Received 21 March 2022
Revised 28 October 2022
Accepted 12 January 2023

What makes hot beverage vending machine cups eco-friendly? A research into consumer views and preferences

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Abstract

Purpose – This study aims to gain a first explorative view on what intrinsic/extrinsic attributes a generic cup for hot beverage should possess to be perceived as eco-friendly, and how some attributes of a hot beverage could influence consumers' purchase decision and willingness to pay (WTP) for that beverage dispensed by vending machines (VMs).

Design/methodology/approach – A questionnaire was developed in 2021 and sent to all students of an Italian university campus. For the first goal, students were asked to assign a score to some eco-friendly intrinsic/extrinsic attributes using a five-point Likert scale. For the second aim, a choice experiment with six scenarios was developed.

Findings – Both intrinsic and extrinsic attributes play a key role in shaping students' opinions and preferences. Results indicate that students are attracted by the idea of a cup that communicates its environmental properties through corresponding labels and information, and it is made by materials that guarantee biodegradability, recyclability or reusability.

Originality/value – The research represents the first academic attempt to provide a first consumers' viewpoint on the importance of eco-friendly attributes of cups for hot beverages able to influence consumers' perceptions and consumption choices of hot beverages dispensed by VMs.

Keywords Vending, Eco-friendly, Cup, Perception, Preferences, Choice experiment

Paper type Research paper

1. Introduction

The vending sector in Europe is a growing food and beverages market, with a total revenue of €17.2 billion in 2019 [1]. There are approximately 1.5 million hot drinks free-standing vending machines (VMs) [1], that is, all machines that serve hot beverages and in which the cup is dispensed automatically with the final drink. The main function of these machines is to serve take-away hot drinks in single-use cups suitable for easy drinking. In 2019, the average number of hot beverages served by a single machine per week in Europe was above 200, and hot beverages' revenue was equal to €11 billion [1]. Overall, over 500 billion hot beverages served within plastic and paper single-use cups are consumed annually worldwide (UNEP, 2021), and only a small amount is recycled (Miller *et al.*, 2019), while the remaining ends up in landfills (Sandhu *et al.*, 2021) or is released into the environment. As a consequence, single-use cups (especially plastic cups) have become one of the ten most commonly found litter items on beaches around the world (Ocean Conservancy, 2020), with severe consequences on both the environment and economies (UNEP, 2021). Such situation has prompted the global community to plan effective strategies to transform the single-use items economy into a

British Food Journal
Vol. 125 No. 13, 2023
pp. 146-163
Emerald Publishing Limited
0007-070X
DOI 10.1108/BFJ-03-2022-0263

new model by 2030. For example, at a European level, the "Farm to Fork" strategy (European Commission, 2020), the "European strategy for plastics in a circular economy" (European Commission, 2018) and the Directive 904/2019 (also known as "single-use plastic directive") encourage entire food supply chains and food sectors to reduce the production of some single-use items made of fossil resources in favor of innovative, alternative and more sustainable materials. Given the high quantities of hot beverages consumed annually, vending sector should not underestimate the challenges posed by the European Union regulations mentioned above and invest in developing new sustainable cups solutions.

To abandon the throwaway culture and contribute to the transition towards a sustainable consumption condition (Tseng *et al.*, 2020), supply chains must not just consider the various production and distribution processes, but also the consumption processes (Kirchherr *et al.*, 2017; Sandhu *et al.*, 2021). Consumer is widely recognized as the key to the success of sustainable food systems transition (Tseng *et al.*, 2020), but, at the same time, as one of its main barrier (Pinheiro *et al.*, 2019; Sandhu *et al.*, 2010), as "little is known about its' willingness to participate in a circular economy" (Kirchherr *et al.*, 2017). According to the literature, although consumers usually report positive attitudes toward eco-friendly products and services, in real life they see at such products with skepticism and restrain in paying more or purchasing them (Goh and Balaji, 2016; Lemke and Luzio, 2014; Pinheiro *et al.*, 2019; Sandhu *et al.*, 2010; White *et al.*, 2019), because they struggle to perceive whether they are sustainable or not through their attributes (Lemke and Luzio, 2014; Tseng *et al.*, 2020; Tseng and Hung, 2013). Such evidence has been found by Sandhu *et al.* (2021), according to which difficulties in distinguish eco-friendly takeaway cups from regular disposable cups hinder consumers' pro-environmental behavior. According to classic economy, consumers are more willing to purchase a product and pay for it only if it possesses some attributes able to maximize their utility. Therefore, making consumers perceive the ecological characteristics of a product through its attributes can satisfy their expectations and push them to purchase it (Steenis *et al.*, 2018). This is why it is so important to investigate and gain insights on which sustainable attributes consumers would like to see in a product and which could translate into actual purchasing behavior.

1.1 Aim of the research study

The present research study is placed within this framework, and it aims to contribute to the development of academic knowledge on vending sector in two ways.

(1) by exploring Italian consumers opinions on what attributes a generic cup for hot beverages served at VMs should possess to be perceived as eco-friendly.

(2) by examining, through a choice experiment, whether and how consumers' purchase decision and willingness to pay (WTP) for a hot beverage dispensed by VMs are influenced by two of its attributes, namely a new disposable cup (made of a more environmentally friendly plastic material and displaying graphical and textual environmental information) and the increase in the price of the beverage related to the cup's characteristics.

