Exploratory analysis of influential factors in the choices of using single-use or reusable cups in vending

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Abstract

Purpose – This study investigates the variables that play a role in the purchase intention of a hot beverage at a vending machine (1) served in a 100% recyclable plastic single-use cup, (2) served in a biodegradable paper single-use cup and (3) served in personal, reusable cups brought by customers. The variables considered are perceived environmental benefits (PEBs), perceived contamination risk (PCR), social norms (SNs), value for money (VM), gender and age. The secondary objective is to investigate respondents' perceptions of these cups using the first four variables and to assess the existence of significant differences among them.

Design/methodology/approach – For the first purpose, three separate logistic regression models on purchase intention were created, considering PEBs, PCR, SNs, VM, gender and age as independent variables. For the second purpose, the analysis relied on Friedman's nonparametric test. The entire survey was conducted in Italy on a sample of 1,006 consumers.

Findings – SNs and VM are the variables with the greatest influence on final purchase intention. PEBs seem to have an effect only in the case of the plastic and paper single-use cups, while PCR only in the case of the reusable cup. Neither gender nor age seem to play a significant role in final purchase intention. Friedman's test revealed significant differences among the three cup types in terms of perceptions, but not in the case of the PCR variable.

Originality/value – The study is the first to compare new single-use cups with reusable cups from vending machines in terms of consumers' perceptions and preferences.

Keywords Green economy, Hot beverages cups, Vending, Sustainable development, Environmental sustainability

Paper type Research paper

Introduction

It's official: in 2023, we crossed 6 of the 9 planetary limits that circumscribe the safe space within which humanity can survive (Richardson *et al.*, 2023). At the root of the problem there is an economic system that is mainly characterised by production and a consumption mindset that is still very much based on the linear "take-make-use-dispose" model, which is fuelled by an ever-increasing rate of extraction of virgin resources (about 100 Gt/year as of 2021) and an almost total inefficiency in their recovery after use (more than 90% of these resources are "lost" annually or turned into waste) (Circle Economy, 2023).

Among the products that best represent this "disposable society" are polystyrene or polyethylene-coated cardboard cups, which, because of their high temperature resistance and hygienic properties, have been used for many years in various food and beverage distribution

sectors (including vending) to hold hot drinks (EVA, 2021). The market for such products has always followed a predominantly linear trend, using raw materials (plastic and paper)—most often virgin—without sending them for proper recycling once their function has been completed (Novoradovskaya *et al.*, 2021; Sandhu *et al.*, 2021). This approach has made them a symbol of our hyper-consumeristic lifestyle and one of the most common types of waste in terrestrial and marine ecosystems worldwide (Foteinis, 2020; Miller *et al.*, 2019; Ocean Conservancy, 2020, 2023; Roy *et al.*, 2021; Sandhu *et al.*, 2021; UNEP, 2021).

At the European level, the "European Strategy for Plastics" (European Commission, 2018) and Directive 904/2019 *"On the reduction of the impact of certain plastic products on the environment"* (European Commission, 2019) have been adopted in recent years to try to reduce the production of such single-use plastic items as much as possible and to significantly increase the rates of their recycling and reuse. This challenge has been taken up by many industry associations, including the European Vending and Coffee Service Association (EVA), which has responded to the call by committing to developing more circular distribution and management systems in which recycling and reuse can co-exist, rather than being mutually exclusive (EVA, 2021). This approach to green economy is in line with the new "Packaging and Packaging Waste Directive" (European Parliamentary Research Service, 2023) that envisages single-use items for those sectors where re-use is not always possible and practical, provided that action is taken in the design and end-of-life management stages to minimise their undeniable environmental impact.

Two of the new types of single-use cups developed in recent years following the principles of eco-design are made of innovative 100% recyclable plastics and biodegradable paper, which possess technical/functional properties suitable for holding hot beverages and are more easily recoverable at the end of their end-of-life phase. Although such cups have replaced the old ones as the only option available in almost all existing vending machines, in recent years, devices have emerged that also allow the use of reusable cups, mainly due to increased consumer demand. The increasingly rapid spread of these vending machines may lead vending service operators to make a choice: either continue to use only the new single-use cups or adopt systems that also open up the possibility of using personal, reusable cups. This choice requires a consideration of the respective environmental contributions of these products (Changwichan and Gheewala, 2020; Cottafava *et al.*, 2021; Moretti *et al.*, 2021; Potting and van der Harst, 2015; UNEP, 2021), as well as the opinions, behaviours and levels of acceptance of each type of cup by the end consumers, which is a key factor in circular development (Borg *et al.*, 2022; Kirchherr *et al.*, 2017; Roy *et al.*, 2021; Sandhu *et al.*, 2021; UNEP, 2021).

