

Article

Segmentation of Hungarian Consumers Based on Circular Economy Values and Awareness of Food Waste

Kinga Nagyné Pércsi ^{1,*} , Apolka Ujj ²  and Paulina Jancsovszka ² 

¹ Institute of Agricultural and Food Economics, Hungarian University of Agriculture and Life Sciences, 2100 Gödöllő, Hungary

² Institute of Rural Development and Sustainable Economy, Hungarian University of Agriculture and Life Sciences, 2100 Gödöllő, Hungary; ujj.apolka@uni-mate.hu (A.U.); jancsovszka.paulina@uni-mate.hu (P.J.)

* Correspondence: nagyne.percsi.kinga@uni-mate.hu

Abstract: This study aims to detect those segments among the Hungarian food consumers who are aware of the climate risks of their food consumption. In order to achieve this goal, a survey was conducted with the participation of Hungarian university students. Data from 1184 households were collected and used in Factor (Principal Component) and Cluster Analysis. Two very conscious clusters were found; both are highly qualified. One favored waste utilization, asserting that and encouraging most of its members to follow a zero-waste lifestyle. The latter mentioned that cluster members are young, and they are in a good financial situation. The findings of this study may be of interest to policy makers for environmentally responsible food consumption guidance and training for planning consumer awareness programs. Even though several previous studies have addressed the concept of consumer awareness concerning food purchase decisions, only few of them dealt with consumer awareness in the environment and climate domain in food consumption in Hungary, so this research could be considered as filling a gap.

Keywords: food waste; environmental awareness; circular economy; food purchasing habits; locality



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1. Introduction

The concept of Circular economy (CE), although not entirely new, has become increasingly popular in the fields of academia, policy and business in the past decade. Meeting the needs of the growing population demands an increasing quantity of natural resources, which represents a highly challenging issue. The economic system is expanding at the expense of the natural environment which results in collapse of the global ecosystem both in terms of quantity (in size and volume) and quality [1]. Since resource scarcity is increasing and the natural environment has limits, the traditional linear economy model is unsustainable. Therefore, a shift to a circular economy is required to reduce the use of raw material inputs and energy and also the outputs as waste disposed of in the environment [2]. Viewed by Gregson et al. (2015) [3] as “an idea and ideal, the achievement in practice of CE is realized principally by the recycling networks where wastes become resources” [3] (p. 218). Cooper (2005) considers the CE as a new way to sustainable production and consumption transition [4]. The amount of food waste generated is one of the most worrying facts through which consumers can/could participate in the circular economy [5,6].

Nevertheless, the assessment of the environmental impact of food waste by consumers is a less studied area, even though the basic objective of agricultural policy is the safe food supply of the growing population, which cannot be imagined without reducing food waste. Accordingly, the aim of the paper is to map Hungarian food consumers, whether there is a segment that is more sensitive to the environmental issues of food production and consumption.

For the purpose of eliciting the answers, the authors formulated 3 questions:

Q1: Can purchasing habits distinguish customers into identifiable consumer groups?

Q2: Which socioeconomic and demographic factors are associated with a particular consumer segment?

Q3: What characterizes domestic food consumption habits, taking into account aspects of environmental awareness?

Since there is no recent study that uses variables that are developed based on previous survey experiences and attempts to detect signs of environmental awareness among Hungarian food consumers, this research could be considered as filling a gap.

2. Literature Review

According to Shove (2014), the transition toward sustainability demands changes in technologies, individuals' competences and practices as well as way of thinking [7]. The circular economy suggests solutions in food production, consumption and waste management for a sustainable food system. It aims at closing the loops in the smallest possible cycles and minimizing supplementary inputs, e.g., energy. Moreover, Jurgilevich et al. (2016) point out that the food waste and surplus avoidance is one of the components of CE regarding the food system which at the same time is a "consumption issue related to consumer food competences and skills" [8]. Kiss et al. state that short supply chains can benefit food waste reduction (by shorter shelf-lives, moderate packaging usage, flexible package sizes and conscious customer behavior change) and serve the goals of the CE even if this is the primary foundation of the concept [9].

While sustainable production and consumption are clearly connected to the CE, famine and overproduction aggravated by food waste are delicate issues justifying that food production and consumption should be treated together and require a comprehensive strategy when considering the reduction potential of food loss and waste. This is even more important as 828 million people do not have access to food of adequate quantity and quality on a daily basis, a number which is 46 million more than the estimation in 2020 and 150 million more than the number in 2019, according to the FAO's latest report on The State of Food Security and Nutrition in the World (2022) [10]. This number can be expected to increase in parallel with the increase in the earth's population. Interestingly, obesity is also often mentioned in connection with food waste and so indirectly with the CE. According to the WHO (2017) [11], between 1975 and 2016, the number of obese people tripled, affecting 650 million adults and 380 million people under the age of 18.

The significance of food loss and waste issues—that are threatening the sustainability of food systems—is even more expressed as there is a pressing need to find comprehensive solutions for feeding the constantly growing population [12]. The food loss and food waste seem to be similar, and in specific cases they are substitutable; nevertheless, they differ regarding origin and scope [13]. Food losses occurring throughout the supply chain refer to resource (e.g., land, water, energy and other inputs) waste in production. In addition, food losses also cause a decrease in edible food quantity and quality, making it less fitting for human consumption [6,14]. According to FAO (2011) estimates from more than ten years ago (2011), one-third of the food produced for human consumption worldwide is lost or wasted throughout the entire food supply chain including primary production, harvest, transport, storage, processing, wholesale, retail and markets, food service and households. These data are reinforced by the State of Food and Agriculture [15] report, UNEP's Food Waste Index Report (2021) [16] and the Sustainable Development Goals Report (2022) [17] declaring that around 13.3 percent of the world's food continues to be lost post-harvest and just before reaching their storage, followed by another 17 percent of food waste at the retailer and consumer level, primarily in households reaching 570 million tons of food waste per year which is equivalent to 74 kg of food loss per capita. FAO estimates that this lost and wasted food would be enough to feed a total of 1.26 billion hungry people every year.

Stenmarck et al. (2016) [18] examined the EU-28 (European Union) and found that based on the data derived from 2012, 88 million tons of food per year is wasted which is equivalent to 173 kg of food waste per person per year. However, there is always a debate

around the definition of food waste as it may include edible food and inedible parts of food or can be categorized as avoidable and unavoidable food waste [19]. Based on the analysis of Stenmarck et al. (2016), 20% of the total food produced is wasted (counting on both edible and inedible parts of food removed from the food supply chain) [18].

Parfitt et al. (2010) reported that food is wasted in the last stages of the food supply chain, for example, lost when the food is put into the markets and when it is consumed. [20]. Attiq et al. (2021) also found that the food that get to be wasted largely in households is far higher in volume when compared to that is being lost in businesses, leading to households being regarded as the primary source of food waste [21].

