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Original Paper

Analysis of consumer behavior zero waste consumers

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ABSTRACT

The article analyzes the consumer behavior of zero waste consumers based on a questionnaire survey, which was attended by 205 respondents of the Slovak Republic. The chi-square test of independence was used for these data, where strength of relationship between qualitative variables was examined, specifically between the place of purchase and the frequency of purchase, the place of purchase and the percentage of cash income spent on the food purchases. In both cases, a dependence was found between the given traits. Subsequently, the differences in the behavior of men and women were examined, while the price and psychological factor was analyzed, namely the discount factor and the environmental impact factor. In the first case, based on calculations in the SAS system using the Mann Whitney U test, we can state the difference in behavior between the sexes, with women being more influenced by the price factor and on the other hand with psychological factor, men being more influenced by the environmental impact than women.

KEYWORDS: consumer behavior, zero waste, questionnaire survey, Chi-square independence test, Mann-Whitney U test

JEL CLASSIFICATION: C14, E20, Q56

INTRODUCTION

Knowing consumer behavior is an essential part of planning a company's marketing activities, which should then contribute, among other things, to profit. The use of a questionnaire survey is generally preferred to examine consumer behavior, and sophisticated methods should be used in the comprehensive analysis and interpretation of the results so that we can consider the conclusions of the survey relevant. It is a fact that the zero waste consumer is a new category among consumers for the trader, despite the fact that the zero waste philosophy is nothing new. That is the main reason why it is very important to know the dependencies

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between the factors that affect the buyer and also correctly identify these factors. Despite the fact that the zero waste philosophy has recently been addressed by more and more authors, the zero waste consumer as such examines only a negligible amount. For example, authors from Spain Calderon-Monge, Pastor-Sanz and Garcia [1] analyzed how consumers incorporate sustainability issues into their buying behavior or authors from Romania analyzed if it is sustainable consumption translated into ethical consumer behavior while Tomsa, Maniu and Scridon [6] found out that the decision-making process of environmentally conscious customers is significantly connected to the intention to engage in politically ethical conduct.

Mauch states that [2] Zero waste is a semi-philosophy of a set of procedures aimed at minimizing waste at the lowest level. The separate concept of zero waste represents the impact of the way we live and manage our resources on the level of environmental pollution. Based on this philosophy, resources should be reused, on the example of how it happens in nature. At the moment, zero waste is considered to be the most cost-effective method by which we as a society can fight climate change or contribute to sustainability. It is for this reason that traders should not only be able to meet the needs of such consumers, but also directly encourage consumers who do not know this philosophy or are not following it to do so. According to Zaman [7] waste is a representation of misallocated resources and a symbol of inefficiency in every modern civilization. As ZWIA states [8]: Everybody has a part to play in leading civilization to a zero-waste future. As everyone produces trash, and if everyone begins to take modest moves in the Zero Waste direction, the process of achieving zero waste will be accelerated. Zero waste should indeed be promoted by all entities (government agencies, non-governmental organizations, companies, and local governments), as well as people. Cities should implement long-term policies and initiatives. Current service providers should adopt zero waste and make every effort to decrease trash, as well as offer a deposit refund service. The research made by Romano G. et al [5] in 2019 shows that municipal policies have an impact on trash strategy implementation. The findings reveal that when municipal trash services are administered by privately held firms, so when the average taxable income of persons per capita is smaller, municipal garbage output is bigger. Ripple et al. states [4] that in last year (2020) cattle numbers have surpassed 4 billion for the first time ever, that is more live weight than the human race and wildlife together. Brazil's deforestation rate went up to a 12-year peak, with the country vowing to end deforestation completely by 2030. The pricing of CO₂ produced by burning fossil fuels is far too low, and it should be numerous times higher if usage need to be reduced. Scientists have hailed the sudden increase of renewables usage, despite the fact that it is still 19 times lower than fossil fuel use. Furthermore, all co2 levels have reached new highs, along with historic highs ocean heat content and, opposite, historically low ocean pH, and also rapid melting of mountain glaciers.

