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Circularity, Sustainability, and the Quality of Coffee Sold via Vending Machines: What Do Italian Consumers Prefer?

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ABSTRACT

Vending is an important sector in the daily lives of many people, and coffee is the most frequently consumed product in the European market. Like many other sectors, vending is responding to the challenge of sustainable development by taking various actions, such as offering increasingly ecologically sound coffee while maintaining/improving its quality. These are factors that consumers care greatly about. Although the scientific literature on coffee is vast, few studies have focused on the vending sector. The aim of the present study was to fill this gap by performing a choice experiment in Italy to understand which attributes (sustainable or nonsustainable) Italian consumers prioritized when purchasing coffee via vending machines. The results showed that the physical quality of coffee was paramount, while sustainability (although important) played a secondary role. The circularity of cups was the least considered aspect. The data obtained for this study contribute to academic knowledge of consumer behavior regarding the purchase of sustainable coffee at vending machines and can be used as a starting point for the development of strategies in line with sustainability principles [EconLit Citations: C9, Q01].

1 | Introduction

Coffee is one of the world's most frequently consumed beverages and one of the most widely traded commodities (ICO 2019, 2020). Although its farming is almost exclusively concentrated in 'tropical belt' countries, the processing and consumption of coffee products occur primarily in industrialized countries, especially in the European Union (ICO 2019, 2022). People see coffee as a good to be enjoyed alone as a daily ritual or as a way to socialize with friends or colleagues (Lanfranchi, Giannetto, and Dimitrova 2016; Samoggia and Riedel 2018; YouGov 2021a).

In this context, the vending sector is particularly important, providing coffee for immediate consumption via vending

machines. Vending machines are widespread in cities in public/private spaces, and they are often the closest, quickest, and most convenient means for people to obtain coffee during breaks from work or study. The vending sector in Europe is a growing food and beverage market (in 2019, before the coronavirus disease 2019 [COVID-19] pandemic, turnover reached €17.2 billion), with coffee as the most sold and consumed product every year (again in 2019, the sale of nearly 5.5 billion cups of coffee generated a turnover of nearly €11 billion, or 66% of the total)¹ (Bertossi, Troiano, and Marangon 2023b).

One of the most important future challenges for the sector is to provide sustainable coffee in a world increasingly threatened by climate change and supply chain vulnerability, as demonstrated

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during the COVID-19 pandemic (Bertossi, Troiano, and Marangon 2023a; Rhiney et al. 2021). The demand for coffee is increasingly shifting towards coffee grown and processed in line with sustainability principles (Peluso 2023), requiring the adoption of cultivation and production techniques that reduce or eliminate all forms of environmental and social impacts currently present (Barreto Peixoto et al. 2023; Sachs et al. 2019). Coping with this scenario requires a shared commitment from every player in the coffee supply chain to shaping future production and consumption trends in line with the Sustainable Development Goals (Sachs et al. 2019). At the European level, the vending sector is responding to these challenges by developing a strategy “from the field to the cup” with the aim of offering consumers not only high-quality, sustainably produced coffee but also coffee served in line with the principles of the circular economy (European Vending and Coffee Service Association [EVA], 2021).

Although the literature has shown that consumers are increasingly attracted to sustainable coffee, to our best knowledge no studies have simultaneously investigated (1) whether this interest translates into purchasing behavior when coffee is dispensed via vending machines, and (2) whether sustainable aspects are really the most important factors determining consumption choices in such circumstances. The aim of the present study was to fill this gap by examining, through a choice experiment (CE), the hypothetical purchasing decisions and willingness to pay (WTP) of consumers regarding coffee with certain sustainable and non-sustainable attributes dispensed via vending machines. The research was conducted in Italy and based on a sample of 1010 consumers. Italy is one of the most important vending markets in Europe: in 2022, it was third (after Germany and France) in terms of turnover (about €1.5 billion), fourth (after the Netherlands, France, and Germany) in terms of coffee consumption (amounting to 2.6 billion cups), but first in terms of the number of vending machines present on the territory (more than 800,000).² Therefore, it was the ideal market in which to obtain valuable information for the sustainable development of the sector.

The entire study makes use of an already methodology well established at an academic level. However, the original aspect of the research lies in the simultaneous inclusion of certain product attributes deemed relevant for steering the vending sector towards a sustainable transition in line with the European manifesto and which had hitherto only been analyzed separately. Furthermore, this study delves more clearly into certain consumer dynamics and explores, for the first time, consumer reactions to a new quality label specific to the vending sector.

This paper is organized into different sections. The Introduction contextualizes the topic of study. Section 2 presents the theoretical background used in the construction of the experiment, with a focus on the three dimensions of the vending strategy for future developments (circularity of cups, sustainability of coffee supply chains, and high-quality coffee), the behavior of coffee consumers with regard to each dimension considered and how the study intends to contribute to the advancement of academic knowledge. Section 3 presents an overview of the study methodology (i.e., the CE and the attributes considered). Sections 4

and 5 describe and discuss the main findings obtained, linking them to current academic literature. Finally, Section 6 presents the conclusions and a number of practical implications.