The research has been performed at an Italian university campus and considered as consumers a sample of bachelor and master students. Italy is the largest European vending market, with more than 800,000 VMs located in public and private spaces [2], especially universities. Hot beverages represent the largest market share, equal to 68% of the entire consumptions, with coffee the most consumed product (more than 2 billion of coffee purchased annually) [2]. Beside this, the Italian sector has been pursuing a path of sustainable transformation for a few years now, especially in the disposable cups market, with major sustainable innovations in both the design of such cups and their handling [2]. Therefore, it

represents the perfect market where valuable information for the sustainable development of the sector can be obtained.

An original aspect of this explorative research is to fill the gap left by previous and current studies on vending sector, still too much focused on exploring how to increase individuals' consumptions of healthy products. Despite in literature studies that discuss about cups for hot beverages exist (e.g. Piqueras-Fiszman and Spence, 2012; Potting and van der Harst, 2015; Sandhu *et al.*, 2021; UNEP, 2021), our research represents the first academic attempt to provide a first consumers' viewpoint on the importance of eco-friendly attributes of cups for hot beverages able to influence consumers' perceptions and consumption choices of beverages.

2. Literature review

2.1 Role of perceptions and products attributes

Sustainable consumption implies the use of products and goods that minimize the environmental impacts along their life cycle (Paul *et al.*, 2016). Such products are known as green products (Dangelico and Pontrandolfo, 2010), and their consumption is influenced by many factors, both personal and contextual (Tripathi and Singh, 2016). However, the product itself plays a key role in consumption dynamics. Put simply, purchase decisions rely on how far consumers are able to perceive the product's benefits (in this case, environmental benefits) in terms of quality and values through its intrinsic and extrinsic attributes (Zeithaml, 1988). Only by making these attributes more salient consumers' perceptions of benefits and, consequently, their purchase intentions can be positively influenced. This is valid for many types of products, among them food products (Symmank, 2019). Below, we will discuss how two extrinsic attributes, that is packaging with eco-friendly attributes and sale price (Symmank, 2019), can influence consumers' perceptions and purchase decisions of food products.

2.2 Eco-friendly packaging attributes

According to Ketelsen *et al.* (2020), consumers generally show positive attitudes and preferences towards food products with eco-friendly packaging. Eco-friendly packaging is designed to minimize environmental impacts along its life cycle, just like green products, and it can be defined as a packaging that evokes its eco-friendliness via intrinsic and extrinsic attributes (Magnier and Crié, 2015).

2.2.1 Intrinsic attributes. Intrinsic attributes are those associated with the structure of a material—size, weight and shape, type and quantity, and properties (Magnier and Crié, 2015). The literature shows that consumers perceive as green those packaging that: are composed of recycled, recyclable, biodegradable or bio-based materials (Boesen *et al.*, 2019; Magnier and Crié, 2015; Scott and Vigar-Ellis, 2014); are made of paper (Lindh *et al.*, 2016; Nguyen *et al.*, 2020) or glass (Boesen *et al.*, 2019); and, present a size appropriate for the product and reduce over-packaging (Magnier and Crié, 2015). The perception of these attributes can positively influence consumers' purchase intentions of daily products (Magnier and Crié, 2015; Steenis *et al.*, 2018), as well as of food products (Ketelsen *et al.*, 2020; Lindh *et al.*, 2016). As for the material, despite plastic is perceived as a highly impactful one (Boesen *et al.*, 2019; Lindh *et al.*, 2016; Steenis *et al.*, 2017), consumers tend to evaluate it positively if it possesses some eco-friendly attributes, such as recyclability (Orset *et al.*, 2017).

2.2.2 Extrinsic attributes. Extrinsic attributes are associated with the graphic (i.e. type of color, images, logos or symbols) and relevant information (i.e. environmental labeling, general environmental claims, disposal information) (Magnier and Crié, 2015) and are important for consumers to perceive packaging as eco-friendly, as well as to influence their purchase

decisions of food products (Ketelsen *et al.*, 2020). Literature shows that green packages should be visually appealing (Nguyen *et al.*, 2020), with white/brown or dull colors (Boz *et al.*, 2020; Herbes *et al.*, 2020; Scott and Vigar-Ellis, 2014), and images showing nature or environmental protection (Magnier and Crié, 2015) and logos/labels (Herbes *et al.*, 2020; Songa *et al.*, 2019). According to Van Loo *et al.* (2015), consumers process product information through labels and the more time they fix at sustainable labels, the more they consider such label as important to perceive a product as sustainable.

It is difficult for consumers to perceive environmental qualities in packaging based on color and images alone, especially if the design is conventional. To overcome this barrier, graphics should be supported by information (Magnier and Crié, 2015), especially the one able to involve consumers in pursuing sustainable behaviors (Peattie and Peattie, 2009). Wensing *et al.* (2020) demonstrated how environmental information congruent with labels led consumers to perceive packaging containing cherry tomatoes as more innovative, healthy, natural and eco-friendly. Similar results have been found by Sandhu *et al.* (2021), according to which the use of strong environmental messages led consumers to make the shift from traditional single use cups to environment friendly takeaway coffee cups.