Nowadays we can also calculate the zero waste index which is based on the worth of materials that might be used to replace virgin materials. The zero waste index is a technique for calculating how much virgin material may be offset by zero waste management systems. Zero depletion of natural resources is one of the most essential aims of the zero waste philosophy [5].

MATERIAL AND METHODS

The article used the calculations of the chi-square test of independence, the Mann-Whitney U test, the Zero waste consumer questionnaire survey using the SAS software and Microsoft Excel.

Characteristics of survey respondents

205 zero waste respondents participated in the questionnaire survey, with 80 men and 125 women. 10% of zero waste respondents was up to 18 years old, 22% was 19-25 years old, 39% was 26-35 years old, 21% was 36-45 years old, 5% was 46-65 years old and 2% was upon 65 years old. Most respondents came from the Nitra region and the least respondents came from abroad. The most numerous group of respondents were women aged 26-35 from the Bratislava region.

Chi-square test of independence

When testing associations, we find out whether between the given attributes, there is a dependence, i.e., we examine whether a given occurrence of a certain attribute X is likely to assume the occurrence of another attribute Y .

The article examines the dependence between attribute X - Place of purchase and attribute Y - % share of income spent on food purchase, attribute X - Place of purchase and attribute Z - frequency of purchase [3]. This dependence was examined on the basis of a questionnaire survey among zero waste consumers.

When examining the dependence between the attributes we verify the following hypotheses:

Null hypothesis: Attributes are independent.

Alternative hypothesis: Attributes are dependent.

The test criterion is expressed by formula:

$$X^2 = \sum_{i=1}^m \sum_{j=1}^r \frac{(E - T)^2}{T}$$

We measured the intensity of the dependence using:

Pearson's coefficient

$$C = \sqrt{\frac{\chi^2}{n + \chi^2}}$$

where:

χ^2 – symbolizes the calculated test criterion,

n – symbolizes total number of respondents.

Cramer V coefficient

$$V = \sqrt{\frac{\chi^2}{n(\min(m, r) - 1)}}$$

where:

m – number of rows, r – number of columns,

n – total number of respondents, χ^2 – symbolizes the calculated test criterion.

Mann-Whitney U test

The Mann-Whitney U test is a nonparametric test. It is used for ordinal data when two samples are independent. When analyzing consumer behavior, it can be used, for example, to examine whether a given product is evaluated by respondents (e.g. by gender or age range) in the same way or whether there is a difference in evaluation.

Calculation of test characteristics according to formulas:

For the first sample :
$$U = n_1 * n_2 + \frac{n_1 * (n_1 + 1)}{2} - R_1$$

For the second sample:
$$U = n_1 * n_2 + \frac{n_2 * (n_2 + 1)}{2} - R_2$$

where:

n_1 – total number of the first sample,

n_2 – total number of the second sample,

R_1 – sum of the order of the first sample,

R_2 – sum of the order of the second sample,

Analyses were performed at the selected level of significance $\alpha = 0.05$.

RESULTS AND DISCUSSION

In the first part of the presented paper, we paid attention to determining the dependence, respectively independence between the frequency of purchase of zero waste consumers and the place of purchase of zero waste foods. Table 1 presents the input data from the questionnaire survey conducted in 2021.

Table 1. Theoretical abundance

		Place of the purchase				
Frequency of purchase		Local stores	The market/ local farms	Zero waste stores	Chain stores	Total
	Once per week	11	14	8	29	62
	2 - 3 per month	3	11	33	5	52
	Daily	2	2	0	5	9
	More than once a week	18	10	6	48	82
	Total	34	37	47	87	205

Source: author's processing

The test characteristic reached a value of 77.55, critical value = 16.92. Based on the results, we can state that the frequency of zero waste consumers' food purchases is statistically significantly dependent on the place of zero waste consumers' food purchases. Based on the results of the coefficients measuring the intensity of the dependence, we can confirm a medium-strong dependence (Pearson's coefficient = 0.524, Cramer's V coefficient = 0.435).

