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Rational Consumer in the Context of Environmental Protection[1]

*Peter DRÁBIK – Róbert REHÁK – Dominika VERNEROVÁ – Marek KUKURA**

Abstract

In recent decades, there is an increase in new environmental problems in the world, which gradually grow from the local to the global level, and their short--term consequences are gradually becoming long-term complex threats to the environment and thus the quality of life of current and especially future generations. The main goal of the article was to review the behavior and attitudes of environmentally responsible consumers on the Slovak market and analyze the individual components of consumption and waste policy within the regions in the Slovak Republic in the context of environmental protection. Based on the cluster analysis and decision trees, we concluded that Slovak consumers rarely include eco-products in their consumption, mainly due to the high price or poor availability of these products. Through a cluster analysis, we analyzed the consumption and specificities of individual Slovak regions, while the recommendation is to create special different strategies focused on the regions of the Slovak Republic, based on waste reduction or the creation of waste recovery plants, which can create a favorable development in the circular economy of the Slovak Republic, and thus reduce the negative aspects of consumption affecting the environment and quality of life in the Slovak Republic.

Keywords: *environment, eco-product, marketing, sustainability, sustainable consumption*

JEL Classification: M31, Q56, Q57

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Introduction

In recent decades, there is an increase in new environmental problems in the world, which gradually grow from the local to the global level, and their short-term consequences are gradually becoming long-term complex threats to the environment and thus the quality of life of current and especially future generations. If a company wants to prosper and at the same time ensure the sustainable development of society, it must take care of protecting the environment throughout the product life cycle by using effective tools, means and technologies that have a positive effect on improving the quality of life. Therefore, we are increasingly encountering relatively new concepts such as eco-product, eco-design or greening. Promoting the environmental interests of companies can also be described as corporate social responsibility, which displays itself as the voluntary integration of environmental and social aspects into everyday corporate operations (Kunz, 2012).

However, sustainable development is affected by both sustainable production by enterprises and sustainable consumption by people. All personal consumer products that consumers buy to meet their daily needs affect the environment. It can be raw material, energy used for the processing process, final products or the waste itself, which is generated by consuming the products or at the end of their life cycle.

Therefore, it's necessary to reduce the mass consumption of people, increase the consumption of renewable natural resources, and last but not least, the preference for eco-products as an important part of sustainable consumption. Although the economic policies of European countries are trying through their strategies and initiatives to ensure sustainable growth, which includes sustainable consumption, the dynamic environment, which is currently characterized mainly by the effects of globalization, increasing energy demand and excessive consumption, makes it difficult to achieve this goal. To evaluate the situation in Slovakia, we will use a survey in the form of a structured questionnaire. The aim will be to understand the behavior of Slovak consumers, their opinions and views in the field of eco-products and sustainable consumption, which we will evaluate through classification trees. The classification trees will divide the file into smaller units (nodes), which will then serve for closer identification of consumers. Then it will be possible to formulate recommendations to increase the number of environmentally responsible consumers. To find out which regions in Slovakia are the most critical in terms of energy, heat and individual waste components, we will use cluster analysis, which will divide the regions based on their similarity. We will formulate the results of individual clusters by using descriptive statistics.

1. Literature Review

1.1. The Sustainable Development in European Union

The concept of sustainable development has been evolving since 1968 (Conference on the Biosphere in Paris) (Caldwell, 1996) and is currently one of the priority goals of all modern world economies (Hronec, Schwarczová and Marenčáková, 2012). It is a development that allows to meet all the needs of current generations without compromising the ability of future generations to meet their own needs (Stričík, 2008). An economically sustainable system is based on the ability to produce goods and services on a sustainable basis, while maintaining a stable resource base, and seeks to prevent the over-exploitation of renewable resouces or damage to the environmental functions of the system. As the European Union considers sustainable growth to be one of its most important goals, it is constantly introducing new initiatives and policies. Their main challenge is to ensure sustainable production and consumption. The priority is to improve the quality of products and increase their environmental properties throughout the life cycle, as well as efforts to increase consumer demand for better and more environmentally friendly products, and finally yet importantly, growth in demand for technologies from companies that have a more favorable impact on the environment (Amanatidis, 2019). An important milestone for sustainable development in the EU can be considered the year 2001, when the European Union adopted the Strategy for Sustainable Development. Its priority goal was a high level of environmental protection, social justice and the promotion of sustainable development (EC, 2019b). This strategy was not renewed in 2010, as the new Europe 2020 strategy was adopted that year, which essentially included the basic priorities and objectives of sustainable development (CKO, 2019). One of the EU's flagship initiatives is the Action Plan on Sustainable Consumption and Production and Sustainable Industrial Policy, adopted in 2008, which aims to improve the quality of life, integrate sustainability into society's activities and ensure quality living conditions for the present and future generation (EC, 2008). The Roadmap to a Resource Efficient Europe was created in response to the enormous increase in consumption. There was a 12-fold increase in fossil fuel consumption, as well as a 34-fold increase in mineral extraction in the 20th century (EC, 2011). The content of this plan is aimed at transforming the economy into a resource-efficient economy that can contribute to the country's economic growth. Last but not least, we are mentioning the Eco-Innovation Action Plan to support eco-growth, which focuses on the specific obstacles and opportunities that arise from meeting environmental objectives through innovation. Emphasis is placed on the justification of the development of innovative technologies,

legislative support for eco-innovation and the integration of environmental policy into the activities of individual market players (EC, 2011).

An important strategy adopted at the 2010 summit is the Europe 2020 strategy, which addresses three key priorities: smart, sustainable and inclusive growth (EESC, 2020). In terms of the issues addressed, we highlight in particular sustainable growth, which should support more efficient use of resources and creating a greener economy (EC, 2010). Sustainable development, which is in line with this strategy, creates space for the application of science and technology in practice, which should ensure higher productivity, efficiency and, last but not least, the protection of natural resources and the environment (Anastasiou and Marietta, 2020). The primary task of Europe 2020 is to increase the EU's competitive strength in the world market and to create a knowledge-based economy and sustainable growth, which will result in higher employment and social unity of individual countries (Stec and Grzebyk, 2016). This strategy applies to all member states of the European Union, including Slovakia, which is among the economies with the highest energy intensity. Slovakia is gradually facing many challenges in the transition to a low-carbon, resource-efficient economy. The main goals arising from the strategy for Slovak Republic include reducing greenhouse gas emissions, creating new solutions for smart grids and electricity storage, and efforts to switch to renewable energy sources for heating and cooling in line with sustainability criteria, the transformation of the economy into a circular economy leading to the re-use and recycling of waste, or investments to promote multimodality and electromobility in the transport sector (EC, 2019a). Slovakia's environmental problems have an increasingly significant impact on the functioning of the economy, employment, but also the level of quality of population's life. The strategy of environmental policy until 2030 describes the possible future development of Slovakia, sets out the main goals to be met and measures to improve the current situation that persists in the country (Kureková, 2019). This strategy is based on the document Strategy, Principles and Priorities of the State Environmental Policy, which was approved in 1993, but no updates were made to it during its operation (Stričík, 2008).