2.2.3 Product price and willingness to pay. Besides the eco-friendly attributes of packaging identified by Magnier and Crié (2015), there is another product attribute that may shape consumers' purchase decision of food products, such as price (Boz *et al.*, 2020; Symmank, 2019), whose role in consumer decision-making is controversial and object of study by many scholars (Bangsa and Schlegelmilch, 2020). For example, according to Martinho *et al.* (2015) and van Birgelen *et al.* (2009), consumers are more willing to purchase a product with eco-friendly packaging as long as the price remains unchanged. On the contrary, Hao *et al.* (2019) found that price only plays a minor role in consumers decisions compared to other factors. In general, although heterogeneity always exists (Bangsa and Schlegelmilch, 2020), consumers seem to be more willing to pay a price premium for sustainable food products, and it seems that eco-friendly intrinsic and extrinsic attributes of packaging may play a key role (Ketelsen *et al.*, 2020). In their work, Klaiman *et al.* (2016) found that packaging recyclability (i.e. an intrinsic attribute) positively influenced consumers' WTP for fruit juices. Similar evidence has been found by Orset *et al.* (2017) regarding water contained in recyclable plastic bottles. In parallel, Van Loo *et al.* (2015) found that the use of eco-friendly labels (i.e. extrinsic attributes) positively influence consumers WTP for coffee. Similar evidence has been found by Wensing *et al.* (2020), who discovered that the use of labels combined with video and texts had the strongest positive effect on consumers' WTP for cherry tomatoes among different strategies. Such evidence has been recently reviewed by Bangsa and Schlegelmilch (2020), according to which consumers' WTP is higher for food products showing sustainable labels on packaging, and it tends to decrease in the presence of insufficient sustainable information.

3. Materials and methods

For the purposes of this research, a two-part questionnaire was developed during 2020, tested in February 2021 through submission to a limited number of students to check of their responses' comprehensiveness, and officially emailed in March 2021 to all undergraduate and master's degree students of a university in northern Italy (equal to a sample of 14,714 students). Before the submission, the entire questionnaire was evaluated and accepted by the ethics review board of the Public Relations Office of the University to guarantee the maintenance each student's privacy. Students were informed about the goal of the survey and invited to participate voluntarily. The questionnaire remained available online on Microsoft Forms platform for two months; the responses of a convenient sample (i.e. non probability sample) were collected at the end of this period, and the data obtained were analyzed.

3.1 Study 1 – cup attributes

To investigate what properties a cup for hot beverages should possess to be perceived as eco-friendly, students were asked to assign a score to each of the intrinsic/extrinsic attributes shown in the questionnaire using a 5-point Likert scale (ranging from 1 = unimportant to 5 = very important), as shown in Appendix. For choosing the attributes, we referred to Magnier and Crié (2015).

3.2 Study 2 – choice experiment

Previously we discussed how consumers' perceptions, preferences and purchase decisions of food products depend on many factors (Symmank, 2019), among them eco-friendly intrinsic/extrinsic attributes of packaging and the sale price of the product. When faced with several product types with different attributes, consumers will choose the one with a combination of attributes they perceive as the most able to maximize their utility. This is the foundation of the Lancastrian demand theory (Lancaster, 1966) on which choice experiments (CE) are based. By approximating consumers' real-world purchasing behavior, CE has proved very useful in economic research for estimating consumer evaluations and preferences for specific attributes of consumer goods (Luce, 1959; McFadden, 1974) and connecting individuals' WTP to each attribute (Hanley *et al.*, 1998).

As recently reviewed by Bangsa and Schlegelmilch (2020), CE has been widely used in the past to investigate relationship between sustainable product attributes and consumer decision-making, with a particular focus on food products. However, from the scant literature on green packaging, we didn't find any study that explores consumers' preferences for cups for hot beverages served within eco-friendly cups by using this methodology. Therefore, with this study we aimed to fill this gap. Our CE focused on buying a hot beverage (i.e. coffee, tea, chocolate, or milk specialties) served in new plastic cups with ecofriendly attributes dispensed by VMs placed within the university. By means of a fractional factorial orthogonal design, 18 alternatives (or profiles) were selected. Six scenarios were prepared, each containing four alternatives: three showing a cup with a specific combination of attributes, and one no choice option. During the experiment, students were asked to imagine buying a hot beverage from a VM and choosing the cup with the combination of attributes they preferred. For choosing the attributes, we relied on the information provided by the manufacturer about the ecological properties of the cup and on the results obtained through a focus group. Second, we referred to Magnier and Crié (2015) to classify these attributes as intrinsic or extrinsic and identified 2–3 levels for each attribute (Table 1). To help students during the decision-making process, a brief explanation of the environmental aspects of each attribute and corresponding levels was given to them before the experiment (see Appendix).

The first attribute we focused on is type of material, an intrinsic attribute of packaging. In their work, Magnier and Crié (2015) do not refer to specific materials (i.e. plastic or paper) but only to their ecological properties (e.g. recyclable). For the purpose of the experiment, we focused on plastic, and the two identified levels refer to the type of plastic used: mix of plastic and natural mineral salts, and recyclable plastic.

Table 1.
Cup attributes and their corresponding levels

Attribute	Levels
Price increase (€/beverage)	0,05€; 0,1€; 0,15€
Material	Recyclable plastic; mix of plastic and mineral salts
Eco-labels	Low carbon (LC); 100% Recyclable (Re); LC + Re
Eco-info	−40% CO_2; Innovative recycling system (IRS); −40% CO_2 + IRS
Eco-project	Safeguard of local hives; Replanting trees in Kenya or Ecuador

The second attribute is labels, an extrinsic attribute of packaging. The aim of labels is to communicate to consumers some intrinsic properties of a product or packaging. The type of labels we included in the experiment correspond to what Magnier and Crié (2015) named "graphical cues", that is "recyclable" and "low carbon emissions" logos. We also included a third level showing the combination of the previous two (i.e. recyclable + low carbon emissions).

