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SUSTAINABLE CONSUMER ACTIVITIES OF VARNA HOUSEHOLDS

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Abstract:

The purpose of this article is to present the process for developing individual indexes of sustainable household actions in several thematic areas of sustainable consumption. These areas are energy efficiency, electricity and water consumption, food consumption, transport use and product disposal. Based on these individual indexes, a proposal for the creation of an aggregated individual household index for sustainable consumption is discussed. Based on the developed indexes, a segmentation of households into three basic segments is proposed. The proposed indexes are designed based on the results of a survey conducted among 342 households from the city of Varna, Bulgaria in the months of January - April 2022. The proposed indexes, after adaptation, can be used as a tool for self-assessment of sustainable household consumption in different cities and countries. In this sense, as a result of their implementation, it is expected that the motivation of households towards inclusion in sustainable consumption will be increased.

Key words: *Sustainable consumer activities, sustainability goals, indexes*

1. Introduction

According to the European Union, "2011-2020 was the warmest decade recorded, with global average temperature reaching 1.1°C above pre-industrial levels in 2019. Human-induced global warming is presently increasing at a rate of 0.2°C per decade'' (Causes of climate change, 2022). The main reasons for these trends are the burning of coal, oil and gas, deforestation, increased livestock farming, and the release of fluorinated gases. On the surface, the activities described are a consequence of the functioning of the industry, but in practice, all these activities are aimed at satisfying end-user demand. In this sense, consumers determine the dynamics and the extent of the impact of industrial production on the environment and, if we accept this argument, on climate change. This argument is shared by a considerable number of people and institutions, which in turn

makes the study of sustainable consumer action extremely important to achieve sustainability goals.

It is common in the scientific literature to consider the achievement of the SDGs in the three main areas of sustainability – social, economic and environmental (Ukko et al., 2019). Household consumption is highlighted as having a significant role to play in achieving these goals, covering five areas of sustainability – food, mobility, housing, household goods, and appliances (Sala & Castellani, 2019). A large part of the research on the ecological footprint left by household consumption is related to energy consumption for heating and cooling (Han & Wei, 2021). In this regard, it is household energy consumption and emissions from private vehicle travel that have been identified as the two most serious contributors to climate change and global warming (Hu et al., 2022). On the other hand, there are trends towards changing consumer behavior related to the use of energy saving products as part of attempts to reduce the ecological footprint of household consumption (Zainudin et al., 2022). This, in turn, puts the phenomenon of increasingly popular online calculators for assessing the environmental footprint of households in the context of conscious attempts to transform consumer behavior into sustainable behavior. In this context, the use of household environmental footprint indexes is interpreted as a tool to promote sustainable behavior (Franz & Papyrakis, 2011).

Of course, it is not only household activities related to mobility and the use of energy-saving appliances and thermal insulation that falls under the focus of researchers. The environmental footprint that households leave through their consumption of food and drink is also under scrutiny. For example, indexes are being developed to determine the environmental sustainability of food consumption at the household level (Panzone et al., 2013). In this direction, it should also be underlined the impact on the purchase decision of sustainable products of the additional costs in their production, reflected in the higher acquisition cost (Held & Haubach, 2017). In this sense, the additional costs that households incur to purchase sustainable products can be seen as directly linked to their motivation to offset the negative environmental footprint they leave through the choice and consumption of food products. Moreover, when considering consumer choice of sustainable products, the influence of egocentric, in addition to ecological, motives must also be taken into account - especially as far as the populations of Eastern European countries are concerned (Kraleva et al., 2020).

Another factor strongly influencing the sustainable behavior of households is the level of urbanization of the area. Such conclusions are reached by the research on sustainable household consumption in three settlements in Bulgaria – Sofia, Varna and Svishtov – cities with different levels of urbanization and social life: the capital of the country, the third largest city with a developed economy in the tourism and services sector and a small city with a low level of industrialization. The study shows the existence of differences in sustainable household behavior in these cities, which are determined by two main factors - the level of urbanization and the socio-demographic characteristics of households (Krastevich & Smokova, 2021). At the same time, the results show that these factors do not have an impact on household profiling, unlike factors such as „socially fair consumption, followed by environmentally friendly consumption and economically reasonable consumption, as well as waste sorting “.

An important stage in exploring sustainable household consumption, seen as a rational and conscious attempt to reduce the ecological footprint of shopping and resource use, is to identify the main areas where households generate an ecological footprint. On this basis, it is proposed to apply the Household Sustainable Consumption Index (HSCI), which can be used to examine differences in sustainable household consumption across EU countries (Bartolj et al., 2018). The study shows the existence of a strong relationship between GDP and sustainable consumption of households in an analysis of data from 17 variables involved in the generation of the index, covering the areas of education, health care, food and beverage consumption, financial status of the household, and actions related to environmental protection. It is interesting to note that, when carrying out a comparative analysis of secondary consumption data across the 28 EU countries, Bulgaria and Romania occupy the last two places when assessing household behavior using this index.

In order to achieve sustainable development of society, a complex approach is needed, as can be seen in the defined 17 SGDs. While each of these is related to a greater or lesser extent to the activities of individuals, five of them appear to be directly related to the role of households in achieving sustainability goals. These are Goals 3, 6, 7, 11 and 12. Goal 3 is related to striving for a healthy lifestyle, which is influenced by the already discussed household actions related to food choices and modes of transportation. Goals 6 and 7 relate to the sustainable management of the consumption of water and energy resources. Goal 11 is about making cities a sustainable place to live, and Goal 12 covers choosing products produced in a sustainable way. The existence of a consensus for the achievement of the highlighted goals, both at the level of world institutions and organizations, such as the UN and the EU, as well as at the level of societies or even individual households, turns SGDs into a tool for achieving sustainability.