Several studies have investigated consumer behaviours regarding the use of hot drink cups (Keller *et al.*, 2021; Loschelder *et al.*, 2019; Maye *et al.*, 2019; Nicolau *et al.*, 2022; Novoradovskaya *et al.*, 2020, 2021, 2023; Poortinga and Whitaker, 2018; Wang *et al.*, 2022). However, these studies have only focused on encouraging the use of reusable solutions in environments such as work-place cafés, university cafés, or coffee shops, to the exclusion of single-use solutions. The only two studies that focused on the vending sector and also considered single-use cups were those of Bertossi *et al.* (2023, 2024). In both research works, a choice experiment was performed to investigate consumer preferences, but whereas the former only considered a 100% recyclable plastic single-use cup in a university environment, the latter also included both a biodegradable paper single-use cup and a reusable cup in the choice and was performed nationwide.

Although the choice experiment is a very powerful tool for investigating consumer preferences in hypothetical markets (Hoyos, 2010), it cannot offer a complete explanation of the intentions expressed by people unless its construction and design are supported by a theoretical background about the topic of interest. The works of Bertossi *et al.* (2023, 2024) have brought out consumer preferences based on existing studies not always focused on vending sector. Moreover, the literature still lacks an in-depth examination of the possible factors that may determine the intention to use one type of cup over another at vending machines. Therefore, the primary objective of this exploratory work is to fill this gap and

contribute to the development of academic knowledge by investigating which variables play a key role in the intention to purchase a hot beverage from a vending machine based on the following options: (1) served in a single-use cup made of 100% recyclable plastic, (2) served in a single-use cup made of biodegradable paper and (3) served in a personal, reusable cup brought by the customer. The methodology used for this purpose is logistic regression, in which perceived environmental benefits (PEBs), perceived contamination risk (PCR), social norms (SNs), value for money (VM), gender and age served as independent variables. The secondary objectives are to investigate how respondents perceive these cups using these same first four variables and to assess the existence of significant differences. The entire survey was conducted in Italy, one of the leading countries in Europe for the vending sector (Bertossi *et al.,* 2023, 2024), with a sample of 1,006 participants.

Theoretical background
Numerous diverse factors drive people to use or not use a product designed to have a limited environmental impact (Gomes *et al.,* 2022; Testa *et al.,* 2020). The theoretical framework proposed by Gomes *et al.* (2022) following a thorough literature review, for example, includes 54 factors classified into 7 categories (i.e. political and legal, economic, environmental, demographic, consumer, product/service offer, product/service related) that can explain the choice of a circular product over another. Such framework includes PEBs through the constituent material of the product itself and its circular properties (Magnier *et al.,* 2019). According to the literature, the more a product (in this case, vending machine packaging) is perceived as having a low environmental impact, the higher the likelihood of final use/ purchase among consumers (Steenis *et al.,* 2018). Material also plays an important role in such dynamics, and the literature agrees that paper is almost always perceived as more environmentally beneficial than plastic (Herrmann *et al.,* 2022; Nguyen *et al.,* 2020; Steenis *et al.,* 2017). However, plastic materials can also be positively re-evaluated if they are recyclable, post-consumer recycled or biodegradable (Herrmann *et al.,* 2022; Otto *et al.,* 2021). Theoretically, recyclability, biodegradability and reusability are the three basic properties on which consumers base their assessment of a packaging's sustainability (Otto *et al.,* 2021). These properties are also considered essential for perceiving packaging as eco-friendly (Nguyen *et al.,* 2020). This was demonstrated in the case of hot drink cups, with a study reporting that these intrinsic properties were rated as the most important by university students (Bertossi *et al.,* 2023). Thus, the inclusion of the PEB variable in the current study makes it possible to contribute to the evolution of academic knowledge by clarifying: (1) which type of cup between disposable (100% recyclable plastic and biodegradable paper) and reusable is perceived as more environmentally beneficial and (2) whether this variable has a relevant influence on consumers' intention of their final use for the purchase of a hot drink.

PCR seems to be another important driver of acceptance or rejection (Magnier and Gil-Pérez, 2023). Existing studies have shown a certain resistance on the part of consumers to purchase circular products derived from recycled or reused material, as they are not only perceived as dirty, unhygienic or contaminated (Gomes *et al.,* 2022; Magnier *et al.,* 2019; Meng and Leary, 2021; Wiefek *et al.,* 2021) but also capable of releasing harmful substances into food. Regarding the latter, several studies in the literature have pointed to the increasing amount of harmful substances in food and beverages released both from plastic packaging (Eriksen *et al.,* 2018; Jadhav *et al.,* 2021; Liu *et al.,* 2022; Shruti *et al.,* 2020; Zuccarello *et al.,* 2019) and from paper (Akhdhar *et al.,* 2022; Ranjan *et al.,* 2021), even those that are recycled or reusable (Geueke *et al.,* 2018). In fact, microplastics, heavy metals and other substances were found in hot drinks, regardless of whether they were contained in plastic cups (Liu *et al.,* 2022) or paper cups (Akhdhar *et al.,* 2022; Ranjan *et al.,* 2021). In a study conducted by Wiefek *et al.* (2021), a respondent's aversion to reusable cups was reported as being unhygienic. In recent years, consumers have become more sensitive and attentive to hygienic, health and safety aspects, to the extent that they include healthiness and nontoxicity for humans in their