The third and fourth attributes concern environmental information, an extrinsic attribute. The first type of information we included was about the environmental properties of the cup, that is "recyclable through an innovative recycling system, "40% CO_2 emissions saving during production," and a combination of both. Such information represents the textual version of the environmental labels shown above and was included to strengthen and better detail their message. The second type of information relates to which environmental project can be supported through the purchase of a beverage dispensed in that cup: "protecting and safeguarding of local hives," and "replanting of trees in Kenya or Ecuador". We chose this last attribute since the vending operator who manages the service within the university declared to support these two types of projects with the sale of hot beverages, and we wanted to test its influence on consumers purchase decision. Even if the both types of information had not been identified by Magnier and Crié (2015), they could be considered as "general environmental claims."

The fifth and last attribute we chose for the experiment is the sale price increasing of the beverage dispensed with that cup, identified by three levels: 0.05€, 0.10€ and 0.15€. Price is an essential element in a CE, since it allows estimating the WTP for each attribute level by dividing β coefficients by βprice:

$$\text{WTP} = -\beta/\beta\text{price}$$

To simplify the decision-making process and reduce the stress of choosing among four alternatives in each choice set, each attribute level was described using words, images, or symbols (Figure 1).

3.3 Data analysis

The CE data were analyzed using Nlogit6© software, relying both on a multinomial logit (MNL) model and a latent class model (LCM). The first considers respondents' preferences as homogeneous and has been used to gain a first explorative view of the results. The second considers respondents' preferences as heterogeneous and is extremely useful to deeply explore consumers' preferences for cup attributes and their differences in decision strategies (Mcfadden and Train, 2000).

4. Results

In the two months during which the questionnaire was available online, 618 complete responses were obtained (4.2% of the total number of questionnaires sent). Respondents were mainly bachelor students ($n = 416$; 67%), mainly female ($n = 415$; 67%), more than half aged around 19–22 years ($n = 345$; 56%) and enrolled in "Agricultural sciences," "Economy" and "Modern languages" courses (Table 2). Moreover, 76% of respondents declared to possess a high level on environmental consciousness.

4.1 Students' perceptions of cup attributes

When students were asked about the attributes they considered most important to consider a cup for hot beverages eco-friendly, post-consumption properties (i.e. intrinsic attributes) occupied the first four places in the ranking (Figure 2). Indeed, for more than 80% of

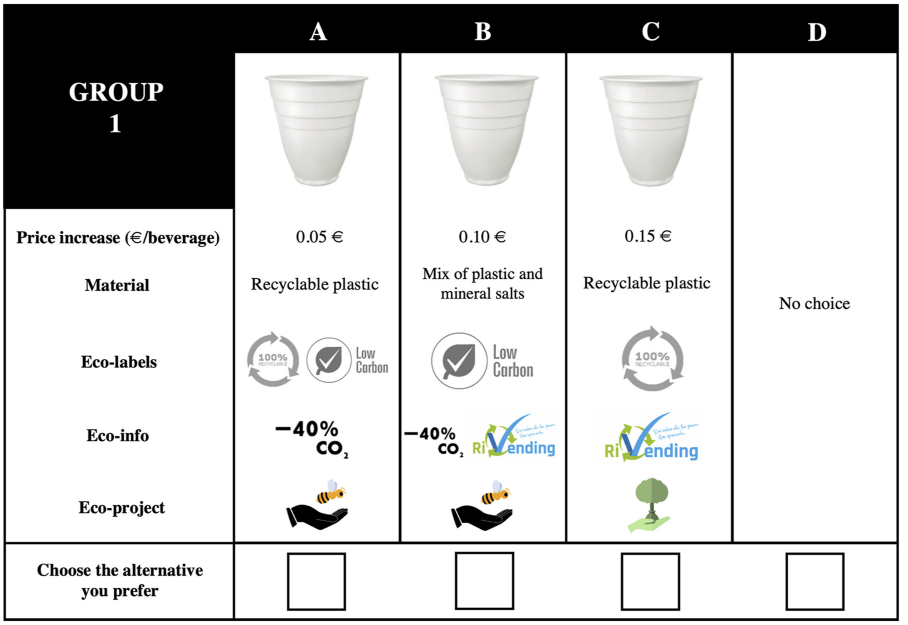

Figure 1.
Graphical example of a choice set

Data	Number of respondents	Percentage
Gender		
Male	199	32%
Female	415	67%
Academic position		
Bachelor student	416	67%
Master student	202	33%
Age		
19–22	345	56%
23–26	168	27%
27–30	47	8%
30 +	58	9%
Field of study		
Agricultural sciences	135	22%
Economy	91	15%
Modern languages	88	14%
Medicine	83	13%
Engineering and architecture	76	12%
Arts and cultural heritage	75	12%
Mathematics and physics	49	8%
Law	16	3%
Biotechnology	5	1%

