sales increase, can be communicated by various means. Companies usually use a wide range of textual and visual cues on food labels to trigger health-related associations in consumers' minds (Carey, 2019; Christoforou et al., 2018). Research has shown that labels frequently include nutrition marketing claims related to the presence of specific ingredients or their nutrient content, regardless of their nutritional composition (Christoforou et al., 2018; Hieke et al., 2016; Schermel et al., 2013). These nutrition marketing claims have been reported to create the belief that products are healthy and to increase purchase intention (Nobrega, Ares, & Deliza, 2020; Saba et al., 2010). Another way to highlight the healthiness (and thus the virtue) of food and beverage options is using a nutritional food labeling system called Traffic Light System (TLS). TLS has been used around the world to inform consumers about the nutritional value of food, to help them to get a better understanding on the level of healthiness of food products, as well as to direct them towards healthier choices (van Herpen & Trijp, 2011). Moreover, in the nudging communication context, simple and graphical labels positioned on the front-of-package (FOP) are increasingly used worldwide (Jones et al., 2019). Many manufacturers

choose nutritional claims (NCs) and health claims (HCs) to help consumers make healthy food choices (Ballco & Gracia, 2022).

In VM setting, traffic light labels and physical activity calorie equivalent labels were more successful at encouraging healthy beverage purchasing than posters reminding customers of Philadelphia's sweetened beverage tax (Gibson et al., 2024). Moreover, if considering labelling only on "healthy products", (i.e. with a green labeling), this will not lead consumers to choose these products (Grummon et al., 2021). These results are consistent with previous laboratory study which found that presenting front-of-package healthy or unhealthy labels on all items led to healthier beverage and snack purchases (Bopape et al., 2022; Bergen & Yeh, 2006)

Another effective strategy in promoting healthy lifestyle, considered widely in previous research is health communication (Giannattasio et al., 2024; Bartels & Van Den Berg, 2011; Van Royen et al., 2022). It helps promote behavioural change in a wide variety of health behaviours and encourage people to make informed health decisions (Van Assema et al., 2001; Eguren et al., 2021; Trudel-Guy et al., 2019). Attitudes and intentions relating to health-conscious behaviours could be inculcated in the public via the presentation of arguments in a message (Jones et al., 2006; Miller-Day et al. 2015; Baker & Watson, 2015; Jones & Watson, 2012) or using persuasive communication, as message framing (Keller and Lehmann, 2008; Trudel-Guy et al., 2019; Eguren et al., 2021). Persuasive communication can be framed positively or negatively, and accordingly, its effect on people's attitudes and behaviour might vary depending on how these messages are framed. (Tversky & Kahneman's 1981).

In the context of advertising and marketing, framing consists in the presentation of a product or service by preferentially highlighting certain attributes or aspects of it instead of others, without changing facts about the promoted products (Entman; 1993). Specifically, one message is usually presented in positive terms (gain-frame) and the other in negative terms (lossframe) (Van't Riet et al., 2016; Guenther et al., 2020; Williamson et al., 2020; Shimul et al., 2021).

Gain-framing often relates to the benefits of complying with a promoted behaviour (e.g. if you take a blood test, you will come to know the risk of an unhealthy diet). By contrast, loss-framing pertains to the costs of not complying with a promoted behaviour (e.g. if you do not take a blood test, you will not know of the risk involved in an unhealthy diet) (Maheswaran and Meyers-Levy, 1990; Gao et al., 2022; Jada & Van Den Berg, 2022). Health behaviours can be either detection or prevention behaviours. Loss-framed messages effectively encourage detection behaviours (e.g. mammography screening, breast self-examination) (Goodall and Appiah, 2008); gain-framed messages effectively promote prevention behaviours (e.g. regular exercise, using sunscreen) (Riet et al., 2010;). Furthermore, when the risk associated with a health behavior is low, people are more receptive to gain-framed messages; however, if the risk associated with a health behavior is high, people are more receptive to loss-framed messages (Bartels et al., 2010)

3. “Going to vending is an archetypal situation, as camera café”. An exploratory qualitative analysis of vending machine users’ behavior

Although historically speaking, the evolution of vending channels started in ancient times with the first coin-operated dispenser of holy water (Segrave, 2015), it is only recently that vending channels have started to regain popularity in the business landscape as retail providers of customer convenience (Bolton, 2019). However, recent reviews highlight the lack of adequate literature on many aspects concerning consumer behavior in the vending sector (Stoyanov, 2021). During the last few years, to the best of our knowledge, five article reviews have been published that have addressed marketing aspects of the vending sector. They have mainly explored the topic from the following perspectives: factors encouraging consumers to make healthier choices (Whatnall et al., 2020; Hua and Ickovics, 2016), the efficacy of nutritional interventions in vending machine (Grech and Allman-Farinelli, 2015; Liberato et al., 2014), methodological tools for nutritional assessment of vending machines (Matthews and Horacek, 2015). In a recent article, Stoyanov (2021) identifies a research gap in the analysis of consumer behavior in the context of smart VMs. Previous literature on innovation in the vending sector comes mainly from the engineering sector and concentrates on the design and development of a fully fletched high-tech vending machine (Sibanda et al., 2020), a mobile robot VM for beaches (Navarro et al., 2015), and designing a control system for VM to make the machine function efficiently (Murena et al., 2020) but nothing about the impact of such innovations on users. The present study aims to contribute to filling this gap by exploring the role that new technologies have on VM users’ experiences and consumption choices using a qualitative investigation.

3.1 Methods

Qualitative research is an inquiry process of understanding a social or human problem based on building a complex, holistic picture, formed with words, reporting detailed views of informants, and conducted in a natural setting (Creswell, 1994; Yilmaz, 2013). It is appropriate for research on little-known phenomena or innovative systems (Marshall and Rossman, 2015), and thus a qualitative exploratory approach was taken considering the lack of literature. Data were collected through semi-structured in-depth interviews with VM users by developing an extensive interview guide based on a literature review. The interviews were conducted with open-ended questions regarding overall experience. After discussing their experiences, and what they liked and disliked, we asked for information about the pros/cons of using VM and we prompted them to share their thoughts about the implementation of technologies in vending and what they would do to improve their experience. Examples of the themes and questions addressed are presented below (Table 3.1)

Themes	Questions
Purchase Habits	How often do you buy products from vending machines?
	"What are the places where you buy most frequently? Have you ever purchased from vending machines in the city?"
	When do you usually purchase?
	When do you choose to buy from vending machines?
	What do you usually buy?
	Have you ever bought products that you could only find in vending machines?
	Can you tell me about one of your purchase experiences?
Decision-Making	"When buying from vending machines, do you usually decide on the spot or have you ever gone directly to a vending machine already knowing what to purchase?"
	Are there any factors that influence your choice?
	"If some products were marked with a banner like 'on sale,' 'product of the month,' or 'consumer-recommended,' similar to supermarkets, what impact would that have on your choice?"
	If the nutritional values, like calories and sugar content, were displayed?
Facilitators	"Are there elements that make you choose or prefer vending machines? Do you think the purchase experience is intuitive?"
Barriers	"Even if you purchase, are there factors that 'limit' your use or reduce its frequency? (e.g., product assortment, cost, vending machine location…)
	What could be done to improve the purchase experience?
Product Perception	Do you think the product assortment inside vending machines has changed?
	Are there products you perceive as healthier? Could you give me an example?
	Are there any products you'd like to be able to purchase from vending machines?
OOS (Out of Stock)	Have you ever found that a product you were looking for was unavailable?
	What did you do?
Smart Vending Machine Usage	"Smart vending machines are machines with touch screens that can send messages (both promotional and advertising...). Have you ever used them?"
	If you've never used them, do you think they could be an alternative? Do you prefer traditional ones?
Technologies	Do you use vending machine apps? e.g., for electronic payments, promotions, etc.
	"Smart vending machines can send messages when you're in front of them. What do you think about the idea of receiving promotional messages? What if they varied based on recognizing your mood?"
	How do you think technologies could change vending machines?
Mobile App	What if messages were sent to promote products?
	What if they reminded you to maintain a healthy lifestyle?
Sustainability	What do you think about sustainable packaging in vending machines? Would you notice or would it influence your choices?
	How important is packaging for you when choosing a product in a vending machine?
	Are you interested in finding organic products in vending machines? Why or why not?
	How much more would you be willing to pay for an organic product in a vending machine?
	Have you ever purchased a fair-trade product from a vending machine? If yes, what motivated you?
	How would a greater availability of fair-trade products in vending machines influence your purchasing habits?
Gamification	Could a promotion motivate you to try a new or different product than usual?
	Would you like to participate in interactive games at vending machines to win points or prizes? Why?
	Would points earned from games encourage you to use vending machines more often?
	What product combinations would you like to see for a combo purchase offer?
	Would you like to receive promotions or "gifts" for your purchases?
	What kind of incentive would you like to receive?

Table 3.1

The participants invited in the study were mentioned the topic of the study and the sample was collected through a snowball approach. It consisted of 22 users, aged between 20 and 55, 50% males and 50% females. Since VMs can be found especially in schools, universities, workplace, we recruited consumers from these contexts. Then, considering new innovations in technologies, it was interesting to consider different generations, with a different approach to technologies, to gather different kinds of pieces of information. The aim was to get useful insights and information and have a broad overview of the experiences. The inclusion criteria for the study were: working/studying in a place with access to VM and using VM at least once per week, both for eating and drinking. We collected the general information about the participants in the following table (Table 3.2).

	Gender	Age	Workplace	Frequency of VMs use
Andrea S.	M	28-37	Employee	3 times per week
Flavia	F	18-27	Freelance	5 times per week
Annamaria	F	28-37	Employee	3 times per week
Serena	F	18-27	Employee	>5 times per week
Ayoub	M	18-27	Student	Once a week
Anna	F	48-59	Employee	Once a week
Arianna	F	18-27	Student	>5 times per week
Andrea G.	M	18-27	Student	>5 times per week
Lucia	F	18-27	Student	>5 times per week
Elisa	F	18-27	Student	3 times per week
Rocco	M	28-37	Employee	Once a week
Krizia	F	28-37	Employee	>5 times per week
Tommaso	M	18-27	Employee	5 times per week
Pietro	M	28-37	Employee	3 times per week
Mariella	F	48-59	Employee	>5 times per week
Martina	F	18-27	Student	3 times per week
Leonardo S.	M	28-37	Employee	5 times per week
Jessica	F	18-27	Employee	>5 times per week
Chiara	F	38-47	Employee	3 times per week
Leonardo R.	M	28-37	Student	>5 times per week
Andrea F.	M	18-27	Student	Once a week
Alessandro	M	18-27	Student	3 times per week

Table 3.2

All the participants willingly gave their written consent for the interview. It was used a standard form from University of Macerata, and it was given before the beginning of the interview.

Interviews were taken both in presence and online through video calls and took an average of 45 min. Each interview has been recorded and transcribed. The analysis of verbatim transcripts involved three coding phases based on Gioia et al. (2013) method. In each phase, the authors closely collaborated to align and discuss coding structures, aiming to agree on code definitions and quantifies before moving to the next phase (Gioia, 2012)

Coding phase 1

The first step of open coding involves reading the transcripts line by line and closely analyzing them in a way that captures the participants' original expressions and meanings. Through open coding, we identified initial patterns, themes, or categories within the data. This process resulted in the identification of 53 firs-order codes. Some of these codes reflected the characteristic of the VMs (e.g. "actual assortment"; "desidered assortment"; "experiences with smart-vm"), while others reflected the consumer's attitudes/characteristic ("choosing in front of the VM", "need of looking at the products"). Codes are reported in Fig.3.1 and Fig.3.2. Multiple coding is often necessary to authentically capture meaning in complex data such as interviews (Campbell et al., 2013).

Name	Files	References
Assortment of VMs	0	0
Actual assortment	22	116
Attention at the weight of product	2	2
Fresh and dried fruit in VMs	3	8
Most-purchased products	22	70
Products with less calories	13	21
Variety in the assortment	10	17
Desired assortment	17	64
Etnic products	2	2
Fresh and express products	11	29
Last minute purchases	2	4
New products	10	21
No-food products	2	3
Ready-to-go products	6	9
Communication in VMs	0	0
Digital communication	0	0
Customised reccomendation	4	6
Promotions through VM	10	12
Nutritional interventions	6	13
Positive reinforcement messages	2	3
Product suggestions for those with special dietary needs	5	8
Reporting nutritional facts	3	5
Purchase experience	0	0
Choice of VM	10	14
Convenience	12	26
Exclusive products in VMs	15	23
Local proximity	18	33
Out of stock	16	34
Speed	6	9

Figure 3.2

Name	Files	References
Decision process	0	0
Choose in front o...	13	17
Planned purchase	9	9
VM as a meeting...	10	14
Payment method	0	0
Digital payment	15	21
Rechargable key	2	2
Products choice	0	0
Brand and food f...	11	17
Diet	5	7
Emotions	5	5
Need of the mom...	3	4
Sustainability	0	0
Sustainable actions...	11	17
Choosing produc...	3	6
No-cup option	2	2
Packaging with e...	5	6
Pay attention to...	2	3
Technology	0	0
Integrations in smar...	4	5
Augmented realit...	1	2
User-friendliness	2	2
Integrations in VM a...	18	47
Automated stock...	7	10
In-App promotions	9	11
Map showing VMs	7	13
Product feedback	2	6
Product informati...	6	9
Previous experience...	7	9
Need to see the...	5	6
VM speed	2	3

Figure 3.3

Coding phase 2

In the second step, we grouped the first-order codes according to prior research about the attitude towards food choice and food consumption (Silva et al., 2023; Magano et al., 2024; Martinez-Perez et al., 2022), new technologies (Carter et al., 2020; Akdim et al., 2022) and sustainability (Randall et a., 2024). We identified also, innovation in the retail sector, as artificial intelligence in retail, gamification, and digital payment (Guha et al., 2021; Bauer et al., 2020; Boden et al., 2020). This process led to the identification of 12 codes (e.g. “actual assortment”, “desired assortment”, “possible integration in the VMs”, “payments methods” and “sustainable actions in VMs”) as reported in Fig. 3.3.

Name	Files	References
Assortment of VMs	0	0
Actual assortment	22	116
Desired assortment	17	64
Communication in VMs	0	0
Digital communication	0	0
Nutritional interventions	6	13
Purchase experience	0	0
Choice of VM	10	14
Decision process	0	0
Payment method	0	0
Products choice	0	0
Sustainability	0	0
Sustainable actions in VM	11	17
Technology	0	0
Integrations in smart VMs	4	5
Integrations in VM app	18	47
Previous experience with smart VM	7	9

Figure 3.4

Coding phase 3

The third step (generating propositions) involved the aggregation of the second-order themes. In this step, we compared consumer narratives with literature about personal attitudes toward food choice, sustainability, communication in retail and experience with technologies. This process led to the aggregation of the second-order codes into 5 final codes (Fig.3.4). Each one represents a relevant topic in the VM sector. The first topic is the assortment. The second-order codes include “actual assortment,” which refers to the current selection of items offered in VMs, and “desired assortment,” representing the products that consumers wish to see based on their needs and preferences. This area highlights potential gaps between what is currently available and what could be added to better satisfy customer demand, such as healthier options, niche

products, or seasonal items. The second one is communication in VMs. The second-order codes include “digital communication” and “nutritional interventions”. We describe different actions to guide consumers through healthier choices and discuss them with consumers. In addition, we discuss the use and the potential impact of communication tools for engaging consumers. The third is Purchase experience. The second-order codes: “decision process”, “choice of VMs”, “payment method” and “product choice”. It focuses on key aspects of consumer interactions with VMs, including the “decision process” (how consumers make purchase decisions), the “choice of VMs” (how and why they select vending machines), the “payment method” (preferred payment options), and “product choice” (how they pick products). These elements shape the overall purchasing journey for consumers using VMs. Then, we discussed Sustainability. The second-order code is “sustainable actions in VMs”. Given its emerging relevance in the retail sector and the growing importance it holds for consumers, our goal was to gather ideas and insights on potential actions for implementation. Finally, we discuss the last topic, technology. The second-order codes: “Previous experience with smart VMs,” “Integrations in VMs,” and “Integration in the APP” explore the current landscape of consumers' interactions with new technologies in VMs and potential areas for improvement. We examine how these technologies are used in retail and propose ways to enhance the user experience through technological advancements.