Consequently, consumers play a key role in reducing environmental impact through their food choices [22]. On one hand, there exists a group of consumers that let their food choices be determined by many factors such as price, convenience, taste and health [23] leaving out the environmental concerns [24]. On the other hand, with the growing availability of environmental information, there is a group of consumers that is aware of environmental concerns related to their food consumption, beings to which we would refer as ethical consumers [25]. Elaborately, an ethical consumer is a person who is cautious about environmental issues, human rights, animal welfare and labor working conditions that exist in the world [26]. Royne et al. (2011) examined factors influencing consumers' attitudes in purchasing an environmentally friendly item, showing consumer concern for waste, biosphere, wildlife, popular issues, public health, energy and environmental technology [27]. The authors discovered that people who place a high value on waste reduction are willing to spend more money on an environmentally friendly product.

According to Lusk, J.L. and McCluskey, J. (2018), consumers play a key role in reducing environmental impact through their food choices [28,29]. Rasool et al. (2021) propose a five-dimensional consumer awareness construct (environmental, hunger, economic, landfill and water supply concerns) for socially responsible food consumption on the basis of a representative consumer survey [30]. This study highlights that consumers tend to evaluate their awareness by assessing the five primary dimensions in socially responsible plate food consumption. The authors found that the least influential concern was "hunger", which has become more important today due to food crises and food shortages in the developing world.

The problem of food waste is also increased by the environmental impacts of the emissions deriving from the different steps of the food supply chain. The later in the supply chain a product is wasted, the greater its negative environmental impact will be, as emissions from all stages of the supply chain add up (e.g., production, processing, transport, etc.). Thus, if the amount of avoidable waste is reduced, food production and its associated negative environmental effects can also be decreased [31].

The Sustainable Development Goal (SDG) 12, target 3, adopted by all United Nations Member States, targets a 50% reduction of food waste at the retail and consumer levels, in addition to reducing food losses along production and supply chains by 2030. It envisages sustainable consumption and production patterns that are essential for a sustainable livelihood in the present and for future generations. It recommends that consumers strive to reduce their waste production and be conscious when purchasing, giving priority to products that serve sustainability. It also recommends that no one throw away food [17]. Nonetheless, L.M. van Bussel et al. (2022) recently found that overall, consumers believe that sustainability does not (yet) influence their food choices [32]. Further changes in eating and food purchasing habits are essential in accommodation to climate change. To help this process it is crucial to understand how consumers interpret circular economy principles in relation to the food supply chain.

Principato et al. (2019) highlight that by decreasing food loss and waste which are main obstacles to sustainability, several SDGs become achievable. In this regard, the CE can speed up the accomplishment of these goals, since they are crucial concerning production-consumption behaviors and patterns in SDG 12 (climate action) [33].

Sustainability applies to all economic sectors and thus also to agriculture [34]. Silva (2019) claims that sustainable agriculture requires compliance with the CE principles throughout the entire process, from production and consumption to efficient waste management [35]. At the core of the CE model is efficient resource management focusing on “closing the loop” [36]. In this way, the value loss of materials can be avoided, and product life can be expanded as result of waste reuse in production [37,38].

The local food systems and the direct channels (direct consumer–producer relations) together with information (about the origin, food miles and innovative purchasing channels) serve the aim of CE by reducing food waste and closing the “loops”.

3. Materials and Methods

3.1. Sampling and Survey Instrument

The data were collected using a Google Form between May and June 2022. A total of 1.223 questionnaires were filled out. A total of 1.184 responses were processed. Questionnaires that were filled out by non-Hungarian respondents were deleted followed by those that contained incorrect or incomplete data.

Before the survey, we tested the questionnaire among our colleagues from the Institute of Rural Development and Sustainable Economy and the Institute of Agricultural and Food Economics, and we modified or deleted certain questions according to their comments.

To collect data, the link to access the questionnaire was distributed among full-time and correspondence students of the Hungarian University of Agriculture and Life Sciences.

The questionnaires were asked by the students of the Agricultural Economics and Agricultural Policy course among their acquaintances based on the following criteria. Each student had to ask at least 5 other people. Each person interviewed had to come from a separate household and be at least 18 years of age.

Anyone who completed the questionnaire at the request of a student had to register, which means that the respondent had to identify who asked her or him to complete the questionnaire.

The questionnaire included demographic questions (6) and questions about the frequency of consumption of the main food categories, followed by questions about environmentally friendly food packaging, the use of food waste, attitudes towards local foods, small producers and the use of various short supply chains. At the time of the study, food prices were not as high as they are now. According to Eurostat, the Statistical Office of the European Union (December 2022), food prices rose the most in Hungary. The recorded annual rates—the highest in the EU—were 25.0%.

L.M. van Bussel et al. (2022) conducted a systematic literature review of quantitative and qualitative studies related to consumers’ perceptions on food-related sustainability and published between January 2010 and June 2020 [32], which reported the separation of different overarching domains. Production, transportation and product were the largest ones identified in the analyzed quantitative studies. The authors determined different subcategories for the different domains, from which “local, workplace ethics, organic, food miles, origin, labelling, information, knowledge, food waste, package” were related to most of the separated domains.

Following the findings of L.M. van Bussel et al. (2022), questions related to these subcategories were selected to detect the food purchasing habits of Hungarian consumers [32].

The habits of using Short Food Supply Chains and the preference to contact directly the farmer are indicators of the attitude towards circular economy principles. The use of short supply chains helps to close the loop. Accurate knowledge of consumer demand helps food production without waste. On the other hand, the direct consumer relationship with the producer helps to avoid food packaging waste, since the consumer can return it to the producer.

3.2. Data Analysis

A descriptive statistic was used for the whole sample whilst factor and cluster analysis were applied to segment the consumers. Factor and cluster analysis were used to answer Q1, and figures were prepared to demonstrate the demographic characteristics of each segment (Q2). Based on the results of the cluster analysis and along the different dimensions of the factor analysis, we formulated the most important habits of the different clusters (Q3). According to [39], the process of factor analysis begins with problem definition, according to which we can apply exploratory or confirmatory (structure-checking) factor analysis. The former is suitable for creating new factors, while the latter is suitable for proving and testing an existing model. This means that we often do not even know exactly what we are looking for, and we are interested in how the given variables are related to each other (exploratory nature). The data were analyzed using SPSS software, version 24. Factor analysis was performed, and a segmentation was conducted using K-means cluster analysis. The factor scales consisting of five factors were used in cluster analysis.

The selected 18 variables (Appendix A) for the analyses were used for grouping the examined sample in terms of environment sensitivity.

Since the analysis also included a 5- and 7-grade metric scale and variables with binary output, we calculated a standardized item Cronbach's alpha value, which was 0.799 for the 18 items (questions) used.

Before K-means clustering, a hierarchical cluster analysis using Ward Linkage was conducted to determine the adequate number of clusters. The results of this cluster analysis indicated that the optimal number of clusters was 4. The differences between the segments were examined using the average related consumer habits scores for certain clusters.

The selected variables were subjected to a factor analysis using principal axis factoring and Varimax rotation to determine the smallest number of meaningful factors.

Bartlett's test of sphericity was significant at the 0.001 level, and the Kaiser–Meyer–Olkin (KMO) value was 0.854, which was greater than the required lower limit of 0.7 [40].

