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A Behavioral Research Approach to Sustainable Household Consumption in Three Bulgarian Cities

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Simeon Jelev[*], Galina Mladenova[**] Borislava Stoimenova[***]

Abstract

This paper aims at examining the sustainable urban consumption (SUC) of households in three Bulgarian cities and determining whether there are significant differences between their sustainable consumption patterns. A conceptual model for measuring SUC is developed with an emphasis on the behavioral component of the attitudes. As part of this, four indexes to study different dimensions of SUC are constructed, namely: Housing Index (provision of the housing with conditions for sustainable consumption); Electricity and Water Index; Food Index; Transportation Index. A Composite Behavioral Index (CBI) was also constructed from the four aforementioned indexes. The model was tested in an empirical study covering a total of 1049 households in the cities Sofia (403 households), Varna (342 households) and Svishtov (304 households). The results reveal that a relatively small portion of the households in the three cities tend to have sustainable lifestyles. Overall, the households from Varna perform the most sustainable behavior. The efficient use of electricity and water prevails the investments in sustainable housing conditions, which signals for orientation towards short term savings rather than reduction of costs in the long run. With no significant differences between the cities, the sustainable transportation practices are least popular among the households. Sustainable food consumption, normally related to preparing at home fresh and locally produced food of mainly vegetable origin, was more widespread among the households from Varna and Svishtov. The proposed research methodology for measuring SUC can be applied both in comparative analyses of SUC for households from different settlements and regions, and for tracking the changes of SUC for households in a given settlement.

Keywords: Sustainable Household Consumption; Housing Index; Electricity and Water Index; Food Index; Transportation Index; Composite Sustainable Behavior Index

Jel: M30

[*] University of National and World Economy
[**] University of National and World Economy
[***] University of National and World Economy

Introduction

This article presents part of the results obtained from the implementation of the research project entitled *Sustainable urban consumption – regional differences* financed by the Bulgarian National Science Fund (BNSF) at the Ministry of Education and Science. It aims to discuss the dimensions of a behavioral approach to exploring the sustainable urban consumption at the households in three Bulgarian cities: Sofia, Varna and Svishtov. The three cities are different along many dimensions: size of the population[1]; level of industrialization and urbanization; structure of the economy; structure of the housing construction; the level of development of public utilities, among other things that are more or less closely related to SUC.

In the article an answer is sought to one of the major research questions: Are there relevant differences between sustainable urban behavior of the households in the three cities? The answer to this question is sought on the basis of the data from the empirical study carried out in 2021 with a sample of 1,049 households in the studied cities: Sofia (403 households), Varna (342 households) and Svishtov (304 households).

Even though there are a number of definitions for sustainable consumption and sustainable urban consumption, it seems that the simplest and most comprehensive one for our research team is the following: our consumption patterns aim to ensure that our successors will live in a better rather than a worse environment than ours, and their successors will live in a better environment than theirs.

Literature review

The consumer behavior in the contemporary urban conditions is strongly impacted by the dominant social paradigm (Disch, 1970; Ehrlich & Dennis C. Pirages, 1974), which encompasses public values, attitudes and beliefs according to which social wellbeing is a function of economic growth, growing incomes and the utilization of more and newer things. However, the critics of the concept of the economic growth-driven wellbeing are increasingly launching the idea of excessive consumption as a form of social pathology (Durning, 1992; Frank, 2000; Fromm, 1976; Galbraith, 1958; Skidelsky, 2013) with an emphasis on the social and psychological problems (Kasser, 2002) and environmental pollution (Jensen, 2008). In response to this view an alternative assumption is held that it is possible to live a higher quality life by consuming sustainably, which for some means less (Jackson, 2005a, 2009), by voluntarily simplifying lifestyles – downshifting (Duane Elgin, 1998; Duda, 2020), by changing consumption patterns towards ethical consumption (I. A. Davies & Gutsche, 2016; Li et al., 2021), anti-consumption, consumer boycotts and a revolt against the unsustainable (in ecological, social and economic terms) practices (Cherrier, 2009; Witkowski, 2021; Ziesemer et al., 2019).