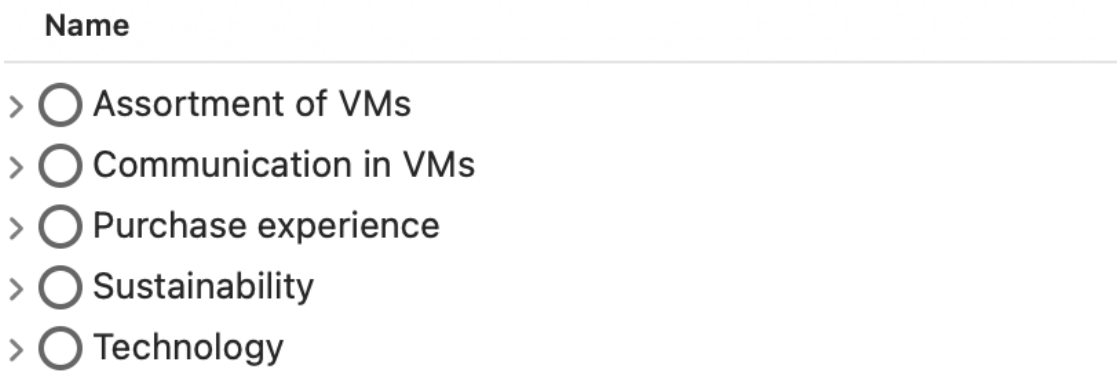

Figure 3.5

3.3 Findings

In this research, different consumer habits, expectations, and possible improvements according to the vending sector emerged. Five different themes related to the experience of VM users have been identified. We describe each of them in detail, through some of the stories we collected through the interviews

3.3.1 Assortment of products

3.3.1.1 Actual assortment

Now, in VMs is possible to buy snacks, both hot and cold drinks. The assortment was analyzed in previous literature, and it was noticed that there are unhealthy snacks and beverages (Faris et al., 2021; Berna et al., 2022). It was tested also the possibility of having healthier VMs (Carrillo-Álvarez et al., 2020), however, it was unclear the real impact on food choice, especially in the long-term (Viana et al., 2018; Grech & Allman-Farinelli, 2015; Hua & Ickovics, 2016).

So, during the interviews, we first discussed the assortment and discovered that it was positively noticed a real change, both from the quantity and quality sides. There are more different products, not only snacks but also small sandwiches (i.e. “Viva La Mamma sandwiches” and tramezzini). Then, we discovered there are some snacks sold exclusively in VMs which are now a kind of a trademark for VMs (i.e. Pipas).

For Alessandro, VMs are also a retailer for “last minute” grocery shopping. He would go there often because VMs were close to his apartment, and he was positively impressed by the change.

> *“On some machines, they started adding a little more product than before. Like I said before, the pasta box, the canned tuna. I saw them on a couple of VMs. (Alessandro)*

Now it is possible to find also low-calories products. This is an important driver for the ones who in the past were more reluctant to use VMsbecause considered them an "unhealthy" outlet.

> *"What I like about vending machines is that there's not just junk food as crisps, chocolate bars, cookies, etc. Then there's yoghurt, or fruit, dried fruit. Generally, not only unhealthy food. (Anna O.)*

In addition, Lucia noticed a growing amount of food for specific diet-related needs and different diet choices (i.e. vegan or vegetarian). Indeed, you can find gluten or lactose-free products, and vegan snacks.

> *"I've noticed that now vending machines have products, not necessarily for celiacs, but for example for those with lactose intolerance. Honestly, when I was younger, I imagined it was filled with unhealthy foods, chocolate products, and other heavy options. However, now I see that there are also healthier choices" (Lucia)*

3.3.1.2 Desired assortment

However, consumers, who are used to buying at VMs are willing to improve their experience. Specifically, they would like to find "fresh food". The need for *freshness* can be described in different aspects. First, there is the localness of food, which is one of the fastest-growing food trends (Graciotti and McEachern, 2023; Shideler and Watson, 2019). Preferences for local food are also conceptualized as an emergent consumer ideology. For Leonardo S., indeed, the localness of the product is an important choice driver and in VMs it would be important too. Knowing there are local products, would lead him to greater choices.

> *"The fact that the product is presented as a local product and it wouldnot come from the other side of the continent, personally, is important for me. I would like it, and it would encourage me to buy more productsand go more to VMs"* (Leonardo S., 27)

Moreover, the *freshness* of products is perceived when buying not long-lasting products. So,

the ones that are pre-packed, but their assortment is changed more often (i.e. sandwiches and salads). These kinds of goods are ideal for those who are looking for a fast meal in case of a short lunch break or they don't want to go out of the building because of the weather, so they choose VMs.

> *"A dream of mine is to find the big salads, the ones from the supermarket, already packaged. Inside you could have also olives and mozzarella"* (Serena, 27)

Finally, the willingness to try new things led them to imagine a VM filled with ethnic food, for example, Japanese or American food. There could be products both in the snack category (i.e. donuts) or ready-to-go meal category (i.e. ramen). Filling VMs with these kinds of products would probably create interest in those who are used to consuming such kinds of food and would love to have access to it more easily.

> *"Maybe something specific that you go there, and you know you'll find it. Okay (...) I don't know, they could sell Japanese mochi, those sweets where there's bean paste inside. Or they put in Reese's, which are American sweets with salty caramel inside"* (Andrea G., 25)

3.3.1.3 Purchase experience

Consumers have a different approach to VMs. On one side, consumers are going to VMs for convenience (time restraint and lower price). On the other side, there are consumers very attached to VMs, who use them daily and going to VMs has become an important part of the daily routine. In the following section, we are going to describe different approaches to VMs, discussing relevant topics that emerged during the interviews.

First, some consumers choose to VMs, because products are cheaper and often it is the only retailer to go and grab a coffee, inside the building (i.e. hospital, library, university). Summarizing it, we can say they mostly prefer VMs for convenience.

Martina, a med-resident in Ancona, usually prefers VMs because are cheaper and it is easy to go there, without moving out. When it is raining or it is cold, indeed, they are the best solution, also considering that usually there is no queue.

> "*Usually, at least at our university, many things cost less at the vending machine compared to the café. Not everything, but coffee does, and sometimes snacks too*" (Martina, 28)

Furthermore, Andrea F. prefers going to VMs because he doesn't want to waste time. When he studies in the library and wants a little break but at the same time wants to keep concentrated, he goes directly to VMs, and it is a win-win situation.

> *"I know myself and once I leave, I find it more challenging to start studying again, especially at the library. So, by not leaving the library, I can remain more focused"* (Andrea F., 22)

Then, speaking of convenience, it was stressed the time-restraint variable which led consumers to prefer VMs rather than a café or other retailers. Specifically, there is no queue and, considering also that the assortment is smaller compared to other retailers, the time dedicated to the choice is shorter.

> *"Well, first, I would say there is the speed variable. Well, going to the bar is not per se something that takes a long time, but it is one thing to go to the bar, wait your turn and wait until the bartender has finished with the others' orders and then move on to your own. It is one thing to go straight to a vending machine, wait those twenty*

seconds if we want to be generous, and be able to get back to doing what needs to be done" (Arianna, 23)

Moreover, it is not important the products they will buy, because usually, they pick what they like, just in front of the VMs. They are not affected by out-of-stock because, if it happens, they just buy something different. This approach is confirmed by previous literature. Numerous studies have determined that brand-switching is the dominant response to OOS situations in grocery retail (Campo et al., 2000; Sloot et al., 2005). This may be attributed to consumers perceiving minimal differences between grocery brands (Verbeke et al., 1998), as well as recognizing that the cost of substituting brands is generally lower than that of switching stores (Kim & Lennon, 2011).

"Since I'm going to have a snack, it means I want it, and usually if I am going there, I buy something and I don't care about the specific product." (Martina, 27)

Like Martina, when Leonardo goes to VMs, he aims to buy something to eat and, even if he has some craving for a specific snack (i.e. pipas) and he doesn't find it, he will choose something else.

"I remember the feeling of going there and craving pipas and not finding them... but, well, what did I do? I don't know, I don't remember. But I would tell you offhand I would react in two ways. If I'm hungry I would choose another product, if I'm not hungry I would give up. So, if it's more like a whim I give up" (Leonardo S., 27)

Usually, as Annamaria told us, she decides what to buy when she is in front of the VMs. However, it happened that, even if she went to VMs, cravings for a specific snack, and in the end, she changed her mind if she couldn't find it.

"*It happened that I went to the vending machine, and I wanted sunflower seeds (pipas), but I couldn't find them. I looked at the snacks and then I completely changed my mind and opted for a sweet snack. It's difficult for me to say no"* (Annamaria, 30)

The same concept was stressed by Pietro:

"Many times it happened that I wanted an espresso and as soon as I arrive in front of the VMs I choose a ginseng coffee" (Pietro, 32)

We can argue that out-of-stock doesn't affect negatively their purchase, because, in the end, they will buy something, out of necessity. However, there are consumers loyal to products inside VMs. They have high expectations when going to VMs, to buy a snack, a drink, or a fast meal. They are not inclined to opt for a different product, and not finding their favourite product makes them sad and frustrated. If the product they planned to purchase is not available, they will probably look for the same product in a different VM.

"I don't know if they (pipas) can only be found at vending machines, but I've only seen them there, so when I arrive at a vending machine and there aren't, it's a bit sad. In this case, I gave up on the snack altogether because I think: "well, it's a pity, I wanted that one" (Elisa, 27)

A similar story was told by Krizia, who shared his dad's experience. He discovered that at Krizia's workplace, the KitKat chocolate bar (his favourite) was cheaper than buying it at the supermarket and most of the time available. However, when he couldn't find it, he just would give up on the snack. He would not settle for something similar.

"For example, where I used to work before, my dad would stop by because he knew he could get Kit Kat for €0.45, which was more convenient than buying it at the supermarket. And maybe those times when he came and couldn't find it, he felt

disappointed. For instance, hewouldn't buy anything because he wanted the Kit Kat at that moment" (Krizia, 32)

For consumers who are used to buy products from the same VMs, knowing the assortments is common. Based on that, they usually have a shortlist of their most-favorite snacks. Consequently, they would choose what to buy before going there. For them, purchase expectations are higher than those of others.

"I usually have an idea of what I would like to buy because there are products I enjoy, so I know I want those. In particular, I remember a OREO chocolate-covered biscuit that I had grown fond of. So, I would always go to the same vending machine and look for it" (Krizia, 32)

Arianna, indeed, choose to go to VMs because she can have a matcha green tea or matcha latte, only there.

"For example, even when I'm out with friends, I know there's a place that serves matcha tea, and we often go there during the winter. When you might prefer to be out and have a walk with your friends, rather than sitting somewhere" (Arianna, 23)

Furthermore, some consumers prefer a more traditional experience (i.e. pick the products and watch it fall from the VM's rack). These aspects characterize the consumer experience with traditional VMs. Moreover, they prefer traditional payment methods, so they don't consider downloading the app or the payment with a card or NFC system (i.e Google Pay or Apple Pay).

Tommaso, for example, when goes to VMs uses a rechargeable key and all his friends and colleagues envy him for having it.

"I have my key[3]*, and whenever people see it, they ask me where I got it. However,*

[3] Rechargable key for VMs

I've often seen people avoid purchasing because maybe they didn't have cash or coins" (Tommaso, 27)

Then, Flavia, going to VMs has become so important that she collects coins, only for buying a coffee or a snack at VMs.

"Going to VMs for buying coffee or for a snack became such an important part of my daily routine that I usually try to have coins to make sure that I can buy" (Flavia, 24)

For her, buying at VMs is a special treat for when she studies and wants to give herself a little reward for the effort or also as a motivation to keep going.

"I consistently remind myself that when I decide to go to the library, I can reward myself with a coffee, which feels like a treat. Moreover, during a study session, particularly when I'm halfway through, I often use the prospect of having a coffee as a source of motivation. This approach doesn't come across as impulsive, rather I think it resembles more a form of negotiation with myself" (Flavia, 24)

In the end, some consumers like going to VMs because it is a quiet place, a "no-contact" zone, where they can go whenever they don't feel like meeting other people. It is a "safe space" for being alone, for a short time, and disconnecting.

"You go to get a coffee from the vending machine, and it costs 0,50€, while at the café is around 1-1,20€. Not to mention the fact that you don'thave to interact with the retailer, with other customers or colleagues, if you are at work" (Andrea S., 33)

On the opposite, it is considered also a meeting point, where have a chat with colleagues, discuss work or generally get to know better peers, in a more informal setting.

"Lately, I have also been re-evaluating the coffee break as a moment of socialisation. During coffee and cigarette breaks, you can often also can meet

professors, to have a chat, to form such connections" (Tommaso, 27)

From Flavia's point of view, a Brazilian student visiting Italy, in addition, preferring VMsis a rational decision based on the choice to avoid an unnecessary cognitive effort. Being a foreign citizen and ordering in a café can be a language challenge.

> *"I prefer going to VMs when I'm not in the mood to talk and interact withother people. So, they are quite helpful and when I don't like speaking Italian, they're great"* (Flavia, 24)

3.3.1.4 Communication

Communication in the retail sector is multifaceted, encompassing a variety of approaches and channels tailored to different contexts. Vending machines, as a distinct and unique retail channel, present specific challenges in devising effective communication strategies that resonate with consumers. Our research sought to deepen understanding in this area, given the critical role communication plays in shaping consumer behavior across retail settings. Specifically, we concentrated on the integration of new technologies within vending machines and their potential to enhance communication strategies. During our interviews, the topic of nutritional interventions emerged, prompting discussions around possible implementations and strategies for their application.

3.3.1.5 Digital communication

During the interviews, we discussed communication strategies, that could be applied in the VM setting. Interviewees were asked to share ideas and experiences with different communication channels. We considered both digital communications, i.e., showing written messages on the smart VM and inserting a banner on the product (i.e., a different color,a flag, etc.) that could point out vegan, lactose/gluten-free products, and low-fat choices. Both methods may be used also for marketing purposes such as signaling the product most sold in that period or highlighting some promotions. It emerged that user like both forms of

communication, screen or banner.

> *"It would be helpful! I could certainly identify and purchase a product more easily if it had a banner. For example, "product of the month" or "most purchased," compared to another one that doesn't have any banner"* (Lucia, 27).

Moreover, users would react positively even if the message would have been sent by a machine or by an AI system because it would be considered a kind of relationship.

> *"It's a very nice thing, because, in any case, it's almost a relationship. You know it's a machine. But still, it's almost something personalized, tailor-made"* (Serena, 27)

As is common in other retail environments, such as supermarkets, brands frequently offer temporary discounts, use point-of-purchase displays, and aim to engage consumers in making purchases. Consumers are familiar with this type of pull marketing strategy, as many are accustomed to seeking out discounted products while grocery shopping and are often drawn to them. Therefore, when they encounter similar tactics in vending machines, they are likely to be attracted to these offers and consider making a purchase.

> *"Yes, it would influence me because I'm just like that at the supermarket too. I look at a lot the offers, so I think at least the first time I see a banner like that, I would immediately go for it or at least I would primarily look at that one anyway"* (Jessica, 22)

Flavia added that she would be inclined to choose products labeled as "most sold" or "purchase of the month," as she would associate them with better quality, given that many people had chosen them. This could be seen as an indirect form of word-of-mouth influence, even if not explicitly stated.