4. Results

The sample can be characterized by the following features. Some 42% of respondents are women; 58% are men; 59% are between 18 and 30 years old; a third (32%) live in small towns, and three quarters (76%) live in urban areas. Some 42% of the examined sample have an employee status, while 36% are students. Some 77% have an average or above income; 49% have a secondary, and 43% have a higher education.

4.1. Results of the Principal Component Analysis

The total variance explained (TVE) is 55% (Table 1), which is satisfactory because according to Peterson (2000) [41] and Merenda (1997) [42] 50% TVE is acceptable as a minimum.

At the same time, due to the TVE below 60%, we used the results of the factor analysis as additional information in the further analysis and did not form aggregate indicators along the factors.

The first component (PC1) contains those variables which are related to localism and ethical production (the importance of buying food from small farmers, contacting farmers directly, the delivery distance in kilometers taken by the chosen food, the information on the label, the origin of the food, the traditional (Hungarian) foods and the choice of the restaurants which use local sources of raw materials). This factor can be called *local and ethical food-related motives* (Table 1).

Table 1. Rotated Component Matrix.

	Components *				
	1	2	3	4	5
	Local and Ethical Food–Related Motives	Traditional Direct Food Channels	Waste and Waste Reduction	Information	Innovative Solutions
biopurchasing	−0.145	0.304	0.179	0.335	−0.029
directfromfarmer	0.245	0.773	0.014	0.110	0.006
frominternet	−0.062	0.307	0.092	0.127	0.703
fromtraditionmarket	0.169	0.757	0.089	0.029	0.038
fromfarmermarket	0.180	0.824	0.059	0.103	0.085
ecowrap	0.139	0.224	0.453	0.031	0.057
avoidfoodwaste	0.225	−0.074	0.767	0.051	−0.063
foodwasteto	0.091	0.047	0.722	0.044	−0.045
importantsmallfarm	0.542	0.170	−0.061	0.030	−0.293
restaurantlocal	0.679	0.251	0.090	0.011	0.102
directcontactfarmer	0.622	0.453	0.002	0.020	0.018
foodtravel	0.633	0.031	0.143	0.174	−0.129
readlabel	0.618	−0.031	0.249	0.118	0.336
origin	0.780	0.124	0.219	0.085	0.131
fromHungary	0.775	0.102	0.169	0.051	0.002
fromcircular	0.139	0.001	−0.042	0.806	0.017
circularmeaning	0.068	−0.069	−0.120	−0.067	0.593
boxsystem	0.184	0.133	0.095	0.683	0.021
% of variance explained	18.980	13.562	8.689	7.405	6.157

Note *: Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalisation. Rotation converged in six iterations. Meaning of the labels: “biopurchasing”—frequency of bio food purchasing; “directfromfarmer”—frequency of buying from the farm; “frominternet”—frequency of buying food online; “fromtraditionmarket”—frequency of buying food at a traditional market; “fromfarmermarket”—frequency of buying food at a farmer’s market; “avoidfoodwaste”—importance of avoiding food waste, “foodwasteto”—utilization of food waste, “importantsmallfarm”—importance of purchasing from small farmers, “restaurantlocal”—importance of use local ingredients in the restaurant, “directcontactfarmer”—importance of the direct contact with the farmer, “readlabel”—importance of reading the food label, “origin”—importance of the origin in food purchasing decisions, “fromHungary”—importance of Hungarian origin in purchasing decisions, “fromcircular”—knowledge of the circular economy, “boxsystem”—knowledge about the box system, “foodtravel”—the importance of the food miles, “ecowrap”—importance of environmentally friendly packaging, “circularmeaning”—what does the circular economy mean for the consumer. The yellow colored areas refer to the variables that make up the individual principal components. These variables are the constituents of each factor.

The variables in the second component (PC2) connect to the traditional SFSCs (Short Food Supply Chains), buying food directly from farmers and from traditional and farmers’ markets except web shops, and are referred to as “*traditional direct food channels*” (Table 1). The variables which are determinative in the third component (PC3) belong to the topic of waste and waste reduction (avoiding food waste and the use of food waste, so zero waste lifestyle) (Table 1). PC4 is connected to the knowledge about the circular economy (knowledge about circular economy and the box system) (*information*) (Table 1). The determinant variables in the fifth component (PC5) are related to the use of the internet and the knowledge which can be easily acquired through the internet. This factor means knowledge about *innovative solutions* (Table 1). (They heard about the box system.)

The fact that food travel—in PC1—is coupled with the importance of using local raw materials in restaurants and the importance of food from Hungary and small food producers

explains that consumers purchase local food due to environmental reasons. In other words, they buy these products for climate awareness reasons and not for their quality.

According to the results of the hierarchical cluster analysis, K-means cluster analysis was performed, and four clusters were separated.

According to the ANOVA table (Table 2) of the K-means cluster analysis, it can be stated that the exempt variable “circularmeaning” is not determinant. “Circularmeaning” variables connect to the question which tried to detect the knowledge of the respondent in connection to the circular economy concept. There were different options to choose from with the answer “Zero waste” coded as 2 and the rest as 1.

Table 2. ANOVA—table of K-means cluster analysis.

ANOVA						
	Cluster		Error		F	Sig.
	Mean Square	df	Mean Square	df		
biopurchasing	4.959	3	0.629	1180	7.889	0.000
directfromfarmer	329.710	3	1.031	1180	319.669	0.000
frominternet	41.446	3	1.380	1180	30.039	0.000
fromtraditionmarket	248.512	3	1.261	1180	197.148	0.000
fromfarmermarket	340.846	3	1.089	1180	313.003	0.000
ecowrap	31.929	3	0.782	1180	40.844	0.000
avoidfoodwaste	15.274	3	0.267	1180	57.100	0.000
foodwasteto	980.269	3	1.508	1180	650.196	0.000
importantsmallfarm	8.157	3	0.135	1180	60.532	0.000
restaurantlocal	178.115	3	0.974	1180	182.895	0.000
directcontactfarmer	244.309	3	0.997	1180	244.996	0.000
foodtravel	90.762	3	0.931	1180	97.464	0.000
readlabel	118.946	3	1.018	1180	116.814	0.000
origin	195.920	3	0.783	1180	250.129	0.000
fromHungary	154.725	3	0.939	1180	164.749	0.000
fromcircular	2.636	3	0.196	1180	13.442	0.000
circularmeaning	0.024	3	0.162	1180	0.149	0.930
boxsystem	7.436	3	0.212	1180	35.077	0.000

Note: The F tests should be used only for descriptive purposes because the clusters have been chosen to maximize the differences among cases in different clusters. The observed significance levels are not corrected for this and thus cannot be interpreted as tests of the hypothesis that the cluster means are equal.

4.2. Features of the Different Clusters

Some 22% of the examined sample was classified in cluster 1; 25% was classified in cluster 2; 38% was classified in cluster 3, and 15% was classified in cluster 4.