The Environmental Strategy of the Slovak Republic entitled "Greener Slovakia" was created in response to this document, and is intended to help Slovakia face various environmental challenges (Sólymos, 2019). The biggest challenges of this strategy include a drastic reduction in emissions (in the trading sectors by 43% and the rest by 20% compared to 2005), the gradual elimination of environmentally harmful subsidies and regulations, increasing the recycling rate of municipal waste to 60%, and reducing its landfilling below 25%, support for green innovations, which will result in an increase in the supply of eco-products on the Slovak market, support for green procurement (up to 70% of all public

procurement will be green procurement), increase biodiversity protection, stabilize the overall value of forest ecosystem services, better planning and water management, which will result in reducing drought and water scarcity, intensifying environmental education as well as education for sustainable development, and, last but not least, creating conditions for responsible production, consumption and nature protection (MINZP, 2019). Slovakia is considered a country in which the use of renewable resources is below the EU average and in which dependence on imports of energy raw materials from foreign countries is high. Slovakia is also one of the most energy-intensive economies, as its energy consumption per GDP is 80% higher than the EU average. However, if we compare Slovakia with other V4 countries, we can consider its energy intensity to be the lowest in the long run. Between 2005 and 2015, Slovakia reduced its energy intensity by more than 50%, which was the largest progress in the entire EU. Hydropower plants have the largest share in the production of electricity from total renewable sources, the production of which represents up to one sixth of the total electricity in the country. Legislative and financial support in the green economy will focus on environmentally friendly resources that meet all sustainable criteria. Transparency and public awareness of energy will be important, as will the removal of harmful subsidies and regulation in this area. It is also a fact that Slovak Republic consumes much more resources than its capacity can produce. We also consider the ecological footprint of the Slovak Republic to be negative, and a slight backwardness can be observed in the area of ecological innovations. Compared to other EU countries, Slovakia produces less waste, but still recycles much less. The introduction of higher landfill fees is also being considered, which may lead, on the one hand, to increased incentives for waste sorting and recycling, and, on the other hand, to the prevention of waste itself (MINZP, 2019).

1.2. Rational Consumption in Slovak Republic

Although the economic policies of European countries are trying to ensure sustainable growth through their strategies and initiatives, the dynamic environment, which is currently characterized in particular by the effects of globalization, increasing energy demand and excessive consumption, makes it difficult to achieve this goal. The consumer society is characterized mainly by its activities, which are focused on the mass consumption of goods. We can also describe this as a consumer lifestyle, in which the share of expenditures on basic needs decreases despite the fact that the total volume of expenditures is growing. This means that consumers often do not perceive their real needs and are influenced by companies' marketing tools, increasing their current quality of life in the short term, but automatically reducing the quality of life for future generations.

Consumer, based on the amendment n. 250/2007 Z.z, is defined as:

1. natural or legal person who purchases goods and services for his personal consumption or the consumption of household members,
2. a natural person selling to consumers plant and animal products from their own cultivation or breeding activities, including forest crops,
3. a natural person who sells his own used products other than food (NRSR, 2007).

The consumer is the bearer of consumption. The impact of consumption on the environment can be in various ways. It is also a fact that the largest increase in CO2 emissions from households comes mainly from passenger transport, electricity and heat consumption, and the over-purchase and consumption of consumer goods and services (Gwozdz, Reisch and Thogersen, 2020). The products or services that the consumer buys throughout the life cycle can directly or indirectly contribute to climate change, biodiversity loss, air pollution or the depletion of raw material supplies, not only within the country but also throughout Europe or the world. The 2020 strategy, which we dealt with in the previous part of the article, also deals in detail with consumers themselves, as it also includes the Consumers program for 2014 – 2020 (Dzurová et al., 2014). This program aims to strengthen the interests of consumers in the transport, food, energy, digital services and financial services sectors (MHSR, 2014). In order to achieve sustainability in consumers' shopping behavior, they need to be motivated to incorporate sustainable and healthy choices into their day-to-day purchasing decisions, which can reduce their own costs as well as society's costs. If the demand for sustainable products were to increase, it could lead to an increase in competition, as well as to an increase in the availability and affordability of eco-products on the Slovak market. However, when buying eco-products, many authors perceive the main disadvantage as the difficult identification of a sustainable product and its quality. Kuchler et al. (2018) focused more deeply on stronger labeling of environmental products, which could support sustainable consumer behavior. In their study, Vermeire and Verbeke (2006) state that consumers often rate the level of availability of sustainable products as very low, which also negatively affects the motivation to buy them. Young et al. (2010) argues that one of the key achievements of sustainability is consumer education, which can lead to a gradual increase in the value of environmental products in the eyes of customers. Gavertson (2018) sees a high degree of consumer distrust in sustainable products as the biggest obstacle to sustainable consumption. Unfair marketing practices by manufacturers, often referred to as greenwashing, contribute to this fact. This is misleading information from companies that present the environmental characteristics of their products, which are not in fact

environmentally or consumer-friendly (Parguel, Moreau and Larceneux, 2011). At the same time, consumers must be sure that companies will not increase prices or reduce product quality in exchange for a higher level of social responsibility for their products and services (Lois, Webb and Harris, 2005). Developed countries are gradually introducing guaranteed labeling schemes for the environmental suitability of products, and the European consumer thus has the option of choosing a product that not only has suitable technical and economic characteristics, but also meets environmental protection requirements (Vokounová, Korčoková and Hasprová, 2013). The first label to indicate the environmental suitability of a product was created in Germany in 1978, but today the Slovak consumer may encounter a large number of eco-labels from different countries, mentioning e.g. Ecolabel EU, Environmentally friendly product of the Slovak Republic, or the Austrian eco-label Österreichisches Umweltzeichen (EC, 2019c; 2020; SAZP, 2018; Ecolabel Index, 2020).