> *"For example, if I'm going to buy a coffee and then it has a banner or something*

like that, saying "oh this coffee was the most sold" or whatever, uh, then I would probably get it" (Flavia, 24)

Then, a personalized message could also lead them to choose products that otherwise, they wouldn't buy or try new products that they don't know. Andrea shared with us a possible situation, when choosing a product in front of a VM and receiving a personalized message, proposing a bundle offer (i.e. when buying coffee, you get a cookie too).

"Well, yeah, you say "come on, why not?". Because maybe, if no one had told you, maybe you wouldn't have even thought about it, but that kind of put that thing in your head and you think 'gee see, I didn't think about it the chips would fit, so I'm starting to think about it.."(Andrea, G., 25)

It is an interesting insight, for retailers, who could imagine possible cross-selling activities, for instance, if you buy a coffee, then you could get an ad for a cookie, a small cake, etc.

However, on the other side, there is a category of consumers who is not interested in trying new products at all and are not sensitive to any communications, both digital (i.e. messages or video on the VM's screen) or traditional (i.e. banners inside VMs).

"Honestly, these (VMs communications) are things that don't affect my purchasing decision" (Tommaso, 27)

Even if they think point-of-purchase communication (pop) strategies (i.e. messages sent through the VMs, banners inside the VMs with nutritional information or pointing new products.) could be interesting, when talking about personal experience, there is no real interest.

*"Maybe it could be an interesting strategy to apply, but I'm not sure how much appeal it would have to me" (*Andrea S., 33)

For these users is probably impossible to imagine cross-selling or up-selling strategies, because

they don’t like changing their habits. Considering also that they are reluctant to the adoption of new technologies, it is hard to plan any kind of indirect communication, for example using social media. However, their loyalty to products is an important aspect to consider for retailers. They are so attached to the same products that might act as brand ambassadors. Communication strategies could not be necessary at all, to have a real impact.

3.3.1.6 Nutritional interventions

During the interviews, we explored various digital communication channels and considered the possibility of sending messages through different mediums. Specifically, we looked into displaying written messages on the vending machine (VM) screen and sending notifications via the app. We also examined how VMs could promote a healthier lifestyle by encouraging healthier food choices.

Interestingly, most participants indicated that they would pay more attention to written messages on the screen rather than vocal ones. Given that VMs are often located in busy, noisy environments with background music and conversations, a written message might stand out more and feel less intrusive. Moreover, they underlined the necessity to send objective messages, meaning using real “scientific” data because they could be more powerful and have a real impact on users.

> *“For example, before making a purchase, while standing in front of the vending machine, a message appears on the screen inviting you to make healthier choices. It could say something like "WHO recommends five servings of fruits and vegetables a day" (...). It should be a general message that encourages people to adopt a healthy lifestyle, perhaps also providing objective data”* (Rocco, 35)

Pietro, in the end, expressed a similar need. He shared with us that he would not accept advice from someone who is not familiar with. However, if he reads a specific message or a banner,

it must be objective and give numbers or statistics.

> *"Let's say, when it comes to external judgments, I accept them only when they come from loved ones, I mean, people I know. So, in the case of banners or external reviews that provide a judgment, I usually only listen to the objective ones, the numerical ones"* (Pietro, 32)

On the other side, Mariella focused more on the tone of voice of the message, rather than the topic of the message per se. She explained that she would like to receive a "personal" message, but the message should not be intrusive at all. It could be, for example, based on her daily purchase, considering the possibility of data collection from the app.

> *"I am aware that it's an advertisement However, it must be said in a very... quiet way. not written or spoken, but written in a nice way, nice, that is also presented with a nice image, something that attracts attention but in a nice way. It doesn't have to be one of those messages that bombards you, an intrusive one"* (Mariella, 50).

Moving forward, we considered the ideal timing for sending the message—whether it would be more effective before the purchase decision or more appreciated afterward. Jessica mentioned that she would prefer receiving a message after the purchase, especially if it highlighted that she made a healthy choice (e.g., buying dried fruit) and offered a reward or advice on a better product to choose next time. She felt that such a message wouldn't be seen as "intrusive." In this scenario, the message could be delivered directly to the consumer via the app.

> *"It would be more rewarding afterwards. It would be more satisfying the choice you made"* (Jessica, 22)

It was stressed by Annamaria, that she would prefer a message sent through the VMs, instead

of a personal message received through the app, so that it will not be perceived as personal.

> *"If the banner is put on the VM, it warns everyone, it's not ad personam, isn't it? So you can take it as you like, so it would be less aggressive, maybe"* (Annamaria, 30)

In addition, Ayoub added the possibility of adding an element for pointing out the category of the product (i.e. healthy/unhealthy), so it would help to choose product, right in front of the VMs.

> *"OK, so for example if there was like a banner or a message saying directly what category it could be, if it is healthy/unhealthy food..."* (Ayoub, 22)

Andrea, then, shared his experience with the use of an app called YUKA, which describes the products and helps consumers choose the best option. It is generally used while grocery shopping, however, it is an interesting feature that could be implemented in the app for the VMs.

> *"Yes, I do use an app where there is also a nutri-score. the yuka app shows the nutritional information and informs you if there are additives, etc.* (Andrea, G., 25)"

3.3.1.7 Technologies

VM users can be broadly categorized into two main groups: a) technology explorers and b) technology avoiders. The first group consists of individuals who are highly comfortable with technology and enthusiastic about imagining new innovations and advancements in vending machines. They are open to trying new products and systems. In contrast, the second group prefers a more traditional experience and tends to be resistant to adopting new technologies. In the VM setting, specifically, they prefer a more traditional experience that could be summarized with the need of "touching the product" and with no real interest in

implementation of new technologies in VMs. They like the experience they have and don't need any changes.

In the VM sector, the introduction of mobile apps is transforming the consumer experience. The innovative feature can be exemplified by Coffee CApp's payment integration and loyalty programs. A notable one is the token-based fidelity program, where users who make at least two purchases per day can participate in a daily prize drawing. This is just the beginning, as numerous additional possibilities could enhance the experience, particularly for tech-savvy users.

Leonardo R., a young med-resident, who used to study at the university and go to the hospital every day downloaded the app for VMs, as soon as it was available at his university. He was, since the beginning, very satisfied. In particular, he was very impressed with the possibilityof paying with the app, without the need to bring money. He considered this feature a very useful one.

> *"Now I use an app that is much more convenient and makes you pay directly from the app. It's easy to download, then it can be charged with PayPal or with cash through the VM you are located" (Leonardo R, 28.)*

Alongside, we discussed the integration of gamification into marketing strategies, considering that creating a gameful experience is a promising way to engage consumers with the brand, increase customer loyalty, and encourage them to purchase (Bauer, 2020; Eppman, 2018). While games (Koivisto and Hamari, 2019) and price discounts (Grewal et al., 1998) have favourable effects on their own, psychological research on motivations suggests that these tools might also hinder each other when combined (Deci, Koestner and Ryan, 1999). Participants expressed their interest in promotions and loyalty programs with activities and a system for collecting points.

> *"I think it could be interesting to have a reward system, for each product bought, you collect "points" and they become a coupon discount. Or, a kind of promotion, every ten coffees bought one is free. You can collect "points" and check the amount of your purchases, on the app. You scan a QRcode, for example on the VM and automatically, you can check the "points" you collected or the promotions"* (*Leonardo R, 28*).

Gamification experiences are interesting because they could be used also to engage consumers in having a different "habit" or behaviour. It could not only be related to purchases but also to rewarding sustainable choices, for example when choosing the "option without cup" or products with FT label:

> *"I believe that this system would encourage people to a kind of competition about who is more sustainable. For example, you can collectpoints if you choose products with Rainforest Alliance certification or with Fairtrade label or if you can choose the option "without cup"* (Andrea G., 25)

Then, for loyal users, it is crucial to be engaged in the selling process. They would like to have the chance to be involved in the decision-making process regarding the composition of VM assortments. Usually, the retailer chooses the assortment, considering which items are the most requested by clients. However, some users would have more power in the composition of VM assortment.

> *"I would like to have the opportunity to choose which products to find within the VM. I have a list of things, and I would have the possibility to find it always (or almost). Using the application for shopping, it's easier to identify which products I buy more frequently, so could be available in the VM I usually use"* (Jessica, 22)

They would like to write reviews about products, which is also an occasion for sharing ideas

with colleagues/friends, considering that going to VMs is an experience to share with others.

> *"When I go to the VM, I can meet with others to discuss and share my day. In the end, it's a bit of an archetypal kind of situation, as camera cafe"[1]". If there's something that intrigues me but I've never purchased it, I will try it and I would like to write a review, sharing my thoughts about the product with the others"* (Leonardo S., 27)

For improving the experience, another aspect that arose during the interview with Leonardo S. is the possible implementation of olfactory feedback. It would be nice to match with the visual feedback that you can get, so far.

> *"It would be interesting to introduce not only visual stimuli but also from other senses. If I had to make a choice, obviously the visual is the quickest, from my perspective. However, if there were the possibility of olfactory feedback, for example, it could be interesting to better understand whether I could like the product or not"* (Leonardo S., 27)

Previous research has explored the effects of conscious odor exposure, suggesting it may influence self-reported appetite (Ferriday & Brunstrom, 2011; Ramaekers, Boesveldt, Gort, et al., 2014). Additionally, according to the concept of sensory-specific appetite (SSA), food odors can convey information about the macronutrient content, taste, and caloric value of the associated food. This sensory information may trigger a corresponding appetite and could potentially affect both food choices and consumption (Ferriday & Brunstrom, 2011; Ramaekers, Boesveldt, Gort, et al., 2014; Ramaekers, Boesveldt, Lakemond, van Boekel, & Luning, 2014; Zoon, de Graaf, & Boesveldt, 2016).

Furthermore, for consumers who are highly attached to vending machines and actively seek them out wherever they go, the ability to geo-locate vending machines using GPS could be highly beneficial. These users often value knowing the assortment of products available at

each location to make informed decisions about where to visit and what to purchase. Integrating GPS-based location features and product information into the vending machine app could enhance their experience by providing real-time information on nearby machines and their offerings, thereby supporting their purchasing decisions and improving overall convenience.

> *"I'd like to know how many units of each snack are left, for example, in each location. For instance, vending machine "A" has a total of 5 units of Kinder Bueno left, while vending machine B has 2. Having this information, I can choose where to go and know what to expect"* (Arianna, 23)

Finally, the growing use of augmented reality (AR) (Rauschnabel et al., 2022b; Qin et al., 2021; Flavián et al., 2019) due to its unique attributes (e.g., contextualization, portability, assortment) has profoundly influenced retailing (Kumar et al., 2024; Schultz and Kumar, 2024). By combining virtual elements with the physical environment in real time, AR provides consumers with a rich multisensory experience (Rauschnabel et al., 2022b; Caboni and Hagberg, 2019). Augmented reality (AR) integration in VMs could add an interactive layer, allowing users to scan products and access detailed information, animations, or even virtual unboxing experiences. Given the development of smart vending machines that display products via digital screens (Fakfare et al., 2024; Wu et al., 2022), this feature could assist consumers in obtaining more information about products, particularly regarding ingredients and nutritional content. These factors have become increasingly important to consumers when making product choices (Beatty & Smith, 1987).

> *"I have this idea, maybe it is a terrible one… but it could be amazing the visualization of a product, in augmented reality (AR)…"* (Leonardo S., 27)

In addition, the implementation of augmented reality (AR) in vending machines could address

several consumer needs highlighted during interviews. For more traditional consumers, who prefer to view a product physically rather than simply selecting it on a screen, AR could offer a solution. With AR, consumers could view a 3D representation of the product, either through an app or directly on the vending machine's screen, bridging the gap between physical inspection and digital interaction.

> "*It's the not seeing the product that's a bit strange to me, I mean... I'm not sure I like it, let's say... You know what you're choosing, but you don't see it until you pick it up"*(Arianna, 23)

AR could provide enhanced information about products, addressing specific needs such as those expressed by Annamaria, a vegetarian who often struggles to determine whether a snack is suitable for her due to difficulty reading ingredient labels. By integrating AR technology, consumers like Annamaria could easily access detailed product information, ensuring they can make informed choices and confirming whether a product meets their dietary requirements.

> *"if I can go to the vending machine, I see that product, I'll click on the list of ingredients to say or even the calories, nutritional facts, ecc, before buying the product, it is an added value to the vending machine"* (Annamaria, 30)

3.3.1.8 Sustainability

In recent years, the study of sustainability in the field of marketing has fueled exponential interest as sustainability actions carried out by companies can attract consumers (Lavorata, 2014; Marín-García et al., 2020; Salciuviene et al., 2022). Consumers are widely recognized as the key to the success of sustainable food systems transition. However, at the same time, they are considered one of its main barriers, as "little is known about its willingness to participate in a circular economy" (Bertossi et al., 2023). In the VMs context, participants expressed their

interest in selecting products that have, for example, fair trade (FT) labels or are from a company involved in CSR activities.

> "*Usually I check which is the corporate brand to have some idea about their sustainability policies and their social, and CSR activities*" (Flavia, 24)

Moreover, Italian consumers prioritize naturalness, healthiness, animal welfare, and environmental impact when having sustainable food choices (Piracci, 2023; Randall., 2024). That said, selling sustainable products might be the main reason to select a VM instead of a store.

> "*If there is a product with an FT or Rainforest Alliance label, generally I always look for that…"* (Arianna, 23)

On the other side, there is the worry about the end of the shelf life. What happens to the products that can't be sold anymore? What is the amount of food waste in the vending sector? In the food sector, waste is a major social, nutritional and environmental issue, affecting the sustainability of the food chain. In the EU alone, we waste 90 million tons of food every year (i.e. 180 kg per person) (European Commission (EC), 2011). For consumers more sensitive to this issue, is important information. This emerged during the interview with Flavia, who shared with us her experience in Norway and Portugal where VMs are filled with fresh products, so the assortments can change every 1-2 days.

> "*I'm assuming that they filled it every day and I have no idea about what happened to what was not consumed or bought. I always wondered if they would give these products to any associations or they just would throw it away*" (Flavia, 24)

It would be interesting for companies to reflect on strategies to fight food waste, considering that food waste is becoming a serious environmental, economic, and social issue (Eičaitė et al., 2022). Considering new technologies in the VM sector, it could be useful to implement a

tracking system for managing and reducing food waste. For example, showing information about the expiration date on the screen of the vending or through an App would be helpful. An automatic system powered with AI could be implemented to check products close to expiry, send an alert, and put them in promotion. Now, technologies such as digital platforms enable individuals or organizations to share and donate their food, thereby creating awareness on food waste prevention and the environmental and ethical benefits (Kör et al., 2021)

Another relevant aspect of the sustainability in VMs sector is the energy consumption. Every day, millions of kilowatt-hours go to waste globally due to devices remaining powered on but unused, leading to accelerated device wear and higher wasteful costs (Yan et al., 2015). The average monthly consumptions for vending machine were registered as follows: snack refrigerated (250 kWh), cold drinks (200 kWh), and hot drinks (100 kWh) (Manzano-Agugliaro et al., 2023).

This issue emerged during the interview with Andrea G. who considered the environmental impact of the VMs and imagined possible solutions. Specifically, we discussed the possibility of the development of energy-efficient VMs.

> *"Considering that vending machines remain on twenty-four hours a day, the ideal would be to find a way to reduce the temperature and keep it a little lower, but obviously without spoiling the products"* (Andrea G., 25)

Fortunately, technology offers promising solutions by utilizing tools to address this issue. The first of these refers to the commissioning of new buildings, which ensures that they deliver or exceed the performance and energy savings promised by their design and intended operation (Mills, 2011).