According to the authors, sustainability is seen as a unifying characteristic of society's development towards which society aspires, and SGDs - as benchmarks for such development. In this sense, highlighting the goals to which individuals can make the greatest contribution is an important task, because these goals can be set as benchmarks for the sustainable actions of households. In this sense, SGDs are seen as steps towards achieving sustainability, including the sustainable actions of households and individuals.

Based on an extensive literature review of publications related to sustainable household consumption, Zhelev et all identify three main areas of sustainable consumption - Housing, Food and Transportation (Jelev et al., 2022). The analysis of the literature argues for the authors' construction of the Composite Behavioral Index (CBI) as a contribution to filling the research gap to date. This index is aggregated from four indexes measuring household actions related to (1) provision of housing with sustainable consumption conditions, (2) water and electricity use, (3) food choices and purchases, and (4) transportation means used. Other research on household sustainable consumption has shown that, in addition to actions taken at the individual level, it is also necessary to consider factors related to households' knowledge of sustainable consumption (Krisciunas & Cizauskaite-Butkaliuk, 2014) and their intentions and attitudes (Silva et al., 2017) towards achieving sustainability goals through individual actions.

Based on the literature review, two more important points can be made related to the study of sustainable household activities:

Sustainable household behavior can be measured and compared at the individual level through the collection and analysis of data covering four basic areas – (1) household demographic characteristics, (2) sustainable activities related to housing, food, mobility, and product disposal, (3) knowledge about sustainable consumption, and (4) values and attitudes about sustainable consumption. The collection and analysis of these data allow the profiling of households at the settlement level into segments that can be targeted by organizations' policies and firms' marketing efforts to achieve sustainability goals.

As a widespread practice, the use of indexes and, based on them, calculators to measure sustainable consumption plays an important role in disseminating and acquiring knowledge on sustainable consumption and in motivating households to use actions related to the SDGs in their daily lives. In this respect, it should be highlighted that it is common practice to use the values of separate indices related to the measurement of the factors that determine sustainable behavior when creating a General Sustainable Consumption Index.

2. Methods

The city of Varna is the maritime capital of Bulgaria and the third largest city in the country. According to the latest census data, the population is 310,664 people (NSI, 2021), with approximately 115,000 households. For the purposes of this study, data from 347 households was obtained through computer-assisted personal interviews. A quota sample was used based on quotas for the number of household members and the age of the head of the household. The information is representative of Varna households with a standard error of 4.5% and a 90% confidence level. The survey is conducted between January and April 2022.

The design of the indexes and the development of the segments described in this article are carried out on the basis of data collected by the basic research project "Sustainable consumption in urban environments – regional differences". The project is financed by the Scientific Research Fund of Bulgaria – 2019 and continues until the end of 2023. The project includes a study of the sustainable consumption of households in three Bulgarian cities - Varna, Sofia and Svishtov and is carried out by teams from three universities: University of Economics Varna , University of National and World Economy - Sofia and Economic Academy "D. A. Tsenov" - Svishtov.

As part of the work on the project, a research tool is being developed, which contains 220 items grouped into 3 main blocks. Block 1 refers to "Actions for sustainable consumption" and was developed by the University of National and World Economy team (Jelev, Mladenova and Stoimenova, 2022). Block 2 - "Knowledge for sustainable consumption" was developed by the team of the University of Economics Varna, and block 3 - "Attitudes for sustainable consumption" was developed by the team of the Economic Academy "D. A. Tsenov" - Svishtov. In this article, only data from the indicators in Block 1 "Actions for sustainable consumption" are used. In the article, the indicators are grouped by following themes: housing, food, mobility and product release. The generation of the

topics and items in the "Actions" block is based on the results of a previously conducted literature review (Jelev et al., 2022).

The Housing block contains indicators on (1) the size and type of dwelling in which the household lives; (2) the type of heating used; (3) the use of appliances, devices, materials and items that are energy or resource efficient, or that use renewable energy sources; (4) everyday actions related to resource and energy saving. Five of the indicators are single-item, measured in ratio and nominal scales, and two are multi-item, measured in dichotomous scales.

The Food block contains variables for: (1) basic actions related to eating, purchase of certain foods, food preparation, stock keeping, shopping patterns; (2) main reasons for food waste. One indicator is a multi-item, dichotomous type and the other is a single-item, measured in a nominal scale.

The Mobility block contains indicators on (1) main actions related to urban mobility, mode of use of personal vehicles, preferred mode of urban mobility; (2) mode of disposal of the last car no longer used by the household; (3) owned vehicles. Two of the variables are single-item variables measured on nominal scales, and one is a multi-item dichotomous variable.

The Product Disposal (Recycling) Block contains indicators for (1) ways of disposing of e-waste; (2) ways of disposing of bulky waste; (3) ways of disposing of dead batteries; (4) ways of disposing of hazardous waste; (5) practicing separate waste collection. One of the variables is a single-item variable measured on a nominal scale, and four are multi-item dichotomous variable.

For each household, individual indexes are calculated for each of the observed sustainable action indicator blocks (see Table 1).

For each block, only indicators that are undoubtedly related specifically to actions of sustainable consumption are selected (Table 2). From the "Housing" block, two variables are involved in the calculation of the index. These are the variable "*the use of appliances, devices, materials and items that are energy or resource efficient, or that use renewable energy sources*" (items with codes in the questionnaire from 14_1 to 14_10) and the variable "*everyday actions related to resource and energy saving* " (items with questionnaire codes from 16_1 to 16_13).

The variables involved in the calculation of the SAIndex (Food) are related to the indicator "*basic actions related to eating, purchase of certain foods, food preparation, stock keeping, shopping patterns*" (items with codes in the questionnaire from 17_1 to 17_18). Items from the next variable "*main reasons for food waste*" are not selected here, because regardless of what the reason for food waste is, a natural aspiration of rational behavior is to reduce this action as much as possible. In this sense, the specific variable can be used in subsequent profiling of individual groups of households.