The Ministry of Sustainable Development divides sustainable consumption into three basic dimensions:

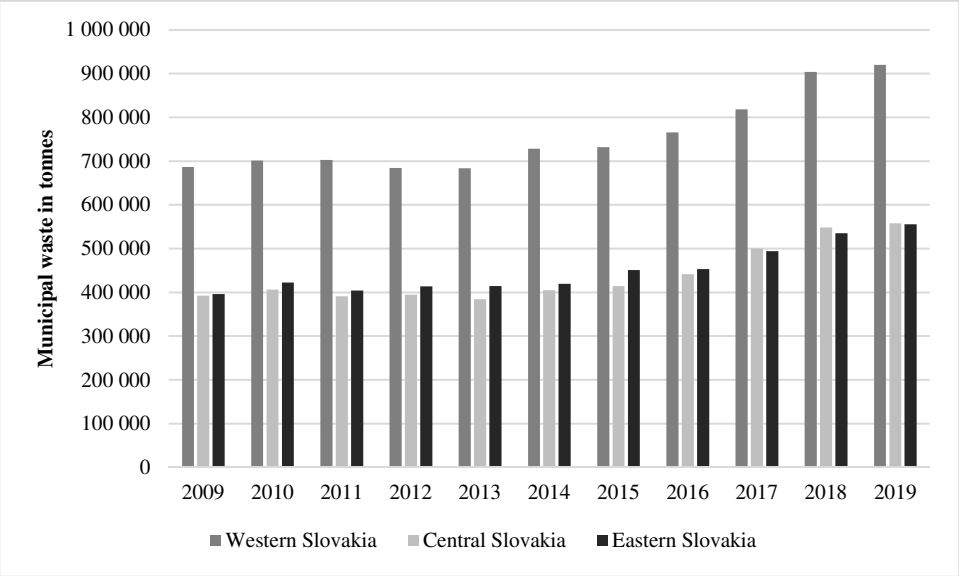
- sustainable purchasing - purchase of greener and organic products,
- sustainable consumption - consumption in smaller quantities,
- and better recycling of used goods.

In the practical part of the paper, we analyze the perception of the offer of organic products by consumers on the Slovak market, we will also be interested in the frequency of buying greener products and last but not least, to which extent Slovak consumers consider themselves as a rational consumer in the context of environmental protection. As we have already mentioned, an important part of sustainable (rational) consumption is also the last phase of the product's life cycle – its recycling. The recycling rate in the Slovak republic increased by 7% year-on-year, with the greatest progress in municipal waste management being recorded in the category of biodegradable waste, where up to 24% more biowaste was recycled in 2019 than in the previous year 2018 (MINZP, 2019). The last phase of the product life cycle is also related to the waste policy of individual countries. The development of municipal waste in individual regions of the Slovak Republic is shown in the following Figure 1.

The development of municipal waste in the Slovak Republic has a linear course, while the largest amount of municipal waste is produced in western Slovakia. In 2019, more than 3 million tons of municipal waste was generated in the whole of Slovakia, with the Nitra Region (14.8%), Bratislava Region (14.1%) and Trnava Region (13.6%) having the largest share. As many as 51% of municipal waste in the Slovak Republic was disposed of in landfills in 2019, and only 18.66% of waste was recovered by recovering organic substances.

Figure 1

Development of Municipal Waste in Various Territories of the Slovak Republic



Source: Own processing of authors according to Slovak Statistical Office.

1.3. Environmental Protection in Slovak Republic

As we have already mentioned, in recent decades countries have faced many environmental problems, among which we advise e.g. global warming, water and air pollution, or ozone depletion, resulting in a reduction in the quality of the environment and human life. Tanner and Kast (2003) considers excessive consumption of natural resources to be the main cause of these problems, especially in industrialized countries. Jungbluth, Tietje and Scholz. (2000) argue in their study, that not only the consumption of products themselves, but also production and trade activities contribute to a large extent to the reduction of the quality of the environment. A very important indicator of individual countries are the so-called environmental protection costs. The indicator evaluates the distribution of costs by sources into general and corporate, analyzes their shares in GDP and divides them according to individual areas of financing.

$$\boldsymbol{C_{EP}} = I_{EP} + CC_{EP} \tag{1}$$

where

C_{EP} – environmental protection costs,

I_{EP} – environmental protection investments,

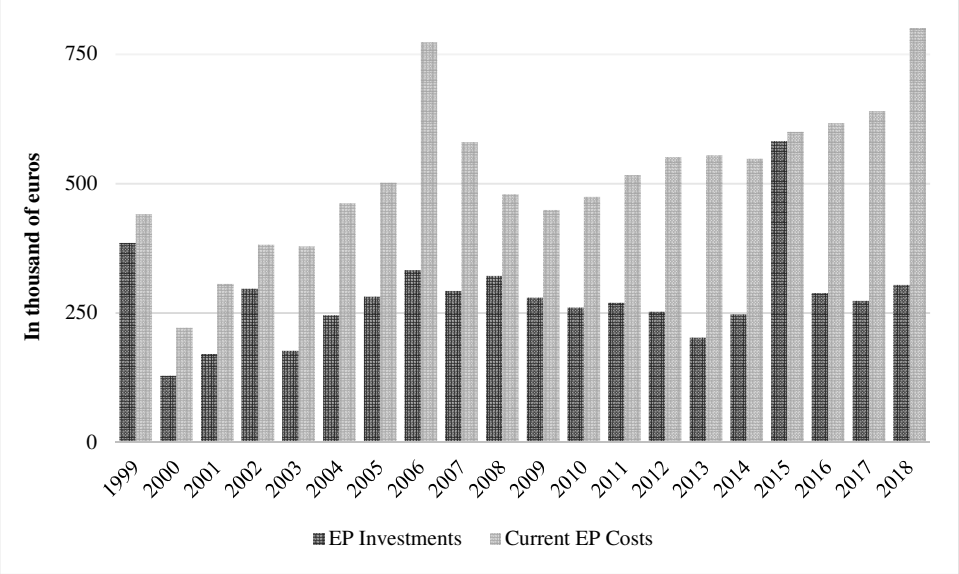
CC_{EP} – current environmental protection costs.

Environmental protection investments include all funds spent during the reference period on the purchase or acquisition of investment property that serves to protect the environment. By contrast, current environmental costs include non-investment costs for environmental activities, which are related to environmental protection.

This includes, for example, the labor costs that organizations incur for environmental services to other entities (Keohane and Olmstead, 2016). If we take a closer look at the environmental protection costs incurred in the Slovak Republic, we can see that during the entire period under review, current costs exceed environmental protection investments.