Finally, we discussed about the packaging of products. Discussing with Chiara (47) and Leonardo (28), it emerged the perception of the environmental impact of the packaging.

Specifically, they consider it the first step a company should take toward being more sustainable. Previous literature, enlightened that the packaging material and the claim both have a significant influence on consumers' sustainability perceptions and these perceptions extend to perceptions of various product attributes (e.g. healthiness, quality) (Hallez et al., 2024).

> *"I don't know if it affects the environment, but I think that the less you produce, the less you have to discard"* (Chiara, 45)

> *"Then for example the wrapping that covers the food, it could be made of bio-plastic or recyclable material"* (Leonardo, 28)

However, literature stressed how the premium price for a different packaging could affect consumer choices. Specifically, consumers are willing to make more sustainable choice but on the other hand they don't want to pay more for it (Hallez et al., 2024). This aspect, was considered also when interviewing Leonardo S. He specified that he would spend around 0,10-0,20 euros more (around + 10-20%) for a product with a different package or with a recyclable claim. Considering the specific context of VMs, where the average price for a snack is 0,70cent, a premium price could not affect negatively consumer's choice, if they perceive the premium quality too.

> *"Yes, it would definitely affect a bit. If I take a packet that is bio-plastic, I do it more willingly than a bag of 'taralli' which is totally plastic. Even if I have to pay 10, 20 cents more...*"(Leonardo S., 27)

3.4 Discussion

This study provides a detailed exploration of vending machine (VM) users' behaviors, preferences, and experiences, highlighting a more complex and diverse interaction with VMs than typically assumed. The findings suggest that while convenience remains a significant

factor, vending machines are not solely used for impulse purchases. Instead, they serve multiple functions: for some, vending machines become a vital part of their daily routine, providing a moment of personal reflection or brief social interaction. A notable outcome is the increasing consumer demand for healthier and more diverse product assortments. Participants expressed appreciation for the expanding variety, including the availability of low-calorie and specialized dietary options (e.g., gluten-free or vegan products). This aligns with broader consumer trends toward healthier eating and the desire for convenience-driven yet nutritious food options. The integration of smart technologies was also a significant theme. While some users embraced new technological features, such as mobile payment apps and personalized product suggestions, others remained attached to the traditional vending experience. This suggests a dual approach for future vending machine innovations: one that caters to tech-savvy consumers while maintaining elements of the traditional vending experience for those less inclined toward digital advancements. Finally, sustainability emerged as an important consideration for users, with a preference for locally sourced, environmentally friendly products. This indicates a potential avenue for future vending machine strategies to align with sustainable consumption trends by offering products with fair trade certifications or eco-friendly packaging.

3.5 Conclusion, implications and future research

The present study aims to contribute to the literature on VM by exploring the experiences of VM users. Several consumer behaviors, expectations, and potential enhancements within the vending industry have come to light. In general, from our research emerged some VM users' characteristics that call for attention in terms of implications and future developments. First, we found out that VMis not only an outlet for grabbing a snack but also a meeting point. Consumers spend an important part of their daily time over there, which means that VMs, especially smartVMs, could be used for promoting products, conducting marketing research

(e.g., sending surveys), or testing new products. Second, since VMs are considered an alternative for main meals to the other stores (restaurants, café, etc.), it emerged an increasing request for healthy fresh products such as salads, rice, pasta, and ethnic food. Third, respondents also manifest an interest in finding local food distributed through VMs. According to Birch et al. (2018), consumers prefer local food primarily due to concerns about food transparency, including knowledge of its origin and production conditions, and because they associate local food with health, social, economic, and environmental benefits. From a managerial point of view, it is important to consider the transparency about food origins, and ingredients also in the VM sector, e.g. finding a way to inform consumers who asked, before the purchase. Fourth, some users seem interested in having a more engaging experience buying at VMs and they are willing todownload and use Apps, receive customized information or promotions, and adopt newdigital technologies implemented by artificial intelligence (such as virtual assistants and games). Future implementation of technologies in VMs could include personalized recommendations based on past purchases, which can enhance the user experience by suggesting new products or promotions that match their preferences. Other innovations could include dynamic pricing based on stock or habits, social sharing features with referral rewards, and sustainability initiatives like discounts for using reusable containers. Finally, expanding payment options, such as accepting cryptocurrencies, and introducing subscription services would increase convenience. Health-conscious users could benefit from fitness tracker integration, while voice control and smartwatch compatibility would simplify transactions, catering to tech-savvy consumers and enhancing engagement with vending machines.

Fifth, the emerging trend of sustainability has led companies to reconsidertheir production and marketing strategies, also in the VM sector. The significance of corporate social responsibility (CSR) has increased in recent years linked to ethical consumerism (Bradu, Orquin, and Thøgersen, 2014). Consumers are widely recognizedas the key to the success of sustainable

food systems transition, but, at the same time, as one of its main barriers, as “little is known about its’ willingness to participate in a circular economy” (Bertossi et al., 2023). Stoyanov (2021) reported how consumers appreciate when vending machines offer social and environmental benefits. Considering this, future research could explore more effective ways to engage consumers in sustainable behaviors through vending machines. One promising strategy is incorporating elements of gamification, which has been identified as a powerful engagement tool (Eppman, 2018). By introducing interactive, reward-based experiences, vending machines could encourage users to make more sustainable choices, whether through incentivizing eco-friendly purchases, recycling programs, or educational campaigns about sustainability. Additionally, integrating digital technologies like mobile apps or loyalty programs could further personalize the experience and increase consumer commitment to sustainable practices.

4. Decisions in a Click! Real-world drivers shaping vice and virtue food choices in vending machine setting

The literature distinguishes foods between vice (less healthy) and virtue (healthier) products. Vice food products are appealing and elicit strong positive affective reactions (Vosgerau et al., 2016). They are usually related to self-rewarding and seeking a positive mood rather than simply wanting to eat tasty foods (Ketron et al., 2021). Meanwhile, virtue food products are often consumed to pursue benefit-related desires such as health (Mishra & Mishra, 2011).

Prior research on vice and virtue food products in the vending machines (VMs) setting does not identify what leads consumers to engage in their consumption. Thus, we aim to explore the effect of different variables on the vice/virtue choice of products in a vending machine (VMs) setting. The present study, indeed, advances the literature on vending machines (VMs), considering the drivers of purchasing vice and virtue products in vending machines. Specifically, it evaluates factors influencing the selection of vice (less healthy) and virtue (healthier) products in vending machines, focusing on brand familiarity, price, time of day, and payment method. We argue that choosing virtue products from vending machines (VMs) is significantly different from selecting the same items for generic food consumption. Firstly, vending machines offer a distinctive purchasing experience due to their automated, impersonal nature. Unlike traditional retail experiences, the absence of a cashier or human interaction can reduce the perception of judgment (Thorndike et al., 2012; Bucher et al., 2016). Secondly, the purchase is mostly unplanned (Benoit et al., 2019), the time spent on decision-making is minimized (French et al. 1999; Cohen et al., 2012) and the consumers' involvement is generally low (Jebarajakirthy et al., 2020).

Our study further contributes to the existing insight by measuring real behavior in vending machine settings, available in different locations. Considering that most current research is

based on self-report data, by using real data collected from vending machine (VMs) purchases, we aim to provide a more accurate representation of consumer choices (Grimmer & Miles, 2016; Sultan et al., 2019)

Finally, the study introduces a fresh perspective on product layout and placement within vending machines. By reexamining these factors through the lens of construal level theory, it highlights how the physical arrangement of products can influence consumer decision-making, particularly in choosing between healthy (virtue) and unhealthy (vice) options.

4.1 Theoretical framework

Consumers tend to categorize foods into vice (hedonic) and virtue (utilitarian) alternatives (Dhar & Wertenbroch, 2000; Wertenbroch, 1998) and shape their performance expectations based on these categories. For example, when we see a chocolate bar cream next to a dried fruit and nut bar, for example, we will likely categorize them as relatively vice and virtue, respectively (Raghunathan et al., 2006). Virtue products are healthier in the long term but appear unappealing in the short, while vice products are tastier and contribute to short-term indulgence but are more harmful in the long run (Ittersum et al., 2024; Chernev & Gal, 2010). The hedonic goal frame represents the desire for indulgent, satisfying foods, often triggered by “vice foods” like chocolate bars (Maehle et al., 2015). Utilitarian goal frames relate to improving own resources, such as finances or health, and it could be triggered by a low-sugar drink or dried fruit snack, indeed (Lindenberg & Steg., 2007).

Thus, consumption of vice (vs. virtue) often emerges from different desires. Namely, vice products may relate to self-rewarding, mood maintenance, and simple desires for tasty foods (Ketron et al., 2021). They are also associated with a lack of self-control, guilt, and regret at later stages (Kivetz & Zheng, 2006). Instead, virtue products are often consumed to pursue health-related desires (Mishra & Mishra, 2011). That is why, when deciding about virtue (vs.

vice) products, consumers tend to rely more on the utilitarian (vs. hedonic) attributes of those products (Ketron et al., 2021).

Drivers of virtue and vice products choice

Previous research has investigated numerous factors that influence consumers' inclination to choose less healthy (vice) over healthier (virtue) products. When choosing between different products, consumers may use the brand as a proxy for product-related characteristics (Chrysochou, 2010). Additionally, individuals who are familiar with a brand are more likely to purchase it (Kemp & Bui., 2011). Hence, brand familiarity has a significant influence on food selection and overall product decision-making (Rizvi & Oney, 2018; Campbell & Keller, 2003).

When choosing between healthier (virtue) and less healthy (vice) products, consumers are willing to pay as much as 20 per cent more for virtue ones, because purchasing these foods is seen as a way of optimizing health and well-being (Baker et al., 2004; Lewis, 2008). In addition, when comparing a regular product with a healthier version of it, they are eager to spend more, if the quality perceived and the healthiness is higher than the regular product (Alsubhi et al., 2022).

Moreover, research has also shown the relevance of contextual elements, such as the time of day (Yang et al., 2022) or the method of payment (Thomas et al., 2011), when describing food choice mechanisms. For example, consumers may be more likely to choose unhealthy options later in the day due to decision fatigue, which reduces their self-control and ability to make health-conscious choices (Yang et al., 2022). Similarly, individuals paying with credit cards or mobile payments are more likely to indulge in vice products compared to those paying with cash, as the immediate emotional impact of spending is diminished with non-cash transactions (Thomas et al., 2011).

Brand familiarity

When someone is tasting new food for the first time, they are typically skeptical (Fenko et al., 2015) but if the food becomes more and more familiar, they will know how the food will taste and the amount it should be eaten. Such familiarity plays a role in consumers' liking and preference (Brunstrom et al., 2010). Brand familiarity, in addition, gives consumers trust and commitment to specific brands and facilitates preference and selection (Paasovaara et al., 2012). The effects of brand familiarity already start at a young age, as demonstrated by fast-food branding on young children's taste preferences (Robinson et al., 2007). A familiar brand is a more accessible factor in a consumer's memory. This effect increases the likelihood that the consumer will use past experiences with that brand as a cue in making product choices (Vizcaino & Velasco, 2019). Given the limited time to select a product in vending machines, consumers rely on cognitive shortcuts, such as their memory of familiar products, to make quick and efficient choices. Familiar brands might evoke positive memories or associations, reinforcing the pleasure-seeking (hedonic aspect) of the product (Khorisantono et al., 2024).

Therefore, brand familiarity acts as a powerful driver of product choices, especially in contexts like vending machines where decision-making time is limited. By leveraging cognitive shortcuts, consumers are more likely to choose familiar brands that evoke trust, positive associations, and anticipated pleasure, ultimately reinforcing the hedonic appeal of vice products.

Price

Unlike traditional retail experiences, on-the-go retailers, as VMs minimize time spent on decision-making, which may lead to less deliberation on food choices and, hence, more impulsive decisions. (Kivetz and Zheng 2006). Regarding food choice indeed, impulsivity seems to be one of the most influential antecedents of unhealthy food (Kivetz & Zheng 2006).

When consuming a vice product, consumers often experience guilt and feel the need to justify their choice (Mishra and Mishra, 2011). Thus, many people adopt a compromise, known as self-rationing, when consumers ration their vice purchases, which allows them the immediate pleasure of consumption but also prevents overconsumption (Wertenbroch, 1998). That said, after consumers put effort into the acquisition of vice goods, they believe that they have earned the right to indulge and thus become more likely to consume (Kivets and Simonson, 2006).

Convenience is another critical aspect influencing consumer behavior in VMs. Research indicates that convenience shoppers, like those going to VMs, are less price-sensitive and more flexible about price, given the urgency of their purchase (Swoboda & Morschett, 2001; Emmelhainz et al., 1991). This dynamic aligns with the broader trend of consumers perceiving vice products in VMs as small, well-deserved rewards, which justifies the acceptability of a higher price (Choi & Park, 2024).

Therefore, we argue that the combination of impulsivity, reduced price sensitivity, and the perceived reward of indulgence creates a compelling case for why VM users might spend more on vice products over virtue ones in this unique retail context.

Time of the day

Differences in consumption behavior are influenced by the time of day (De Castro, 1987; Kramer et al., 1992), considering that nutritional choices and needs vary throughout the day (Guan, Probst, Neale, Batterham, & Tapsell, 2018; Krok-Schoen, Jonnalagadda, Luo, Kelly, Taylor, 2019; McLeod et al., 2020; Phan Chambers IV, 2018). It is widely acknowledged that time of day is associated with individuals' choices due to the fluctuation of physiological processes (Hofstra & de Weerd, 2008). For instance, people tend to eat healthy breakfasts in the morning but consume progressively unhealthier foods throughout the day, ending with junk food by nightfall (Burnham, 2012). Previous research has shown also that foods eaten earlier in

the day, such as breakfast, tend to be associated with positive nutrients (e.g., calcium). In contrast, those consumed later in the day, such as lunch and dinner, are dominated by negative nutrients (e.g., saturated fat) (Khare & Inman, 2006).

The motivations behind consumers' food choices throughout the day have been a focal point of research. As a leading factor, self-control was analyzed, a limited regulatory resource that diminishes over the day (Baumeister, 2002; Burnham, 2012). When an individual's self-control resources are low, it often leads to impulsive behaviors, including unhealthy eating (Baumeister, 2002; Hagger et al., 2019). Thus, individuals tend to maintain high self-control in the morning but lose it in the evening (Haynes et al., 2016; Boland et al., 2013). Furthermore, people often have preconceived notions about the appropriate times to consume certain foods, affecting their preferences during different meal periods (Birch, Billman, & Richards, 1984). This can explain why people might consume more unhealthy snacks, such as cookies, chips, and M&Ms, in the afternoon due to the perceived appropriateness of having an indulgent snack later in the day (Boland et al., 2013). Ultimately, the well-established differences in food choices at different times of day may also be influenced by culture, marketing, and fulfilling various psychological needs (Spence, 2021).

Payment methods

Previous research on payment methods and consumer behaviors has primarily focused on comparing credit cards with cash. These studies consistently found that credit cards increased spending (Chatterjee & Rose, 2012; Liu & Chou, 2020; Thomas et al., 2011), a phenomenon known as the credit card effect (Feinberg, 1986). Similarly, several studies have examined mobile payments and found that they facilitate purchases (i.e. the mobile payment effect) (Falk et al., 2016; Liu, Luo, & Zhang, 2021; Ma et al., 2021). Both effects have been attributed to a lower pain of paying, described as “an immediate negative emotion when giving money or

imagining giving money" (Zellermayer, 1996). Paying in cash, indeed, elicits greater pain than paying by other modes of payment (Prelec and Loewenstein, 1998). Credit card payments, instead, are relatively painless and weaken impulse control (Thomas et al., 2014). Then, it was demonstrated that card payments increase the purchase and presumably, the consumption of vice products (Thomas, 2011). That is because, when consumers encounter vice products the emotive imagery and associated desire trigger impulsive purchase decisions. In contrast, when buying virtue products consumers tend to make more deliberative choice. Paying in cash reinforces this control, giving consumers a greater sense of restraint when choosing healthier options.