From the "Mobility" block, items from two variables are involved in the calculation of the index. These are the variable "*main actions related to urban mobility, mode of use of personal vehicles, preferred mode of urban mobility*" (items with codes in the questionnaire from 20_1 to 20_8) and from the variable "*mode of disposal of the last car no longer used by the household*" only one response on actions related to sustainable consumption is

included (this indicator is single-point and respondents can indicate only one response - with a code in questionnaire 21).

Five variable items are involved in the calculation of the SAIndex (Recycling). These are from the variable "*ways of disposing of e-waste*" all items related to sustainable practices (items with codes in the questionnaire from 22_4 to 22_8); from the variable "*ways of disposing of bulky waste*" only items related to sustainable practices (items with codes in the questionnaire from 23_3 to 23_5, 23_7 to 23_10 and 23_12); from the variable "*ways of disposing of dead batteries*" only items related to sustainable practices (items with codes in the questionnaire of 24_1, 24_2 and 24_4); from the variable "*ways of disposing of hazardous waste*" only one item is selected (with code in the questionnaire 25_4) and from the variable "practicing separate waste collection" only an answer for practicing separate waste collection and disposal was reported (this indicator is single-item and respondents can indicate only one answer - code in the questionnaire 26).

Each index is calculated as follows:

$$SAIndex(Topic)i = \frac{\sum_1^n SAItems(Topic)ij}{n} \quad \text{Equation (1)}$$

Where:

$SAIndex(Topic)i$	Sustainable activities index by topic for the i-th household
$SAItems(Topic)ij$	Response by the i-th household to the j-th item in each topic
n	Number of items in the topic

Table 1. *Sustainable activities index by topic*

Symbol	Sustainable activities index by topic
SAIndex(Housing)	Sustainable Activities Index on Housing
SAIndex(Food)	Sustainable Activities Index on Food
SAIndex(Mobility)	Sustainable Activities Index on Mobility
SAIndex(Recycling)	Sustainable Activities Index on Recycling

Source: Own research

Households are awarded 1 point for each item in the relevant topic (Jelev et al., 2022). All the scores for each topic are summed, and the total score is divided by the number of items selected in the topic. The Sustainable Activities Index for Housing is calculated from 23 points, the Sustainable Activities Index for Food from 18 points, the Sustainable Activities Index for Mobility from 9 points, and the Sustainable Activities Index for Product Disposal from 18 points (see Table 2).

Table 2. *Items included in the calculation of the sustainable activity indexes*

Symbol	Name
Housing	
14_1	Own appliances that are energy and water efficient
14_2	Presence of appliances using renewable energy

14_3	Energy-saving cooking and food storage facilities
14_4	Presence of tap water cost reduction devices
14_5	Availability of appliances that have a self-regulator for the amount of water, according to the work performed
14_6	Availability of energy saving lighting
14_7	Presence of solar panels to heat water or generate electricity
14_8	Presence of heat insulation on the walls or floor
14_9	Presence of aluminum, PVC or wooden double-glazed windows
14_10	Presence of external plasters or building cladding
16_1	We try not to leave lights on if there is no one on the premises
16_2	We try not to leave the TV on when no one is in the room
16_3	We try not to leave the computer on for long without anyone using it
16_4	We try to leave the windows open for long periods when the heating is running
16_5	We try not to keep the air temperature unreasonably high in winter (from 22 degrees upwards)
16_6	We try to keep the water running while brushing our teeth with toothpaste
16_7	We try not to run a washing machine full of clothes
16_8	We strive not to neglect the use of night power
16_9	We strive to let the shower run and the soaping feast
16_10	We aim not to use washing machine programmes with very high temperature
16_11	We try not to leave the water running while washing the dishes and utensils with detergent
16_12	We try not to run the dishwasher without dishes and utensils full
16_13	We try not to use the bath every time we bathe
Food	
17_1	We try to consume more organic food, certified and commercially available (without artificial additives, chemical preservatives, colors, flavors, genetically modified organisms, antibiotics, hormones and other unnatural ingredients).
17_2	We try to buy more food directly from the producer
17_3	We try to consume more locally produced food (produced in Bulgaria)
17_4	We try to consume foods and products (fruits, vegetables, meat and meat products, dairy products, etc.) of our own production (personally or from relatives)
17_5	We try to consume more home cooked food
17_6	We aim to consume more food in biodegradable and/or recyclable packaging
17_7	We aim to consume mostly seasonal fruits and vegetables
17_8	We try to avoid the use of convenience and semi-prepared foods
17_9	We try to avoid the daily use of meat
17_10	We aim to consume more fish and seafood
17_11	We aim to consume more fruit and vegetables
17_12	We aim to consume more cereals and legumes