definition of sustainable packaging (Nguyen *et al.*, 2020). In the literature thus far, no study has explored the role played by PCR in the purchasing dynamics of hot beverages from vending machines. Therefore, the current research offers a new perspective on the topic, that is, including a comparison between disposable and reusable cups in this context.

People behave in a certain way and make choices based on existing SNs, that is, based on the perceived pressure to align with socially desirable behaviours (Allison *et al.*, 2021; Carfora *et al.*, 2019; Dorn and Stöckli, 2018; Gomes *et al.*, 2022; Lin and Niu, 2018; Zhuang *et al.*, 2021). For example, according to Dorn and Stöckli (2018), individuals observing others using a reusable takeaway box increases the likelihood of choosing one of their own. Meanwhile, Allison *et al.* (2021) pointed out that buying biodegradable compostable plastic packaging is perceived as a civilised and socially valued behaviour. In the case of hot beverage cups, Loschelder *et al.* (2019) and Terrier *et al.* (2020) showed that informing people of a common behaviour or opinion in a given environment can increase the use of sustainable cups more than nonsustainable take-away cups. Using planned behaviour theory, Wang *et al.* (2022) strongly emphasised the role of social norms in one's intention to use reusable cups in a university setting. Keller *et al.* (2021) also included SNs in their complex stage model of self-regulated behavioural change. According to the authors, these norms directly influence personal norms, which, in turn, create the intention to replace disposable cups with reusable cups over time. The role of social norms is well known when considering reusable cups, but so far, no study has included the option of more eco-friendly disposable cups. The present work fills this gap by investigating whether such single-use cups are also accepted by the community.

The last factor included in the models proposed in the current work is VM, which is defined by Grewal *et al.* (1998) as "the perceived net gains associated with the products or services acquired" on the basis of the different economic and quality benefits that people think they obtain when using certain products. A very close relationship exists between this concept and the concept of quality (Grewal *et al.*, 1998); recycled or recovered products can lower people's expectations of quality and, consequently, the VM of the product. However, this is not always true, as shown by Magnier *et al.* (2019), who reported that people are more willing to buy more sustainable products when they believe they obtain the same quality and functionality as a product made by more traditional processes (e.g. from virgin materials). Investigating whether consumers react in this way in the context of buying a hot drink from a vending machine served in disposable or reusable cups is something original and is a topic that is still missing from the literature.

Methodology
Questionnaire preparation and data collection
The entire study followed the methodological approach used by Park and Lin (2020). In particular, three separate logistic regression models on purchase intention were created considering different cup types, and their outcomes were compared. The study variable was the intention to purchase a hot beverage at a vending machine (1) served in a disposable recyclable plastic cup (model 1), (2) served in a disposable biodegradable paper cup (model 2) or (3) served in the consumer's personal, reusable cup (model 3). Intentions were initially measured with classic seven-point Likert scales (1 = strongly disagree, 7 = strongly agree) found in the literature and adapted for the purposes of the survey. These ordinal variables were subsequently transformed into dichotomous ones by assigning each respondent binary values of 1 ("Yes") or 0 ("No"), depending on whether the mean of the responses was above or below 3.5. The independent variables included were PEB, PCR, SN and VM, which were also ordinal and measured using 7-point Likert scales taken from the literature and adapted for the purposes of the survey to ensure that they related to each type of cup. The questions of the questionnaire can be viewed in the Appendix. In addition, two sociodemographic variables were also used as independent variables: gender (a binary variable with a value of 1 for males and 2 for females)

and age of the respondents (a categorical variable with five levels: 18–29, 30–39, 40–49, 50–59 and 60+ years). The basic equation common to all three models is as follows:

$$p(x) = \frac{e^{\beta_0 + \beta_{peb}X_{peb} + \beta_{pcr}X_{pcr} + \beta_{sn}X_{sn} + \beta_{vm}X_{vm} + \beta_{gender}X_{gender} + \beta_{age}X_{age}}}{(1 + e^{\beta_0 + \beta_{peb}X_{peb} + \beta_{pcr}X_{pcr} + \beta_{sn}X_{sn} + \beta_{vm}X_{vm} + \beta_{gender}X_{gender} + \beta_{age}X_{age}})}$$

where p(x) is the probability that the dependent variable is 1 ("Yes"), β_0 is the model constant, $\beta_{(peb,pcr,sn,vm,gender,age)}$ is the regression coefficient of each independent variable considered and $x_{(peb,pcr,sn,vm,gender,age)}$ is the value of that variable.