Vending machines as a unique decision-making setting

Although it may seem obvious that factors such as brand familiarity, price, payment methods, and time of day influence consumer product choices, it is essential to recognize the unique characteristics of the vending machine (VM) setting compared to traditional retail environments. Unlike traditional retail stores, vending machines offer limited items due to space constraints (Hua & Ickovics, 2016) and a fully automated purchasing process. Moreover, the VM context is defined by quick decision-making, a lack of human interaction, and a heightened need for convenience—factors that are not as prevalent in other retail settings. These unique aspects of VMs suggest that consumer behavior might be influenced differently than in conventional retail environments. Therefore, it is crucial to study how these factors specifically impact consumer choices within the VM context, underscoring the relevance and necessity of our research.

Based on the aforementioned considerations, we argue that when consumers are in front of a VM and choose between various products, beverages, and snacks, they are willing to pay more for vice products, considering the perceived greater value gained from that choice. Moreover,

we argue that brand familiarity positively impacts product choice, specifically when choosing vice products and considering that consumers often make quick decisions at vending machines and that familiar brands reduce decision-making time and effort as they are seen as reliable and satisfying (Kemp & Bui, 2011; Hoyer, 1984). Then, previous research has shown that consumers choose different products based on the moment of the day, so virtue in the morning and vice later in the day (Hagger et al., 2019). However, it is not clear if, in the VM setting, the time of the day affects the choice in the same way. Moreover, in the past few years, new technologies have been added to VM, giving consumers new cashless payment methods. Along with card payment and mobile payment (i.e., Google Pay, Apple Pay), it is possible to have a digital payment wallet in the app (Alam et al., 2021). Considering that previous research has shown that different payment methods can impact the choice differently (Thomas et al., 2011), we argue that also in the VM setting, it might be a relevant variable to consider. Previous research suggests that brand familiarity, price, payment methods, and time of day drive consumers' product choices in vending machines. Specifically, consumers are more likely to spend on vice products, led by urgency and perception of the product value. A higher brand familiarity further encourages vice choices by enhancing the hedonic appeal of the products. Paying method adds another layer, when paying by cash, consumers are more likely to choose more virtuous products. Finally, consumers would make more virtuous choices in the morning while switching to more vice in the evening.

Thus, we hypothesize the following:

H1: The choice of more virtuous products in vending machines is driven by low brand familiarity, low price, traditional payment and earlier time of day.

The role of product placement on consumers' product choice

To investigate how the physical placement of food items impacts consumer choices, previous research explored the effects of increasing the distance between offices and snack or beverage stations within workplaces (Baskin et al., 2016). Studies also examined how adjusting the assortment of unhealthy (vice) and healthy (virtue) products influences decision-making, with experiments increasing the availability of healthier options like water over less healthy alternatives like soda in vending machines (Calabro et al., 2024). Similarly, in a school setting, the availability of healthy and moderately healthy products was significantly expanded (Stamos et al., 2019), further underscoring the potential impact of product placement on healthier consumer choices.

The way products are presented, whether vertically or horizontally, also has a significant effect on consumer decisions (Mukherjee, 2021). Research has shown that vertical product displays can result in lower variety seeking than horizontal displays (Deng et al., 2016) and a greater tendency to prefer options presented on the edge (vs middle) (Kim et al., 2019). Then, eye tracking experiments showed that consumers look first at the top of the screen, then gradually lower their eyes to view the options presented, and finally look at the bottom (Holsanova et al., 2006). The literature highlighted that high (vs low) verticality leads to a greater willingness to delay short-term gains for larger long-term gains (Slepian et al., 2015). Thus, experiences of verticality, such as looking up or down, can influence consumer behavior in numerous domains, including self-control (McCrea et al., 2008). Hence, when consumers are in front of a VM, they tend to look at the upper (lower) product with a more concrete (abstract) mindset because they consider it closer (further) when it is on top (at the bottom) (Van Kerckhove et al., 2014).

Furthermore, research suggests that individuals tend to mentally or visually position the “actor” on the left side rather than the right when adopting a more abstract and big-picture thinking. This phenomenon can be attributed to the activation of cognitive schemas that prioritize general

patterns and conventions, such as the culturally ingrained habit of reading from left to right (Suitner, 2012). Consequently, when in front of a VM, consumers will tend to look at the left (right) with a more abstract (concrete) mindset.

Moreover, abstract thinking promotes hedonic choices, while concrete thinking favors utilitarian options (Ishikawa et al., 2019). Therefore, considering that less healthy food (vice) is perceived to be tastier and consequently often triggers an impulsive, short-term indulgence goal (hedonic value), whereas healthy food (virtue) contributes more to a long-term health goal (utilitarian value) (Ittersum et al., 2024). We argue, indeed, that high (low) verticality and horizontally, left (right) positioning of product moderates the choice of vice (virtue). Specifically, that is because high (low) verticality and left (right) positioning are associated with an abstract (concrete) mindset, which leads to more impulsive (rational) food choices.

Thus, we hypothesize the following:

H2: Product layout moderates the positive impact of brand familiarity and price on choice. Vertically, (H2a) a layout with virtue products on top will diminish (increase) brand familiarity and price's impact on vice (virtue) choices. Horizontally, (H2b) a layout with virtue products on the right will diminish (increase) brand familiarity and price's impact on vice (virtue) choice.

The role of Location in virtue (vice) product choice

Each location where consumers spend everyday life has behavioral expectations tied to a social group or category that defines appropriate and permitted behavior for group members (Rizzo et al., 1970). A wide knowledge base suggests that these expectations substantially affect eating behavior, too (Higgs, 2015).

Considerable research has shown that the social environment can impact consumers' food choices, including both their choices between vice and virtue options and their portion size

choices (Higgs, 2019; Engell et al., 1996). For example, individuals tend to eat more when they are with familiar people (De Castro, 1987) and adjust their eating habits to match the eating norms set by others (Engell et al., 1996). There is also evidence that social norms can encourage healthy eating (Thomas et al., 2016). When their choices are observable and subject to evaluation by others, consumers often seek to shield themselves from negative judgment. They attempt to impress by selecting various options (Ratner & Kahn, 2002) and opting for lighter foods (Amiraian & Sobal, 2009). In workplaces, indeed, lunch breaks and coffee breaks are usually sharing moments, when people tend to meet and eat together. Thus, the influence of social norms can be higher than in other situations. Moreover, VMs are usually available to workers, who would prefer them, instead of other outlets (Grech & Alleman, 2015). Hence, product price has a stronger effect on food choice, considering the frequency of the purchases, while brand familiarity has a weaker impact.

Furthermore, the presence of VMs in hospitals underscores the relevance of analyzing them, as these environments similarly affect consumer purchase experiences by prioritizing accessibility and convenience. First, the unique working demand of hospital workers (i.e., nurses, and doctors) is to provide 24-hour care to others (Perry et al., 2015). Second, some nurses can't bring food from home or have inadequate facilities (i.e., fridges, kitchens, and eating rooms) so they frequently use vending machines (Brogan et al., 2021). Nurses frequently prioritized the job's responsibilities, leading to less attention to healthy eating, feeling the responsibility of taking care of patients, and duty even during breaks (Wills and Kelly, 2017).

Then, in the hospital setting, caregivers play a significant role with nurses and doctors. When in the hospital, there are rules to respect (i.e., visit hours, and a limited number of persons admitted), which can lead to major stress (Carroll et al., 2020). Moreover, studies indicate that guilt-reducing mechanisms, such as helping others (i.e., caregivers), can heighten the preference for less healthy products (Khan & Dhar, 2006). Generally speaking, both hospital workers and

caregivers commonly experience eating behaviors as a coping mechanism to the stress and exhaustion experienced by job demands and emotional overload, leading to more indulgent choices (Van Strien, 2018). So, given the urgency of their purchases, they are less price-sensitive (Swoboda & Morschett, 2001), however, prefer choosing familiar food which could evoke positive emotions, compensating for the negative emotions (i.e. stress and mental overload) (Khorisantono et al., 2024).

Finally, university students often experience significant stress due to a blend of academic, social, and financial pressures (Leguizamo et al., 2021). The confluence of personal, social, and academic demands and pressures associated with the transition to college often results in stress and anxiety for students. The same multifaceted stressors impact faculty and administrative staff too (Evans et al., 2018). In the demanding academic environment, students and faculty members often turn to self-indulgent behaviors to respond to stress. For students, the pressure to achieve high grades, meet deadlines, and balance academic responsibilities with personal life can lead to escapism through activities like binge-watching shows, engaging in excessive gaming, or indulging in comfort food (Clohessy et al. 2019). Similarly, faculty members facing the pressures of research productivity, teaching responsibilities, and administrative duties may resort to overeating as temporary relief (Lunardo, 2022; Klatzkin et al., 2021).

In sum, consumers' food choices are shaped simultaneously by multiple levels of influence, including the location of VMs (Lorenz & Langen, 2018). In a more stressful context (i.e., university or hospital) people tend to self-indulge more (de Witt Huberts et al., 2012) so buying fewer healthy products, to compensate for their negative emotional overload. This leads to diminishing the need for convenience, typical of the VM setting, while enhancing the positive effect of brand familiarity. Considering the need to reduce the mental effort of choosing a product (XXXX).

In the workplace, instead, a strong driver of food choice is the social influence. Consumers would indeed prefer healthier products, which are positively accepted, and shield themselves from negative judgment (Higgs & Thomas 2015). Along with social norms, considering the frequency of purchases from VMs, convenience drives their choice, too, leading consumers to prefer healthier products. Employees often prioritize making a quick, healthier choice, focusing on how a product aligns with these social norms, rather than taking the time to evaluate brands. Hence, the effect of brand familiarity, instead, is weaker in workplaces (Nestle et al., 1998).

Thus, we propose:

H3: The vending machine's location moderates the positive effect of brand familiarity and price on product choice. Specifically, (H3a) in workplaces, the positive effect of brand familiarity and price on virtue product choice is strengthened, while (H3b) in hospitals and universities it is weakened.

Overview of the studies

We conducted three studies: Study 1 tests H1, examining how brand familiarity, price, time of day, and payment method affect product choice in the context of vending machines. Study 2 tests H2 and therefore the moderating role of the physical placement of products in the vending machine (bottom vs. top rows; left vs. right) on consumers' choice. Finally, Study 3 tests H3 and therefore if and how vending machines' location affects consumers' virtue or vice product choice.

4.3 Method

Study 1

Sample

A planogram is a strategic visual merchandising tool that dictates the precise placement of products on retail shelves or displays to optimize sales and enhance the shopping experience. Planograms facilitate effective product presentation and category organization by specifying each product's location, shelf space allocation, and arrangement. These diagrams utilize sales data and consumer behavior insights to maximize product visibility and profitability while ensuring consistency across various store locations. Additionally, planograms aid in inventory management by systematically guiding product replenishment, minimizing out-of-stock situations, and overstocking. As a pivotal instrument in retail operations, planograms contribute significantly to efficient stock management and improved sales performance. In the context of vending machines, planograms serve the same purpose by organizing product placement to optimize sales and customer satisfaction.

The dataset comprises 13,709 transaction records for 121 different products (Stock Keeping Unit SKU) derived from the vending machine telemetry and the planograms of eight vending machines from December 12, 2021, to April 7, 2022. Each transaction refers to a single product purchased by the customer.

Measurements

The recorded data include the product's EAN (European Article Number), description, date and time of purchase, price, payment method, and location in the vending machine’s planogram. This information was recorded automatically for each transaction.

First, based on previous literature, we classified the payment method into cash, cards and mobile payment (Bechler et al., 2023). When considering mobile payment, we included also Google Pay, Samsung Pay and Apple Pay system (Ma et al., 2023). Moreover, the data automatically recorded the purchases' time of the day and we categorized into five-time slots: 07:00:00 AM to 10:59:59 AM, 11:00:00 AM to 02:59:59 PM, 03:00:00 PM to 05:59:59 PM, 06:00:00 PM to 11:59:59 PM, and 12:00:00 AM to 06:59:59 AM, to reflect different meal periods throughout the day (breakfast, lunch, afternoon snack, dinner, and night snack). Previous literature analysed how food choice can change along the day and classified salient moment of the day in morning, afternoon, and evening (Krok-Schoen et al. 2019; Boland et al. 2013). However, considering that consumers have access to vending machine also during night or early in the morning, when other retailers are not accessible (Grech & Allman-Farinelli, 2015; Matthews & Horacek, 2015), we considered relevant to expand the classification of the different moments of the day, to have a better representation of food choices in this specific setting.

Then, to measure the dependent variable, we conducted a study with 131 Italian respondents, averaging 31.79 years in age and consisting of 50.38% females. Data was collected online via SurveyMonkey, and each participant evaluated 20 randomly assigned products from the 121 that were sold in the vending machines. Each product was presented with an image, and respondents rated the product's vice-virtue nature and brand familiarity each measured a single-item measure on a 5-point scale. At the beginning of the questionnaire, we reported the definition of vice and virtue from the literature (Ketron et al, 2022; Carrillo-Álvarez et al. 2020) to make sure that respondents would be knowledgeable about their rating task. A manipulation check confirmed that all participants correctly recalled these definitions. Although it has been collected as a convenience sample, its characteristics, in terms of age, gender, and nationality of the participant, well approximate the population participating in the main study.

The prediction of the Vice-Virtue choice was modeled as a regression task, with the dependent variable being the Vice-Virtue score of the chosen product(s).

The dataset was standardized and filtered to remove duplicates, ensuring the quality and integrity of the data. Summarising the model features were ‘time slot' and 'payment method' both categorical, 'Familiarity', and ‘Price’ both numerical.

To identify the best-performing regression model, we utilized AutoGluon, an automated machine-learning toolkit that tests various models and hyperparameters to find the optimal solution (Erickson et al., 2020). AutoGluon streamlined the model selection process by efficiently evaluating multiple models and configurations. A train/test split with a 0.25 holdout fraction was selected. A validation set with a 0.1 holdout fraction was extracted from these for hyperparameter tuning (Picard et al., 1990).

To ensure the interpretability of the analysis, we calculated the feature importance for our best model using permutation importance. Feature importance refers to determining the relative significance of each input feature in predicting the target variable. This helps in understanding which features have the most substantial impact on the model's predictions. Permutation importance is a robust method for calculating feature importance, as it involves shuffling the values of each feature and measuring the decrease in model performance. This method is advantageous because it is model-agnostic and can be applied to any machine learning model, regardless of its complexity or structure (Breiman, 2001). By using permutation importance, we can consistently and reliably assess each feature's contribution to our model's predictive power, thereby enhancing the transparency and explainability of our results.

4.4 Results

Different regression models have been compared to maximize the coefficient of determination (R2). Results are highlighted in **Error! Reference source not found.**, and the best model is

KNeighborsDist. This model represent a regression based on k-nearest neighbors where the weight function used in prediction is ‘distance’: it weights points by the inverse of their distance. in this case, closer neighbors of a query point will have a greater influence than neighbors which are further away.

Table 1 Model comparison. In bold, best result.

Model	R2
KNeighborsDist	0.9803
WeightedEnsemble_L2	0.9795
LightGBMLarge	0.9791
RandomForestMSE	0.9790
KNeighborsUnif	0.9789
XGBoost	0.9777
LightGBM	0.9716
ExtraTreesMSE	0.9444
CatBoost	0.9431
LightGBMXT	0.8732
NeuralNetFastAI	0.7130
NeuralNetTorch	0.6390

Additional metrics have been calculated for the best model: RMSE: 0.1859, MSE: 0.0345, MAE: 0.0395. Feature importance for R2 is reported in **Error! Reference source not found.**,

where ‘importance’ is the calculated feature importance score, together with its standard deviation and ‘p-value’, the p-value comes from a statistical t-test evaluating the null hypothesis that the importance equals 0 against the alternative hypothesis that the importance is greater than 0.