2 | Theoretical Background

Orienting the coffee market towards Sustainable Development Goals requires actions regarding both production and consumption (Barreto Peixoto et al. 2023; Guimarães et al. 2022; Sachs et al. 2019; van Keulen and Kirchherr 2021). According to the literature, people's purchasing decisions regarding sustainable products are far from simple (White, Hardisty, and Habib 2019), since they are influenced by numerous factors (Testa et al. 2020; Tripathi and Singh 2016) that interact with each other dynamically and at different stages. This underlies several behavioral theoretical frameworks, such as the “Total Food Quality” model (Brunso, Ahle Fjord, and Grunert 2002), according to which the decision to purchase a food product occurs thanks to a multi-interaction process between intrinsic/extrinsic attributes, costs, perceptions, expectations, and the shopping context, both before and after the purchase. This applies theoretically to every food product, including coffee, for which sustainability labeling (e.g. organic or fair trade), the country of origin, and intrinsic (e.g., quality or roasting), extrinsic (e.g., packaging), and economic (i.e., price) attributes are particularly relevant (Samoggia and Riedel 2018).

As will be discussed in the following paragraphs, the European vending industry aims to contribute to the sustainable development of the market by acting on these attributes through a strategy based on the pillars of circularity, sustainability, and quality.

2.1 | Circularity of Cups

One of the central aims of the “from field to cup” strategy is to increase both the circularity (i.e., post-use recovery) of cups (EVA 2021) and their use, which are critical issues that need to be addressed by the coffee supply chain (Barreto Peixoto et al. 2023). The vending sector has traditionally relied on single-use cups made of polystyrene or polyethylene-coated cardboard for technical and safety reasons (EVA 2021). However, the environmental pollution caused by these cups (Chen et al. 2021; Foteinis 2020; Sandhu et al. 2021; UNEP 2021) has prompted the sector to consider more sustainable, circular (i.e. compostable/recyclable, biodegradable, and reusable) materials in line with recent European regulations (European Commission 2018, 2019, 2020a; Zero-Waste-Europe 2019).

Investigating consumer behavior is crucial for supporting this circular transition (Borg et al. 2022; Sandhu et al. 2021), and many studies have dealt with the topic (Keller et al. 2021; Loschelder et al. 2019; Maye, Kirwan, and Brunori 2019; Novorodovskaya, Mullan, and Hasking 2020, 2021; Poortinga and Whitaker 2018; Sandhu et al. 2021). The only study on the subject of vending was conducted by Bertossi, Troiano and Marangon (2023b), who analyzed, among other things, which characteristics a hot beverage cup should possess to be

perceived as environmentally friendly. According to their results, the most important attributes were end-of-life properties (i.e., biodegradability, recyclability, and reusability). What is currently missing is knowledge of which of the three solutions consumers prefer when purchasing coffee via vending machines. This study contributes to the development of scientific knowledge of this topic.

2.1.1 | Sustainability of the Coffee Supply Chain

The vending sector's second strategic aim is to steer supply towards coffee that is as healthy, natural, and sustainable as possible (EVA 2021) by intervening in the supply chain to reduce presently negative externalities. Numerous environmental and social problems are associated with the cultivation phase (Barreto Peixoto et al. 2023; Giraldi-Díaz et al. 2018; ILO 2020; Sachs et al. 2019), mainly due to the adoption of intensive techniques to increase production yields and meet growing consumer demand (ICO 2019, 2020). Strong impacts also occur during the transport and processing stages due to the massive use of fossil fuels and energy (Barreto Peixoto et al. 2023; Giraldi-Díaz et al. 2018; Nab and Maslin 2020). For some time now, the vending sector has been responding to these issues through the ongoing commitment of numerous companies operating in the sector, such as Lavazza.³ The intention of this path is to align the sector with European policies and initiatives (ECF 2022; European Commission 2020b) developed to create a more sustainable coffee market for better production, better nutrition, a better environment, and a better life, leaving no one behind (FAO 2021).

Regarding coffee consumption in general, the academic literature confirms that in recent years, there has been an increase in the willingness to buy and pay for sustainably grown and processed coffee throughout the supply chain (Birkenberg et al. 2021; Fuller and Grebitus 2023; Gatti et al. 2022; Takahashi 2021; Thøgersen and Nielsen 2016; Van Loo et al. 2015). However, this positive predisposition is not always constant and common to all people (Samoggia and Riedel 2018), and even the most “devoted consumers of sustainable coffee may compromise their sustainability ideals in favor of other characteristics offered by conventional products” (Cailleba and Casteran 2010; Lee and Bateman 2021). To the best of our knowledge, the only study to have dealt with the sustainability of coffee sold via vending machines is that of Takahashi (2021). According to the author, informing Japanese consumers about coffee's eco-friendliness significantly increases ecofriendly coffee sales (+7%), but only in social spaces (e.g., office buildings) and not in non-social spaces (e.g., shopping malls). Although Takahashi, (2021) work (conducted in Japan) aligned with the other literature, further investigation is needed regarding more traditional coffee markets, such as Italy. The present study intends to fill this gap by investigating the weight attributed by Italian consumers to sustainability both at the coffee growing stage and during subsequent stages, as well as to find out which of the two is most considered in purchasing decisions.