The theoretical development of the analysis model and the questionnaire used for the survey took place in collaboration with the managers of EVA (the European reference organisation for industry standards and the funder of the study) and other stakeholders selected through snowball sampling method. The purpose of the meetings (which took place both online and in-person) was to listen to the stakeholders' different opinions on which variables could influence the choice of one cup over another, based on their experience and the market information in their possession.

For the experiment, in March 2023, we sent a two-part online questionnaire to 1,006 Italian consumers using a third-party service that was also responsible for its ethical review, preparation, piloting test and data collection. 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 (e.g. gender and age). In the second part, they were asked to evaluate the three types of hot beverage cups with the appropriate items to measure the proposed constructs.

Statistical analysis
The data analysis and processing were conducted in two stages on opensource R software, using Field *et al.* (2012) as a reference for packages and functions and Park and Lin (2020) as a case study. First, an exploratory factor analysis (EFA) was performed during the preliminary phase to test the validity of the independent variables through the principal components method with varimax rotation, the suitability of which was assessed using Bartlett's sphericity test and Kaiser-Mayer-Olkin's (KMO) sampling adequacy test (Field *et al.*, 2012, pp. 760–771).

At the conclusion of the preliminary phase, Friedman's nonparametric test was performed on the collected data to investigate—at an exploratory level—the presence or absence of significant differences for each respondent on the three types of cups in terms of PEB, SN, PCR and VM (Field *et al.*, 2012, pp. 686–692). The use of this test was necessary because the data did not have a normal distribution and because the entire survey involved repeated measures. The test outcomes were useful for interpreting the results obtained subsequently from the logistic regression models, the statistical adequacy of which was assessed by means of various measures (Field *et al.*, 2012, pp. 315–322).

Results
The study sample contained an equal distribution of participants in terms of gender (Table 1). In contrast, there was more heterogeneity in the distribution of age groups, although we noted a prevalence of consumers over the age of 50 (Table 1). By comparing the socio-demographic data of the respondents with national data, the study sample could be considered comparable to the Italian population.

As shown in Table 2, the EFA correctly extracted four factors with eigenvalues greater than 2, which are capable of explaining 84% of the variance in the case of the recyclable plastic disposable cup (model 1) and 82% in the case of both the biodegradable paper disposable cup (model 2) and the reusable cup (model 3). For each model, the hypotheses of the test of

Table 1. Sociodemographic characteristics of the respondents

Gender	Sample	%	Italy	%
Male	487	48.4%	28.851.041	48.9%
Female	519	51.6%	30.138.708	51.1%
Age				
18–29	154	15.3%	7.097.508	14.3%
30–39	163	16.2%	6.600.786	13.2%
40–49	197	19.6%	8.277.541	16.6%
50–59	224	22.3%	9.602.066	19.2%
Over 60	268	26.6%	18.323.142	36.7%

Source(s): Created by the authors

Table 2. Results obtained by EFA using PCA with varimax rotation as an estimation method

Factor	Model 1 – Recyclable plastic cup				Model 2 – Biodegradable paper cup				Model 3 – Reusable cup			
	1	2	3	4	1	2	3	4	1	2	3	4
Perceived environmental benefits (PEB)	0.86				0.88				0.88			
	0.85				0.87				0.89			
	0.80				0.81				0.84			
Social norms (SN)		0.80				0.83				0.85		
		0.80				0.82				0.81		
		0.83				0.85				0.87		
Value for money (VM)			0.81				0.82				0.77	
			0.83				0.87				0.86	
			0.82				0.80				0.82	
Perceived contamination risk (PCR)				0.86				0.85				0.86
				0.90				0.91				0.91
				0.90				0.88				0.86
Eigenvalues	2.59	2.50	2.59	2.41	2.51	2.46	2.44	2.38	2.56	2.52	2.35	2.39
Variance explained	0.22	0.22	0.21	0.20	0.21	0.21	0.20	0.20	0.21	0.21	0.20	0.20
Cronbach's alpha	0.91	0.93	0.91	0.87	0.89	0.91	0.87	0.86	0.91	0.92	0.84	0.86
Bartlett's test of sphericity	9,431***				7,862***				8,063***			
KMO's test	0.89				0.86				0.86			

Note(s): ***$p < 0.001$
Source(s): Created by the authors

sphericity ($\chi^2_1 = 9,431$, $p < 0.001$; $\chi^2_2 = 7,862$, $p < 0.001$; $\chi^2_3 = 8,063$, $p < 0.001$) and sample adequacy (KMO$_1$ = 0.89, KMO$_2$ = 0.86, KMO$_3$ = 0.86, with KMO values for individual items greater than 0.70) are fulfilled. Finally, Cronbach's α was used to test the reliability of the measurement scales, obtaining values greater than 0.80 for each case.