Table 2 Feature Importance

Feature	Importance	Standard Deviation	p-value
Familiarity	1.6803	0.03262	< 0.05
Price	0.6146	0.0194	< 0.05
Payment Method	0.0019	0.0022	> 0.05
Time Slot	-0.0001	0.0002	> 0.05

Table 2 shows that time slot and payment method are not statistically significant, while the most significant features are familiarity and price. For the best model, the Adjusted R^2 was calculated, yielding a value of 0.97956, which is close to the R2 value (0.97958). The value of R2 and adjusted R2 are close to 1.0 that is very high and has indicated a high correlation between the predicted values and the observed values. Additionally, the Variance Inflation Factor (VIF) was computed to assess multicollinearity among the regression variables, and the results are presented in Table 3. The table indicates no significant multicollinearity between the features.

Table 3 VIF

Feature	VIF
Price	7.602028

Familiarity	13.820670
Vice_Virtue	5.874378
Time Slot	5.809677
Payment Method	6.350148

After identifying the optimal regression model for predicting the Vice_Virtue variable, we further investigated the roles of key features to understand their individual impact on the prediction. To achieve this, we fitted a simpler linear regression model and analyzed the regressor coefficients to interpret the contribution of each feature more transparently. Our findings indicate that both Price and Familiarity have a negative effect on Vice-Virtue, with coefficients of -0.66 and -0.17, respectively, suggesting that higher price and familiarity are associated with a lower Vice-Virtue score, hence towards Vice Products. Interestingly, while the linear model suggests Price as the more influential feature, results from more complex models, including decision trees and gradient boosting, consistently highlight Familiarity as having a more substantial impact on Vice-Virtue. This discrepancy is likely due to the ability of advanced models to capture non-linear interactions and complex dependencies between features, revealing a more nuanced relationship where Familiarity contributes more significantly when interactions between features are considered. This comparison underscores the importance of feature interactions in understanding Vice-Virtue preferences and the value of using interpretable models alongside complex ones for comprehensive insights.

Study 2

Study 2 tests H2a and H2b which are about the moderation by the physical placing of the products in the vending machines (bottom vs. top rows; left vs. right columns).

Sample and procedure

Study 2 uses the dataset of 13,709 transaction records for 121 different products as used in Study 1, but accounts for the row and column the products occupy in the vending. Again, the dependent variable is the virtue or vice score of the chosen product, and the data are actual consumer transactions. Using Hayes' PROCESS macro for SPSS with 5,000 bootstraps and normalized column and row data, we tested how the row and the column moderate price and familiarity's relationship with the dependent variable.

Results

Accounting also for the row and column shows that price is no longer significant in predicting the choice of a virtue or vice product (B = .019, SE = .001, p = .068), while familiarity remains significant and negative (B = .658, SE = .030, p < .001). The negative coefficient sign for familiarity reduces the probability of choosing a virtue product and enhances that of a vice product. Furthermore, the impact of familiarity is significantly moderated by both the row (B = .729, SE = .034, p < .001) and the column (B = .071, SE = .034, p = .035).

As further confirmed by the PROCESS test of highest order unconditional interactions on the price-choice relationship, the row has a 10-fold stronger moderation than the column (R2-change for Row = .014, F= 456.549, p < .001 vs. R2-change for Column = .001, F = 4.426, p = .035). This evidence means that. Although the row and the column influence the familiarity-choice relationship, the row is a much more powerful effector.

Observing the conditional effects at the values of the moderator shows that the row counteracts the familiarity-choice relationship by -.419 (SE = .013, p < .001) when the product is placed on the top. As the product moves downwards, the effect becomes +.038 (SE = .015, p < .001). The reversal in sign means that the top-bottom product placement weakens familiarity's impact on product choice in the top rows and enhances it in the bottom rows. In other words, virtue

products benefit from being placed on top, as the negative impact of familiarity is weakened, while vice products benefit from being placed bottom.

Regarding the column, the conditional effects at the values of the moderator reveal that, as products move from left to right, the negative impact of familiarity on virtue choice becomes weaker: the column's effect goes from -.218 (SE = .020, $p < .001$) to -0.040 (SE = .019, $p = .036$). This is to say that vice products are advantaged by being placed left, while the right side favors virtue products.

Furthermore, the data also reveal a significant direct effect of the row on the probability of choosing a virtue product. Specifically, moving upwards vertically in the vending machine favors the choice of a virtuous product (B = 1.558, SE = .168, $p < .001$).

Study 3

Study 3 tests H3 which is about the moderation by the location of the vending machine.

Sample and procedure

Study 3 uses the dataset of 13,709 transaction records for 121 different products as used in Study 1, but accounts for the location where the vending machine is placed. Again, the dependent variable is the virtue or vice score of the chosen product, and the data are actual consumer transactions. Using Hayes' PROCESS macro for SPSS with 5,000 bootstraps and normalized column and row data, we tested how the vending machine's location moderates price and familiarity's relationship with the dependent variable. As derived from the literature review supporting H2, three locations were identified: hospitals, schools, and universities accounting -respectively- for 1,296, 7,515, and 4,898 of the 13,709 total transaction records. The products sold in each location were the same.

Setting

The vending machines were in diverse environments, including a company, two universities, two hospitals/ nursing homes. These varied locations cater to user demographics, providing a rich dataset for analyzing purchase behavior across different contexts. This diversity allows for a comprehensive examination of how location and user profiles influence vending machine transactions, providing valuable insights for optimizing product placement and sales strategies.

Results

Accounting also for the vending machine's location shows that price weakly (B = -.03, SE = .001, $p < .001$) and brand familiarity more strongly (B = -.705, SE = .034, $p < .001$) affect the choice of a virtue product. The negative coefficient sign means that the probability of choosing a virtue product is reduced while that of choosing a vice product is enhanced. As anticipated by H2, location significantly moderates the impact of familiarity (B = .252, SE = .014, $p < .001$). Instead, the moderation effect on price is negligible (B = .003, SE = .000, and insignificant).

The PROCESS test of highest-order unconditional interactions on the familiarity-choice relationship shows a significant R square change (F = 330.671, $p < .001$), and the conditional effects of the focal predictor at the values of the moderator (location) show that the impact of location is as advanced in H2. Specifically, familiarity leads even more to the choice of vice products when the vending machines are placed in schools (.118, SE = .028, $p < .001$ and hospitals (BE = .145, SE = .041, $p < .001$), while the oppositive holds in workplaces, where the sign reverts (BE = -.297, SE = .014, $p < .001$).

Furthermore, the data also reveal a significant direct effect of the location on the probability of choosing a vice product. Specifically, as locations move from schools, to hospitals, to workplaces, the choice of a virtue product is discouraged (B = -1.194, SE = .068, $p < .001$).

4.4 Discussion

This study provides a comprehensive exploration of consumer behavior in VM settings, offering new insights into how specific factors — brand familiarity, price, product placement, and location — shape choices between vice (less healthy) and virtue (healthier) products. Unlike traditional retail environments, VMs represent a unique context characterized by impersonal, automated transactions, minimal decision-making time, and a focus on convenience. These attributes significantly influence purchasing behavior, differentiating VM-based decisions from those made in conventional retail settings. As most of the current research is based on self-report data (Grimmer & Miles, 2016), our study contributes to the body of knowledge that already exists, by measuring actual behavior in vending machine settings.

Our findings highlight the pivotal role of brand familiarity and price in driving consumer preferences. Products with higher brand familiarity and price are more likely to be chosen, particularly when they are less healthier (i.e. vice products). Familiar brands offer a sense of trust and reliability, which reduces decision-making effort, while higher prices for vice products are often justified as small indulgences or self-rewards. This is coherent with previous literature that showed how consumers tend to pay more for a vice product considering the perceived greater value gained that impact also self-reward and XXX (Choi & Park, 2024). Interestingly, the anticipated effects of time of day and payment method, which have been widely documented in traditional contexts, did not significantly impact consumer choices in the VM setting. This discrepancy may stem from the isolated nature of VM purchases, which are typically single-instance decisions rather than part of a sequential series. Consequently, factors such as decision fatigue (linked to time of day) and the pain of payment (associated with cash vs. cashless methods) seem to have diminished influence in this context. These findings underline the distinct psychological mechanisms at play in VM transactions, where immediacy and convenience often override routine patterns or reflective decision-making.

The moderating role of product placement emerged as a critical aspect of consumer choice in VMs. Our results indicate that placing virtue products in the upper rows or on the right-hand side of the display significantly increases their likelihood of being selected. This supports prior research on construal level theory, which suggests that higher and rightward placements align with more abstract, goal-oriented thinking, fostering preferences for healthier, long-term choices (Van Kerckhove et al., 2014). Retailers and VM operators could leverage these insights to design layouts that subtly nudge consumers toward virtue products without compromising the overall shopping experience.

Location-specific dynamics further illuminate the complexity of consumer behavior in VMs. High-stress environments, such as hospitals and universities, exhibit increased vice product purchases, driven by emotional overload, stress, and the need for immediate comfort or indulgence. Familiar brands are especially influential in these contexts, offering a cognitive shortcut that minimizes the mental effort required to make a choice. Conversely, workplaces demonstrate a stronger preference for virtue products, likely influenced by social norms and professional expectations. Employees may feel a heightened need to align their choices with perceived standards of healthy behavior, especially in settings where choices are visible to peers. These findings emphasize the importance of tailoring VM strategies to the specific characteristics of their locations, as consumer priorities and behaviors vary significantly across different environments.

In conclusion, this study bridges a significant gap in the literature by focusing on real purchasing behaviors in VM contexts rather than self-reported data, which often lacks ecological validity. Our findings not only contribute to a deeper understanding of the drivers of vice and virtue product choices but also highlight the potential for VMs to serve as effective tools for influencing healthier eating habits. As VMs continue to grow in prevalence and

importance worldwide, their role in shaping consumer behavior presents an exciting avenue for both academic research and practical innovation.

The findings of this study offer several actionable insights for VM operators, retailers, and policymakers seeking to influence consumer behavior and optimize sales strategies.

First, the critical role of product placement in encouraging virtue product choices highlights the need for smarter and more deliberate planograms. For instance, placing healthier options in top rows or on the right side of VM displays can capitalize on consumer tendencies toward abstract, goal-oriented thinking, thereby promoting better choices. Retailers should prioritize these strategic layouts, particularly in environments where health-conscious decision-making is encouraged, such as workplaces and schools.

Second, the influence of brand familiarity underscores the importance of offering recognizable products that consumers trust. By collaborating with popular brands to introduce healthier versions of familiar vice products, retailers can drive sales while subtly shifting demand toward more virtuous choices. Point-of-purchase communication, such as highlighting familiar brands through interactive screens or promotional banners, can further reinforce consumer trust and simplify decision-making.

Pricing strategies also emerge as a critical lever for shaping consumer behavior in VMs. Given the demonstrated impact of price on product choices, implementing targeted pricing, such as discounts on virtue products or “healthy bundles,” can steer consumers toward healthier options. These strategies are particularly relevant in workplace settings, where frequent purchases amplify price sensitivity. Conversely, in high-stress environments like hospitals and universities, promotional efforts should focus on reducing the perceived effort of choosing healthier options, such as offering bundled discounts or loyalty rewards for virtue purchases.

Lastly, VM operators should leverage advancements in technology, such as smart VMs equipped with dynamic pricing and personalized recommendations, to create adaptive interventions tailored to specific consumer contexts. For example, interactive screens could provide real-time feedback or gamified incentives, rewarding consumers for choosing healthier items. Location-specific marketing campaigns, such as positioning virtue products as “brain food” in universities or as “energy boosters” in workplaces, can further align product offerings with consumer needs, driving both profitability and well-being.

By adopting these strategies, retailers and VM operators can enhance the consumer experience, encourage healthier eating habits, and maximize sales performance. These interventions not only align with public health goals but also position vending machines as a more socially responsible and innovative retail format in a rapidly evolving marketplace.

4.5 Conclusion

Our study acknowledges certain limitations that future research could address. First, we did not account for personal factors such as stress or workload, which are likely to influence VM choices and vary across settings (e.g., workplaces, hospitals). Future studies should examine these individual variables to better understand their impact on vending machine behavior. Additionally, while our analysis focused on real consumer purchase data, it did not delve deeply into demographic factors, such as age and gender, which prior research suggests may significantly shape food choices. Investigating generational and demographic differences in VM usage could provide valuable insights.

Further research could also explore the broader context of consumption, including not only the timing of purchases but also the duration and social context (e.g., whether consumers are alone or with others). Collecting detailed data on these variables would help uncover more nuanced patterns of consumer behavior.

Our research was conducted within a single country, limiting its applicability to regions with different cultural and dietary norms. Future studies should undertake cross-national comparisons to explore how cultural differences and eating habits influence VM choices. For example, countries like Japan, with a high prevalence of vending machines, may exhibit distinct patterns compared to European countries with less exposure. Examining these regional variations could shed light on the global drivers of VM usage and food preferences.

In conclusion, our study highlights the importance of encouraging healthier eating through vending machines. By demonstrating the direct impact of price and brand familiarity on vice and virtue choices, as well as the moderating effects of VM location and product placement, our findings emphasize the potential of VMs as tools for promoting healthier habits. We hope this research sparks further discussion among retailers and scholars about the role of VMs in fostering better consumer choices and improving public health outcomes.