2.1.2 | High-Quality Coffee

The third strategic aim is quality. Since 1970, coffee consumers' preferences have changed, following what are called “coffee

waves” (Barreto Peixoto et al. 2023; Morris 2017). Although the market now demands coffees with increasingly special, exclusive, and sustainable attributes, high quality has remained a constant demand. Defining coffee quality is complex (Toledo et al. 2016), as it has both objective and subjective components (Giacalone et al. 2016), and all supply chain actors have their own opinions of what it comprises (Rendón-Mera, Corrales, and Peñuela Mesa 2022). Besides organoleptic and sensory attributes, coffee quality can be expressed in physical terms according to the length, width, thickness, or weight, shape, and color of the coffee beans used (Bemfeito et al. 2021; Luna González et al. 2019; Rendón-Mera, Corrales, and Peñuela Mesa 2022). In this regard, the Italian vending market developed the DTP-114 standard, which defines parameters for the functional quality of coffee beans (oxygen and moisture content, the presence of cracks, bean size, and the absence of foreign bodies) that are higher than those already defined by law.

As for consumption, the steady increase in the demand for high-quality coffee (Barreto Peixoto et al. 2023) suggests that consumers' coffee knowledge is becoming more sophisticated. Arce Alvarado and Linnemann (2010) discovered that respondents had little difficulty in rating coffees with the same scores as a professional coffee taster. Unfortunately, this is not always the case (Bemfeito et al. 2021; Giacalone et al. 2016), and even the most dedicated coffee consumers often fail to distinguish high-quality coffee due to a lack of information. Providing consumers with more information, such as by publicizing high-quality certification, can help them overcome any information asymmetry that prevents them from making informed decisions (Bemfeito et al. 2021), as is the case with sustainability certifications (Plank and Teichmann 2018). By including it in the CE, we aimed to explore for the first time the effectiveness of high-quality DTP-114 certification in attracting consumers' attention and influencing their purchasing decisions.

3 | Materials and Methods

A CE helps to investigate the link between a product's attributes and consumer decision-making (Bangsa and Schlegelmilch 2020; Luce 1959; McFadden 1974; Mcfadden and Train 2000) and has previously proved extremely useful in economic research for estimating consumer evaluations and preferences for specific sustainable attributes of coffee (Birkenberg et al. 2021; Fuller and Grebitus 2023; Gallenti et al. 2016; Gatti et al. 2022; Hindsley, McEvoy, and Morgan 2020; Thøgersen and Nielsen 2016; Van Loo et al. 2015). This method is based on Lancaster's demand theory, according to which consumers, when faced with several product types with different attributes, choose the one with a combination of attributes they perceive as most effectively maximizing their utility (Lancaster 1966).

In a CE, participants are usually presented with multiple decision scenarios (choice sets) and asked to select their preferred product option or alternative. Each decision scenario comprises several product alternatives with experimentally designed attributes, as well as a no-purchase option to simulate a real market situation. Our CE followed this structure, focusing on the purchase of coffee dispensed via a vending machine. By means of a fractional factorial orthogonal design, which does

not need any a priori knowledge of the population parameter estimates (Yao et al. 2015), eighteen choice options were selected, which were randomly organized into six choice sets with three options each, plus the above-mentioned no-purchase option (Figure 1).

3.1 | Chosen Attributes

The five attributes and corresponding types used for the experiment are shown in Table 1. They resulted from five focus groups (online and in person) comprised of various stakeholders selected through snowball sampling (Wayne 2013), including managers of the EVA, which is the European reference organization for standards and data about the vending sector and the funder of the study. The meetings, held in 2022, focused on identifying the most relevant and important attributes for steering the vending sector towards a sustainable transition in line with the European manifesto (EVA 2021).

The first attribute in this study was the type of cup holding the coffee, for which we provided three options: a single-use compostable and recyclable plastic cup, a single-use biodegradable paper cup, and a reusable cup. These types represent the alternatives currently under market evaluation for the vending sector and meet both technical and legislative requirements. Besides the cups' properties (i.e., composability/recyclability, biodegradability, and reusability) and material (i.e., plastic or paper), such attributes also focused on end-of-life. In particular, the single-use plastic cup can be recycled through RiVending, which is an Italian initiative developed to “close the loop” by using recycled plastic to produce new cups for vending

machines. The single-use paper cup can be disposed of using classic paper bins, but the reusable cup does not have a definite end-of-life phase.

The second attribute concerned the cultivation stage, and we provided three options regarding the type of agriculture used: organic, conventional, and integrated. Several studies have dealt with this aspect, but they have focused only on the first two solutions. The introduction of a third option (i.e., integrated farming) is an original aspect of the study that allowed us to explore consumer predispositions to compromise, since this mode of farming involves a balanced combination of natural and artificial nutrients (e.g., phytosanitary) and the use of low-impact farming techniques with the aim of finding a compromise between environmental, health, and economic needs (European Commission 2009). Therefore, it represents a middle ground between organic and conventional farming.

The third attribute focused on sustainability throughout the coffee supply chain and concerned the introduction of a program for monitoring and reducing environmental and social impacts. This attribute extended the concept of sustainability in all its forms (e.g., nonuse of pesticides and fertilizers, adoption of measures to combat climate change, water saving, and fair pay for workers) and allowed us to explore consumer interest in these aspects, rather than only the cultivation phase.

The fourth attribute related to coffee quality, particularly to the presence/absence of DTP-114 high-quality certification.

The last attribute was coffee price, for which we presented three levels: (1) €0.60, (2) €0.75, and (3) €0.90. The corresponding




SCENARIO 1	A	B	C	D
				
Price of the beverage	0,60 €	0,75 €	0,90 €	
Type of cup	Single-use (plastic, compostable, recyclable through RiVending)	Single-use (paper, biodegradable, collection bin)	No cup (use your own cup)	None of the alternatives
Farming technique	Conventional	Organic	Integrated	
Monitoring and reduction of impacts along the supply chain	No	No	Yes	
DTP 114 high quality certification	No	Yes	No	
Choose the preferred alternative	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

FIGURE 1 | Example of a choice set used for the choice experiment (CE). A, B, and C represent the three product alternatives with specific combinations of attributes; D is the no-purchase option used to simulate a real market scenario. The five product attributes used for the study are presented on the left.