F i g u r e 2

Development of Investments and Current Costs of Environmental Protection in Slovak Republic



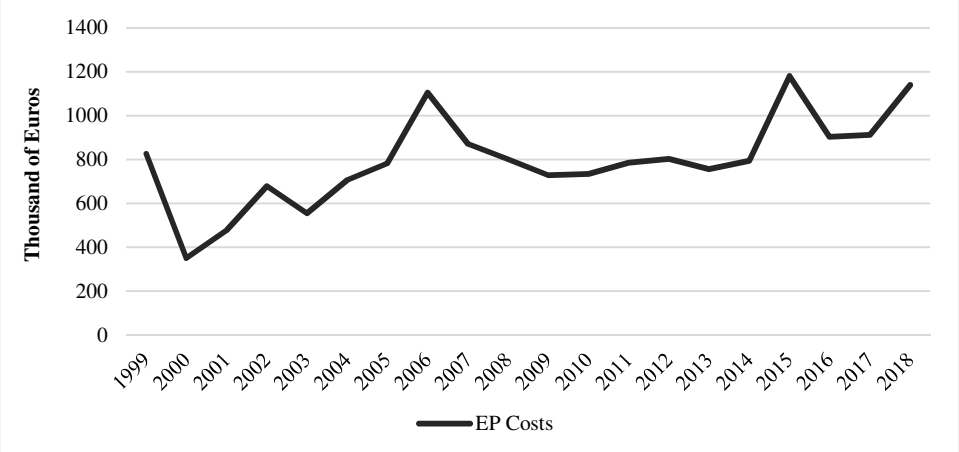
Source: Own processing of authors according to Slovak Statistical Office.

The year 2015 was the most balanced in terms of investments and costs (Figure 2), and in 2018 up to 836 thousand of euros were spent by companies and municipalities, which represents the highest achieved value of costs during the entire period under review.

The development of total environmental protection costs fluctuates (Figure 3), with the largest decrease between 1999 and 2000 (a decrease of 57.5%) and, conversely, the highest increase between 2005 and 2006 (an increase of 41.12 %) and between 2014 and 2015 (an increase of 48.74%).

Figure 3

Development of Total Environmental Protection Costs in Slovak Republic



Source: Own processing of authors according to Slovak Statistical Office.

Table 1

Share of Environmental Protection Costs by Economic Activities in Total Corporate Expenditure (%)

	2014	2015	2016	2017	2018
Agriculture	0.4	0.2	0.3	0.29	0.3
Extraction of mineral resources	0.4	0.2	0.5	0.11	0.2
Industrial production	33.7	25.2	26.7	35.1	29.5
Production of electricity, gas and water	36.6	49.6	40.1	29.5	20
Specialized manufacturers	24.7	22.3	29.2	31.2	44.8
Other activities	4.1	2.5	3.2	3.8	5.2

Source: Own processing of authors according to Slovak Statistical Office.

In 2014, the highest share of business costs was recorded in the production of electricity, gas and water (36.6%), industrial production (33.7%) and specialized producers (24.7%). A negligible share can be seen throughout the period considered in agriculture and mining. In 2018, the largest share of environmental protection costs belonged to specialized manufacturers (44.8%) and industrial production (29.5%).

2. Data and Methodology

The main goal of the article was to review the behavior and attitudes of environmentally responsible consumers on the Slovak market and analyze the individual components of consumption and waste policy within the regions in the Slovak Republic in the context of environmental protection and detected by cluster

analysis. In our research, we count on a 5% error, which we accomplish with the number of 413 respondents. Data collection took place in the period from 1.4.2020 to 22.5.2020. The questionnaire was implemented using online platforms, using the CAWI method due to the ongoing pandemic situation in the country.

Decision trees are a popular technique for in-depth data analysis, which is used for prediction and classification. The advantage of this technique is a clear and understandable interpretation using a dendrogram (Terek, Horníková and Labudová, 2010). Classification trees can be defined as recursive analysis, by which a group of *n* statistical units is divided into homogeneous groups according to the division rule (Giuduci and Figini, 2009). Classification trees consist of three components (Terek, Horníková and Labudová, 2010): *a) Root node; b) Non-leaf node; c) Leaf node.*

The principle of classification trees is based on branching from the Root node from top to bottom. A node that does not continue branching is called a Leaf node. We will use the CHAID (Chi-Square Automatic Interaction Detection) method to analyze categorical data. CHAID identifies the main factors associated with the attitude and behavior of the environmentally responsible consumer and automatically generates potential interactions (Niu et al., 2020). The CHAID algorithm is set with a significance level of 0.05 to three levels of branching, and the minimum number of objects in nodes to 50 (Řezánková, 2010). CHAID is based on the Chi-square test, which is a criterion for stopping branching. The Chi-square test is based on determining the dependence/independence of variables.

$$\chi^2 = \sum \frac{\left(observed_{ij} - model_{ij}\right)^2}{model_{ij}} \tag{2}$$

If the decrease of χ^2 is significant (if the p-value is less than the level of significance α, then the node is divided to the next level, otherwise it becomes listovy uzol, Giuduci and Figini, 2009). Five parameters were used to fine-tune the process of creating a CHAID tree: (1) significance level for splitting, (2) significance level for merging, (3) adjustment of significance values technique, (4) minimum change in expected cell frequencies, and (5) maximum iterations for convergence. A statistically significant level of cell merging and splitting is set at 0.05. To eliminate error 1 of the hypothesis testing type, we use the Bonferroni correction method (Zhang et al., 2020).

The second method used was cluster analysis. In statistical methodologies, the purpose of cluster analysis is to group the classification objects according to the characteristics of the particular dataset (Huang et al., 2020). A cluster is a collection of records that are similar to one another and dissimilar to records in other clusters (Larose, 2006).

Cluster analysis is a popular marketing method that helps solve segmentation tasks. Three methods can be used to determine the similarity between objects: coefficient of similarity, data behavior or distance measurement (Lesáková, Hanuláková and Vokounová, 2010). In our research, we work with distance measurements, which are sometimes referred to as measures of dissimilarity of objects. To interpret the results, we worked with the Euclidean distance, which is defined as:

$$d_{ij} = \sqrt{\sum_{k=1}^{n} \left(X_{ik} - X_{jk} \right)^2} \tag{3}$$

This measure is often used; the only condition for its application is an orthogonal coordinate system (Stankovičová and Vojtková, 2007). Euclidean distance was recommended for distance measure and most used whenever applying Ward's method. For this study, Ward's method applied with Euclidean distance presented the clearest image of clustering (Wang and Pham, 2020). Based on theorem we used Ward's method, which create a cluster by minimizing the sum of the within-cluster variance. Mathematically, it is possible to express Ward's method as:

$$ESS = \sum_{i=1}^{n_h} \sum_{h=1}^{q} \left(X_{hi} - \overline{X}_{C_h} \right)^2 \tag{4}$$

where

$\overline{X}_{C_h}$ – vector of averages of character values in a cluster C_h,

X_{hi} – vector of values of the character of the i-th object in the cluster C_h.