Cluster 1 (C1) members are very interested in the localization and origin of food. They also pay attention to food sales channels and prefer direct contact with farmers. Furthermore, as illustrated in Figure 1 they pay most attention to buying locally produced food stuff. The average age is the highest in this cluster (Figure 2). Most of them live in a town (Figure 3) and have completed college, or they are in pursuit of a university degree. This is the most educated cluster (Figure 4). Their consumption of locally produced food has earned them the “Local patriots” title.

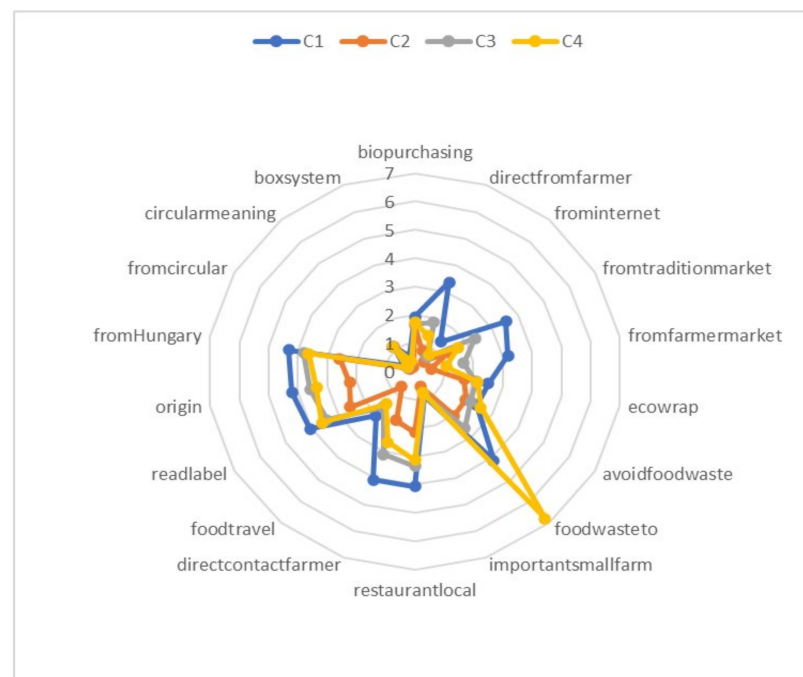


Figure 1. Differences between the different clusters (the average scores of the analyzed variables in the different clusters).

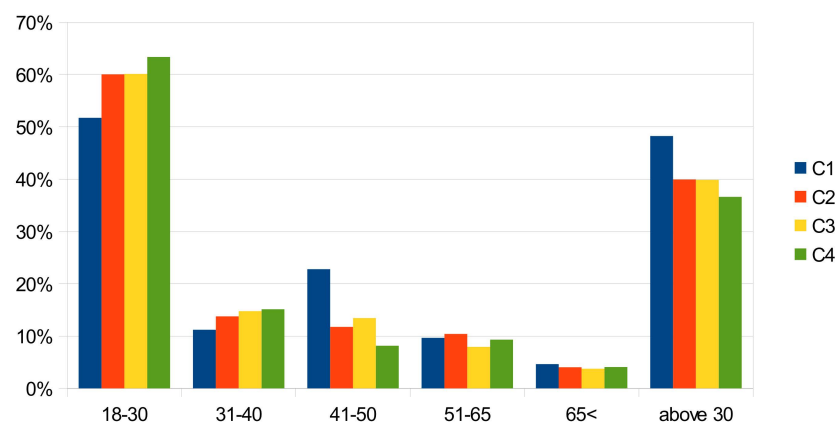


Figure 2. Age distribution in each cluster.

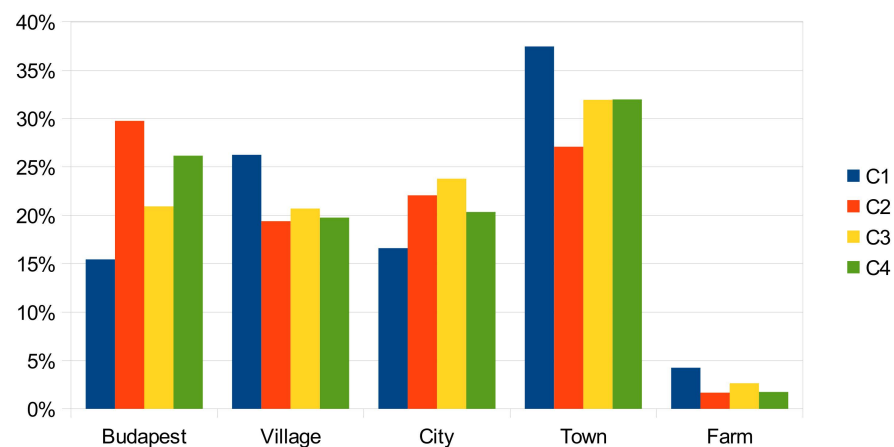


Figure 3. Distribution of residences in each cluster.

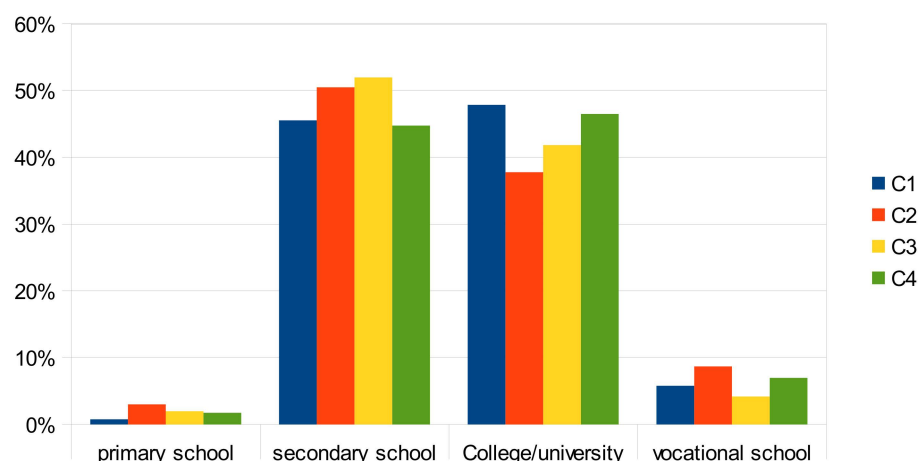


Figure 4. Distribution of qualifications in each cluster.

The members of cluster 2 (C2) are the least interested in the analyzed aspects. They are indifferent about food travels (“foodtravel”) and throw the food in the garbage. They do not even try to avoid it (“avoidfoodwaste”) (Figure 1). The average age of the members of the 2nd cluster (C2) is younger than that of the members of the 1st cluster (Figure 2). Most of them live in Budapest (Figure 3) and have graduated from secondary school (Figure 4). The proportion of people with higher education is the smallest here (Figure 4), while vocational training graduates are represented in this cluster in the largest proportion. Employees are also represented in cluster 2 in the largest proportion (Figure 5). (They are the “Non-Sensitive Ones”).