TABLE 1 | Chosen attributes and corresponding levels.

Attributes	Options
Type of cup	Single-use compostable plastic cup recyclable through RiVending, single-use biodegradable paper cup, or reusable cup
Farming technique	Organic, integrated, or conventional (intensive)
Monitoring and reduction of environmental and social impacts throughout the supply chain	Yes or no
Presence of the DTP-114 high-quality certification	Yes or no
Price of the beverage	€0.60, €0.75, or €0.90

levels were set accordingly to average Italian prices for coffee dispensed via vending machines.

3.2 | Data Acquisition and Analysis

For the experiment, in March 2023, we sent a two-part online questionnaire to 1010 Italian consumers using a third-party service that was responsible for its ethical review, preparation, and data collection. Ethical approval was granted for this research due to the full compliance of the study with the principles stated in the Declaration of Helsinki and the avoidance of any form of risk or actual and potential harm (physical or psychological) to participants. In the first part of the questionnaire, the participants were presented with the objective of the study and were asked to provide their informed consent to take part in the research along with their sociodemographic data (i.e., gender, age, and employment status) and the frequency of coffee consumption via vending machines. The second part focused on the CE, and we asked consumers to imagine being in a place with a high possibility of them purchasing coffee from a vending machine and to choose the alternative with the combination of attributes they preferred. To help them during the decision-making process, we provided a brief explanation of each attribute and the corresponding options before the experiment began and a cheap talk script was used to try to reduce hypothetical biases (Carlsson, Frykblom, and Johan Lagerkvist 2005).

We analyzed the CE data using NLOGIT6 software—first with a multinomial logit (MNL) model and second with a latent class model (LCM) which assumes, in contrast to a mixed logit model, that there is a finite number of discrete preference groups and that each respondent has a probability of being in each group. LCM was chosen as it allows investigation of market segments for vending machine coffee and improved marketing strategies. Both models were estimated sharing the following linear utility function:

$$\begin{aligned}
 U(x_i) = & \beta_{\text{optout}} * \text{OptOut}_i + \beta_{\text{paper}} * \text{PAPER}_i \\
 & + \beta_{\text{reusable}} * \text{REUSABLE}_i + \beta_{\text{monitor}} * \text{MONITOR}_i \\
 & + \beta_{\text{quality}} * \text{QUALITY}_i + \beta_{\text{organic}} * \text{ORGANIC}_i \\
 & + \beta_{\text{conventional}} * \text{CONVENTIONAL}_i + \beta_{\text{price}} * \text{PRICE}_i
 \end{aligned}$$

OptOut was a dummy that assumed a value of 1 for the no-purchase option and 0 otherwise; PAPER was a dummy that indicated the single-use biodegradable paper cup; REUSABLE

was a dummy that indicated the reusable cup; MONITOR was a dummy that indicated sustainability monitoring throughout the supply chain; QUALITY was a dummy that indicated high quality DTP-114 certification; ORGANIC was a dummy that assumed an organic farming method; CONVENTIONAL was a dummy that assumed conventional production; and finally, PRICE was the price variable.

The MNL model considers respondent preferences to be homogeneous and was used to gain an initial explorative view of the results. LCM allowed us to consider heterogeneous respondents and assign them to classes to investigate the differences among the classes and estimate WTP (McFadden and Train 2000) by dividing β coefficients by β price:

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

We used the Akaike information criterion (AIC), Bayesian information criterion (BIC), log likelihood function (LL), and McFadden pseudo-R-squared (MF R^2) indices to define the most suitable and useful number of classes.

4 | Results

The study sample contained an equal distribution of participants in terms of gender (Table 2). In contrast, there was more heterogeneity in the distribution of age groups (although we noted a prevalence of consumers over the age of 40 years), occupations (almost 50% of the sample were company employees or in public administration), and the frequency of use of vending machines (Table 2). By comparing the socio-demographic data of the respondents with national data (obtained by consulting the databases of the National Statistical Institute), the study sample could be considered comparable to the Italian population. Indeed, the breakdown percentages of the sample under study and of the Italian population in terms of gender (male and female) are almost identical, as are those concerning certain age groups.

4.1 | CE Results

The MNL analysis considered all respondents to have homogeneous preferences. Based on the results (Table 3), the coefficient for the alternative specific constant (ASC – OptOut) was significant and negative (−3.39), suggesting that

TABLE 2 | Sociodemographic characteristics of the respondents and their frequency of coffee consumption.