Ward's method produces clusters of similar size and tends to eliminate small clumps (Stankovičová and Vojtková, 2007).

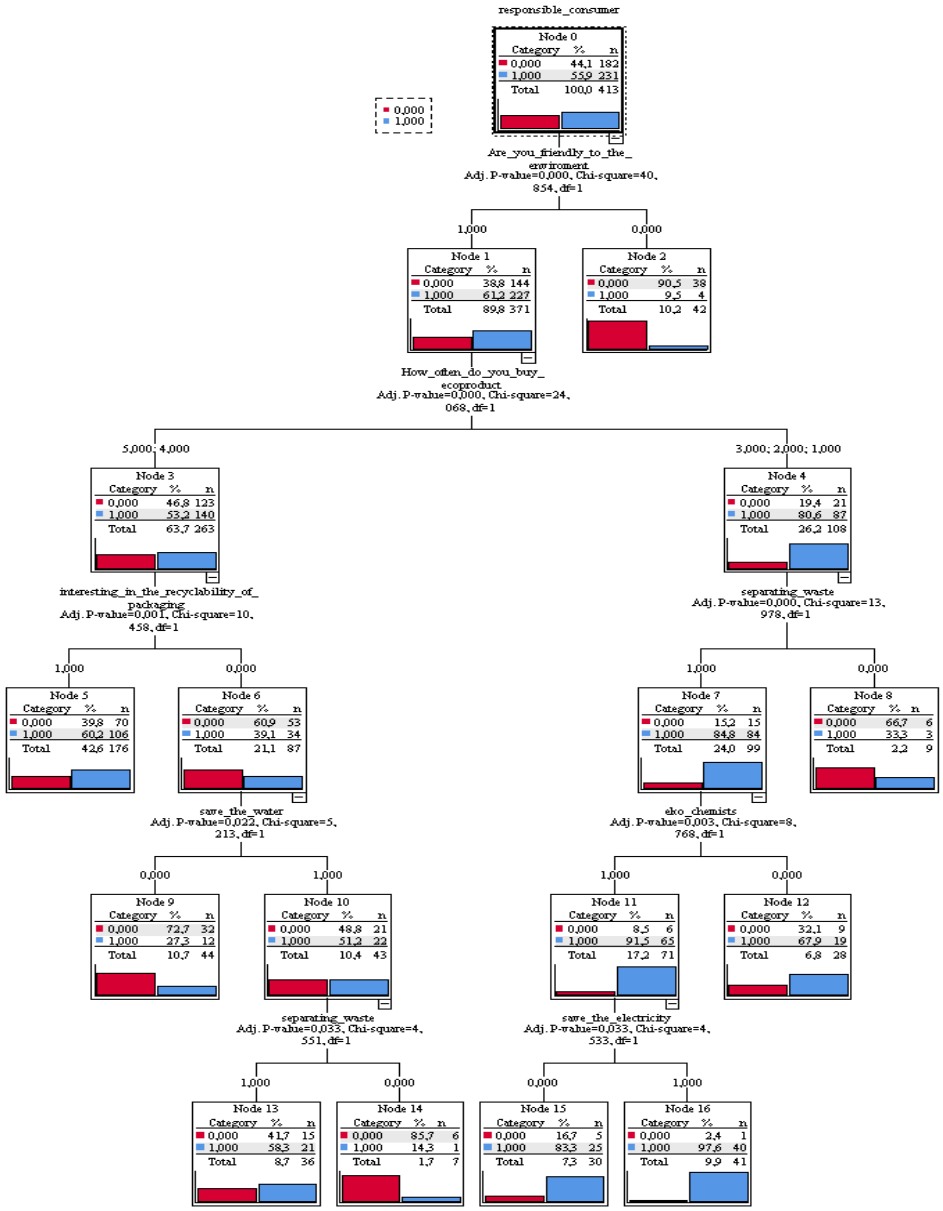
3. Results

The analysis was based on a database of respondents through a questionnaire survey. The questionnaire was divided into two sections, where the first section addressed the attitudes and opinions of respondents in the field of research. The total number of respondents to the database was 485, while the respondents were selected by the question of whether they bought an eco-product at least once in their lives. 413 respondents answered the given question positively, which in relative terms accounted for 85.16%. For a closer analysis, we continued to work with the given respondents. We were interested whether the respondents who identified themselves as environmentally responsible consumers met this definition. The responsible consumer should monitor the packaging, support local sellers, be

interested in eco-cosmetics, and be environmentally friendly, which is associated with waste and drinking water issues. We have included in the model several variables corresponding to an environmentally responsible consumer.