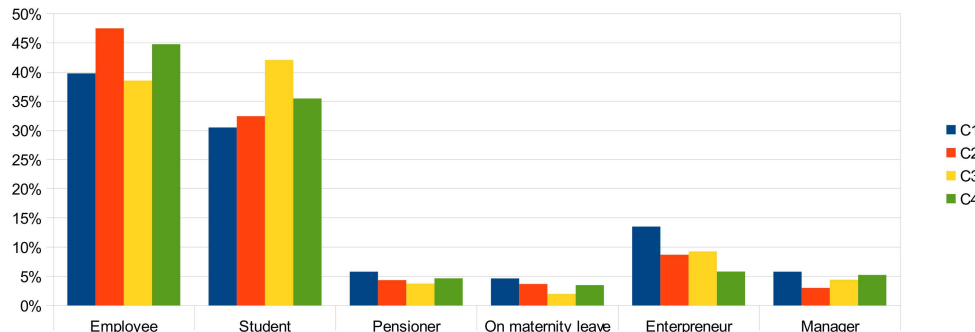


Figure 5. The distribution of occupations in each cluster.

Cluster 3 members are the second most interested ones in contacting directly farmers (“directcontactfarmer”), the origin of the food and traditional short food supply chains. They also make sure that the restaurant they visit buys local ingredients (“restaurantlocal”). They probably link the quality to the source of supply. Most of them finished secondary school, and they are students (Figures 4 and 5). Most of them live in town (Figure 3). (They are “Quality oriented ones”).

The members of cluster 4 are the most conscious in the field of utilization of food waste (“foodwasteto”, “avoidfoodwaste”). In terms of the other indicators, it is the second or third most engaged cluster. It is also very important that the members of the cluster identify the circular economy with zero waste production in most cases. Most of them have completed or are currently studying at a higher educational institution (Figure 4). The cluster’s members are the youngest of the four (Figure 2). (They are the “Waste conscious”).

In summary, it can be said that the most qualified cluster is C1 (Figure 4), while the wealthiest is C4 (Figure 6). Most of the members of cluster C1 live in rural areas, and the most unskilled are members of cluster C2 (Figures 2 and 3).

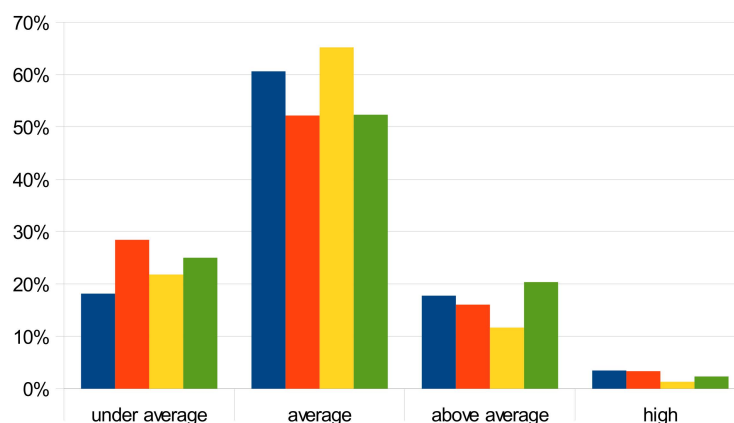


Figure 6. Distribution of income in the different clusters.

By plotting the average values of the clusters along the main components as dimensions the differences can be clearly seen (Figure 7).

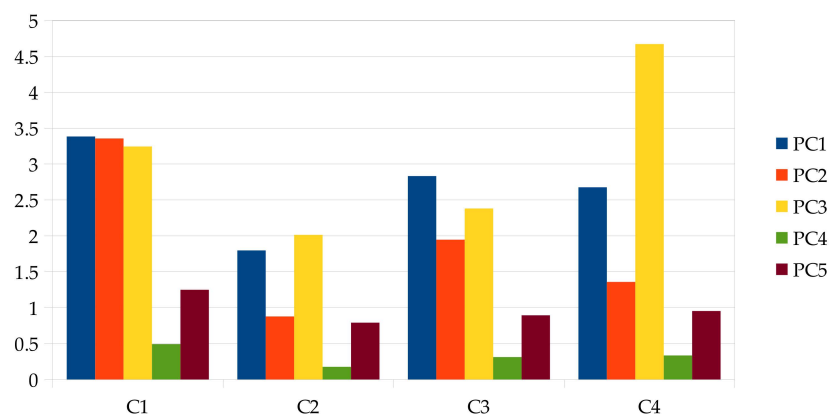


Figure 7. Differences between the clusters according to the average scores of the PCs.

In order to do a complete statistical analysis, the literature [39] considers it important to present the effect of the variables omitted from the factor analysis. Accordingly, the two variables, namely bio food purchasing frequency and environmentally friendly food wrapping (Figure 8), were not included among the main components, although their values and differences between clusters are also interesting.

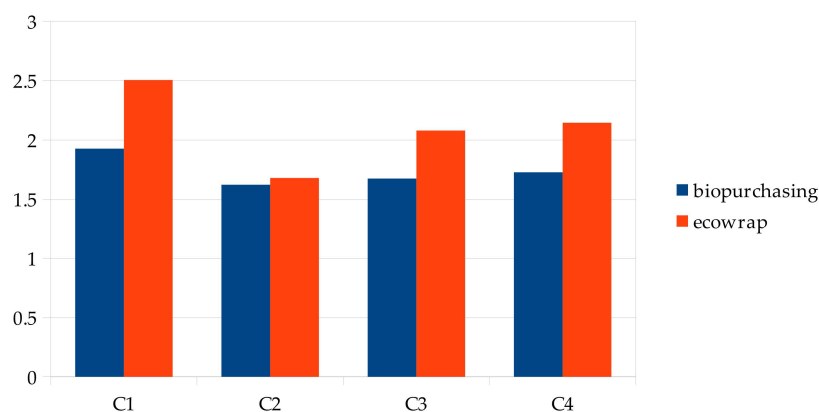


Figure 8. The frequencies of bio food consumption per week and the importance of environmentally friendly food wrappings in the different clusters (explanation in Appendix A). Meaning of the labels in the figure: “biopurchasing”—frequency of bio food purchasing; “ecowrap”—importance of environmentally friendly packaging.

The most conscious cluster (C1) pays the most attention to the environmentally friendly wrapping (ecowrap), and they are followed by cluster 4 (C4), Which is the “Waste conscious” cluster.

According to Figure 9, the members of the C4 segment identified the circular economy with zero food waste, which was the concept closest to the essence of the circular economy among those given.