17_13	We try to pay attention to the type of preservatives (E's) when buying food
17_14	Aim to use reusable bags more regularly when buying food
17_15	We try not to keep unnecessary stocks of food
17_16	Aim to reuse plastic shopping bags
17_17	Avoid using plastic shopping bags
17_18	We strive to convert biodegradable waste into biofertilizer (composting)
Mobility	
20_1	We try to avoid travelling by car alone (one person)
20_2	We prefer to travel mainly by public transport
20_3	We try to get around more by bicycle
20_4	We try to get around more often on foot
20_5	We get around mainly by motorcycle or scooter
20_6	When shopping for groceries and personal care and home care products, we visit outlets close to home to avoid using additional transportation
20_7	We are striving to use the private car less and less to get around our locality.
20_8	We aim to avoid the use of the private car when travelling to central parts of our locality
21	The last car disposed of by the household was sold to a salvage yard or disassembled and sold for parts or a government recycling program or disassembled and turned in for parts recycling
Products disposal	
22_4	When disposing of old household appliances, we use the services of a company to transport them from the home
22_5	When disposing of old household appliances, we donate them to people in need
22_6	When we dispose of old electrical household appliances, we leave them with the church for them to pass on to those in need
22_7	When we dispose of old electrical household appliances, we give them for recycling
22_8	When we dispose of old household appliances, we sell them
23_3	When disposing of bulky waste (sofas, sofas, armchairs, tables, chairs, sanitary ware, carpets, linoleum, boards), we leave them by the bins
23_4	When we dispose of bulky waste, we donate it to people in need
23_5	When we dispose of bulky waste, we leave it for the church to give to those in need
23_7	When we dispose of bulky waste, we sell it
23_8	When we dispose of bulky waste, we hand it over for recycling
23_9	When we dispose of bulky waste, we use the services of a company to transport it from the home
23_10	When disposing of bulky waste, take it to the village
23_12	When disposing of bulky waste, we dismantle it and use the parts for something else
24_1	We don't use batteries

24_2	We only use rechargeable (rechargeable) batteries
24_4	We leave spent batteries in special bins in shops or other public buildings
25_4	When disposing of hazardous waste, we use the services of a company to transport it away from home
26	We practice separate collection and disposal of waste

Source: Own research

Several single-item variables are recoded to make them suitable for index calculation.

Index values range between 0 and 1. The indexes indicate how much of the observed activities are practiced or shared by households. Values close to zero indicate that the household performs almost no activities of the corresponding theme. Values close to 1 indicate that almost all activities of the relevant topic are performed or shared by the household. Households are categorized by index values (see Table 3).

Table 3. Individual Sustainable Activity Index thresholds by topic and household category

Interval	Household category
0	**no action** on sustainable consumption on the topic
0,001 – 0,300	**low** number of sustainable consumption actions on the topic
0,301 – 0,500	**low to moderate** number of sustainable consumption actions on the topic
0,501 – 0,700	**moderate to high** number of sustainable consumption actions on the topic
0,701 – 1,000	**high** number of sustainable consumption actions on the topic

Source: Own research

For each household, an overall sustainable consumption index (SCIndex) of the type:

$$SCIndexi = \frac{SAIndex(Housing)i + SAIndex(Food)i + SAIndex(Mobility)i + SAIndex(Recycling)i}{4} \quad \text{Equation 2}$$

The values of the general index range between 0 and 1. The index indicates what proportion of all observed activities are practiced or shared by households. Values close to zero indicate that the household demonstrates a low level of sustainable consumption. Values close to 1 indicate that the household demonstrates a high level of sustainable consumption. Households are categorized by index value (see Table 4).

Table 4. Sustainable consumption index thresholds and household categories

Interval	Household category
0.000 - 0.300	**low** level of sustainable consumption
0,301 – 0,500	**low to medium** level of sustainable consumption
0,501 – 0,700	**moderate to high** level of sustainable consumption
0,701 – 1,000	**high** level of sustainable consumption

Source: Own research

A comparative analysis of Varna households by sustainable activity index by topic and by sustainable consumption index is carried out. This shows one of the possible applications of the indices. The second possibility for the application of the indexes is demonstrated by segmenting households by index. For this purpose, a two-step clustering analysis is performed. At the first level, hierarchical clustering is performed to determine the number of cluster groups. The method of between-groups linkage is used with the applied distance metric of Squared Euclidean Distance. At this stage, it is determined that a reasonable number of cluster groups, in which sufficient groups of households are accumulated, is 3. No other previous research is identified to perform additional validation of the decision for the possible number of clusters. At the second level, a K-means clustering is performed to determine the cluster centers, from where the shape of each of the identified segments is determined. The calculation of the indices and the performance of the clustering procedures is carried out with the licensed IBM SPSS v. 21.

3. Results

The starting point for the comparative analysis of households on the Sustainable Activities Index by topic and the Sustainable Consumption Index is the characteristics of the households surveyed. The average number of members in a household in Varna is 2.9. The structure of households by number is as follows: 13.5% are one-member households, 30.1% – two-member households, 27.2% – three-member households, 23.4% – four-member households and 5.9% – five or more members. Slightly less than half of the households (42.1%) have children under the age of 18, with the highest proportion of households (13.1%) having children under the age of 3. In 75.5% of households, the "head of household" is male.

Varna households live in medium sized dwellings – half live in dwellings up to 79 sq.m. and the rest in larger dwellings. The average area of dwellings is 88.44 sq.m. The majority of households (77.8%) live in flats, while the rest live in a detached house or condominium. Almost two-thirds of the dwellings are owned (65.5%), 15.8% are rented and the rest live in parents' or relatives' properties. 76.9% use electricity to heat their homes, 9.4% use wood, 5.8% use central heating, 3.5% use pellets, 3.2% use gas and 1.7% use other.

Varna households perform relatively well on sustainable activities related to home and housing maintenance. The average SAIndex(Housing) is 0.530, corresponding to the category "moderate to high number of sustainable consumption activities on the topic".