F i g u r e 4

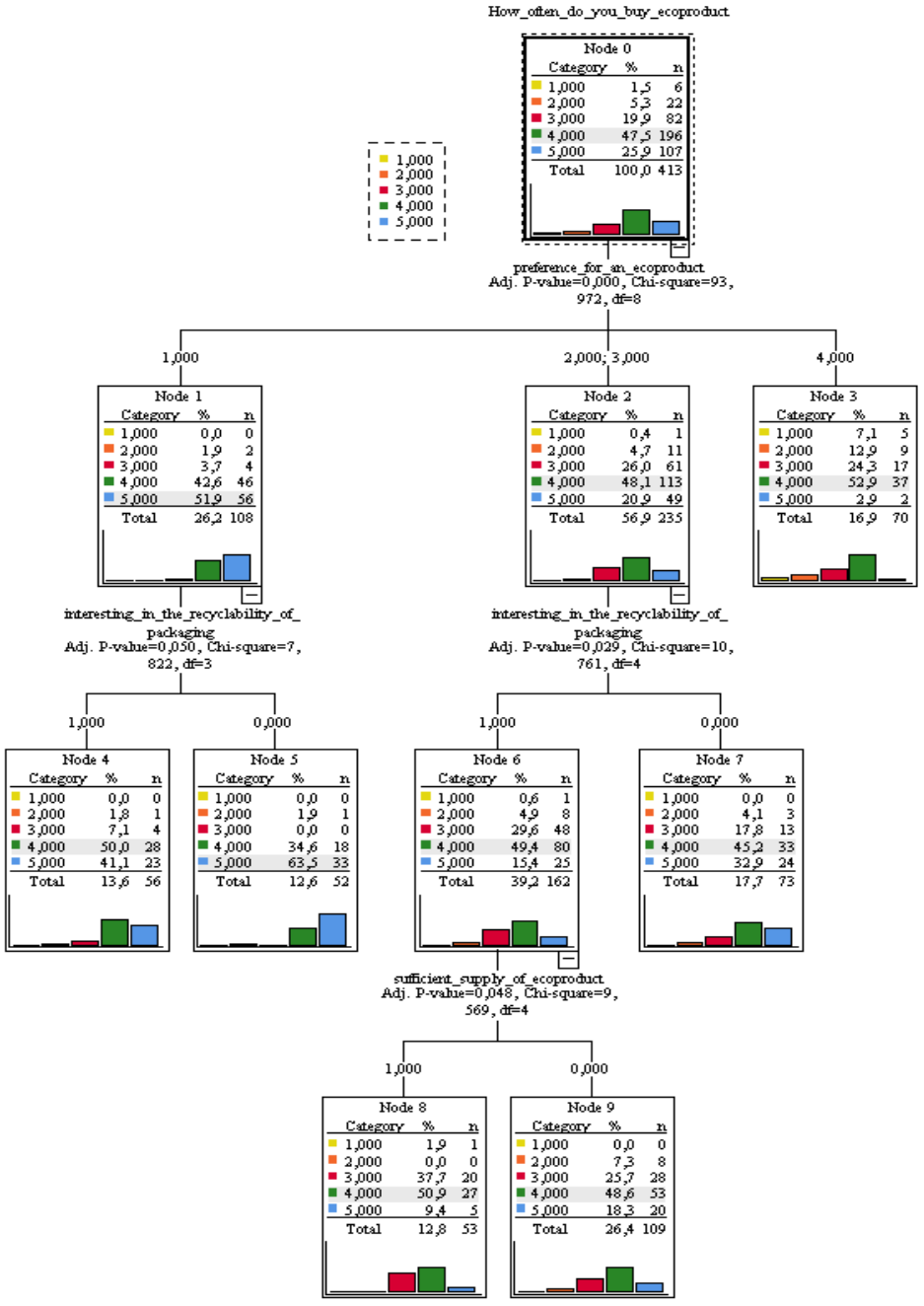
Responsible Consumer Decision Tree



Source: Own processing of authors.

F i g u r e 5

Purchase Frequency Decision Tree



Source: Own processing of authors.

We set the CHAID algorithm to 5 levels of branching, while the model selected variables that depend on the explained variable zodpovedny_spotrebitel'. Based on the dendrogram, it can be seen in node 16 that 9.68% of respondents are considered to be responsible consumer, who is environmentally friendly, regularly buys eco-products, separates waste, buys eco-drugs and saves electricity. The question remains respondents in the third node, who do not buy organic products regularly, of which up to 33.89% are considered ecologically responsible consumers. These consumers can become potential customers of the eco-product market. For a better recommendation, we chose as the explanatory variable in the following analysis: how_often_do_you_buy_ecoproduct? We have included variables in the model that will tell us more about their purchasing decisions: what product will you prefer when making purchasing decisions, interest in information about packaging, and the opinion of respondents on the offer of eco-products.

As can be seen from the classification tree, it is irregular buyers that are interested in organic products regardless of the price, while they see a problem in the offered assortment. It can be stated that the insufficient range of assortment limits the respondents who shop occasionally in the regular purchase of organic products.

In the second analysis, we wanted to look at social responsibility within the regions. For a more complex interpretation, we worked with a cluster analysis, which placed regions with similar consumption into common groups. The data were obtained from the Statistical Office of the Slovak Republic for 2018. To meet the Euclidean distance condition, we must verify the linear independence using a correlation matrix.

Based on the correlation matrix, we exclude from the model the variable consumption of drinking water – for households in m^3, which is not independent even at the level of significance of 1%.

After removing the variable, we can state a linear independence between the input variables at the significance level of 1%. The variables entering the model: heat consumption (GJ), electricity consumption (MWh), natural gas consumption (1000 m^3), consumption of hard coal, lignite, coke (thousand m^3), small construction waste (tons), other municipal wastes : mixed waste (tons), waste from gardens and parks (tons), components of municipal waste from separate collection of which: dangerous waste (tons), components of municipal waste from separate collection (tons) and amount of discharged wastewater (thousand m^3). Before inserting the variables into the cluster analysis, we had to standardize the variables using the Zscores function, which removes the differences in units of measure. We created the dendrogram using Ward's clustering method, through the Euclidean distance.

T a b l e 2a

Correlation Matrix of Input Variables

	Heat consumption (GJ)	Electricity consumption (mwh)	Natural gas consumption (1000m3)	Consumption of hard coal, lignite, coke (1000 m3)	Consumption of drinking water - for households in m3	Amount of discharged wastewater (1000 m3)	Small construction waste (tons)	Other municipal wastes: mixed waste (tons)	Waste from gardens and parks (tons)	Components of municipal waste from separate collection of which: dangerous waste (tons)	Components of municipal waste from separate collection (tons)
Heat consumption (GJ)	1	0.742	0.74	0.296	0.907	0.231	0.1	0.574	0.208	0.524	0.42
Electricity consumption (mwh)	0.742	1	0.475	0.329	0.607	0.327	0.414	0.18	0.075	0.535	0.084
Natural gas consumption (1000m3)	0.74	0.475	1	0.114	0.808	0.125	0.047	0.751	0.74	0.212	0.052
Consumption of hard coal, lignite, coke (1000 m3)	0.296	0.329	0.114	1	0.391	0.004	0.014	0.202	0.303	0.204	0.147
Consumption of drinking water – for households in m3	0.907	0.607	0.808	0.391	1	0.319	0.034	0.718	0.421	0.351	0.232
Amount of discharged wastewater (1000 m3)	0.231	0.327	0.125	0.004	0.319	1	0.359	0.265	0.178	0.245	0.589
Small construction waste (tons)	0.1	0.414	0.047	0.014	0.034	0.359	1	0.313	0.344	0.213	0.386
Other municipal wastes: mixed waste (tons)	0.574	0.18	0.751	0.202	0.718	0.265	0.313	1	0.809	0.379	0.564
Waste from gardens and parks (tons)	0.208	0.075	0.74	0.303	0.421	0.178	0.344	0.809	1	0.096	0.362
Components of municipal waste from separate collection of which: dangerous waste (tons)	0.524	0.535	0.212	0.204	0.351	0.245	0.213	0.379	0.096	1	0.477
Components of municipal waste from separate collection (tons)	0.042	0.084	0.052	0.147	0.232	0.589	0.386	0.564	0.362	0.477	1

Source: Own processing of authors according to DataCube Statistics.

