Comparative Analysis of the Use of Wine Pouch Based on Sustainability and Consumer Resilience Aspects

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Abstract Wine packaging, which is one of the largest CO2 emitting areas of the wine market, is undergoing significant changes. Alternative packaging has appeared on the market and is expected to gain ground in the near future, replacing the classic glass bottles. The key research question is: how do different types of packaging influence wine purchasing decisions and what cognitive biases can be identified in the decision-making process? The aim of this paper is to investigate two alternative packaging formats, the pouch and the bag-in-box, from two perspectives: sustainability and consumer behavior. To carry out the sustainability analysis, we used data provided by a Hungarian winery, with the help of which we determined the production and transport emissions of pouch and bag-in-box. In addition to presenting sustainability indicators, we aimed to assess the level of resilience of these consumers in the wine market, using an experiment. The results suggest that Hungarian participants are resilient to use new alternative packaging types, but prefer bag-in-box packaging to pouches, which can be considered the novelty of the study.

Keywords:
wine market, alternative packaging, cognitive biases, resilience, sustainability

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1 Introduction

The role of food packaging is of growing concern from an environmental perspective due to waste management impacts, but it also plays a very important role from a health perspective, as packaging also serves to protect food (Ferrara & De Feo, 2020; Wikström et al., 2014). Nowadays, a number of packaging alternatives are available for drinks, such as PET (polyethylene terephthalate) bottles, bag-in-box, aseptic cartons and cans (Nesselhauf et al., 2017). The different types of packaging have also been studied in a number of academic studies from a sustainability perspective (Ferrara & De Feo, 2020; Ponstein et al., 2019; Gomes et al., 2019) and in relation to consumer behaviour in terms of purchasing decisions (Orlowski et al., 2022; Ruggeri et al., 2022). In our previous research, we examined the sustainability indicators of PET and single-use glass bottles, the results of which show that PET bottles are a viable alternative for lower and mid-range wines in terms of cost and CO_2 emission reduction. It is important to note that a glass bottles are considered less sustainable than PET bottles if they are not in a multi-pass system, i.e. it is not reused.

In the next part of the study, we present the sustainability background related to individual wine packaging, as well as consumer behavior based on the literature. After knowing the related background, we will present the two applied methodologies, then carry out the sustainability calculations related to the two types of wine packaging and the experiment measuring consumer attitudes. In this study, the aim is to investigate two alternative packaging formats, the pouch and the bag-in-box, from two perspectives: sustainability and consumer behaviour. By carrying out the experiment, we are looking for the answer how consumers perceive alternative packaging types and what is their resilience level?

2 Theoretical Background

The packaging industry has developed several alternatives for packaging wine, such as aluminum can, Tetra Pack, PET bottle, Bag in Box or Pouch. These alternative packaging types are lighter and more flexible than glass bottles, while glass bottles are heavier and more fragile (Gomes et al., 2019). To investigate how environmentally damaging each packaging alternative is, researchers often use Life Cycle Analysis (Ferrara & De Feo, 2020; Gomes et al., 2019). When considering the

environmental impact of different wine packaging, it is also essential to consider the environmental impact of transport. Logistics and global emissions from transport are major contributors to environmental pollution (Wild, 2021; Stojanović et al., 2021).

Product packaging is one of the most powerful ways to communicate with consumers, as it can influence consumer behaviour through perception. Since consumers most often do not have the opportunity to taste food, they often rely on external characteristics (shape, colour, size, etc.) (Orlowski et al., 2022; Spence, 2016). Parr (2019) examined the cognitive processes associated with wine and the perception of wine through the lens of cognitive psychology. During wine tasting, the colour of wine can also influence perceived flavours and aroma (Wang & Spence, 2019). Cognitive biases have also been observed in relation to wine packaging. Consumers tend to judge the quality of wine on the basis of perceptual characteristics. Several studies have concluded that wine bottles are associated with higher quality compared to other alternative packaging (Ruggeri et al., 2022; Ferrara et al., 2020). Hearnshaw and Wilson (2013) define resilience as the ability of a system to return to its original or even a better state after an unexpected event. In this case, this reflects the ability of consumers to adapt to changes in the wine sector (Forbes & Wilson, 2018).

3 Methodology

To approach the problem under study from the perspective of sustainability and consumer behavior, two methodologies were used. The sustainability aspect associated with alternative packaging (bag-in-box and pouch) is presented in terms of the CO_2 value of the products produced and the CO_2 emitted during the delivery of the products.