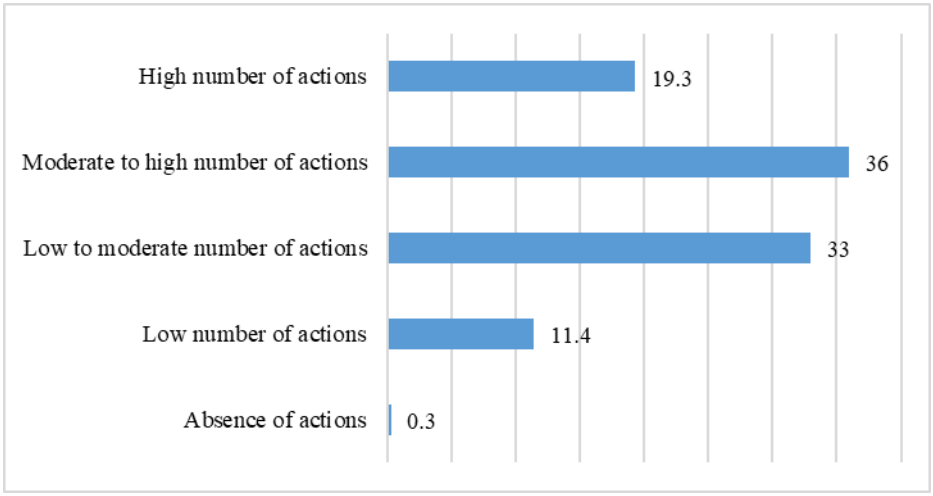


Figure 1. Household Structure by Sustainable Activities Index on Housing - SAIndex(Housing). Source: Own research

The data show that a significant share of the households (44.7%) practices up to 50% of the observed activities on the topic "housing". There are 6 activities that are practiced by more than 70% of households: Own aluminum, PVC or wooden windows with glazing (93.8%); try not to leave the lights on when no one is in the premises (83.4%); own energy saving lighting (83.3%); try not to leave the TV on when no one is in the room (79.9%); try not to leave windows open for long periods when the room is heated (77.5%); the home has external plastering or insulation (73.9%). On the other hand, 5 activities are observed to be practiced by less than one-third of bathing households: aim not to use the bathtub every time they bathe (27.5%); own appliances with a self-regulator for the amount of water needed (17.9%); own appliances that use renewable energy (12.6%); own devices to reduce the cost of tap water (12.0%); use solar panels to heat water or generate electricity (7.0%).

The performance of households in Varna on the topic "food" is slightly worse compared to the performance on the topic "housing". The average value of the index of sustainable activities on the topic "food" (SAIndex(Food)) is 0.490, corresponding to the category "low to moderate number of sustainable consumption activities on the topic".

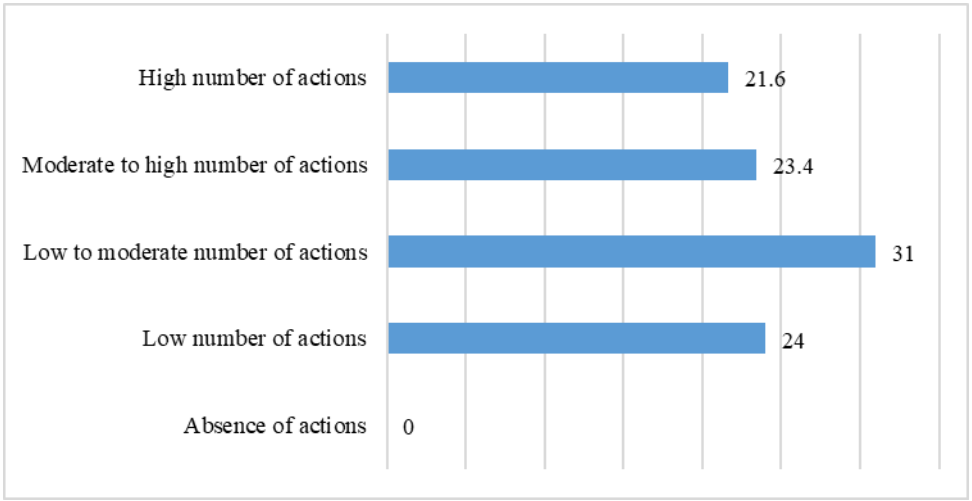


Figure 2. Household Structure by Sustainable Activities Index on Food - SAIndex(Food).
Source: Own research

Under the food topic, it clearly emerges that more than half of the households (55%) practice up to 50% of the observed activities. What is positive here is that not a single household is observed not practicing any of the observed activities. At the same time, there is a significantly higher percentage of households that have low index values, indicating the practice of no more than 30% of the observed activities. Two of the observed activities are practiced by more than 70% of households: striving to consume more home cooked food (83.3%) and striving to consume more fruits and vegetables (78.4%). Four of the activities are practiced by less than one third of households: avoid daily meat consumption (27.8%); consume more organic food certified and distributed in the retail chain (27.2%); aim to consume more food in biodegradable and/or recyclable packaging (20.2%) and aim to convert biodegradable waste into biofertilizer (compost) (9.1%).

A multi-item indicator related to food waste, which does not enter the index calculation, was also observed in the food topic. Slightly more than a third (37.4%) of households in Varna reported that they do not throw food away. The most common reason for throwing away food was the expiry date of products, cited by the remaining 43.9%, and for 24.3% of households the main reason was that more food than the required amount was cooked or purchased.

The value of the index for sustainable activities is very low for the topic "mobility", which is related to ways of getting around the city. The average value of the SAIndex(Mobility) is 0.330 - "low to moderate number of sustainable consumption actions on the topic“.