Table 2b

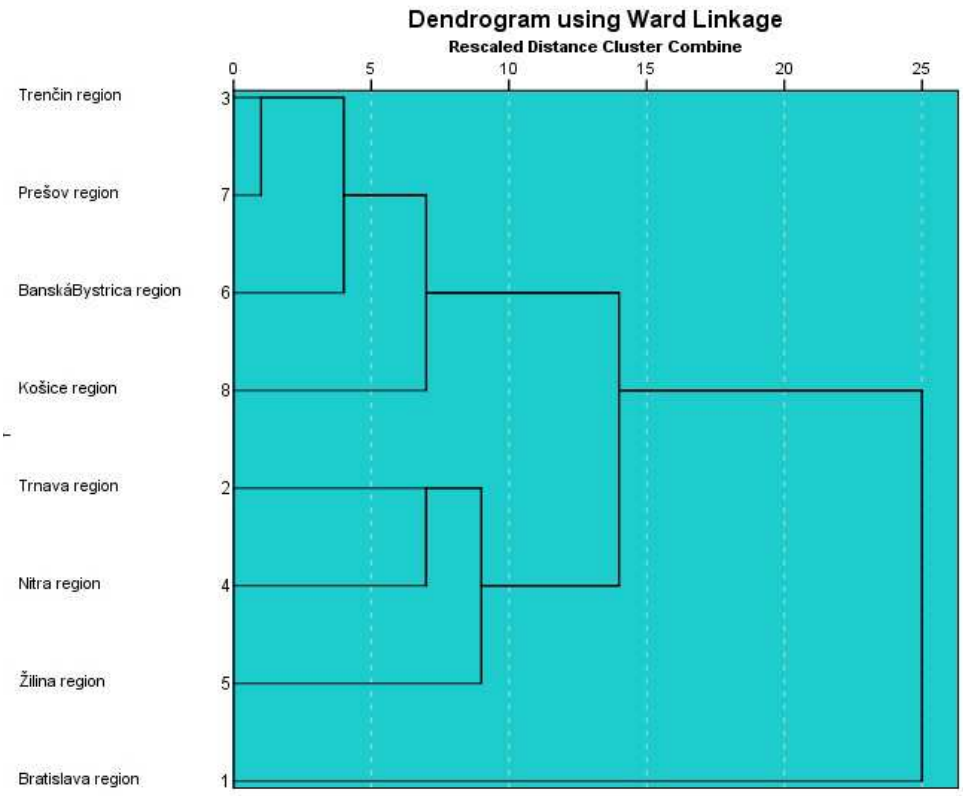
Correlation Matrix of Reduced Variables

	Heat consumption (GJ)	Electricity consumption (mwh)	Natural gas consumption (1000m3)	Consumption of hard coal, lignite, coke (1000 m3)	Amount of discharged wastewater (1000 m3)	Small construction waste (tons)	Other municipal wastes: mixed waste (tons)	Waste from gardens and parks (tons)	Components of municipal waste from separate collection of which: dangerous waste (tons)	Components of municipal waste from separate collection (tons)
Heat consumption (GJ)	1	0.742	0.74	0.296	0.231	0.1	0.574	0.208	0.524	0.42
Electricity consumption (mwh)	0.742	1	0.475	0.329	0.327	0.414	0.18	0.075	0.535	0.084
Natural gas consumption (1000m3)	0.74	0.475	1	0.114	0.125	0.047	0.751	0.74	0.212	0.052
Consumption of hard coal, lignite, coke (1000 m3)	0.296	0.329	0.114	1	0.004	0.014	0.202	0.303	0.204	0.147
Amount of discharged wastewater (1000 m3)	0.231	0.327	0.125	0.004	1	0.359	0.265	0.178	0.245	0.589
Small construction waste (tons)	0.1	0.414	0.047	0.014	0.359	1	0.313	0.344	0.213	0.386
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Components of municipal waste from separate collection (tons)	0.042	0.084	0.052	0.147	0.589	0.386	0.564	0.362	0.477	1

Source: Own processing of authors according to DataCube Statistics.

F i g u r e 6

Dendrogram Regions SR



Source: Own processing of authors according to DataCube Statistics.

T a b l e 3

Distribution of Slovak Regions into Clusters

Cluster Membership	
Case	3 Clusters
1: Bratislava region	1
2: Trnava region	2
3: Nitra region	2
4: Žilina region	2
5: Trenčin region	3
6: Banskabystrica region	3
7: Prešov region	3
8: Košice region	3

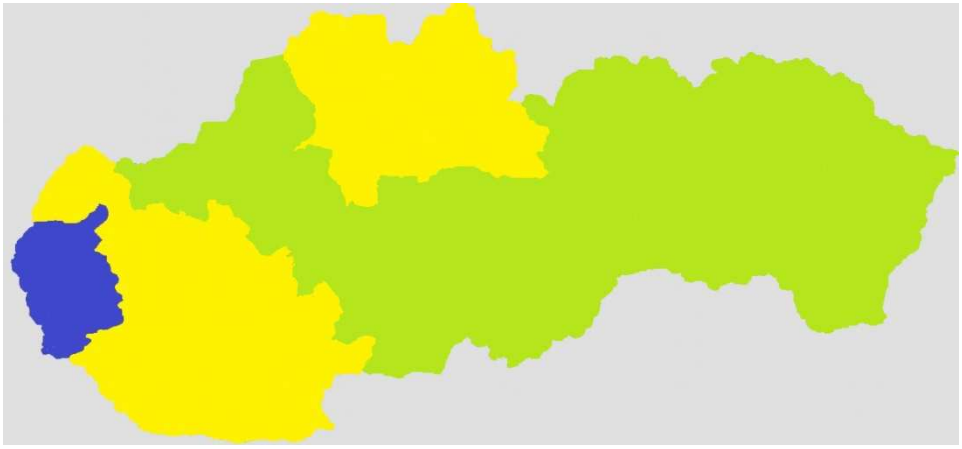
Source: Own processing of authors according to DataCube Statistics.

Cluster analysis created three clusters for us, where Bratislava forms a separate cluster. Even when changing the number of clusters to two or four clusters, the Bratislava Region created a separate cluster.

The second cluster consists of the Trnava region, Nitra region and Žilina region. The system includes Trenčín Region, Banská Bystrica Region, Prešov Region and Košice Region in the third cluster. The individual division of regions into clusters is also expressed in Table 3 and the figure shows the distribution of clusters within Slovakia.

F i g u r e 7

Distribution of Clusters within the Slovak Republic



Source: Own processing of authors according to DataCube Statistics.