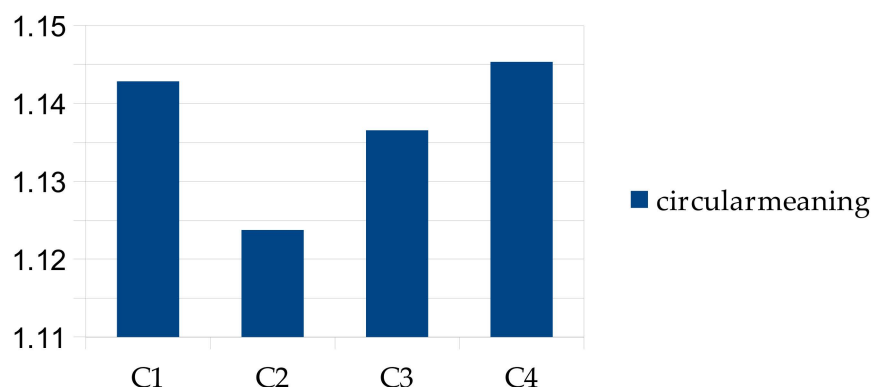


Figure 9. Knowledge about circular economy. Note: “circularmeaning” means what the circular economy means to the consumer. Respondents had to choose between the following meanings: Zero waste production; Sharing economy; Small ecological footprint; Environmental Protection; Low CO₂ emissions; Recycling; Social responsibility; A sustainable future. They could only choose one, and zero waste was coded as 2 while the others were coded as 1.

To support the reliability of the groups obtained during the K-means procedure, the results were compared with the clusters obtained in the case of the Ward method (hierarchical cluster analysis). The previous clusters can be identified in this way also (Figure 10).

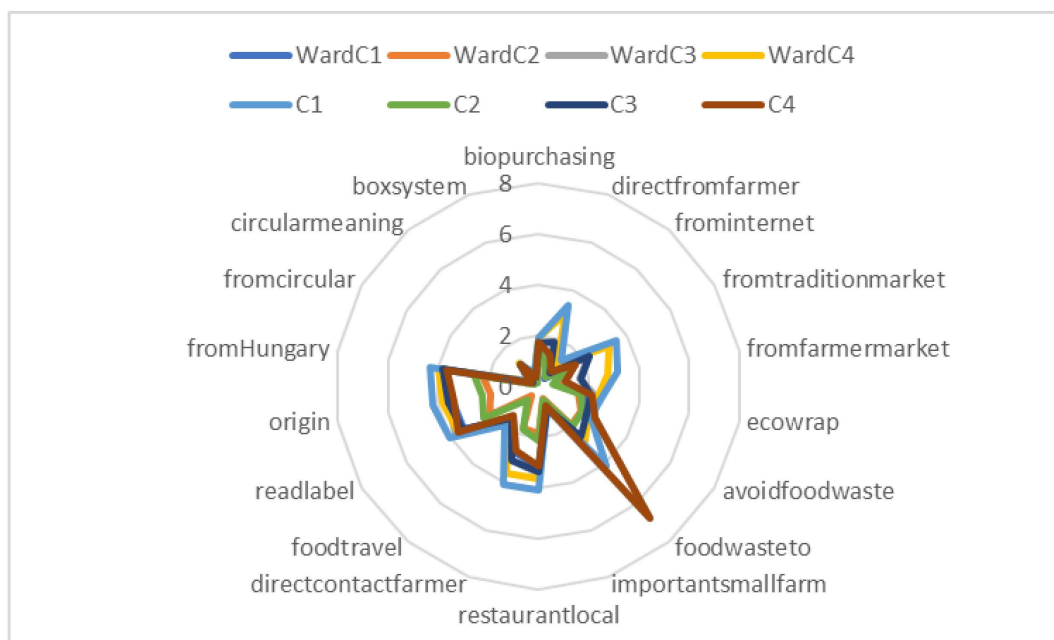


Figure 10. Differences between the Ward method clusters and the K means clusters.

The clusters resulting from the Ward method similar to the previous ones and Ward C1 are K-means C3; Ward C2 is K-means C2; Ward C3 is K-means C4, and Ward C4 is K-means C1.

The demographic characteristics for each cluster were also very similar (Figures 11–13).

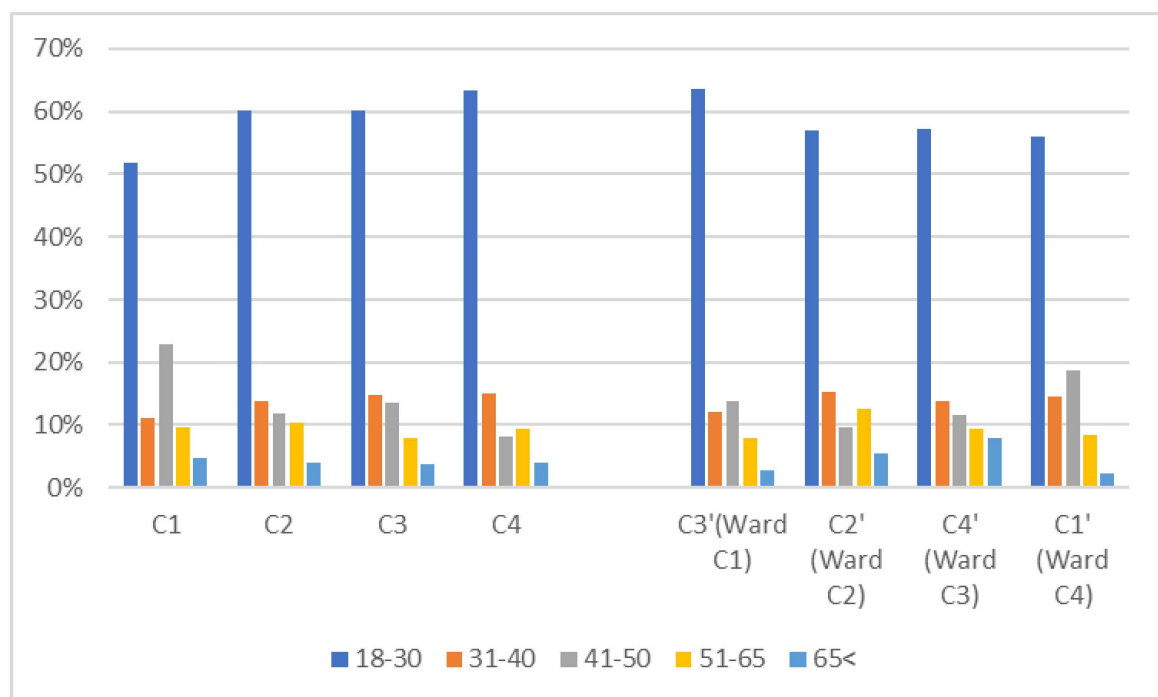


Figure 11. Age distribution in the Ward method clusters and the K means clusters.