Table 3 shows the results of the Friedman test. As can be seen, the reusable cup is perceived by the respondents as the best solution in environmental terms (mean$_{PEB}$ = 5.89), the one for which they feel most social pressure from their peers (mean$_{SN}$ = 5.07) and the one that gives the most value for the money they spent (mean$_{VM}$ = 4.87). This is followed, in descending order, by the disposable biodegradable paper alternative and the recyclable plastic alternative. The differences between the three solutions all appear highly significant (p < 0.001). It is a

Table 3. Results obtained from the Friedman test

| | Mean (dev. std) | | | Differences (Friedman test) | | |
	Single-use recyclable plastic	Single-use biodegradable paper	Reusable	Single-use recyclable plastic vs single-use biodegradable paper	Single-use recyclable plastic vs Reusable	Single-use biodegradable paper vs Reusable
PEB	4.45 (1.56)	5.46 (1.16)	5.89 (1.26)	TRUE ***	TRUE ***	TRUE ***
SN	4.24 (1.49)	4.82 (1.34)	5.07 (1.26)	TRUE ***	TRUE ***	TRUE ***
PCR	2.77 (1.54)	2.72 (1.54)	2.96 (1.67)	FALSE	FALSE	TRUE *
VM	4.12 (1.43)	4.48 (1.32)	4.87 (1.36)	TRUE ***	TRUE ***	TRUE ***

Note(s): $*p < 0.05$; $***p < 0.001$
Source(s): Created by the authors

different matter with regard to the risk of contamination, whereby the cups perceived as better (i.e. low risk) are the disposable ones ($\text{mean}_{\text{PCR recyclable}} = 2.77$; $\text{mean}_{\text{PCR biodegradable}} = 2.72$), with no significant differences between the two. In comparison, the reusable cup is seen as the riskiest alternative among the three ($\text{mean}_{\text{PCR recyclable}} = 2.96$). However, this perception, despite being low, is significantly different only when compared with the biodegradable paper disposable cup ($p < 0.05$), whereas there is no difference when compared with the recyclable plastic disposable cup.

Table 4 shows the results obtained from the logistic regression models. First, each proposed model demonstrates a lower deviance (-2LL index) than the corresponding null model, signifying a better predictive ability of the dependent variable. This is confirmed by the chi-square test, which is statistically significant ($p < 0.001$) in all three proposed models. The VIF index obtained for each variable demonstrates the absence of multicollinearity, which is a basic requirement for performing regression analyses.

In each model, we see that both social expectations and returns in terms of economy and/or quality are the variables with the greatest influence on final purchase intention. SNs appear to be significantly stronger in the case of the reusable cup ($b_{\text{reusable}} = 0.76^{***}$) and less so in the case of the single-use alternatives ($b_{\text{recyclable}} = 0.38^{***}$; $b_{\text{biodegradable}} = 0.47^{***}$). The opposite situation is found when considering VM: they are more present for the disposable alternatives ($b_{\text{recyclable}} = 0.79^{***}$; $b_{\text{biodegradable}} = 0.89^{***}$) and slightly less for the reusable solution ($b_{\text{reusable}} = 0.61^{***}$). PEBs and PCR seem to have an effect only in the case of the disposable cup ($b_{\text{recyclable}} = 0.43^{***}$; $b_{\text{biodegradable}} = 0.27^*$) and only in the case of the reusable cup ($b_{\text{reusable}} = -0.20^*$), respectively. Regarding the sociodemographic variables, neither gender nor age seem to play a significant role in final purchase intention, with the exception of the 60+ age category in the case of the reusable cup, for which a negative relationship is noted ($b = -1.06^{**}$). Together, all of these variables seem to have moderate predictive power on the dependent variable, as shown by the R^2 indices of McFadden and Negelkerke. Specifically, the variables explain 49% of the total variance in the case of the recyclable plastic disposable cup, 38% in the case of the biodegradable paper disposable cup and 43% in the case of the reusable cup.

Discussion
To the best of our knowledge, this study is the first to compare new single-use cups (made of 100% recyclable plastic and biodegradable paper) with reusable cups from vending machines. The objective is to explore and investigate not only the different consumer opinions about each