Table 2.
Socio demographic characteristics of respondents

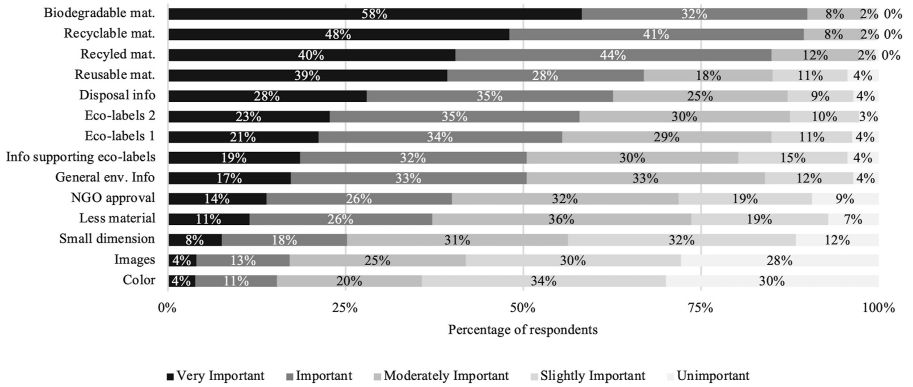

Figure 2.
Preferences for single-use cups' attributes

respondents, it was "important" and "very important" that a cup is made of a biodegradable, recyclable, or recycled material. Reusable material occupies the fourth position and is considered "important" and "very important" by 67% of respondents. The remaining intrinsic attributes regarding structure (i.e. "less material" and "small dimensions") are perceived definitely as less important.

As for extrinsic attributes, the presence of disposal information, eco-labels (type 1 and 2), environmental information and NGO approval is perceived mainly as "important" and "moderately important" rather than "very important". In the end, the remaining extrinsic attributes (i.e. images and color) are considered by 58% and 64% of respondents as "slightly important" and "unimportant," respectively.

4.2 Results of the choice experiment

The MNL analysis considers all respondents as having homogeneous preferences. Looking at its results (Table 3), the coefficient of the alternative specific constant (ASC) is significant and negative (−2.54), suggesting that respondents gain a higher utility from choosing the hot beverage served within one of the plastic cups than from choosing the "no choice" option. As for packaging elements, students are more sensitive to extrinsic (i.e. labels and product environmental information) than intrinsic (i.e. the material) attributes, but this difference is not clear. Specifically, students seem to prefer cups that show more than one label (low carbon + recyclable) (0.77) and more than one environmental performance information coherent with labels (40% CO_2 saving + innovative recycling). This last point can be understood by observing the coefficients referred to the single information (−0.80 for "40% of CO_2 saving" and −0.54 for "innovative recycling"). Negative coefficients show that the utility perceived by students decreases significantly in the presence of products with only one environment-specific information. In terms of material, respondents tend to prefer cups composed of a mixture of plastic and mineral salts (0.25) rather than those composed entirely of plastic, even if recyclable. The analysis also revealed a significant, albeit weak, sensitivity to price increases (−0.09). Finally, the study found a complete indifference to information about the "safeguard of local hives" environmental project supported through the purchase of hot beverages served in the cup (0.02).

Compared to MNL, LCM allows considering respondents as heterogeneous to differentiate them into classes, to investigate the differences that appear among these classes and to estimate WTP. The definition of the best number of classes is an exogenous process, and scholars usually rely on the comparison of the Akaike information criterion (AIC), Bayesian

Table 3. Choice experiment results: MNL and LCM models

	MNL	LCM							
		Class 1		Class 2		Class 3		Class 4	
Variable	Coeff. (S.E.)	Coeff. (S.E.)	WTP (€/Bev)	Coeff. (S.E.)	WTP (€/Bev)	Coeff. (S.E.)	WTP (€/Bev)	Coeff. (S.E.)	WTP (€/Bev)
ASC	−2.54 (0.10) ***	−2.28 (0.36) ***	/	−6.33 (1.15) ***	/	−2.92 (0.28) ***	/	4.26 (1.29) ***	/
"Low carbon" + "100% recyclable" labels	0.77 (0.05) ***	0.15 (0.13) ns	/	0.51 (0.23) **	0.02	1.13 (0.14) ***	/	−1.36 (1.57) ns	/
"40% CO_2 saving" info	−0.80 (0.09) ***	−0.75 (0.25) ***	−0.37	−1.56 (0.66) **	−0.05	−1.44 (0.25) ***	/	0.59 (1.48) ns	/
"Innovative recycling system" info	−0.54 (0.05) ***	−0.38 (0.14) ***	−0.19	−1.13 (0.86) ns	−0.04	−0.92 (0.15) ***	/	0.69 (0.87) ns	/
"100% recyclable" label	0.37 (0.07) ***	−0.38 (0.17) **	−0.19	−0.40 (0.65) ns	/	0.29 (0.16)*	/	2.08 (1.50) ns	/
Price increase	−0.09 (0.00)***	−0.02 (0.01) *	/	−0.32 (0.07) ***	/	−0.00 (0.01) ns	/	−0.16 (0.12) ns	/
Mix of plastic and mineral salts	0.25 (0.09) **	0.85 (0.23) ***	0.42	−1.27 (0.47) ***	−0.04	−0.21 (0.20) ns	/	5.46 (2.30) **	/
"Safeguard of local hives" project	0.02 (0.07) ns	0.53 (0.18) ***	0.26	0.72 (0.48) ns	/	−0.24 (0.16) ns	/	−3.09 (1.70) *	/
Estimated latent class probability		0.28		0.27		0.40		0.04	
LCM statistical indices		LL	−3607.218	AIC	7.284	BIC	7.502	MF R^2	0.298

Note(s): Number of observations: 618
Single, double, and triple asterisk (*, **, ***) indicate statistical significance at the 10%, 5%, and 1% level, respectively. n.s. indicates "not statistically significant"
LL = Log Likelihood; AIC = Akaike Information Criterion; BIC = Bayesian Information Criterion; MF R^2 = McFadden Pseudo R-squared

information criterion (BIC), the value of the log likelihood (LL) function and the McFadden Pseudo R-squared (MF R^2) for different latent class models. Considering their values shown in Table 4 for each model, the fact that these criteria did not provide a univocal result and the difficulty in understanding the meaning of the results in the case of a high number of classes, we opted for a 4-class model with AIC index equal to 7.284, BIC index equal to 7.502, LL index equal to −3607.218 and MF R^2 index equal to 0.298 (Tables 3 and 4).