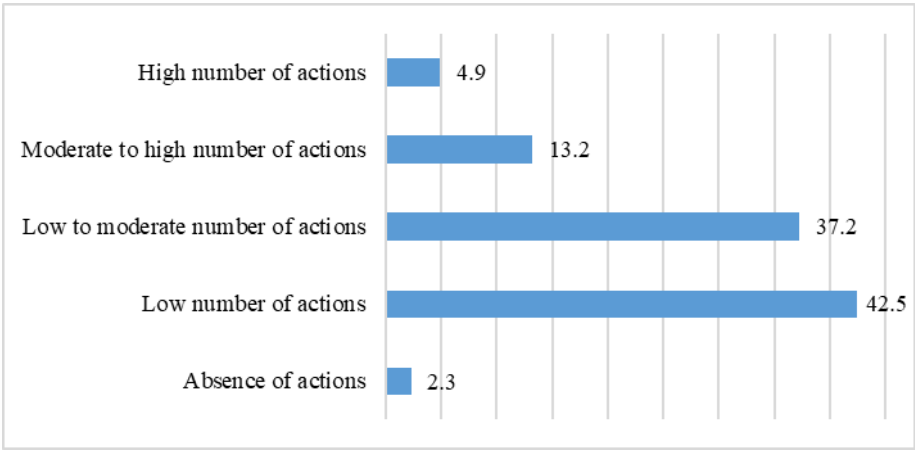


Figure 3. Household Structure by Sustainable Activities Index on Mobility - SAIndex(Mobility).
Source: Own research

More than two-thirds (77%) of households in Varna own a passenger car, and another 10.5% own a minivan/jeep/SUV. Only 13.8% of households say they own a bicycle. On the topic of mobility, more than two-thirds of households (82%) practice up to 50% of the observed activities.

There was no single activity observed under the mobility topic that was practiced by more than 70% of households. Further, six of the observed activities are shared by less than 30% of households: Avoiding the use of the private car to get to central parts of the city (29.5%); preferring to travel mainly by public transport (24.3%); aiming to use the private car less to get around the city (21.9%); avoiding travelling alone in their car (18.4%); aiming to get around more by bicycle (12.9%) and getting around by motorbike or scooter (5.0%).

The most unfavorable situation is that of the activities under the topic "product disposal". The average value of the SAIndex (Recycling) is 0.187 - "low number of sustainable consumption activities on the topic".

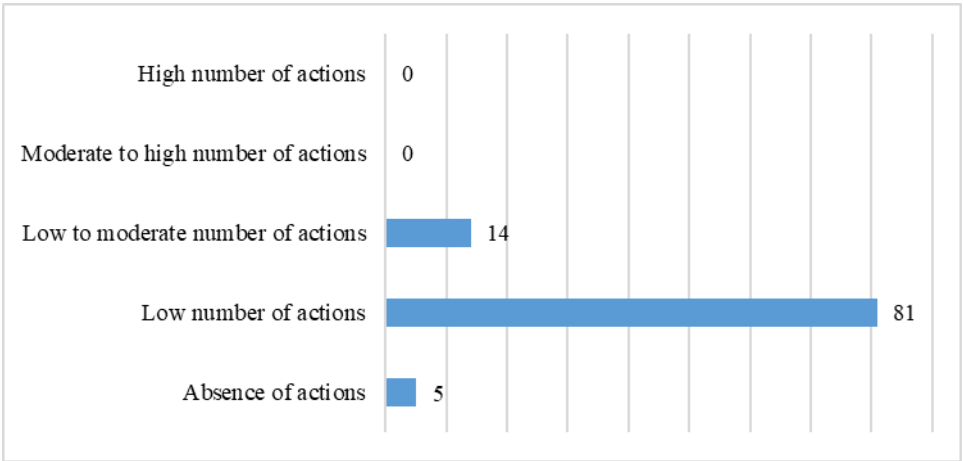


Figure 4. Household Structure by Sustainable Activities Index on product disposal - SAIndex(Recycling).
Source: Own research

There is also no single activity on this topic that is practiced by more than 70% of households in Varna. Even the disposal of batteries in designated places is practiced by 62.3% of the households in Varna. 13 out of 18 observed activities on this topic are practiced by less than 30% of households.

The general sustainable consumption index for households in Varna has an average value of 0.388, which corresponds to the category "low to medium level of sustainable consumption". A low level of sustainable consumption is demonstrated by 28% of households, a medium to moderate level is demonstrated by almost half of households (48.9%), a moderate to high level is demonstrated by 21.2%, and only 1.9% demonstrate high levels of sustainable consumption.

The direct comparison of the values of the five indexes makes it possible to map the state of sustainable consumption and also, with periodic monitoring, to track progress or lagging behind on the monitored activities.