Table 4. Results of logistic regression analysis

	Model 1 – Recyclable plastic cup			Model 2 – Biodegradable paper cup			Model 3 – Reusable cup		
	B (se)	O.r	VIF	B (se)	O.r	VIF	B (se)	O.r	VIF
Intercept	−4.23 (0.57) ***	0.01		−3.74 (0.87) ***	0.02		−3.50 (0.76) **	0.03	
PEB	0.43 (0.08) ***	1.55	1.2	0.27 (0.12) *	1.32	1.21	0.13 (0.09)	1.15	1.21
SN	0.38 (0.09) ***	1.47	1.32	0.47 (0.12) ***	1.60	1.31	0.76 (0.10) ***	2.15	1.22
PCR	−0.04 (0.08)	0.96	1.04	−0.11 (0.11)	0.90	1.12	−0.20 (0.08) *	0.82	1.15
VM	0.79 (0.10) ***	2.23	1.18	0.89 (0.13) ***	2.44	1.12	0.61 (0.11) ***	1.85	1.11
Gender	−0.01 (0.20)	1.01	1.01	−0.04 (0.27)	0.96	1	−0.23 (0.22)	0.79	1.02
Age			1.06			1.08			1.08
30–39	−0.41 (0.34)	0.66		−0.04 (0.47)	0.96		−0.53 (0.39)	0.59	
40–49	0.09 (0.36)	1.10		−0.11 (0.47)	0.89		−0.34 (0.40)	0.71	
50–59	−0.01 (0.34)	0.99		−0.03 (0.45)	0.97		0.52 (0.38)	0.59	
60+	−0.57 (0.32)	0.57		−0.49 (0.42)	0.61		−1.06 (0.35) **	0.34	
−2 LL	609.83			389.43			558.21		
Chisq	376.68 ***			183.68 ***			289.15 ***		
AIC	629.83			409.43			578.21		
BIC	678.97			458.56			627.34		
McFadden pseudo R^2	0.38			0.32			0.34		
Negelkerke pseudo R^2	0.49			0.38			0.43		

Note(s): *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$
Source(s): Created by the authors

type of cup in terms of PEB, PCR, SN and VM but also to determine which of these factors play an important role in influencing consumers' intentions of purchasing a hot beverage served in each alternative.

Theoretical implications
The results of the Friedman's test reveal that consumers have generally positive but varied opinions about each of the three types of cups. Of these, the alternative perceived as most socially acceptable and the best in terms of environmental benefits and quality is the reusable cup, followed by the disposable cup made of biodegradable paper and 100% recyclable plastic. Moreover, the reusable cup is also perceived as having a low risk of contamination, although not much better than disposable cups in this respect.

According to the scientific literature, consumers are likelier to use and/or purchase a product/packaging when it is perceived as sustainable in terms of environmental impacts (Steenis *et al.*, 2018) and health safety (Nguyen *et al.*, 2020). A product/packaging can also be considered desirable if it is in line with community expectations (Zhuang *et al.*, 2021) and capable of delivering an economic, quality or functional advantage equal or similar to traditional alternatives (Magnier *et al.*, 2019). Therefore, combining these considerations with the results obtained in the first phase of the study with the Friedman test, we can expect a

greater influence of all of these variables on the likelihood of using a reusable cup rather than disposable alternatives.

However, the results of the regression analysis in the second phase seem to partially confirm the abovementioned hypothesis. Even though the reusable cup is rated as the most environmentally beneficial according to Friedman's test, logistic regression analysis shows this perception is irrelevant to consumers' final usage intentions. Nevertheless, it is decisive in the case of the two disposable solutions, especially for the one made of recyclable plastic (considered the least eco-friendly of the three). The same curious situation occurred in the case of PCR. In fact, although the two disposable cups were rated as the safest in this regard, this seemed to be irrelevant to the likelihood of their final use. In contrast, a significant relationship emerged in the case of the reusable cup, which is regarded as the riskier alternative according to Friedman's test, albeit not too different from the disposable ones.

One explanation for these results could lie in how consumers perceive certain characteristics as obvious. For example, it is possible that the PEBs of continuously reusing the same cup are being taken for granted, making this aspect irrelevant to the final purchasing dynamics. In parallel, it is possible that the environmental benefits of the post-use recovery of single-use recyclable and biodegradable cups are more difficult to perceive and, therefore, not so obvious at first sight. A similar situation could concern contamination aspects. The wholesomeness of disposable cups could be taken for granted, making it a default feature that consumers do not pay attention to when purchasing a hot drink from vending machines. Instead, the fact that the reusable cup is a healthy option is something uncertain, achievable only through careful post-use washing. This explanation is proposed on the basis of a careful analysis of the results of the study and is not reflected in the literature, especially since no existing research on the topic of hot drink cups has ever combined the Friedman's test with a logistic regression. Therefore, this theory needs further investigation and confirmation, in particular whether consumers actually take for granted the environmental benefits in the case of the reusable cup and the healthiness in the case of disposable cups.