From the given figure, it is possible to observe a difference in the consumption of individual factors in comparison with Western and Central and Eastern Slovakia. The table of descriptive statistics for individual clusters also expresses the difference of individual clusters.

Based on descriptive statistics, we observe that cluster one has the highest value in almost all indicators, and despite the fact that cluster analysis should remove individual clusters, the difference between Bratislava and the rest of Slovakia is not negligible. The main differences can be seen in heat consumption (GJ), natural gas consumption (1000 m^3) and consumption of hard coal, brown coal, coke (thousand m^3).

The second cluster reached the highest average values in the production of construction waste – 12,555 tons, garden and park waste – 32,540 tons and in separate collection – 85,025.33.

Third cluster, despite the highest population in the area, does not reach the highest value in any indicator.

T a b l e 4

Table of Descriptive Statistics of Model Variables

Cluster 1	**X1**	**X2**	**X3**	**X4**	**X5**	**X6**	**X7**	**X8**	**X9**	**X10**
Mean	199 431 154.00	4 426 549.00	870 942.00	1 843 517.00	60 535.00	7 925.00	175 216.00	31 969.00	2 995.00	79 209.00
Standard Deviation	–	–	–	–	–	–	–	–	–	–
Minimum	–	–	–	–	–	–	–	–	–	–
Maximum	–	–	–	–	–	–	–	–	–	–
Range	–	–	–	–	–	–	–	–	–	–
Cluster 2	**X1**	**X2**	**X3**	**X4**	**X5**	**X6**	**X7**	**X8**	**X9**	**X10**
Mean	7 112 728.00	1 500 843.33	348 007.67	125 612.00	55 299.33	12 255.00	159 125.00	32 540.00	1 903.33	85 025.33
Standard Deviation	6 532 618.69	651 260.96	307 219.27	186 803.12	31 177.20	5 623.38	8 569.09	12 179.78	934.45	4 960.18
Minimum	2 717 947.00	1 027 170.00	123 065.00	459.00	35 382.00	7 923.00	152 135.00	22 207.00	926.00	80 429.00
Maximum	14 619 500.00	2 243 512.00	698 038.00	340 333.00	91 229.00	18 610.00	168 685.00	45 969.00	2 788.00	90 283.00
Cluster 3	**X1**	**X2**	**X3**	**X4**	**X5**	**X6**	**X7**	**X8**	**X9**	**X10**
Mean	10 156 266.00	2 094 655.25	204 015.25	1 345 982.75	47 098.50	6 600.00	130 368.75	19 158.50	1 474.00	73 677.50
Standard Deviation	9 073 374.89	1 145 751.64	58 567.25	2 444 139.90	8 184.12	2 448.42	4 751.85	2 636.45	683.23	4 383.53
Minimum	4 959 140.00	713 423.00	120 106.00	71 896.00	35 896.00	3 748.00	127 230.00	16 870.00	960.00	68 080.00
Maximum	23 742 906.00	3 468 238.00	252 950.00	5 011 765.00	54 540.00	9 648.00	137 447.00	21 769.00	2 473.00	78 401.00

Source: Own processing of authors according to DataCube Statistics.

Conclussion

The main goal of the article was to review the behavior and attitudes of environmentally responsible consumers on the Slovak market and analyze the individual components of consumption and waste policy within the regions in the Slovak Republic in the context of environmental protection. The initial step was the elaboration of scientific literature related to the given issue, based on which we can classify the Slovak Republic among the most energy-intensive countries within the EU. The energy consumption in the country is 80% higher in terms of GDP than in other EU member states, and we consider this fact to be one of the main reasons for the creation of the Environmental Strategy 2020 for the Slovak Republic. Many authors see obstacles in the sustainable consumption of eco-products, especially in the difficult identification of these products and their quality, poor environmental labeling of products, poor availability of eco-products, or low confidence in eco-products by end consumers. Based on the cluster analysis and the decision tree method, we came to several conclusions. Despite the fact that the majority of respondents (55.93%) identified themselves as a responsible consumer, 90% answered yes to the question of whether they are environmentally friendly, which means that the answers are ambivalent. The discrepancy between the answers encourages the population to be misinformed in the field of environmental responsibility, and education could help to increase the purchase of eco-products, recyclability of products, water saving. He also confirms the need for awareness-raising (Pinto et al., 2011), which examined the relationship between environmental awareness and uneconomic habits and concluded that there is a negative correlation between awareness and wasteful habits, what means with higher awareness bring lower wasteful habits and opens up opportunities for building young people's environmental literacy, which has also been highlighted by research through eco-advertising (Rahim et al., 2012). We perceive the limitation mainly in the different perception of who we consider to be a "responsible consumer", as this concept does not have a clear definition and definition of what it should fulfill. Only 9.68% actually meet the condition of a responsible consumer (they save electricity, buy eco-products, separate waste). Based on the analysis through the decision tree, 17.3% of respondents belong to irregular shoppers, who consider the main problem of eco-products to be the breadth of the assortment in the close area of their home and in Slovakia. This fact is also confirmed by the very overview of Slovak products marked EU Ecolabel, where the Slovak Republic is among the 5 worst ranked countries in the European chart (Ecolabel, 2020).The high price of eco-products is perceived as a negative by almost 25% of respondents, which creates space for companies to create alternative products in a lower price category, or adjust the price of products

to wages in a given country, because research in Switzerland has shown that price does not play a significant role in deciding to buy eco-products (Tanner and Kast, 2003). Almost 34% of respondents rarely buy eco-products, but as many as 75% recycle or are interested in recycling packaging or the products themselves.

We can see a precondition for addressing a given segment of customers who would increase the purchase of eco-products by more active sustainable marketing, increasing the level of their education in the given area, or improving the availability of products, as they are interested in ecology and the environment. The cluster analysis divided the Slovak regions into individual groups, with Bratislava representing an independent area of strategy with the highest values despite the lowest population. Based on the similarity of quantities, Trnava, Trenčín and Žilina regions were also merged, in which a better introduction of the circular economy is recommended, either in the form of reduction of construction, garden waste or waste of separate collection, or creation of factories for waste recovery. It is the incentive to reduce and recycle waste that can be in the end the successful approach, as the European survey shows, where Slovak consumers labeled waste as the most important part of the environment (EC, 2017). Other regions of the Slovak Republic formed the third cluster of analysis, where we can also consider the high number of industrial and other enterprises in the region as similar characteristics. The main recommendation in the field of circular economy is to choose a separate strategy for each cluster separately, which may create a favorable development in the field of circular economy of the Slovak Republic in the future, and thus reduce negative aspects of consumption affecting the environment and quality of life in Slovak Republic.

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