In the following part of the article, we again focused on determining the dependence or independence between the place of purchase of food and the percentage of money spent on food by zero waste by consumers. Table 2 presents data from a questionnaire survey in 2021.

Table 2. Theoretical abundance

		Place of purchase				Total
		Local stores	The market / local farms	Zero waste store	Chain store	
% share of income spent on food purchase	10 - 25%	14	21	36	35	106
	25 - 45%	11	12	7	38	68
	About 50%	6	3	1	7	17
	< 10%	3	0	3	6	12
	> 50%	0	1	0	1	2
Total		34	37	47	87	205

Source: author's processing

The critical value is 21.03 and the calculated test characteristic is 29.42. Based on the results, we can observe that the percentage of money income spent on food purchases is statistically significantly dependent on the place of purchase of food zero waste consumers. Based on the results of comparison criteria, which the intensity of dependence can confirm a weak dependence (Pearson's coefficient = 0.354, Cramer's V coefficient = 0.219). SAS software using Mann-Whitney U test, was used to detect differences in the behavior of zero waste consumers by gender, and we assumed that there was no significant difference in the assessment of the discount factor between men and women.

Based on the results (Figure 1), we can say that our assumption was not correct (test characteristic = -3.32, P -value = j 0.0005), which means that men and women behave significantly differently when buying stock, respectively discounted products purchased according to the zero waste philosophy.

From Figure 2, it can be seen that women were more influenced by the price factor when buying food than men.

Subsequently, the impact factor on ecology was examined in the same way, while our assumption was determined similarly, while according to the following outputs we can state that our assumption was again incorrect.

According to the results (Figure 3) (test characteristic = 5.22, and P -Value < j 0.0001), we find out that men and women behave significantly differently when buying foods that have a negative / positive impact on the environment.

As can be seen in Figure 4, there are gender differences between the sexes, with men being more affected by environment factors than women.

Wilcoxon Scores (Rank Sums) for Variable Value Classified by Variable Gender					
Gender	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
Female	126	14300.0	12978.0	398.209152	113.492063
Male	79	6815.0	8137.0	398.209152	86.265823

Average scores were used for ties.

Wilcoxon Two-Sample Test	
Statistic	6815.0000
Normal Approximation	
Z	-3.3186
One-Sided Pr < Z	0.0005
Two-Sided Pr > Z	0.0009
t Approximation	
One-Sided Pr < Z	0.0005
Two-Sided Pr > Z	0.0011

Z includes a continuity correction of 0.5.

Figure 1. Output from SAS
Source: author's processing



Figure 2. Boxplot by gender (discount factor)
Source: author's processing

The NPAR1WAY Procedure

Wilcoxon Scores (Rank Sums) for Variable Value Classified by Variable Gender					
Gender	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
Male	79	10188.50	8137.0	392.752328	128.968354
Female	126	10926.50	12978.0	392.752328	86.718254

Average scores were used for ties.

Wilcoxon Two-Sample Test	
Statistic	10188.5000
Normal Approximation	
Z	5.2221
One-Sided Pr > Z	<.0001
Two-Sided Pr > Z	<.0001
t Approximation	
One-Sided Pr > Z	<.0001
Two-Sided Pr > Z	<.0001

Z includes a continuity correction of 0.5.

Figure 3. Output from SAS
Source: author's processing



Figure 4. Boxplot by gender (impact on environment factor)
Source: author's processing

CONCLUSIONS

Our intention was based on a questionnaire survey to analyze the relationship between the place of purchase and the frequency of buying food zero waste consumers, in the next part we analyzed the relationship between the place of purchase and the percentage of money spent on food purchase. We can argue that there are differences in the assessment of factors that influence respondents when buying food, so that women are more affected by the price factor than men and men are more affected by the impact on the environment than women. The article presented the use of statistical methods in the analysis of consumer behavior of zero waste respondents. Based on the results, the trader can then guide the planning of his marketing activities. Such results could also help, for example, in targeting the advertising of non-packaging products or in the use of emotional appeals to the customer.

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