Looking at the LCM results (Table 3), as for MNL, the ASC coefficient is significant and negative for most of the respondents, suggesting a higher utility from choosing one of the plastic cups than from choosing the "no choice" option. However, some differences from the MNL analysis appear. First, classes 1 and 4 are made up of individuals that, when asked to choose a hot drink, they positively evaluate the combination of plastic and natural mineral salts (0.85 for class 1 and 5.45 for class 4) and the information about economic support for sustainable project. In particular, class 1 is more interested in the safeguard of local hives (0.53), while class 4 prefers reforestation of trees in Kenya or Ecuador (−3.09). The interest found in sustainable projects is particularly relevant as it is the aspect that most differentiates the heterogeneous respondents (LCM) from the homogeneous ones (MNL). The class 1 respondents also appear to be very sensitive to information about the cup's environmental performance, preferring cups with combinations of information than those with only one fact (−0.75, −0.38), unlike class 4 respondents (0.59 ns, 0.69 ns). Regarding WTP, it was possible to estimate it only for class 1, since price sensitivity for class 4 appeared to be non-significant (−0.16 ns). The analysis for WTP shows mixed results: in particular, WTP is positive both for the mixture of plastic and mineral salts (€ 0.42) and for eco-projects (€ 0.26), while it is negative for single labels (€ −0.19) and single information (€ −0.37 and € −0.19). However, these last results also suggest that WTP could be positive for the combined information.

Compared to classes 1 and 4, the respondents of classes 2 and 3 seem to pay no attention to the information about environmental projects. Class 2 includes individuals that give great importance to price increase (−0.31) and to the presence of only recyclable plastic as a structural material instead of a mixture (−1.26). They represent classic old-style consumers who are not willing to pay a price premium for green packaging. Indeed, WTP is negative, except for cups showing more than one label (0.02 €/cup). Class 3, however, is represented by individuals more interested in extrinsic attributes than structural ones. In particular, it is very important for them that the environmental characteristics are communicated in a congruent way. Class 3 is the only class that shows a lot of interest in both combined labels (1.13) and combined information (−1.44; −0.92). It was not possible to estimate WTP for class 4.

5. Discussion

5.1 Students' opinion about cup attributes

When consumers' opinions on the features that a hot beverage vending machine cup should possess to be perceived as eco-friendly are explored, our results seem to confirm the central role of intrinsic properties of packaging (i.e. biodegradability, recyclability and reusability) previously highlighted by other international studies (Boesen *et al.*, 2019; Orset *et al.*, 2017;

	LCM-2	LCM-3	LCM-4	LCM-5
LL	−3928.746	−3692.115	−3607.218	−3590.361
AIC	7.891	7.436	7.284	7.269
BIC	7.997	7.598	7.502	7.542
MF R^2	0.236	0.282	0.298	0.301

Table 4. Models criteria comparison

Scott and Vigar-Ellis, 2014). In other words, consumers are attracted by the idea of a cup designed to minimize its environmental impact by decomposing into the environment, being reintroduced into the production cycle, or being reused again and again. By focusing on cups for hot beverages, this present study is similar to the ones performed by Boesen *et al.* (2019) and Orset *et al.* (2017), who discovered that "recyclability" and "biodegradability" are the two parameters most frequently chosen by Danish and French consumers, respectively, to assess environmental sustainability of liquid food packaging (soft drinks and water, in particular). The importance of "recyclability" and "biodegradability" for consumers has been demonstrated in the qualitative study by Magnier and Crié (2015) and recently reviewed and discussed by Nguyen *et al.* (2020) and Otto *et al.* (2021): according to them, such properties give the impression of an environmentally-friendly packaging to consumers. Indeed, cups made by biodegradable or recyclable materials may have lower life cycle impacts compared to traditional fossil-source alternatives (UNEP, 2021). However, this is not always true, and among all, reusable materials are the ones more environmentally sound than any other single-use alternative (UNEP, 2021). Our study integrates these findings with consumers' opinions, demonstrating that 67% of the respondents consider "reusability" as a valuable and indispensable property to perceive a hot beverage cup as eco-friendly, below "recyclability" and "biodegradability." These data are in line with Scott and Vigar-Ellis (2014), who discovered that 84.5% of South African consumers perceived "reusability" as a benefit associated with environmentally-friendly packaging. While our analysis confirmed the importance of material properties, it rejected the role played by the other two intrinsic attributes, lower quantity of material and smaller dimensions. Indeed, Italian students do not seem to consider them as fundamental attributes to perceive a hot beverage cup as eco-friendly. These results are in contrast with the findings of Magnier and Crié (2015) and Boesen *et al.* (2019), according to which consumers perceive packaging made by as low a quantity of material as possible and small in size, as eco-friendly.