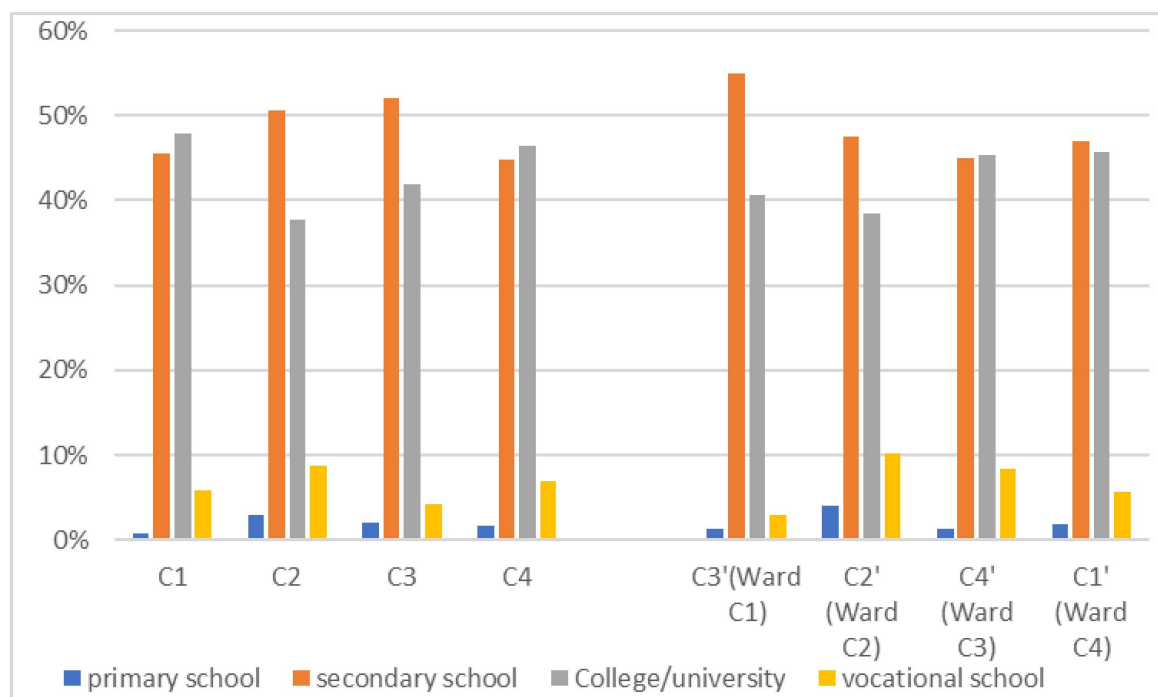


Figure 12. Distribution of qualification in the Ward method clusters and the K means clusters.

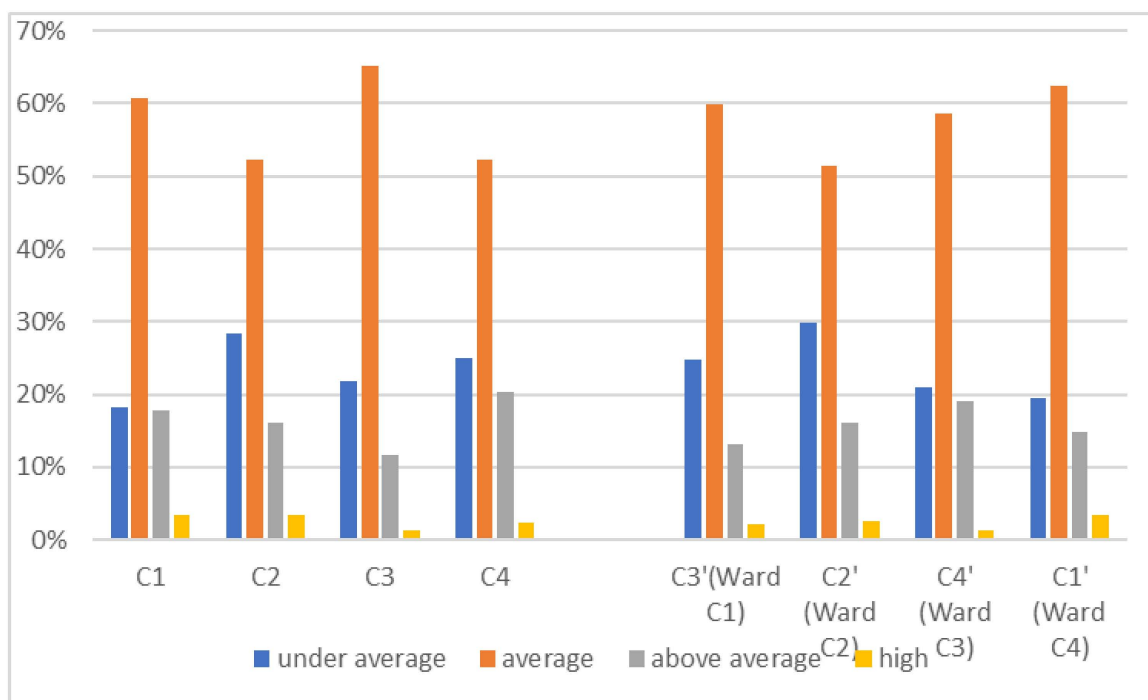


Figure 13. Distribution of income in the Ward method clusters and the K means clusters.

5. Discussion

The frequency of buying organic food and paying attention to environmentally friendly packaging have little effect on the main explanatory factors of conscious food consumption habits. The reason for this is the trust problem related to the labeling of organic foods and the fact that some basic foods may have few environmentally friendly alternatives. It should be also mentioned that according to Bussels et al. (2022) consumers stated that it was environmentally beneficial to have the minimum amount of packaging, but on the other hand they mentioned that to some extent packaging was necessary to protect the food products [32]. Another interesting finding is that food consumers know that organic food production is not necessarily more sustainable than conventional consumption, as organic food production requires more land [43].

The results of the empirical investigation show that the biggest differences among the separated clusters can be detected in the case of PC2 and PC3. So, in variables related to habits using direct sale forms (Short Food Supply Chains) and food waste, the cluster C4 is outstanding in avoiding food waste or using it alternatively (e.g., as a dog food or compost ingredients). It is even more interesting as most consumers are not aware of the fact that they produce food waste. They consider their food wastes “an inevitable consequence of consumption” and thus admissible [44]. In this relation, the food waste production can be considered “a socially acceptable process” since the consumers are not conscious of their waste quantity and also their behavior is imperceptible to their environment, thus not criticized [45]. A study by Elshaer et al. [46] adopted a theory of planned behavior (TPB) to examine customers’ intentions to generate food waste. The study showed that determinants of TPB fully mediate the link between religiosity and food waste intention. Additionally, they partially mediate the link between the food consumption culture and the food waste intention.

The authors found that the members of the C1 and C4 clusters are the most qualified or are currently studying. Some researchers recommend education, e.g., in the field of food planning and preparation [47], or labeling [48] in order to reduce food waste. Moreover, these authors also emphasize the significant role of comprehensible communication about problems affecting the environment, highlighting food waste. Surprisingly, if people can be convinced through increasing environmental awareness and education to do something

good for the environment (e.g., composting) and make them feel this, then there is no need to strive to reduce food waste [44].

According to the results of the survey, food travel counts in one principal component along with the importance of using local raw materials in restaurants, as well as the importance of food from Hungary and small food producers, which can explain that the purchase of local foods is significant to consumers from an environmental point of view.

It is also a question of why customers avoid food waste. Graham-Rowe et al. (2014) [49] note in their study that the environmental effects are not often considered a compelling reason to reduce food waste, which is also claimed by WRAP (2006) [50]. Contrary to this, Doron (2013) states that people are mostly encouraged to reduce food waste by concern for the environment instead of saving money [51]. Our findings underpin this latter one because the membership of the cluster which is very conscious in this area (C4) is in a good financial situation.