	Sample	%	Italy	%
Gender				
Male	501	49.6%	28.851.041	48.9%
Female	508	50.3%	30.138.708	51.1%
Not declared	1	0.01%		
Age				
18–29	161	15.9%	7.097.508	14.3%
30–39	148	14.7%	6.600.786	13.2%
40–49	204	20.2%	8.277.541	16.6%
50–59	227	22.5%	9.602.066	19.2%
Over 60	270	26.7%	18.323.142	36.7%
Employment status				
High school student	13	1.3%		
University student	64	6.3%		
Employed	481	47.6%		
Self-employed	117	11.6%		
Unemployed	170	16.8%		
Retired	165	16.3%		
Frequency of coffee consumption via vending machines				
Never (I do not use this service)	201	20%		
Rarely (once a week or less)	251	25%		
Occasionally (maximum 1–2 times per week)	187	19%		
Sometimes (maximum 3–4 times per week)	129	13%		
Frequently (maximum 5 times a week)	98	10%		
Often (at least once every day)	85	8%		
Always (at least 2 times every day)	59	6%		

respondents gained higher utility from choosing coffee with the investigated attributes than from choosing the “no-purchase” option. According to this first analysis, the main purchase drivers for Italian consumers in decreasing order of importance were the quality of the coffee (0.86***), the monitoring and reduction of environmental and social impacts throughout the supply chain (0.38***), the use of organic farming techniques during the cultivation phase (0.20***), and the provision of a single-use biodegradable paper cup (0.14***). Having to use one’s own cup (−0.30***) and an excessive price (−0.03***) were the only attributes associated with a decrease in utility. Regarding the three types of attributes, the use of the single-use compostable plastic cup recyclable through RiVending was secondary to the use of paper cups, as was integrated agriculture compared to organic farming. However, these options were preferred over a reusable cup and conventional farming, respectively.

Regarding the LCM analysis, the definition of the best number of classes is a process which relies on comparisons of the AIC, BIC, LL, and McFadden pseudo R^2 information criteria values for different latent class models. However, according to Scarpa, Thiene and Galletto (2009) and Scarpa and Thiene (2005, p. 11), to identify

the number of classes scholars “must also account for significance of parameter estimates”. In addition, the choice must “be tempered by the analyst’s own judgment on the meaningfulness of the parameter signs”. Notice that five- and four-class models are statistically preferred considering the information criteria values (Table 4); however, they present a number of statistically insignificant parameter estimates and difficulties in interpretation. Taking into consideration the above-mentioned recommendations, we opted for a three-class model with an AIC index of 2.056, a BIC index of 2.060, an LL index of −6203.226, and a McFadden pseudo R^2 of 0.262. This last index describes a good interpretative capacity and better performance compared to the MNL model.

Based on the LCM results, as for the MNL results, the ASC (OptOut) coefficient was significant and negative for most of the respondents. All estimated parameters are significant, considering a 1% significance level, and the price attribute has a negative sign as expected (the higher the price, the lower on average respondents’ utility). The LCM results confirm the presence of quite heterogeneous preferences among respondents. The high preference for and interest in the DTP-114 high-quality certification of coffee was evident for all three classes of respondents (2.69*** for Class 1, 0.50*** for Class 2, and 1.29** for Class 3), as well as the unattractiveness of

TABLE 3 | MNL and LCM results.

Variable	LCM											
	MNL			Class 1			Class 2			Class 3		
	Coeff. (S.E.)	Coeff. (S.E.)	WTP (€/bev)	Coeff. (S.E.)	WTP (€/bev)	Coeff. (S.E.)	WTP (€/bev)	Coeff. (S.E.)	WTP (€/bev)	Coeff. (S.E.)	WTP (€/bev)	
ASC (OptOut)	-3.39 (0.11)***	-4.14 (0.46)***	/	-4.59 (0.15) ***	/	-4.51 (0.91)***	/	-4.51 (0.91)***	/	-4.51 (0.91)***	/	
Price of the beverage	-0.03 (0.00)***	-0.03 (0.00)***	/	-0.03 (0)***	/	-0.10 (0.01)***	/	-0.10 (0.01)***	/	-0.10 (0.01)***	/	
Single-use biodegradable paper cup	0.14 (0.04)***	-0.39 (0.16)**	-0.13	0.21 (0.05)***	-0.13	-0.88 (0.39)**	+0.07	-0.88 (0.39)**	+0.07	-0.88 (0.39)**	-0.09	
Reusable cup	-0.30 (0.05)***	-2.84 (0.47)***	-0.94	0.04 (0.09)ns	-0.94	-1.86 (0.47) ***	/	-1.86 (0.47) ***	/	-1.86 (0.47) ***	-0.18	
Sustainability monitoring throughout the supply chain	0.38 (0.05)***	-0.31 (0.22)ns	/	0.50 (0.09)***	/	0.73 (0.39)*	+0.16	0.73 (0.39)*	+0.16	0.73 (0.39)*	+0.07	
High quality DTP-114 certification	0.86 (0)***	2.69 (0.40)***	+0.89	0.50 (0.13)***	+0.89	1.29 (0.64)**	+0.16	1.29 (0.64)**	+0.16	1.29 (0.64)**	+0.13	
Organic farming	0.20 (0.04)***	-0.38 (0.24)ns	/	0.36 (0.06)***	/	0.98 (0.49)**	+0.12	0.98 (0.49)**	+0.12	0.98 (0.49)**	+0.10	
Conventional farming	0.02 (0.05)ns	0.57 (0.21)***	+0.19	0.04 (0.10)ns	+0.19	0.35 (0.49)ns	/	0.35 (0.49)ns	/	0.35 (0.49)ns	/	
Estimated latent class probability		0.324		0.582		0.093		0.093		0.093		
Theta in class probability model												
18–29 age group		0.23 (0.41)ns		0.72 (0.38)*		0.00(fixed parameter)		0.00(fixed parameter)		0.00(fixed parameter)		
50–59 age group		-0.00(0.99)ns		0.40 (0.20)ns		0.00(fixed parameter)		0.00(fixed parameter)		0.00(fixed parameter)		
Male		-0.082(0.75)ns		-0.061 (0.81)ns		0.00(fixed parameter)		0.00(fixed parameter)		0.00(fixed parameter)		
LCM statistical indices				LL -6203.226, AIC 2.056, MF R ² 0.262, BIC 2.060								

Note: Single, double, and triple asterisk (*, **, ***) indicate statistical significance at the 10%, 5%, and 1% level, respectively. Abbreviations: AIC, Akaike information criterion; ASC, alternative specific constant; BIC, Bayesian information criterion; LCM, latent class model; LL, log likelihood function; MF R², McFadden pseudo-R-squared; MNL, multinomial logit; ns, not statistically significant; S.E., standard error; WTP, willingness to pay.