Beside intrinsic attributes, students seem to pay adequate attention also to the presence of extrinsic attributes in the form of: (1) labels and logos certifying both the eco-friendliness of the production cycle (eco-label type 1) and the ecological properties of the cup, such as its recyclability or biodegradability (eco-label type 2); (2) disposal information; (3) verbal or numerical claims supporting the message of labels (e.g. by providing information on CO_2 savings during production). Our results support previous researches about the role played by labels and information (Herbes *et al.*, 2020; Magnier and Schoormans, 2015; Sandhu *et al.*, 2021; Takahashi, 2021; Tseng *et al.*, 2020; Van Loo *et al.*, 2015; Wensing *et al.*, 2020). According to Herbes *et al.* (2020), the attribute on which consumers focus most to differentiate green packaging from conventional packaging is the label. However, labels must be supported by trustworthy environmental information to help consumers make accurate assessments about the impact of their purchases (Tseng *et al.*, 2020). Wensing *et al.* (2020) demonstrated that packaging may be perceived more innovative, healthy, natural and eco-friendly when labels are supported by their description, plus general info about the environmental benefits of ecological post-consumption properties of the material. The extrinsic attributes found as not indispensable for students to perceive a hot beverage cup as eco-friendly are stylish elements, that is color and images. In general, consumers rely on attractive design to differentiate eco-friendly packaging from conventional packaging (Magnier and Crié, 2015; Magnier and Schoormans, 2015; Nguyen *et al.*, 2020; Scott and Vigar-Ellis, 2014). However, our results seem to be more in line with Martinho *et al.* (2015), who demonstrated that packaging design is not a relevant feature. Magnier and Schoormans (2015) help to explain our data; they maintain that if consumers possess high concern for the environment, they can sometimes consider stylish elements as secondary compared to the presence of information demonstrating the eco-friendliness of packaging. Our sample included students mainly aged around 19–22, belonging to what is known as Generation Z and recognized as a generation that cares about

environmental issues (Dwidienawati *et al.*, 2021). From the survey we measured a high level of environmental concern. Therefore, it is possible that this led them to consider color and images as irrelevant features to perceive a cup for hot beverages as eco-friendly.

5.2 Value of choice experiment

The choice experiment confirmed some of the results obtained from the first study about students' opinions on cups' features, especially the role of intrinsic (i.e. the material) and extrinsic (i.e. product environmental information and eco-labels) attributes. As demonstrated by the MNL analysis, students perceive a higher utility from buying hot beverages dispensed in cups composed of an innovative and ecological material and communicating their environmental performance through matching eco-labels and information. In particular, students' perceived utility seems slightly higher for extrinsic rather than intrinsic attributes. However, as revealed by the LCM analysis, preferences also depend on the type of consumer. Indeed, for some respondents (classes 1, 2 and 4), the type of material plays a primary role.

Beside this, the choice experiment also demonstrated how the type of environment-related graphical and textual information can influence consumers' perceived utility and purchase decisions, in line with academic literature (e.g. Sandhu *et al.*, 2021; Takahashi, 2021; Van Loo *et al.*, 2015). Both the MNL and LCM analyses revealed a higher preference for hot beverages served within cups with more than one environmental information, as well as labels describing CO_2 saving along the cup life cycle and the benefits related to an innovative recycling system; students perceive a slightly higher utility from the first type (CO_2 savings). In the presence of credible information about eco-efficiency of cups coherent with eco-labels and the integration of sustainable concepts about production cycle and post-consumption phase, consumers may be perceiving plastic cups as relatively more innovative, healthy and eco-friendly (Wensing *et al.*, 2020). Higher perceived naturalness can, in turn, mediate the effects on purchase intentions of products (Steenis *et al.*, 2018). In other words, once any hidden information is disclosed, consumers can consider to choose eco-friendly products (Lemke and Luzio, 2014), even if made of plastic. However, the disclosure of too much information about sustainable design innovation do not necessarily increase purchase intentions (Steenis *et al.*, 2018); the same may happen with the disclosure of additional information not strictly related to product design. This could be the reason why economic support for sustainable projects represents the least impactful attribute on consumers' choices.

Finally, the choice experiment made it possible to estimate consumers' WTP, a price premium for hot beverages served within cups with a particular attribute level. In general, recent research shows that consumers are more willing to pay a premium for products with eco-friendly packaging (Hao *et al.*, 2019; Ketelsen *et al.*, 2020; Steenis *et al.*, 2018; Wensing *et al.*, 2020) and that the type of material, its properties and available information play a key role (Klaiman *et al.*, 2016; Orset *et al.*, 2017; Van Loo *et al.*, 2015; Wensing *et al.*, 2020). However, our study is partially in line with these findings. The MNL analysis revealed a significant, albeit weak, sensitivity to price increases. In other words, when considered as homogeneous, consumers tend to dislike paying more for hot beverages dispensed in ecological cups. However, as previously discussed, WTP depends on both the type of consumer and the attribute considered. The only two classes for which it was possible to estimate WTP are 1 and 2. Class 1 consumers are willing to pay a price premium for beverages dispensed in cups composed of an innovative mixture of materials and that support the safeguard of local hives. Moreover, the results suggest that their WTP would be also positive in the presence of combined product environmental information, in line with Bangsa and Schlegelmilch (2020). In contrast, class 2 declines to pay a premium if the cup is composed of an innovative mix and if there is only one piece of information. This suggests that class 2 would be willing to pay

more for hot beverages served within classic recyclable cups with more than one info. Overall, our results confirmed that both intrinsic (i.e. type of material) (Klaiman *et al.*, 2016; Orset *et al.*, 2017) and extrinsic attributes (i.e. information) (Wensing *et al.*, 2020) have the power to influence consumers' WTP. In particular, providing more than one information appears to be effective to influence a large spectrum of consumers probably thanks to its ability to decrease the informational asymmetry (Gallenti *et al.*, 2019).