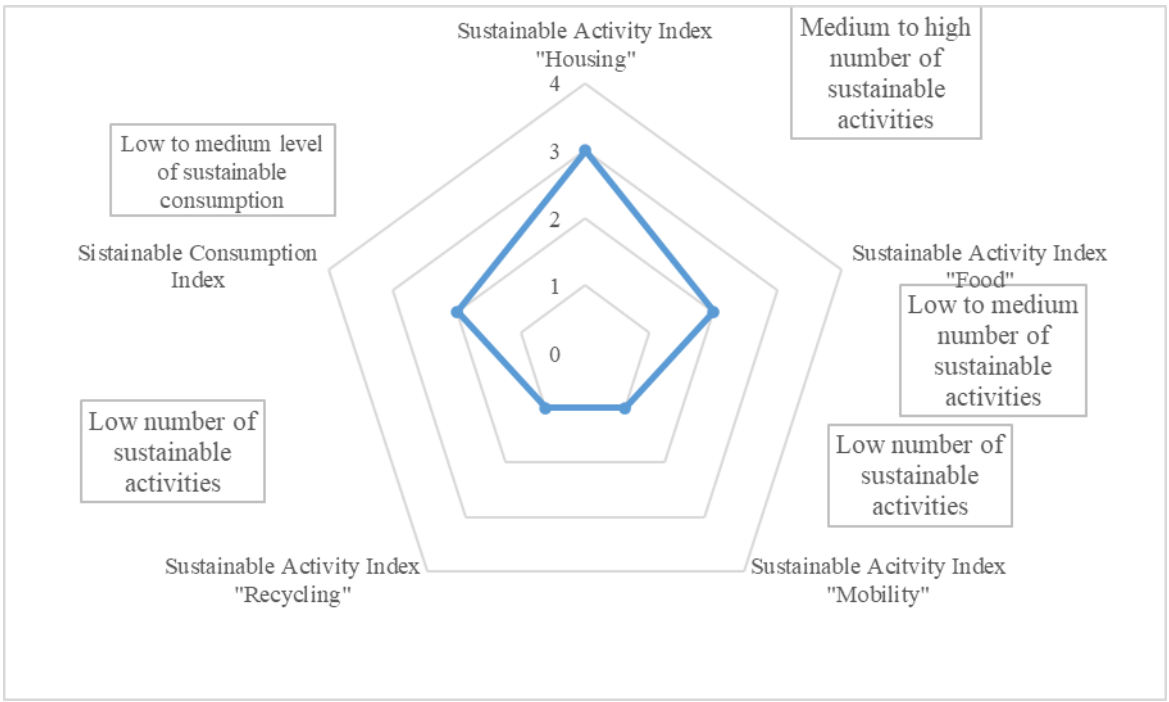


Figure 5. Radial map of the sustainable consumption areas of households in Varna.
Source: Own research

One of the main objectives of sustainable marketing is to communicate the challenges related to the limitation of basic resources in order to guarantee a good way of life for future generations and to offer solutions related to consumption in this direction. In this sense, achieving sustainable consumption by households is one of the important tasks. The design and implementation of the proposed indices provide opportunities for tracking the progress of households in terms of their sustainable consumption. The use of indices also makes it possible to identify problem areas in sustainable household consumption.

The proposed indices also allow the application of household segmentation and the development of differentiated strategies to achieve sustainable consumption targets. The question of what picture the segmentation of the Varna households according to the five indices has painted is a matter of debate. Hierarchical clustering showed that 3 cluster groups could be clearly distinguished from each other. Using a k-means clustering procedure, the cluster centers were determined. The cluster profiles are defined based on the categories of the five proposed indexes.

In terms of sustainable consumption activities and of basic demographic characteristics, the three segments can be described as follows:

- Following the daily routine are households with a predominantly female head of household, aged between 31 - 50, who have low incomes and live in rented accommodation mostly in a condominium. These households seem to be focused on their daily activities and are not paying attention to most of the activities observed in the survey. The analysis of sustainable consumption activities that are widespread among households in this cluster shows an orientation towards only basic ones - glazed windows, energy saving lighting, energy saving appliances. The hypothesis that income is the reason for the demonstration of such behaviour cannot be fully accepted because these households do not exhibit actions that can lead to a reduction in household expenditure, such as a desire not to run a full washing machine, or a desire to wash clothes at a lower temperature. Rather, one can speak here of consumption patterns that are based on routine and inertia and neglecting environmental issues. This characteristic is the main argument for the segment to be named "Following the Daily Routine".
- "Focused on Cost Reduction" - the head of the household is a man or woman, aged over 60, who lives mostly in apartments - owned or relatives. The number of household members is usually one or three, with monthly incomes between 3000 and 5000 BGN. In terms of sustainable consumption activities, the orientation of these households is mainly towards those that directly lead to saving and optimizing household expenditure – use of energy-saving devices and energy-saving lighting, presence of thermal insulation of the walls and/or floor and of glazing in the windows, as well as energy efficiency of the dwelling.
- Households with sustainable consumption habits are predominantly male-headed, aged over 41. These are mostly 3 - 5 member households with incomes over 5000 BGN per month, living in their own houses. The segment is named "Households with Sustainable Consumption Habits' because these households demonstrate a clear orientation towards the majority of activities related to sustainable consumption. Nevertheless, even within this segment there are opportunities to increase the average number of sustainable activities practiced by these households.

Table 5. Cluster profiles

Cluster name	Cluster Profile	Cluster size
Following daily routine	The first segment includes households which have a low to medium number of actions on Housing; a small number of actions on Food; a low number of actions on Mobility; a low	39% of the households

	number of actions on Product Disposal; and a low level of sustainable consumption in general.	
Focused on cost reduction	The second segment includes households that have a medium to high number of actions on Housing; a medium to high number of actions on Food; a low number of actions on Mobility; a low number of actions on Product Disposal; and a low to medium level of sustainable consumption in general.	36% of the households
With sustainable habits formed	The third segment includes households that have a medium to high number of actions on Housing; a high number of actions on Food; a medium to high number of actions on Mobility; a low number of actions on Product Disposal; and a medium to high level of sustainable consumption in general.	25% of the households

Source: Own research

A more in-depth analysis of the structure of household actions related to sustainable consumption in the areas of "housing," "food," "mobility," and "product disposal" across the three segments reveals that:

- In the "Following daily routine" segment, only eight of the 23 observed variables in the "housing" category are practiced by more than half of the households. Here, 90% of households have double-glazed windows, 73% have energy-saving lighting, 54% have external wall insulation and cladding on the building they live in, 58% have energy-efficient appliances, 51% have wall and floor insulation, 68% try not to leave the TV on when no one is in the room, 60% try not to leave the lights on when no one is in the room, and 58% try not to leave windows open for long periods of time when the heating is on. In the "food" category, only one of the 18 observed actions is practiced by more than half of the households in this segment - they try to consume more home-cooked food (59%). None of the observed actions in the "mobility" and "product disposal" categories are practiced by more than half of the households in this segment. Only 12% of households in this segment share that they try to avoid traveling alone in their cars, and only 17% try to use their personal car less frequently for moving around in the city. In this segment, the largest share of households (50%) state that they dispose of batteries together with other waste, and 65% dispose of hazardous waste in the same way. This segment also has the lowest share of households practicing separate waste collection and disposal.
- In the "Focused on cost reduction" segment in the "housing" block, 14 out of 23 observed actions are carried out by more than 50% of households. Here, 97% of households have double-glazed windows; 88% have energy-saving lighting; 92% have external plaster and cladding on the building in which they live; 77% have appliances that are energy-efficient; 83% have thermal insulation on walls and floors; 86% try not to leave the TV on when nobody is in the room; 94% try not to leave the lights on when nobody is in the room; 88% try not to leave windows open for a long time when the heating is on; 83% try not to run a partial load in the washing machine; 69% try not to leave the computer on when nobody is using it; 71% try not to use programs for washing at high temperatures; 72% try not to leave the water running while washing dishes with detergent; 66% try not to ignore the use of night energy; 70% try not to keep the water running while brushing their teeth with toothpaste. In the "food" block, 11 out of 18 observed actions are practiced by more than 50% of