The connection between environmental awareness and attitudes towards food waste can be questioned. The members of the C1 cluster are also aware of the environmental effects of their food consumption, but they are less prepared than the members of the C4 cluster when it comes to the utilization of food waste. The relationship between information and knowledge or between information and awareness regarding the food waste is not clearly proven. Researchers also dispute the impact of increasing consumer awareness of food waste. According to some studies (e.g., [50]), increasing awareness is a way to change food wasting behaviors by generating responsibility and guilt [52,53]. Certain authors conclude that higher awareness does not automatically result in food waste reduction, which can be explained by the fact that it cannot change the processes causing food waste in practice [54]. Maybe this explains the lower average score given to this variable by members of cluster C1. Due to the intentions–behavior gap [55,56], the good intentions and the knowledge acquired do not absolutely guarantee their appearance in costumers' daily routines [26]. As stated by Stefan et al. (2013), morally aware individuals can intend not to waste food that does not necessarily influence their behavior and in consequence the food waste [57].

Concerning the results related to clusters C2 and C3, it can be concluded that in the case of cluster C2 the most important limitation is education, while in the case of cluster C3 the income situation represents an obstacle in the development and enforcement of environmental awareness. A generally accepted approach is to raise awareness in schools or through public campaigns by providing information to consumers about food preparation, storage, etc. [58]. However, the information transmitted in such cases cannot be related to the intended behavior, as it appears in an irrelevant context.

Actors in the food supply chain in general, including consumers, as mentioned above, are often unaware of the food waste they produce and underestimate its amount, given that, by supplying information to the actors, they can be encouraged to reduce the food waste [15]. At the same time, Porpino et al. (2016) claimed that the information is not sufficient for implementation of the knowledge into consumers' everyday routines and practices [59]. Obstacles of different aspects (environmental, institutional and cultural), which in fact impede the sustainable and healthy response of individuals, could hinder food waste messages even though the knowledge exists [60]. Lim et al. (2017) point out that although one of the ways to reduce food waste is to improve consumer perception and knowledge (e.g., refrigerator use, planning meals, making lists., etc.), this is not necessarily effective [61]. However, it should be also added that the degree of awareness, understanding and assimilation of the ethical attitudes related to food waste can lead to long-term behavioral changes, bringing about a transition to desirable, feasible, viable, sustainable and responsible behavior [62].

6. Limitations

The research was carried out on a small non-representative sample, so no exact behavioral patterns can be deduced from the composition of the respondents. The main limitation of the generalization of the results of the study is that the younger generation

(18–30 years old) is overrepresented, which stems from the sampling method. Our study does not cover all possible topics as it is limited to the factors we consider important. The research carried out does not represent the consumer habits of all food consumers living in Hungary; however, the results identify trends in the consumer community.

The present study can serve as a starting point for further investigations, since the variables related to the values of the circular economy were taken into account without the need for completeness.

7. Conclusions

The value of the study is that a narrow segment could be defined whose members are very young and highly educated compared to the other segments, and they place a great emphasis on the utilization of food waste. They also identified the concept of the circular economy with waste-free production to the greatest extent, compared to the members of the other clusters. In the future, they can demonstrate the consumer behavior and attitude necessary for the implementation of the circular economy.

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Appendix A

The investigated questions of the survey questionnaire and the related encoding.

Category of “the local and short food supply chains”:

How important is it to you that the restaurant you visit uses local ingredients (“restaurantlocal”)? 1–5, 1 is not important, 5 is very important

How important is direct contact with the producer to you (“directcontactfarmer”)? Please mark 1–5! 1 is not important, 5 is very important

How often do you buy from a producer, directly from the farm (“directfromfarmer”)? Please mark it with the numbers below!

0—never; 1—several times a year; 2—months; 3—several times a month; 4—weekly; 5—several times a week

How often do you buy food online (“frominternet”)? Please mark it with the numbers below!

0—never; 1—several times a year; 2—months; 3—several times a month; 4—weekly; 5—several times a week

How often do you buy food at a traditional market (“fromtraditionmarket”)? Please mark it with the numbers below!

0—never; 1—several times a year; 2—months; 3—several times a month; 4—weekly; 5—several times a week

How often do you buy food at a farmer’s market (“fromfarmermarket”)? (where only producers can sell) Please mark with the numbers below!

0—never; 1—several times a year; 2—months; 3—several times a month; 4—weekly; 5—several times a week

Category of “food waste”

How important do you think it is to avoid food waste (“avoidfoodwaste”)? 1–3

I don't have time for this in this fast-paced world.—1
 I consider it important, but I cannot avoid it.—2
 I consider it important and avoid its occurrence.—3.
 What do you do with food waste ("foodwasteto")? Multiple answers can be checked! 1–7
 I throw it in the trash.—1
 I mainly throw it and partially compost it or give it to an animal.—2
 I give it to an animal.—3
 Compost.—4
 Compost and animal.—5
 I try to avoid it. I take some to the local composter or to my colleague's dog.—6
 I avoid its occurrence.—7
 Category of "ethics"
 Do you think it is important to purchase food from small producers ("smallfarmer")?
 No—0, Yes—1
 Category of "labelling and information"
 How important do you think it is to read the food label, research the information about the food ("readlabel")? Please enter 1–5, where 1—not important, 5—very important!
 Category of "origin"
 To what extent do you consider the origin of food in your purchasing decisions ("origin")? Please enter 1–5, where 1—not important, 5—very important
 To what extent do you take into account the fact that the food comes from Hungary in your purchasing decisions ("fromhun")? Please enter it from 1 to 5, where 1 is not important, 5 is very important
 Category of "knowledge"
 Have you ever heard of the circular economy ("fromcircular")? No—0, Yes—1
 Are you familiar with the "box system" (selected foods that can be ordered directly from the producer at a given price) ("boxsystem")? No—0, Yes—1
 Category of "package"
 Variables "ecowrap" belongs to the question: "Do you care about environmentally friendly packaging?" and the encoding of the answers was the following:
 (a) Unfortunately, I cannot pay attention to this.—1
 (b) I take a shopping bag and other storage containers with me (e.g., jug for milk) and only buy the product if its packaging is environmentally friendly (e.g., biodegradable).—4
 (c) I carry a shopping bag and other storage containers with me, but I will buy the product even if its packaging is not environmentally friendly (e.g., milk in a plastic bottle).—2
 (d) I do not buy food products wrapped in plastic wrap.—3
 Category of "organic"
 The frequency of bio food purchasing was measured by the following scores ("biopurchasing"):
 Never—0
 Occasionally—1
 Rarely—2
 Often—3
 Always—4.
 Category of "food miles"
 Is it important to you how far the food "travels"? ("foodtravel")
 Yes, I pay attention to buying locally produced products.—3
 No, I didn't think of that.—0
 Unfortunately, in my current life situation, I cannot pay attention to this.—1
 I try to pay attention to this, but I don't always succeed.—2

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