TABLE 4 | Latent class model statistics.

	LCM-2	LCM-3	LCM-4	LCM-5
LL	-6480.820	-6203.226	-6115.894	-5854.958
AIC	2.144	2.056	2.030	1.947
BIC	2.139	2.060	2.018	1.932
McFadden pseudo R^2	0.229	0.262	0.272	0.303

Abbreviations: AIC, Akaike information criterion; BIC, Bayesian information criterion; LCM, latent class model; LL, log likelihood function; MF R^2 , McFadden pseudo- R^2 squared.

both a price increase (-0.03^{***} for Classes 1 and 2; -0.10^{***} for Class 3) and (above all) the prospect of using their own cups (-2.84^{***} for Class 1, 0.04 for Class 2, and -1.86^{***} for Class 3). The interest in high quality translated into a strong WTP at a price premium, especially for Class 1 (amounting to €0.89 per cup of coffee), but it was lower for Class 2 (€0.16) and Class 3 (€0.13) respondents. However, this positive propensity was sharply reversed regarding the prospect of using one's own cup: in particular, Classes 1 and 3 refrained from paying more for this service ($-\text{€}0.94$ for the former, $-\text{€}0.18$ for the latter). Regarding the other attributes, the preferences were similar for Classes 2 and 3, which behaved in the opposite way to Class 1. For example, the presence of a plan to monitor and reduce environmental and social impacts throughout the supply chain was highly valued by respondents in these classes (WTP of $+\text{€}0.16$ and $+\text{€}0.07$, respectively), but it was completely ignored by those in Class 1. The same situation was found for the use of organic farming techniques, highly appreciated by Classes 2 and 3 (with consequent WTP of $+\text{€}0.12$ and $+\text{€}0.10$, respectively) but ignored by Class 1 respondents. The latter, in fact, seemed to prefer or perceived greater utility from the use of conventional/intensive farming techniques, for which they would be willing to pay a premium of €0.19. The use of a biodegradable paper cup, on the other hand, generated similar negative responses in Classes 1 and 3, but the responses were positive in Class 2. This meant that for Class 2, the single-use biodegradable paper cup solution was preferable (with a positive WTP of €0.07), although Classes 1 and 3 preferred the single-use compostable plastic cup recyclable through RiVending.

The sociodemographic and behavioral variables shown in Table 2 were included in the LC model in the first step of the model estimation, with the aim of better explaining the probability of class membership. We found that these variables were generally not statistically significant for explaining the probability of each class; in other words, that they generally had no influence on the latent class segmentation. However, for the model presented in Table 3, we retained only a number of gender and age characteristics, and the "18–29 age group" variable proved significant, with a positive coefficient (0.72^*) for Class 2 relative to the base case (i.e., Class 3). This means that Class 2 has a lower age than Class 3.

5 | Discussion

In this section, we discuss the results and link them to existing scientific literature under the three dimensions of sector strategy.

5.1 | Circularity of Cups

In recent years, discussions concerning the role of hot beverage cups in our economy, and how people can be encouraged to support more sustainable solutions, have intensified. According to the academic literature, people respond positively to biodegradable, recyclable, and reusable packaging (Nguyen et al. 2020; Otto et al. 2021), and this also seems to apply to hot beverage cups (Bertossi, Troiano, and Marangon 2023b). However, so far, there is little clarity regarding which solution people prefer when they buy hot drinks via vending machines. To the best of our knowledge, our study is the first to shed light on this topic by using a CE considering, at the same time, disposable (biodegradable, recyclable) and reusable cups. Indeed, a previous study (Bertossi, Troiano, and Marangon 2023b) had only considered a single-use cup made of recyclable plastic.

According to the results, for most people, the prospect of using their own cup is distinctly unappealing; they prefer single-use biodegradable paper cups (first choice) or single-use compostable and recyclable plastic cups (second choice). These results represent a deepening of those of Bertossi, Troiano and Marangon (2023b). In fact, their experiment showed that, between plastic disposable solutions and a no-choice option, respondents strongly preferred the former. Although the authors did not specify what the no-choice option was, the only possible alternatives were disposable cups made of biodegradable paper or reusable, personal cups. Including these variables in the CE allowed us to compare which variable was actually the preferred one, showing a strong predisposition to choose the biodegradable disposable cup in particular and to ignore the reusable one. There are many explanations for this last result. According to Sandhu et al. (2021), the main reason is the pervasiveness of a take-away coffee culture, with "takeaway-and-throwaway" having become the accepted norm. However, Keller et al. (2021) presented the transition from disposable to reusable cups as a complex process involving several stages that is influenced by various factors (e.g., social norms, awareness, perceived behavioral control, and emotions). Another possible explanation may be the respondents' lack of environmental attitudes, consciousness, or values. For example, a study by Novoradovskaya, Mullan and Hasking (2020) showed that the decision to use a reusable cup became stronger the more environmental values people had. However, in our case, such lack would only explain the choice of Class 1 (composed, according to the results, of people not interested in sustainability in any way), and it was not consistent with the choices of Classes 2 and 3 (which were greatly concerned with coffee sustainability throughout the supply chain). In addition, Italian