To carry out the sustainability analysis, a Hungarian winery provided the required data, through which the production and transport emissions of pouch and bag-in-box are described. As the wine market is changing rapidly due to environmental and other aspects, it is essential to assess the level of consumer resilience in this area. To investigate consumer attitudes and consumer resilience level towards alternative wine packaging, an experiment was conducted in January 2023 at Széchenyi István University in Hungary with a total of 330 participants. The scales used in the

experiment were adopted from the study by Orlowski et al. (2022). In this study only a subset of the experiments were conducted, showing participants only a picture of each alternative packaging type. For validation purposes, a pilot study was conducted with 23 participants. The aim was to explore whether the experimental method is appropriate for the phenomenon under investigation. Based on the participants' feedback, minor changes were made, but the method was found to be appropriate. In the experiment, the students were shown a picture of two types of wine packaging (pouch and bag-in-box), which they had to evaluate by means of a questionnaire. The two types of alternative packaging were from a Hungarian winery called Feind. To avoid distorting the label, a wine label from a foreign brand was also used.

Table 1: Study measures

Measure		
Traditionality	2 questions	6 point Likert scale
Familiarity	1 questions	
Purchase intention	4 questions	
Product Appeal	3 questions	
Taste expectations	3 questions	
Uniqueness	8 questions	
Demographic questions	4 questions	

Source: Orlowski et al. (2022).

The questionnaire used in the experiment contained a total of 25 questions. With the exception of the demographic questions, we used a 6-point Likert scale. The questions were grouped into a total of six categories: Traditionality, Familiarity, Purchase intention, Product appeal, Taste expectations and Uniqueness (Table 1).

4 Results

The carbon dioxide (CO_2) emissions from bag-in-box and pouch production were calculated using a combination of data from Ponstein et al. (2019) and Ecoinvent 3.4 using SimaPro software. In the analysis, transport data are taken from a specific winery in Hungary for the year 2023.

Table 2: Sustainability data for alternative packaging types

	Bag-in-box (5l)	**Pouch** (3l)
Product weight (kg)	5.20	3.10
Weight per package (kg)	5.20	18.80
Weight per pallet (kg)	749.00	475.20
Weight per truck (kg)	23,968.30	15,682.30
CO_2 per product ($kgCO_2$)	0.35	0.29
Weight per place (t/m^3)	0.26	0.17
Co2 per delivering weight (gCO_2/t-km)	32.69	49.96

Source: Data from a selected Hungarian winery.

Table 2 shows the characteristics of Pouch and Bag-in-box alternative packaging, such as weights and Co2 emissions. The above table contains the necessary data that can be used to calculate the CO_2 generated during transport. For truck transport, CO_2 emissions are calculated using the indicator "gCO_2/t-km", which includes the payload weight, the distance travelled and the CO_2 emissions weighted by these factors. In the case of wine transport, the problem is not necessarily the weight transported, but the lack of space, the goods to be loaded or the pallet's inability to carry the additional load. Thus, trucks may not reach their maximum load (ECTA, 2011), based on an average CO_2 emission of 783.50 gCO_2/km for a truck with a load of 13.84 tonnes, which corresponds to 56.60 gCO_2/t-km (ECTA, 2011). For the bag-in-box it was 32.69 gCO_2/t-km, while for the pouch it was 49.96 gCO_2/t-km. This means that the bag-in-box is more sustainable than the pouch in terms of transport. This is confirmed by the volume of litres transported, as CO_2 emissions per litre transported are lower for the bag-in-box than for the pouch. For the bag-in-box, 23,100 litres are transported per lorry, compared to 14,256 litres for the pouch.

The statistical analysis of the data from the experiment was analysed using statistical software. The data are not normally distributed, the test was performed with Saphiro-Wilk Index, which in all cases showed a result of p=<.001. The reliability of the uniqueness questions used as variables was tested using Cronbach's alpha, and the variables were found to be reliable (0.855-Hungarian; 0.850-foreign). Wine

knowledge did not correlate with any of the other wine packaging factors in the foreign test. In the case of the "foreign" test, traditionalism was weakly positively related to the other factors in the analysis of bag-in-box, meaning that the more traditional the participant found the BIB packaging to be, the more the other factors were positively related. In the evaluation of taste, the more positively the participant rated the expected taste, the higher the propensity to buy. The appearance of the BIB was positively and strongly associated with the expected taste. In the 'foreign' test, traditionalism showed a moderately strong relationship with willingness to buy, appearance and expected taste. Willingness to buy showed a positive moderately strong relationship with pouch appearance and expected taste. Furthermore, positive ratings of pouch appearance showed a positive and moderately strong relationship with expected taste. The uniqueness variable did not show a strong relationship with either variable, so participants who like unique things or are more open to new things were not more open to alternatively packaged wines.