The only two variables whose significant and positive predictive power emerged for all three solutions are SNs and VM. Regarding the former, increased social pressure leads to a higher likelihood of purchasing a hot drink in a reusable cup compared with a disposable cup made of biodegradable paper and recyclable plastic. This is in line with the findings of Loschelder *et al.* (2019), Terrier *et al.* (2020) and Keller *et al.* (2021), and shows that SNs do indeed play a greater role in pushing people to use reusable cups than disposable cups (albeit more ecofriendly than in the past). The logistic regression results reflect what has been found in the first phase of the study: the fact that this positive relationship is also present in the case of disposable cups seems to mean that these alternatives are still socially accepted, although less so than the reusable option. This finding is in line with Allison *et al.* (2021), according to whom the use of biodegradable and compostable plastic packaging is still a civilized and socially accepted behaviour, despite the fact that it refers to a single-use item. Finally, the perceived economic and/or quality value has been found to be highly influential in the case of both disposable and reusable cups. Therefore, the higher the perceived functional quality of the cup, the higher the likelihood of its use for the purchase of a hot drink.

Overall, the pseudo-R^2 indices of each regression model suggest the moderate ability of the explanatory variables to predict the purchase intention of a hot beverage served in each cup. However, the values obtained indicate the existence of other variables not considered in this study, which may also be capable of contributing to a more accurate prediction of final usage intentions. According to Gomes *et al.* (2022), there are 54 factors classified into 7 categories (i. e. political and legal, economic, environmental, demographic, consumer, product/service offer, product/service related) that can explain the choice of a circular product over another. One of these is the ability to perform such behaviour. In their work, Bertossi *et al.* (2024) reported that when faced with a choice, consumers overwhelmingly prefer disposable cups, ignoring reusable alternatives. Among the various explanations offered is the finding of Keller *et al.'s* (2021) investigation that the use of reusable cups requires an ongoing commitment over

time to make it a habit. In addition, some people may find it very inconvenient to have to remember to bring a cup from home. Future studies that expand the research to include other contextual or political factors mentioned by Gomes *et al.* (2022) are needed.

Practical implications
The vending industry has always used disposable cups as the only available option for purchasing hot drinks from vending machines. Systems that allowed the use of a reusable cup were rare and present only in certain virtuous places or countries. The reason behind this is simple: most consumers prefer disposable cups to reusable ones, as pointed out by Bertossi *et al.* (2024). In other words, "single-use" still represents an alternative that is not entirely replaceable by "reuse", especially in markets such as Italy, which make end-of-life recycling their workhorse. This may give the idea that service managers are tied to this option without any possibility of intervening. However, this perception is false because considering reusable alternatives is still possible, albeit not easy (Keller *et al.,* 2021; Sandhu *et al.,* 2021).

Today, we are increasingly seeing the spread of vending machines that, while offering the simple, convenient and more eco-friendly single-use cups, provide the "more determined and virtuous" consumers with the option to buy a hot drink in their own reusable cups. This approach to green economy considers disposable and reusable as two sides of the same coin, in line with the Packaging and Packaging waste directive. Sooner or later, vending service operators will be called upon to make a choice: continue to use only the new disposable cups, or adopt systems that give the possibility of using personal, reusable cups. To this end, understanding consumer behaviour is crucial, and this study is intended to provide an initial overview of the topic.

On the one hand, should the choice fall in the first case, it should not be assumed that consumers will not switch to other services (e.g. cafeterias) if they have negative environmental opinions towards disposable cups. The results of the present study reveal that the higher the positive environmental perceptions of such cups, the higher the likelihood that consumers will buy a hot drink from a vending machine. Therefore, a communication campaign emphasising the real environmental benefits of such solutions would be ideal and could also convince new potential consumers who have so far never used the service because it is perceived as "resource-intensive". In their work, Bertossi *et al.* (2023) showed that consumers were more likely to choose a single-use plastic cup when it presented an effective combination of eco-labels and information. According to the literature, the presence of credible sustainable information can lead consumers to perceive the product positively (Wensing *et al.,* 2020), influencing their purchase decision (Steenis *et al.,* 2018). In parallel, it would also be appropriate to always reassure consumers of the quality and functionality of such cups in containing hot drinks. Indeed, this factor has been found to be the most influential factor in the choice of end-use.

If, on the other hand, the choice should fall in the second case, it would be preferable to first develop systems that ensure, in one way or another, the thorough cleaning of reusable cups. For example, water fountains could be installed to give consumers the opportunity to wash the cup immediately without having to resort to other more inconvenient systems. In fact, according to the results of the present study, the more the perception of contamination in a cup increases, the less likely it is to be used. This is in line with Wiefek *et al.* (2021), and some consumers may choose not to use systems that allow them to use their cup in the absence of proper washing and sanitising methods. Campaigning by presenting the environmental benefits of this choice over disposables, meanwhile, may not translate into an increase in their use. Although this solution is the easiest and most obvious to implement, the results of this study show that PEBs do not play a key role in the final choice. Rather than emphasising environmental aspects, it would be preferable to reinforce SNs, perhaps through credible and inspiring messages. For example, Loschelder *et al.* (2019) demonstrated the effectiveness of the message *"more and more*

customers are switching from to-go-cups to a sustainable alternative. Be part of this movement and choose a reusable mug" in stimulating the use of reusable cups.