consumers perceive biodegradable and recyclable cups as more ecofriendly than reusable ones (Bertossi, Troiano, and Marangon 2023b). According to the literature, the more a product is perceived as ecofriendly, the higher the intention to use/purchase it (Steenis et al. 2018). However, although reusability has been rated as less important than biodegradability and recyclability for perceiving a cup as ecofriendly, this difference appears to be minimal (Bertossi, Troiano, and Marangon 2023b) and would not justify the clear rejection shown in this study. Therefore, based on the latest scientific evidence, our results suggest that the real reason consumers do not want to use this type of cup could be the lack of practicality and convenience. Further studies are needed to confirm this hypothesis.

The choice of a paper cup rather than a plastic one depended, instead, on the higher perceived sustainability of the former than the latter. Indeed, according to the literature, most consumers see plastic as a highly polluting material (Boesen, Bey, and Niero 2019; Lindh, Olsson, and Williams 2016; Steenis et al. 2017), perceiving paper or cardboard to be more environmentally friendly (Lindh, Olsson, and Williams 2016; Nguyen et al. 2020). However, it is also true that some consumers may evaluate plastic positively if it possesses some ecofriendly attributes, such as recyclability (Bertossi, Troiano, and Marangon 2023b; Orset, Barret, and Lemaire 2017) or biodegradability (Otto et al. 2021). The choice of the disposable biodegradable paper cup as the preferred solution was not common to all respondents but only to those in Class 2. Class 1 and 3 respondents seemed to prefer the recyclable plastic cup. The reason for the Class 3 preference could lie in the presence of an ecofriendly attribute (i.e., an innovative recycling system with a lower environmental impact), but this could not be the case for Class 1 respondents. For them, the reason could instead be based on a greater perception of the safety and functionality of plastic for containing a hot drink. The exclusion of the sustainability factor in this explanation stems from the fact that, according to the survey results, Class 1 respondents were not interested in any sustainable attributes of coffee, but only in its quality.

5.2 | Sustainability of the Coffee Supply Chain

Coffee has numerous environmental and social impacts at every stage of the supply chain that require considerable political and, above all, industrial interventions (Barreto Peixoto et al. 2023). Over the years, several production standards oriented towards sustainable supply chain management have been developed (Dietz et al. 2018), and most consumers seem to respond positively when they find themselves choosing a coffee that has such a certification (Birkenberg et al. 2021; Fuller and Grebitus 2023; Gatti et al. 2022; Takahashi 2021; Thøgersen and Nielsen 2016; Van Loo et al. 2015).

The results of our work are partially in line with the scientific literature. The monitoring and reduction of negative environmental and social impacts throughout the life cycle of the beverage, as well as the use of organic farming techniques in the first phase of the supply chain, are attributes that influence Italian consumers' purchase choices and WTP for coffee sold via

vending machines. The same can be assumed for integrated agriculture; in fact, this turned out to be the second preferred choice of all respondents, whether they were interested in sustainability or not. However, as stated by Samoggia and Riedel (2018) and found by Takahashi (2021), not all consumers always respond positively to sustainability. Our survey showed that only for respondents belonging to Classes 2 and 3 did such sustainable attributes weigh in their purchasing decisions. This could be explained either by their sustainability values or by their perception of the greater healthiness of and, consequently, the better taste of a product with such attributes (i.e., halo effect) (Nadricka, Millet, and Verlegh 2020).

This could also be the case (although in reverse) for the Class 1 respondents in our study, who perceived greater utility from buying coffee grown using intensive, nonenvironmentally friendly techniques. Lee and Bateman (2021) found that, at the same price, coffee with sustainable attributes was not always chosen by consumers over conventional coffee. Among the reasons, the authors mentioned mistrust or a lack of understanding of sustainable certifications, a lack of interest in such issues, or a perceived deterioration of the taste of the beverage. In our case (although all these elements could coexist), we believe the main reason was the perception of a decrease in the quality of the drink in terms of taste and healthiness—a phenomenon that was discussed by Nadricka, Millet and Verlegh (2020) and Magnier, Schoormans and Mugge (2016). For Class 1 respondents, high coffee quality was the most important attribute of all, and they certainly did not accept any compromise that could decrease quality.

5.3 | High-Quality Coffee

The results of our study showed that the presence of the DTP-114 high-quality certification (which guarantees that certain physical characteristics of the coffee, such as oxygen content, bean size, and an absence of breakages and foreign matter are maintained) was the most important attribute for all survey participants, for which each would be willing to pay a significant premium depending on the class. This attribute was found to be as important as the adoption of an environmental and social improvement program throughout the supply chain for respondents belonging to Class 2, and it was the favorite option for all other respondents.