households in this segment. The problematic zones (actions with a lower share) in this segment relate to the desire to consume more fish and fish products (45% of households); avoiding the use of plastic bags for shopping (39% of households); avoiding daily consumption of meat (31% of households); paying attention to the type of preservatives (E's) when buying food (30% of households); consuming more foods in biodegradable and/or recyclable packaging (18%); consuming more organic food (17% of households); composting (3%). In this segment, 36.5% is the share of households that share that they do not throw away food. In the "mobility" block, only one of the observed activities is practiced by more than 50% of households - the desire to walk more (53%). Here, too, the share of households that share that they are trying to use their personal car less when moving around the city is very low (9%). Regarding the activities of the "product disposal" category, only 2 out of the 18 observed activities are practiced by more than 50% of households in this segment. These two activities are disposing of batteries in designated locations (76%) and releasing large waste items while continuing to use them on rural properties (50.6%). In this segment, there is also an exceptionally high percentage of households that admit to disposing of hazardous waste together with other types of waste (65% of households).

- In the "With sustainable habits formed" segment, only five of the observed 23 activities are practiced by less than half of the households: using appliances with a self-regulator for the necessary amount of water (32%); using appliances that use renewable energy (20%); using solar panels (15%); using devices to reduce the flow of tap water (14%); and trying not to use a bathtub for every bath (42%). Two activities in the "food" block are problematic in this segment: trying not to consume meat every day (46% of households) and composting (25%). Three of the observed activities in the "mobility" block are practiced by more than 50% of households in this segment: trying to walk more (96%); trying not to use transportation when shopping (71%); and trying to use their personal vehicle less frequently for getting around the city (51%). Even in this segment, the most problematic areas are in the "product release" block, although only here do four of the observed 18 activities are practiced by more than 50% of households: releasing electronic waste by selling it (50%); continuing to use bulky items on rural properties (62%); disposing of batteries in special places (81%); and practicing separate collection and disposal of waste (51%). However, in this segment, the proportion of households (51%) that dispose of hazardous waste together with other waste is very high.

It can be summarized that all three segments need to be targeted with specific actions to stimulate sustainable activities, because they exhibit different problems regarding their sustainable consumption.

4. Conclusions

The results of the research show the current state of sustainable activities of households in Varna at the time of data collection. These results show the presence of three different segments of Varna households. This can be taken as an argument for the

need to conduct selective policy actions on the part of institutions tasked with providing the infrastructure for sustainable activities - such as recycling, increasing the energy efficiency of homes and the corresponding lower consumption of energy from non-renewable sources, the use of public and/or environmentally friendly transport, etc.

At the same time, companies developing the market for sustainable products can target campaigns focused on different content according to the defined characteristics of the three main segments. For example, content related to the dissemination of knowledge about the Sustainable Development Goals and the contribution of sustainable household consumption to the achievement of these goals can be communicated to the 'Following the Daily Routine' segment, which in turn can play a role in stimulating household members to take similar actions. On the other hand, the focus of communications to the "Focused on Cost Reduction" segment may fall on the promotion of products and services that lead to cost reductions for households using sustainable products. By the same reasoning, companies' communications to the third segment, "With Sustainable Habits Formed", can be aimed at strengthening understanding of the role that sustainable household behavior plays in achieving sustainability goals. The segments obtained and characterized based on the results of the use of the household sustainable activities indexes can also find application in adjusting the marketing activities of organizations, especially as regards those that focus on achieving the goal of being climate neutral (Angelova, 2021).

Of course, these illustrative guidelines do not complete the future applications of the use of the General Sustainable Consumption Index. As already commented in the introduction, online calculators and the related use of indexes for sustainable behavior and sustainable activities have an impact in at least two directions. One is the educational role in promoting the ideas of sustainable consumption and sustainable consumption - it is considered that through them individuals are informed about existing practices and opportunities to influence processes related to environmental protection and the achievement of sustainable development goals. The second one is related to the motivating effect that the availability of such calculators has on the behaviour of individuals and households.

We believe that in the cities for which such tools have been developed, they would improve outcomes related to household engagement in the sustainable consumption ecosystem. As commented on in the literature review, since the level of urbanization influences the degree of household involvement in sustainable activities, the need for using individual indexes is more than evident. Moreover, such indexes could work mainly at the city level, as they would allow each individual or household to compare its level of sustainable consumption against the average levels for the settlement in which it lives. As an additional argument, the differences found when forming the segments for the whole population in the three Bulgarian cities and those described in this paper for the households in Varna can be highlighted.

One of the other possible directions for future adaptation of the results obtained in this research is related to the definition of the specific differences that determine the sustainable activities of households in the city for which the General Sustainable Consumption Index should be introduced. An argument for this could be the already commented regional differences in sustainable consumption of households determined by

different factors. Moreover, the collection of data for each of the proposed indices allows to establish the distribution of households in the three segments. At the same time, the data analysis provides information to describe the frequency of sustainable actions by zones already formulated. This can play an important role in deciding whether and to what extent the policies of institutions and businesses to stimulate sustainable household actions are adequate in the respective cities under study. For this, however, it is necessary to study the specified policies for each of the cities for which indexes are formed.

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