Appendix

Table 4.1 – Products in VMs

N	PRODUCT	BRAND FAMILIARITY	RATE OF VICE-VIRTUE
1	Ferrarelle water	4,56	4,52
2	Sanbenedetto sparkling water	4,69	4,38
3	Monte Cimone sparkling water	2,85	4,33
4	Natural Monte Cimone water	2,27	4,73
5	Sanbenedetto natural water	4,78	4,96

6	Air Action Vigorsol	4,63	2,9
7	Peanuts Mister Nut	2,36	2,44
8	Orangeade Sanpellegrino	4,29	2,03
9	Mulino Bianco Baiocchi	4,74	1,91
10	Be kind with dark chocolate and salted almonds	2,38	3,07
11	Be kind, almonds and coconut	2,74	3,53
12	Grisbi chocolate biscuits	4,5	1,46
13	Bon Fruit flavour mix Fruit-Tella	2,65	4,03
14	Bounty	4,5	1,38
15	Buoni Così Galbusera	3,57	3,26
16	Cereal Yo - Vitasnella	3,74	3,13
17	Chinò Sanpellegrino	3,93	1,86
18	Chips rustic Salati Preziosi	3,69	1,65
19	Coca Cola	5	1,33
20	Coca Cola Zero	4,87	2,26
21	Crunchy Scotti	2,78	3,03
22	Bacon-flavoured crispy treats	3,65	1,7
23	Pizza crispy treats	3,97	2,17
24	Croccantelle with ham	3,86	1,82

25	Bauli Apricot Croissant	4,09	1,87
26	Bauli Croissant 7 cereals and seeds	3,9	2,38
27	Bauli Chocolate Croissant	4,29	1,79
28	Tart falcone Apricot and Peach	1,89	1,79
29	Tart Falcone Gianduia	2,5	2,22
30	Crostatina Cacao Germinal Bio	3,04	2,56
31	Lively Golden Crostini San Carlo	4,79	2,37
32	Red Orange Derby	2,74	2,35
33	Doricream cacao Doria	3,35	1,8
34	Duplo	4,61	1,61
35	Energade orange	3,77	2,31
36	Energade red orange	3,92	2,96
37	Energade lemon	3,76	2,24
38	Estathé lemon	4,88	2
39	Estathé peach	4,72	1,83
40	Fanta	4,77	1,52
41	Fiesta	4,9	1,45
42	Fonzies cheese	4,5	1,46
43	Fragrantini Fiorentini	3	2,61

44	Fiorentini organic cornflakes	3,76	3,92
45	Gatorade orange	4,29	2,67
46	Gatorade lemon	4	2,52
47	Scotti rice gems	3,68	2,9
48	Gran Pavesi Cracker tomato and cheese	4,16	2,9
49	Kellog Special K dark chocolate	4,29	3,07
50	Kinder Bueno	4,95	1,35
51	Kinder bueno white	4,64	1,29
52	Kinder Cereals	4,95	1,5
53	Kinder délice	4,74	1,3
54	Kinder milk slice	4,96	1,89
55	Kinder Maxi King	3,81	1,28
56	Kinder pingui chocolate	4,62	1,71
57	Kinder pingui coconut	4,5	1,75
58	KitKat	4,88	1,46
59	Levissima sparkling water	4,5	4,54
60	Levissima still water	4,64	4,76
61	Loacker Chocolate	4,75	2,03
62	Loacker Napolitaner	4,71	1,81
63	m&m's	4,91	1,32
64	Mikado	4,58	1,69

65	Milka cookie sensation	3,75	1,5
66	Milka Oreo	4,04	1,29
67	Falcone Yoghurt Muffin	2,4	2,36
68	Falcone Yoghurt Plumcake	2,14	2,18
69	Nic Nac's	2,85	1,67
70	Nutella bread	4,21	1,25
71	ORO Ciok	4,75	1,79
72	Viva la mamma, raw ham and cheese sandwich	2,48	2,78
73	Viva la mamma Salami sandwich	2,92	1,92
74	Paquita Crock Canyon	2,83	1,87
75	Patastick PATA	3	1,52
76	Classic potato PATA	3,91	1,59
77	Pepsi	4,63	1,26
78	Pipas artesana	1,97	3,31
79	Red Bull	4,3	1,3
80	Red Bull ZERO	4,16	1,84
81	Ringo vanilla Pavesi	4,73	1,57
82	Rulade milk	2,18	1,61
83	Rulade hazelnut	2,22	1,48
84	SalaMini taralli and Beretta salami snacks	3,76	1,94

85	Sanpellegrini non-alcoholic cocktail	3,63	2,12
86	Schiacciatella tomato and oregano	3,11	2,77
87	Schiacciatelle Olives	3,04	2,69
88	Schiacciatelle Rosemary	3,46	2,85
89	Orange Schweppes	3,88	1,71
90	Schweppes lemon	4,28	1,78
91	Snack parmareggio Snack & Go	3,37	3,22
92	Special K Red fruits	4,1	3,48
93	Student mix peanuts FOX	2,48	4,26
94	ACE Derby sugar-free juice	3,44	3,68
95	Juice AQ purple Yoga	3,04	3,64
96	Juice Red Orange Derby sugar-free	3,67	3,53
97	Santal Big Pear Juice	3,61	3,39
98	Santal Peach-Lemon Juice	4,16	2,6
99	Juice Peach/Mango Yoga	3,7	2,91
100	Valfrutta Apricot Juice	4,61	3,06
101	Valfrutta Pear Juice	4,2	3,15
102	Valfrutta Peach Juice	4,49	2,95
103	Juice Yoga 100% Orange Juice	3,71	4

104	ACE Yoga Juice	4,39	3,58
105	Red Orange Yoga Juice	3,57	3,48
106	Juicy ZERO Mixed Fruits SAN BENEDETTO	3,77	3,45
107	Succoso ZERO San benedetto red fruits mix	3,86	3,86
108	Tarallino snack Natur Puglia	2,95	3,38
109	San Benedetto Lemon Tea	4,45	2,6
110	San Benedetto Lemon Tea ZERO sugar	3,97	2,97
111	San Benedetto peach tea	4,23	2,35
112	Green tea San Benedetto	4,19	3,26
113	Tramezzino Viva la mamma Beretta cooked ham and artichokes	3,27	2,62
114	Tramezzino Viva la mamma Beretta Tuna and tomato	2,84	2,72
115	TUC pocket	4,43	2,3
116	Twix	4,78	1,3
117	Vivident blast fresh	4,29	2,71
118	Grisbi chocolate wafers	3,44	1,78
119	Matilde Vicenzi chocolate wafers	3,13	1,84

120	Grisbi vanilla wafers	3,7	1,78
121	Yovi banana bar	2,5	3,7

5. Promoting healthy or preventing unhealthy? An experimental investigation in the context of food products sold through smart vending machines

Vending machines offer 24-hour access to food and drink and are found in high-traffic areas, including, but not limited to, worksites, schools, universities, and healthcare facilities (Matthews & Horacek, 2015; Whatnall, Patterson, and Hutchesson, 2020). Products available in vending machines can be classified into two main categories such as vice and virtue. Vice products give small immediate rewards such as pleasure and taste for larger delayed costs, particularly for health. Virtue products instead offer small immediate costs, for larger delayed rewards. They are perceived as less tasty, offer health benefits, and increase long-term well-being (Ruiz-Conde, Mas-Ruiz, and Parreño-Selva, 2021; Ketron, Naletelich, and Migliorati, 2021). Consumers frequently find themselves facing a self-control dilemma when selecting either a virtue or a vice product to eat (Kuo, Chuang, Huang, and Wu, 2019). Since the nutritional quality of food and beverage products sold in vending machines has been implicated as a contributing factor to the development of an obesogenic food environment

(Matthews & Horacek, 2015), several public policy initiatives for the promotion of healthy lifestyles through vending machines have been tested and implemented (Grech & Allman-Farinelli, 2015): for example, the introduction of nutritional labeling with a color-coding model (Campbell, Pitt, and Mclennan, 2020), the price reduction of healthier products (Hua &

Ickovics, 2016), till the replacement of unhealthy products with healthier solutions (Pechey, Jenkins, Cartwright, and Marteau, 2019; Griffiths, Powel, Usher, Boivin, and Bott, 2020).

The present study aims at contributing to the literature that tests the efficacy of different solutions to promote healthier consumption choices through automatic distributors.

Specifically, as smart vending machines can send vocal or written messages to the consumer contextually with choice, it is possible to decide what kind of messages to send to the consumers and how to frame them, to encourage healthy food choices. As Gallagher and Updegraff (2012) reported, health messages can be framed to highlight either the benefits of engaging in a particular behavior (a gain frame) or the consequences of failing to engage in a particular behavior (a loss frame). To explain the effectiveness of message framing, the focus regulatory theory (Higgins, 1997) suggests that people adapt their behavior based on a goal focused on promotion, expecting positive outcomes or prevention, and avoiding negative outcomes. In the present study, through a between-subjects experimental design (2x2), we manipulated the product type (vice vs. virtue) and the message type (prevention-focused vs. promotion-focused) to see what strategy would be more effective in increasing (decreasing) the intention to buy healthier (unhealthier) products from vending machines. Results show how prevention-focused messages seem more effective in reducing the intention to buy vice products than promotion-focused messages to increase the consumption of virtue products.

5.1 Theoretical background

Self-regulatory focus theory foresees that different strategic inclinations for self- regulation play a key role in directing behavior (Higgins, 1987; Higgins, 1997). A promotion focus refers to a tendency to aim for reaching an end-state because is desirable. The motivating force of a promotion focus is looking for pleasure. A prevention focus denotes a tendency to aim for reaching an end-state because of a fear of an undesirable alternative. The motivating force of a

prevention focus is the avoidance of pain (Stam, Van Knippenberg, and Pieterse, 2018). Promotion and prevention orientation lead to different perceptions and goal- pursuit behaviors without altering the goal itself; that is, two people with the same goal will think, feel, and act differently depending on whether they view the goal through a promotion or prevention lens (Weber & Bauman, 2019). Prevention and promotion focus can be situationally induced (Higgins, 1997) through different communications. Based on Regulatory Focus Theory, Fransen, Reinders, Bartels, and Maassen (2010) found that exposure to a communication message matching a consumer's regulatory orientation (i.e., regulatory fit) leads to greater intention to buy for the product than exposure to a communication message that does not match with a consumer's regulatory orientation. So, previous research findings document that when an individual's regulatory goals match the message frames in terms of regulatory orientation, that is when there is goal compatibility, more persuasive effects result (Aaker & Lee, 2001).

Considering that virtue products are healthier in the long term but appear unappealing in the short, while vice products are tastier in the short term but harmful in the long run (Chernev & Gal, 2010), we speculate that consumers' regulatory focus varies between different product categories. So, we propose that claims have to be carefully developed not only to identify with the consumers' regulatory orientation (Aaker & Lee, 2001) but to also be appropriate for the specific product type, such as vice or virtue in this case. Specifically, we predicted that a promotion-focused message will increases the intention to buy virtue products, while a prevention-focused message will decrease the intention to buy vice products. We hypothesize a direct effect of message type on intention to buy and moderation by product type. Thus, policymakers could choose two different but equally efficient ways to boost healthier consumption habits: by pushing virtue products with promotion-focused messages and by reducing the consumption of vice products with prevention-focused messages. Thus, we hypothesize:

H1: Promotion-focused messages will increase ITB more than prevention-focused messages.

H2: Product type moderates the effect of message type on ITB so that ITB will be highest for promotion-focused messages on virtue products and lowest for prevention-focused messages on vice products.

Several studies, in the context of retailing, have shown that consumers not only feel satisfied consuming the product (i.e., eating the snack) but first, and foremost, they feel satisfied with the decision-making process (Fitzsimons, 2000). In particular, when consumers have developed a clear intention, this will be reflected in a higher certainty of the choice and also greater satisfaction with the choice (Pizzi, Scarpi, and Pantano, 2021). So, similarly, we hypothesize that a stronger intention to buy will be reflected in greater decision satisfaction.

H3: A higher (lower) ITB will increase (decrease) decision satisfaction.

Finally, to the best of our knowledge, previous literature has never predicted a direct link between message type (prevention-focused/promotion-focused) and decision satisfaction. The message type has been linked to the regulatory focus theory (Micu & Chowdhury, 2010), however, the literature has shown that it is possible to have high/low levels of decision satisfaction in the face of a focus on prevention/promotion. Therefore the literature does not provide any elements to hypothesize a direct link between a prevention/promotion focus and decision satisfaction. In other words, we hypothesize that prevention/promotion messages impact decision satisfaction only to the extent that they translate into a purchase intention. In short, we hypothesize a total mediation of ITB in the relationship between message type and decision satisfaction. Accordingly:

H4: The message type (prevention-focused vs. promotion-focused) does not impact decision satisfaction.

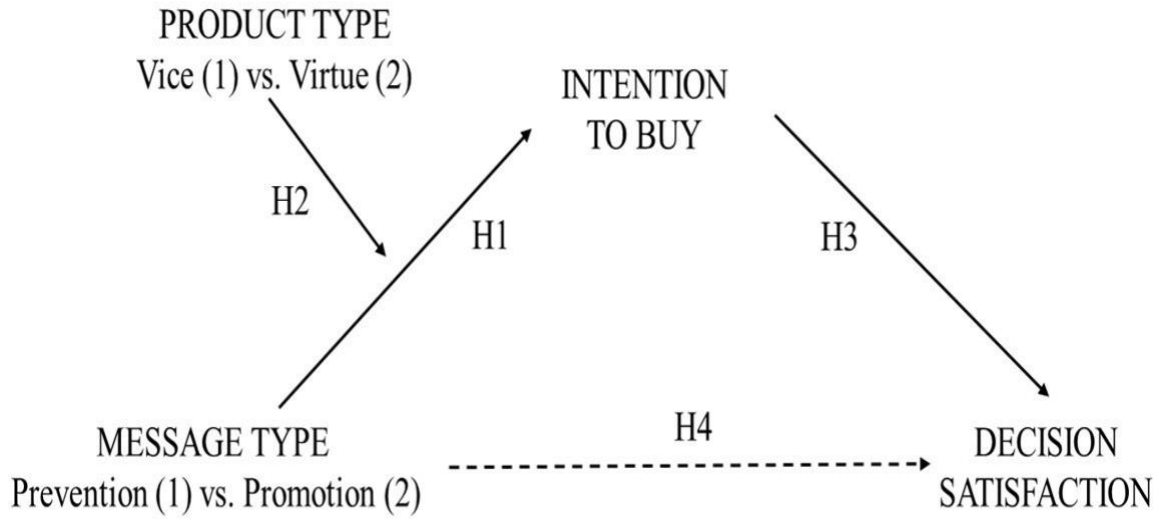

Fig. 5.1 The theoretical model

5.2 Methodology

We realized a between-subjects experimental design (2x2). The independent variables were the kind of product (vice vs. virtue) and the kind of message (prevention vs. promotion). Since smart vending machines may send voice messages to consumers standing in front of them before they choose the product to buy, the study aims to investigate how effective would be a message (i.e., prevention-focused or promotion-focused) in avoiding/promoting an unhealthy/healthy choice and if the message has a different impact considering the kind of the product (i.e., vice or virtue).

Before running the main study, we conducted a pre-test to select the products to be used in the experiment representing both categories of vice and virtue. Specifically, after defining vice products and virtue products, we asked consumers to rate (on a range from 1 - completely disagree to 7 - completely agree) how much they perceived each picture of snack proposed as

vice and virtue by picking from a set that is usually sold through vending machines. To eliminate potential confounding variables, we decided to use real products of the same category (i.e., snacks). The snacks reported also the same family brand (i.e., Mulino Bianco) to not affect consumer perception. Moreover, we indicated that all snacks have the same price. In the pre-test participated 49 Italian consumers (73,5% females, and 26,5% males, with a mean age of 42,24 SD 14,20). Respondents identified "Mulino Bianco - Cioccosole" as vice [$t(48) = 4{,}142$ $p < 0.05$] and "Mulino Bianco – Pandyò" as virtue [$t(48) = 2{,}783$ $p<0.05$].

In the main study, we collected a sample of 190 Italian consumers (53,1% females, 44,8% males, and 2,1 other) with an average age of about 31 years old (SD 9,18) that participated online in the experiment through the Qualtrics platform. Respondents were randomly assigned to one of the four experimental scenarios. As dependent variables, we measured: the intention to buy (please indicate your intention to buy this snack? 1 – very low, 7 – very high) and the decision satisfaction (Fitzsimons, 2000) (how satisfied would you be with your decision? 1 – very low, 7 – very high), while as covariate we measured: the brand familiarity (the "Mulino Bianco" brand is very familiar to me. 1 – strongly disagree, 7 – strongly agree), the consequences of unhealthy behaviors (Kees, Burton, and Tangari, 2010) (4 items, Likert type, 1-7, Cronbach's Alpha = 0,834), the health motivation (Hung & Labroo, 2011) (4 items, seven-point semantic differentials compose the scale, Cronbach's Alpha = 0,718). At the end of the questionnaire, after the socio-demographic section, to verify if the stimuli were perceived correctly, we included also two manipulation checks. The former about the product: "Mulino Bianco Cioccosole" has been perceived as a vice product [$t(190) = -12{,}501$ $p<0.001$], "Mulino Bianco Pandiyò" has been perceived as a virtue product [$t(177{,}21) = 17{,}849$ $p<0.001$]. The latter was about the message. The promotion-focused message has been set as: "consider that moderate daily calorie consumption helps you live better and longer. It is advisable to prefer foods that promote health"; while the prevention-focused message has been defined as:

“consider that high daily calorie consumption increases the likelihood of contracting diseases and shortens life expectancy. It is advisable to avoid foods that are harmful to health”. Respondents correctly identified promotion and prevention messages [t(126,15) = -4,635 p<0,001].