6. Conclusions

The global community (especially the European Union) has realized that there is an urgent need to reverse the long-established trend of using single-use items derived from fossil fuels by designing more environmentally friendly and innovative materials that can contribute to the sustainable transition by 2030. Such transition is not limited to production and distribution processes but also includes consumption phases. To encourage a shift from traditional single-use items to the production of new eco-friendly products, it is fundamental to know what product's attributes influence consumers' perception and their WTP. This study makes several contributions to the academic literature and to the debate about the single-use items economy and the role of the vending sector towards a sustainable development condition, since it gains insights on which sustainable attributes consumers would like to see in a cup for hot beverage and which could translate into actual purchasing behavior.

First, the research provides an in-depth analysis of the set of ecological cues perceived and interpreted as such by consumers and available to marketers and designers to signify the ecological nature of single-use cups for hot beverages. According to the results, consumers perceive a cup for hot beverages as eco-friendly when biodegradable, recyclable or reusable, and demonstrate its eco-friendliness through eco-labels and verbal/numerical environmental claims. Other attributes, such as less packaging material, smaller dimensions, color and images evoking eco-friendliness are perceived as unimportant.

Second, the research study extends existing knowledge about the importance of ecological intrinsic and extrinsic attributes of packaging in shaping consumer perceptions, purchase decisions and WTP for food products by focusing, for the first time, on single-use plastic cups for hot beverages dispensed by VMs. Our study demonstrates that cups for hot beverages (even if made by plastic) can be chosen by consumers if they are designed with innovative materials able to be minimizing its environmental impact post-consumption, and if they communicate their actual environmental properties through labels and information. However, the choice experiment also revealed that not all consumers give the same importance to the same attributes and that heterogeneity in preferences and opinions exists.

The study has some limitations, generating scope for additional research on the topic. First, our research was explorative in nature and focused only on Italian university students by approximating their purchase decisions. Moreover, the response rate and respondents' features cannot be considered enough to represent the entire Italian population; hence, it is important to extend the research to the average consumer's behavior in other contexts (e.g. companies, public offices and spaces) to better understand consumer preferences. Second, we concentrated on plastic cups, and more choice experiments using other alternatives, such as paper, and other attributes would be helpful. Third, we relied on students' self-declared opinions about the expected sustainable properties of the cup and which eco-friendly attributes they consider important in their consumption decisions. However, there is no guarantee that what declared would correspond to reality, especially when considering WTP. Therefore, additional studies in real life and settings using a more qualitative approach are needed.

Notes

1. Data provided by the European Vending & Coffee Service Association (EVA) https://www.vending-europe.eu/
2. Data obtained from the Italian vending association website https://www.confida.com

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(The Appendix follows overleaf)

Appendix
Extract of the questionnaire sent to the students

Study 1

	Using a 5 points scale, (from 1 = unimportant to 5 = very important), please indicate how much you consider important the presence of the following attributes to perceive a cup for hot beverages as eco-friendly
	Small dimensions
	Lower quantity of material
	Recycled material
	Recyclable material
	Biodegradable material
	Reusable material
	Color (for example, green or white)
	Images referred to the nature or landscapes (for example, trees)
	Labels showing a low environmental impactful production process (e.g. “eco-label”, or “Nordic Swan)
	Labels showing an ecological property of the cup (e.g. “100% recyclable”, or “Low carbon emissions”)
	Information supporting eco-labels (e.g. detailing the environmental impact in terms of CO_2 emitted, or the technological innovation used for production process)
	Disposal information
	NGO approval
	General environmental claims (e.g. “ecological material”)

Study 2 (choice experiment)

You will now face 6 different purchasing situations. Select the solution with the attributes you prefer. Below there is a more detailed description of each attribute:

Price - it represents the price increase of the hot beverage dispensed within a cup with certain attributes (type of material, type of label, type of environmental information, and environmental project financed).

Material - it refers to the material of the cup, which can be composed entirely from recyclable plastic, or by an innovative mixture in which 20-40% of the polystyrol normally used for the production of conventional cups has been replaced by natural mineral salts, with consequent lower environmental impacts.

Logo - It indicates the type of logo / logos present on the cup and showing a particular eco-friendly attribute (100% recyclable or low carbon emissions)

Environmental info

Rivending project - it is an innovative closed circuit recycling process exclusively for cups in the vending sector. It is a “zero waste process” because the plastic used is entirely recycled and reintroduced in the production cycle, with advantages in terms of quality and lower environmental impacts.

- 40% CO_2 - it is a project that permitted to reduce the amount of CO2 emitted by 40% (compared to a traditional cup) thanks to design and technological innovations in the production process.

Environmental project

Replanting trees in Kenya or Equador - it is a project that has joined the company that manages the vending machines service within university, to which the sum declared in the price "will be devolved"

Safeguard of local hives - it is a project that has joined the company that manages the vending machines service within university, to which the sum declared in the price "will be devolved"

GROUP 1	A	B	C	D
				
Price increase (€/beverage)	0,05 €	0,10 €	0,15 €	
Material	Recyclable plastic	Mix of plastic and mineral salts	Recyclable plastic	No choice
Eco-labels				
Eco-info				
Eco-project				
Choose the alternative you prefer	☐	☐	☐	☐

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