Table 3: Analysis results in the case of the 'foreign' test

		Traditionality	Purchase Intention	Product Appeal	Taste expectations	Traditionality	Purchase Intention	Product Appeal	Taste expectations
BIB	Traditionality								
	Purchase Intention	0.241**							
	Product Appeal	0.326***	0.624***						
	Taste expectations	0.276***	0.593***	0.752***					
Pouch	Traditionality	0.583***	0.366***	0.360***	0.273***				
	Purchase Intention	0.332***	0.688***	0.393***	0.447***	0.522***			
	Product Appeal	0.398***	0.476***	0.525***	0.530***	0.541***	0.738***		
	Taste expectations	0.356***	0.478***	0.447***	0.565***	0.453***	0.729***	0.763***	

Source: Own research

Table 3 shows the results of the correlation calculation. Wine knowledge showed a weak and positive relationship with willingness to buy for the "Hungarian" test for BIB and Pouch respectively. In the case of the "Hungarian" test, the variable of traditionalism was weakly and positively related to willingness to buy in the bag-in-box evaluation of appearance and taste. For BIB, willingness to buy was positively and moderately strongly related to the appearance and expected taste of the product. Furthermore, the appearance of BIB was positively and moderately strongly related to the expected taste. In the case of the "Hungarian" test, the traditionality of the

packaging was positively and moderately strongly related to the willingness to buy, the expected taste and the appearance of the product. Furthermore, the purchase intention of the pouch was positively strongly related to the appearance and expected taste of the product. Product appearance was positively and moderately strongly related to expected taste. The uniqueness variable was weakly and positively related to both variables for wine packaging, meaning that more open participants tended to rate each attribute positively (Table 4).

Table 4: Analysis results in the case of the 'Hungarian' test

		Traditionality	Purchase Intention	Product Appeal	Taste expectations	Traditionality	Purchase Intention	Product Appeal	Taste expectations
BIB	Traditionality								
	Purchase Intention	0.160*							
	Product Appeal	0.261**	0.582***						
	Taste expectations	0.182*	0.545***	0.598***					
Pouch	Traditionality	0.321***	0.233**	0.394***	0.281***				
	Purchase Intention	0.154*	0.638***	0.358***	0.428***	0.438***			
	Product Appeal	0.268***	0.349***	0.446***	0.392***	0.510***	0.714***		
	Taste expectations	0.294***	0.453***	0.407***	0.550***	0.398***	0.691***	0.660***	
	Uniqueness	0.180*	0.188*	0.317***	0.264***	0.301***	0.220**	0.329***	0.215**

Source: Own research

Based on the Mann-Whitney test, there is a significant difference (p=<.001) between the two groups (Hungarian, foreign) in the perception of traditionalism with a power of 0.2968 for BIB and 0.1695 for taste expectations (p=0.006). For pouch, there was no difference between the two groups. Furthermore, uniqueness attitude showed a significant difference (p=0.042) with an effect size of 0.1243 (Table 4).

The analyses suggest that the perception of wine packaging as traditional packaging is related to other perceptional factors. A product perceived as traditional may be more acceptable in some cases than new things that are not yet experienced. Willingness to buy products is higher when the product is familiar, has more positive expectations and is attractively-packaged. The bag-in-box is an older alternative packaging method than the pouch, and therefore this type of product may seem more traditional to participants.

5 Discussion and Conclusion

The present study presented the CO_2 emissions and transport parameters (t/m3; gCO_2/t-km) of two alternative packaging options. The calculations show that the bag-in-box has better transport parameters and that the CO_2 emissions of bag-in-box packaging are lower compared to pouch. As a result of the experiment, it should be underlined that the BIB wine packaging was rather more acceptable than the pouch type packaging. Some practical, quality and aesthetic aspects can be responsible for this finding. The fact that the factor of traditionality is related to the other factors suggests that consumers are more accepting and more willing to purchase alternative packaging with packaging types that they perceive as more traditional. For this reason, overall, the level of resilience to the unpredictable among the participants cannot be considered high. To make it more comfortable and flexible for consumers to accept certain changes in the wine sector, it is necessary to increase their level of resilience. Further research is needed to facilitate this but informing and educating consumers can increase their resilience. As an avenue for future research, we will use data from wineries to demonstrate which of the single-way and multi-way packaging options is the most sustainable in the long term. In the light of the sustainability results, we will conduct consumer research among Hungarian consumers on their attitudes towards different types of packaging.

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