5.3 Results

To test the moderated mediation model reported in Fig.1 we used the macro PROCESS for SPSS (Hayes, 2018). In particular, we used the Model 7 with 5,000 bootstrapped samples (see also Zhao, Lynch, and Chen, 2010). The index of moderated mediation was significant (effect = 0.18, 95% CI = [0.00, 0.41]) as the 95% CI did not include zero (Hayes, 2018). The data show that promotion messages (compared to prevention messages) led to higher ITB (effect =2.17, p < 0.01), providing support for H1. Furthermore, as advanced in H2, Product type (vice vs virtue) moderates the effect of Message type (prevention-focused vs. promotion- focused) on ITB (effect = -1.14, p <0.05). Specifically, in the case of vice products, a prevention-focused message significantly reduces the ITB (ITB promotion = 3.86, SD = 1.60 vs ITB prevention = 2.96, SD = 1.58; t(94) = -2.80, p < 0.01) while in the case of virtue products, a promotion-focused message does not significantly increase ITB (ITB promotion = 3.76, SD =1.56 vs ITB prevention = 3.82, SD = 1.58; t(92) = 0.17, p = 0.86). This means that prevention- focus message campaigns are more efficient in reducing vice product consumption while promotion-focused campaigns seem not to increase the consumption of virtue products in a significant way. So, if a public policy institution aims to promote healthier consumption habits, prevention-focused message campaigns seem to be more efficacy.

Moreover, ITB positively affected Decision satisfaction (effect = 0.15, p <0.05), as advanced in H3. Finally, as predicted in H4, the Message type (prevention-focused vs promotion-focused) does not impact Decision satisfaction directly (effect = 0.04, p = 0.85). This means that ITB

fully mediates the relationship between Message type and Decision satisfaction. These effects remained statistically significant after controlling for several covariates as indicated in table 1

	Mediator variable model: Intention to Buy		Outcome variable model: Decision Satisfaction	
	b	*T*	*B*	*T*
Costant	-2.70	-1.30	3.42	3.41**
X: Message Type [prevention-focused (1) vs. promotion-focused (2)]	2.17	2.97**	0.04	0.19
M: Intention to Buy			0.15	2.57*
Gender	-0.26	-1.20	0.14	0.78
Age	0.04	2.96**	0.02	1.60
Brand Familiarity	0.05	0.40	0.11	1.05
Consequences of unhealthy behaviors	-0.06	-0.65	0.11	1.30
Health Motivations	-0.17	-1.70	0.03	0.37
W: Product Type [vice (1) vs. virtue (2)]	3.35	2.83**		
X*W	-1.14	-2.48*		

Conditional Indirect effect(s) of X on Y at values of the moderator

Bootstrap 95% confidence intervals for conditional indirect effect – bias-corrected and accelerated

	Product Type	Effect	Lower	Upper
M: Intention to Buy	Vice	-0.16	-0.34	-0.01
	Virtue	0.02	-0.08	0.14

R squared: 0.07; Index of moderated mediation: 0.18, 95% CI = [0.00, 0.41]

Table 5.1. Moderated mediation analyses

5.4 Discussion

Smart vending machines are becoming increasingly ubiquitous (in schools, hospitals, sports, and recreational centers, worksite locations, etc.) and account for important market shares of food and beverage consumption out-of-home. Recent reviews highlight the lack of adequate literature on many aspects concerning consumer behavior (Stoyanov, 2021). Since food vending machines are always scrutinized for contributing to over-consumption and unhealthy lifestyles (Grech & Allman-Farinelli, 2015), the present study aims at contributing to the literature on how to boost the efficacy of nutrition interventions through this channel. Health nutrition promotion is a major branch of vending literature (Stoyanov, 2021). Picking from the domain of the Regulatory focus theory (Higgins, 1987; Higgins 1997), we developed four Hypotheses that our results confirmed. First, we found that the message type conveyed to consumers through smart vending machines at the point of sale, affects their intention to buy and, in turn, their decision satisfaction. Second, such full mediation effect of ITB between message type (prevention-focused vs promotion-focused) and decision satisfaction is moderated by the product type (vice vs virtue). This means that in the case of vice products, a prevention-focus message reduces the intention to buy while in the case of virtue products the intention to buy does not increase significantly. In other words, since the creation of healthier food environments is an essential objective of public health initiatives to reduce levels of diet- related diseases, we found that prevention-focused messages seem more efficacy in decreasing the intention to buy vice food products while promotion-focused campaigns fail to increase the intention to buy virtue products. Overall, the findings suggest that smart vending machines can play a significant role in creating healthier food environments, particularly in high-traffic public spaces, where VMs are usually placed. Specifically, smart technology in vending machines provides an opportunity to deliver personalized messages in real-time. Retailers could use these insights to

encourage healthier consumption patterns, by developing communication strategies emphasizing prevention-focused messages.

5.5 Conclusions

This study highlights the effectiveness of smart vending machines in promoting healthier food choices through strategic message framing. The findings demonstrate that prevention-focused messages are particularly effective in reducing the intention to purchase vice products, whereas promotion-focused messages do not significantly increase the intention to buy virtue products. These results emphasize the importance of tailoring message strategies to align with the type of product being offered.

From a managerial perspective, the findings of this study offer valuable guidance for operators of smart vending machines, policymakers, and organizations seeking to promote healthier consumption habits. First, it is crucial for vending machine retailers to adopt prevention-focused messaging when developing communication and marketing strategies. These messages have been shown to effectively reduce the intention to purchase unhealthy items, aligning with broader public health initiatives aimed at curbing the consumption of indulgent snacks.

However, there are some limitations to this research. Considering that vending machines are situated in high-traffic area, the messages sended through them could not arrive directly to consumers, instead be broadly delivered**.** Future research could in fact, examine the effect of personal messages delivered directly to users, for example by using mobile app connected to the vending machines. Moreover, considering the technological innovation, further studies could focus on the relationship between technology and vending, in particular focus on the possibility to use artificial intelligence system to create customized messages for the users, considering for example age, gender and sentiment.

Then, while promotion-focused messages may not directly increase the consumption of healthier products, future research could test the effect of these messages, combining them with additional incentives (i.e special discount, bundle promotions) Furthermore, future research should expand on these findings through field experiments in diverse settings and product categories, as well as explore the long-term impact of message framing on consumer behavior. By leveraging AI and real-time data, vending machines can better tailor messages to individual consumers, potentially amplifying the impact of health-focused campaigns.

Finally, the design of healthier food environments can be supported by partnerships between public health agencies and vending machine operators. These collaborations can facilitate the replacement of less healthy options with healthier alternatives while emphasizing prevention-focused messages to encourage better dietary choices. Together, these strategies can create a more health-conscious food environment, especially in high-traffic public spaces where vending machines are widely used.

General conclusion

The retail landscape has undergone dramatic transformations over the past several decades, largely driven by shifts in socio-economic factors, technological advancements, and changing consumer behaviors. In the past, food consumption was predominantly a home-based, family-centered activity. However, as urbanization accelerated and lifestyles became increasingly fast-paced, there was a growing need for convenient, on-the-go food options. This shift in consumer habits was further amplified by rising incomes, particularly in urban areas, which increased disposable income and spending on dining outside the home. In parallel, the rise of global mobility and longer work hours, led to greater reliance on retail formats that cater to the needs of busy, time-constrained individuals. Retail formats such as fast-food outlets, restaurants, and, most notably, vending machines, became essential solutions to this evolving demand for convenience. The convenience culture, which prioritizes time-saving and accessibility, has fueled the growth of these food retail formats across the globe.

With the proliferation of these retail options, technology has played a crucial role in reshaping the retail environment. Innovations in digital technology have enabled retailers to provide 24/7 access to food and drinks, allowing consumers to purchase products whenever and wherever they need them. The use of advanced machines, cashless payment systems, and personalized offerings has further transformed the way food is consumed outside the home. Additionally, the ongoing trends of urbanization and high foot traffic in city centers and workplaces have made vending machines a particularly appealing solution for both consumers and businesses. The automated nature of vending machines allows them to cater to the growing demand for convenience while minimizing the need for human interaction, offering food at the touch of a button.

In parallel with these shifts in the retail environment, vending machines (VMs) have emerged as a key player in the convenience-driven food retail sector. VMs are now ubiquitous, appearing in schools, workplaces, healthcare facilities, public transportation hubs, and other high-traffic areas. These machines offer quick, easy access to snacks, beverages, and even meals, catering to people who are on the move and need food options that require minimal time and effort.

Unlike traditional retail stores, vending machines offer limited items due to space constraints (Hua & Ickovics, 2016) and a fully automated purchasing process. The absence of a cashier or human interaction can reduce the perception of judgment (Thorndike et al., 2012). Additionally, purchases from vending machines are often unplanned (Benoit et al., 2019), decision-making is typically swift (Cohen et al., 2012), and consumer involvement tends to be low (Jebarajakirthy et al., 2020). VM context is defined by quick decision-making, a lack of human interaction, and a heightened need for convenience, aspects that are less present/relevant in traditional retail settings. These distinct features suggest that consumer behavior in VMs may be shaped differently than in traditional retail environments. Thus, understanding how these unique factors impact consumer choices in the VM context highlights the importance and relevance of this research.

These unique features highlight the need to examine how they shape consumer behavior in this setting. At the same time, food choices are inherently multifaceted, complex, context-dependent, and dynamic, making them susceptible to change over time (Marijn Stok et al., 2018; Sobal & Bisogni, 2009). They involve a complex interplay of considerations, influenced by various factors such as food attributes (e.g., price, brand familiarity), consumer goals (e.g., immediate pleasure or health objectives), and social contexts (e.g., peer influence while eating) (Chen & Antonelli, 2020; Silva et al., 2023; Koster, 2009).

Research in food marketing consistently reveals that consumers perceive food products in distinct ways. Some foods are associated with nutrition and health benefits, while others are

linked to indulgence and pleasure (Drugova & Curtis, 2024; Wertenbroch, 1998). Foods promoting health are often referred to as "virtues," whereas those offering immediate gratification but being less healthy are labeled as "vices" (Dhar & Wertenbroch, 2000). Prior studies have conceptualized vice and virtue differently: some treat them as binary categories, classifying products strictly as either vice or virtue (Van Doorn & Verhoef, 2011), while others interpret them as a spectrum, allowing for nuanced evaluations of virtuosity (Stockli et al., 2016; Londono & De Maya, 2022; Ketron et al., 2021).

This research collection seeks to contribute to the literature on vending machines by exploring VM user experiences and potential improvements, examining the variables that influence the choice between vice and virtue products, and testing different messaging strategies to promote healthier food choices.

Several consumer behaviors, expectations, and potential enhancements within the vending industry have come to light. In general, from our research emerged some VM users' characteristics that call for attention in terms of implications and future developments. First, we found out that VM is not only an outlet for grabbing a snack but also a meeting point. Consumers spend an important part of their daily time over there, which means that VMs, especially smart VMs, could be used for promoting products, conducting marketing research (e.g., sending surveys), or testing new products. Second, since VMs are considered an alternative for main meals to the other stores (restaurants, café, etc.), it emerged an increasing request for healthy fresh products such as salads, rice, pasta, and ethnic food. Third, respondents also manifest an interest in finding local food distributed through VMs. Fourth, some users seem interested in having a more engaging experience buying at VMs and they are willing todownload and use Apps, receive customized information or promotions, and adopt new digital technologies implemented by artificial intelligence (such as virtual assistants and games). Fifth, the emerging trend of sustainability has a real impact on consumers, also when choosing products at VMs.

Specifically, consumers prefer buying products with sustainability certification (e.g fair-trade, b-corp) and also are reflecting on potential actions companies could lead to improve the energy consumption of VMs. Retailers and VMs companies should then reconsider their production and marketing strategies, to improve their sales revenues and consumers' engagement.

Moreover, we investigated the unique consumer behaviors in vending machine (VM) settings, focusing on factors influencing the choice between vice (less healthy) and virtue (healthier) products. Our findings highlight that the VM environment differs significantly from traditional retail spaces, where choices are often influenced by more deliberate considerations. The quick, impersonal nature of VMs allows for unplanned, impulsive purchases that are less affected by social judgment, providing a distinct context that fosters different consumer behaviors. We conducted three studies examining the drivers of product choices in vending machines (VMs), specifically testing the influence of brand familiarity, price, time of day, payment method, product placement, and VM location on vice and virtue choices. Findings reveal that brand familiarity and price significantly affect product choice, with lower familiarity and price correlating with virtue selections. Interestingly, product placement moderates these effects, with virtue products placed at the top and on the right more likely to be chosen. Additionally, location context influences vice-virtue choices, with work environments favoring virtue products and high-stress locations like hospitals and universities encouraging vice selections. These findings offer actionable insights for retailers on optimizing vending machine layouts and promoting healthier consumer choices.

Furthermore, with the emerging trend in VM literature on health-focused interventions and considering that health nutrition promotion is a major branch of vending literature (Stoyanov, 2021), the latter study we conducted contributes to a growing understanding of how VMs can support public health goals. Using Regulatory Focus Theory (Higgins, 1987; Higgins 1997) we tested the effects of prevention-focused vs promotion-focused messages, finding that

prevention-focused messages significantly reduced the intention to purchase vice products, though promotion-focused messages did not notably increase virtue purchases. Since creating healthier food environments is an essential objective of public health initiatives to reduce levels of diet- related diseases, this insight suggests that public health initiatives could benefit from prevention-oriented messaging within VM settings. Such results extend the findings of previous studies in the context of vending machines by a call for attention to investigate the impact of communications conveyed directly to consumers at the point of sale by the smart vending machines.

These insights provides useful guidelines for VM operators to enhance user engagement and satisfy the increasing consumer demand for healthier choices. Our finding further justifies the rationale of considering food choices at VMs different from traditional setting. Therefore, sales and communication strategies should differ from those used in traditional settings. Firstly, with technology advancements in VM setting, retailers could equip vending machines with interactive screens or apps that provide real-time feedback or rewards for healthier selections. For instance, consumers choosing virtue products could accumulate points redeemable for discounts on future purchases.

Following the discussion on technology implementation, further enhancements could include dynamic pricing, where users receive time-sensitive discounts or special offers based on factors like stock levels or personal buying habits. Social sharing features, coupled with referral programs, would allow users to earn rewards by promoting the app and products to their networks. Incorporating sustainability initiatives, such as rewarding users who bring reusable containers, would not only encourage eco-friendly behavior but also strengthen brand loyalty. Furthermore**,** personalized recommendations based on past purchases could create a more tailored experience, offering suggestions for new products or special promotions that align with the user's preferences. Real-time inventory tracking would notify users when their favorite

items are available at nearby vending machines, saving time and avoiding frustration of out-of-stock experiences. Then, with the development of smart VMs that allow flexible layout adjustments, product positioning within VMs is a potential innovation strategy for retailers and companies, when defining planogram. By optimizing product layout, retailers can effectively influence consumer behavior and enhance VM profitability by using smart VM capabilities. For example, placing virtue products in high-visibility areas (e.g., top rows, right side) can encourage healthier choices.

These advancements would not only create a more engaging and convenient user experience but also appeal to technology explorers eager to embrace innovation in everyday tasks like making vending machine purchases.

Given consumers' price sensitivity, implementing targeted pricing or promotional strategies in VMs could prove beneficial. Previous research showed that price can influence choices. Specifically, a price reduction can lead to virtue choices (Mason et al., 2014; French et al. 2010), aligned with our results. Retailers could promote "healthy bundles", encouraging multi-item purchases by bundling a virtue product with a lower-demand item, such as pairing a water bottle with dried nuts or a yogurt drink. Alongside, an incentive for consumers could be a "reverse discount", a promotion strategy offering a discount on a future purchase, when purchasing a virtue product. Finally, health-conscious users could benefit from app integrations with fitness trackers, receiving recommendations for healthier snack choices or tracking calorie intake.

In sum, this research contributes to a deeper understanding of consumer behavior in VMs and offers actionable insights that may guide efforts to promote healthier food environments in this growing on-the-go market.

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