Conclusions

This exploratory work has begun to shed light on what governs the dynamics of hot drink consumption at vending machines. Although there are a number of limitations that need to be overcome and which will be described below, this work represents a novelty in the field of academic research, as it not only considered for the first time disposable and reusable cups simultaneously, but also brought to light principles of consumption that, at first glance, might appear to be opposing and conflicting. Moreover, the results obtained are a first step towards a better understanding of the behaviour of Italian consumers who use the vending service to get a hot drink on a daily basis. The information contained and described in the discussion may be useful to service operators in order to better plan their business.

Limitations

This study has several limitations that point to future research directions. First, the low number of independent variables made it possible to begin to explore the topic and still obtain moderate predictive effects. However, these values indicate that there may be other variables with greater weight in utilisation decisions. Second, this is an exploratory study focusing on determinants that can explain the probability of a behaviour. Therefore, further theoretical and practical studies are needed to confirm what we found and to examine the effects of these variables on actual purchasing behaviours. Third, the study took place in an Italian context. Hence, studies replicating the analysis in other European countries, where other consumption dynamics exist, would be useful. Finally, the study looked at the three most common types of cups, but other very promising materials have recently been developed to strike a balance between function (i.e. containing hot drinks) and sustainability, such as plastic made from 100% recycled material. Therefore, future studies could replicate the analytical approach used here, consider new alternatives and investigate how consumers perceive them.

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Appendix

Table A1. Questionnaire used for the survey

Perceived environmental benefits adapted from Magnier *et al.* (2019)

[A, B, C] offers significant environmental benefits
A   The use of disposable cups made of recycled and compostable plastic
B   The use of disposable cups made of biodegradable paper
C   The reuse of one's personal cup

[A, B, C] is an important strategy for creating a sustainable future
A   The use of disposable cups made of recycled and compostable plastic
B   The use of disposable cups made of biodegradable paper
C   The reuse of one's personal cup

[A, B, C] can help save the environment
A   The use of disposable cups made of recycled and compostable plastic
B   The use of disposable cups made of biodegradable paper
C   Reusing your personal cup

Social norms adapted from Carfora *et al.* (2019) and Koch *et al.* (2022)

People who are important to me think I should buy a hot drink
A   in a disposable cup made of recycled and compostable plastic
B   in a disposable biodegradable paper cup
C   using my personal cup

People who are important to me approve of my buying hot drinks
A   in a disposable recycled and compostable plastic cup
B   in a disposable biodegradable paper cup
C   using my personal cup

People who are important to me want me to buy hot drinks
A   in a disposable recycled and compostable plastic cup
B   in a disposable biodegradable paper cup
C   using my personal cup

(continued)

Perceived contamination risk adapted from Magnier *et al.* (2019) and Wiefek *et al.* (2021)

I think drinking a hot beverage [A, B, C] is very antigenic
A   in a disposable cup made of recycled and compostable plastic
B   in a disposable biodegradable paper cup
C   using my personal cup

In my opinion [A, B, C] are dirty
A   the disposable recyclable plastic cups
B   the disposable cups made of biodegradable/compostable paper
C   one's own personal cups

I think there is a possibility of the hot beverage being contaminated if drunk [A, B, C]
A   in a disposable recycled and compostable plastic cup
B   in a disposable biodegradable paper cup
C   using my personal cup

Value for money adapted from Magnier *et al.* (2019)

I think I would spend my money well by buying a hot beverage [A, B, C]
A   in a disposable cup made of recycled and compostable plastic
B   in a disposable biodegradable paper cup
C   using my personal cup

I believe that buying a hot beverage [A, B, C] meets my quality and price requirements
A   in a disposable cup made of recycled and compostable plastic
B   in a disposable biodegradable paper cup
C   using my personal cup

I think I would get very good value for money if I bought a hot beverage [A, B, C]
A   in a disposable recycled and compostable plastic cup
B   in a disposable biodegradable paper cup
C   using my personal cup

Purchase intention adapted from Koch *et al.* (2022)

In future, I intend to buy hot beverage from a vending machine that
A   uses disposable cups made of recycled and compostable plastic
B   uses paper and biodegradable disposable cups
C   allows me to use my own cup

I will always try to buy hot beverages from a vending machine that
A   uses disposable cups made of recycled and compostable plastic
B   uses disposable paper and biodegradable cups
C   allows me to use my own cup

I regularly choose hot beverages from a vending machine that
A   uses disposable cups made of recycled and compostable plastic
B   uses disposable paper and biodegradable cups
C   allows me to use my own cup

Source(s): Appendix created by the authors

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