The explanation for this phenomenon could lie in the consumption habits of Italians, who are among the most frequent coffee consumers in Europe (YouGov 2021a). In particular, the most frequently consumed type of coffee in Italy is espresso (Lanfranchi, Giannetto, and Dimitrova 2016; YouGov 2021b), and the attributes considered most important are aroma and taste (YouGov 2021b). Espresso coffee is a specific type of coffee with characteristics that could be described as 'gourmet' (Van Der Merwe and Maree 2016), and it is an integral part of Italian culture and identity, as well as a symbol of 'Made in Italy' worldwide. In addition to being the most popular type of coffee in cafeterias, it is also the most frequently consumed via vending machines. Therefore, for such an appreciated and valued beverage, the absolute importance of quality certification that emerged from the survey is not surprising.

There may be an additional reason. Coffee quality is a complex concept, and most consumers rely on the aroma and taste to define it. These aspects are expressions of the intrinsic quality of coffee, but they depend on many factors, including the quality of the beans used (Toledo et al. 2016). Although consumers are becoming increasingly savvy (Arce Alvarado and Linnemann 2010), their knowledge of the hidden secrets of coffee is limited (Giacalone et al. 2016), effectively preventing them from making reasoned purchase choices and enjoying the maximum possible sensory experience with absolute awareness. However, the literature has shown that providing accurate information to consumers can improve this situation, since through it, people will be able to infer several previously unnoticed characteristics of coffee (Bemfeito et al. 2021). This is what often happens with sustainability certifications, such as organic or fair-trade certifications (Apaolaza et al. 2017; Berry and Romero 2021; Plank and Teichmann 2018), which make people perceive and expect certain food products to be healthier and better tasting. Therefore, it is possible that survey respondents chose DTP-114 certification as the most important attribute because it was perceived as a guarantee not only of quality but also of coffee aroma and taste.

6 | Conclusions

The results obtained from the CE generally align with those of other scientific studies. However, our results offer more detail on the dynamics of coffee consumption in Italy via vending machines, focusing on specific attributes, some of which have never been explored. The study firmly highlights three key aspects: (1) coffee quality is something Italian consumers do not want to give up, sometimes even at the expense of sustainability; (2) the Italian market is characterized, on the one hand, by new potential buyers of sustainably grown and processed coffee along the supply chain and, on the other hand, by people who are skeptical and cautious about these aspects and still more oriented towards conventional coffee; and (3) Italian consumers seem to prefer classic disposable paper and plastic cups to personal and reusable ones.

A number of practical implications and suggestions for future research can be drawn from these results. Regarding quality, DTP-114 certification is something consumers should be made aware of through appropriate labeling, as doing so could lead to important market growth by including the type of consumer who still perceives coffee sold via vending machines to be “too artificial” and/or of poor quality. Moreover, communicating this aspect could make a coffee break a more pleasant drinking experience by acting on sensory expectations and perceptions. Based on the above, we suggest that future research investigate this hypothesis in more detail (e.g., consumers’ preferences), thus contributing to the development of academic knowledge of the topic. Regarding sustainability, adapting the coffee supply to meet the demand of both kinds of consumers would be a reasonable choice and would allow further exploration of the behavioral dynamics of new buyers interested in sustainability. Convincing and sensitizing the group of skeptical consumers, however, is a crucial issue that will have to be addressed in the future. The sustainability of supply chains is increasingly

becoming an essential development requirement in the dynamics of agri-food markets, for which huge investments are required. The only way to make certain these investments pay off is to ensure that demand increases, and this can only happen by involving as many consumers as possible. We therefore suggest that future studies focus on investigating how consumers might respond to price increases due to sustainable interventions along the supply chain; in particular, whether they would really be willing to pay for such increases (as emerged in some cases in this study), or whether they would stop consuming coffee or switch to other, cheaper beverages or choose other coffee services (e.g., cafeterias or cafes). Regarding the circularity of cups, the vending sector should continue to innovate and design more environmentally friendly and easily recyclable disposable cups, provided that action is taken to create an effective end-of-life management system that eliminates the risk of their release into ecosystems. However, we believe that the sector could also consider developing systems in which disposable and reusable solutions can coexist rather than being mutually exclusive. Two reasons support this last statement: (1) merely because respondents stated that they prefer disposable cups does not mean that they would never consider other alternatives if properly incentivised; (2) disposable and reusable cups can be seen as two sides of the same coin, and having vending machines that make it possible to apply both solutions would be perfectly in line with the European Union’s new “Packaging and Packaging Waste Directive.” Future studies could monitor the actual behavior of consumers in a real-world context, investigating the reasons and barriers that affect their decision whether to opt for disposable or reusable cups.

The study has two main limitations. First, the experiment considered only a few sustainability attributes, but many others deserve to be investigated. Second, the results concern only the Italian market and, thus, cannot be extended to other European countries, where other dynamics (e.g., sustainability awareness, coffee price, and coffee culture) may govern. Future research could therefore investigate these other European markets.

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Ethics Statement

The study received a formal ethical approval by the Independent Ethical Committee of Demetra [Opinioni.net](https://www.opinioni.net) srl due to the full compliance of the study with the principles stated in the Declaration of Helsinki and the avoidance of any form of risk or actual and potential harm (physical or psychological) to participants. Informed consent was obtained from all survey participants.

Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Endnotes

- ¹Data provided by the European Vending and Coffee Service Association based on their most recent market research.
- ²Data provided by the European Vending and Coffee Service Association based on their most recent market research.
- ³<https://www.lavazzagroup.com/en/how-we-work/the-sustainability-report.html>.

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Supporting Information

Additional supporting information can be found online in the Supporting Information section.