The concept of sustainable consumption

According to what is written in chapter four of the basic document that outlines the global concept and policies for sustainable development in the current century – the UN Agenda 21 (UN, 1992), sustainable

[1] According to the data from the National Statistical Institute, the number of the population in the studied cities as of 31.12.2020 is as follows: Sofia - 1,249,277 people; Varna - 390,916 people; Svishtov - 23,576 people. Population by cities and sex | National Statistical Institute (nsi.bg)

development is connected with a different view of social wellbeing through a shift to sustainable consumption patterns that allow for higher living standards, a changed lifestyle and a reduced dependence on natural resources. What has been universally adopted to date as a definition of *sustainable consumption* is the one presented at the Oslo symposium of Norway's Ministry of the Environment (Ofstad et al., 1994): "the use of services and related products which respond to basic needs and bring a better quality of life while minimising the use of natural resources and toxic materials as well as emissions of waste and pollutants over the life cycle of the service or product so as not to jeopardise the needs of future generations". In the handbook on sustainable consumption and production of the United Nations Environmental Program (UNEP, 2015, p.10) sustainable consumption and production is described as "a holistic approach to minimising the negative environmental impacts from consumption and production systems while promoting quality of life for all" and the call is for preserving resources for future generations. Based on analyses of many other definitions of sustainable consumption Jackson and Michaelis, Lebel and Lorek (2003; 2008) suggest that the differences between these definitions pertain largely to whether sustainable consumption means consuming *differently*, consuming *responsibly,* or consuming *less.*The same reasoning was supported recently emphasisng on global problems such as overconsumption and poor waste management (Doran, 2021; Glavic, 2021).

- Consuming differently (ecologically) means switching from the consumption of more products to the consumption of more services, sparing electricity and water, sharing products, using products of higher quality and a longer life cycle, using organically produced products, using ecological means of transportation, minimizing waste and managing waste disposal in an environment-friendly way.
- Consuming responsibly (socially responsibly) means taking into consideration the principles of ethical production and commerce, labor conditions and social justice.
- Consuming less (economically) means utilizing the resources to meet basic needs and avoid wasting resources on redundant things.

Major theories on sustainable consumption

According to the theory of reasoned action developed by Ajzen and Fishbein (1980), behavior is a result of specific *intentions*. Intentions, in turn, are influenced by *attitudes* and *subjective norms*, which are defined as the assessment of the result of the respective behavior (whether favorable or unfavorable) and the perceived social pressure for either displaying or avoiding a specific behavior. The theory of planned behavior developed by Ajzen and Madden (1986) added a third dimension – *control over the will*, which is defined as man's ability to carry out some action only by virtue of their own will without the impact of any external factors. Kaiser, Wölfing and Fuhrer (1999) developed the theory of the reasoned action, by adding the variable of *knowledge* as a determinant of attitudes and the variables of *social and moral values* as determinants of the subjective norm.

Household values with regard to sustainable consumption determine the things that are generally seen as important for households that drive them towards taking

some action or another (Schwartz, 1977, 1992; Thøgersen & Ölander, 2002). The value orientation towards sustainable consumer behaviour is sought in various directions such as meeting functional needs, the creation of desired identities, the search for status and social distinction, the participation in social debates and the maintenance of social cohesion, social selection and the pursuit of personal and collective meaning (Dittmar, 1992; Douglas & Isherwood, 1979; Jackson, 2014). In the literature there can be found evidence that people with a pro-social, altruistic and biospheric (nature-oriented) value orientation consume more sustainably compared to people with an individualistic and/or egocentric value orientation (Dunlap & Van Liere, 1978; Paul C. Stern, 2000; Schwartz, 1977; P. C. Stern et al., 1999; Paul C. Stern et al., 1995). Accorning to the findings of Lee et al. (2015), individuals who identuify with their community are oriented towards sustainable consumption because they value clean and healthy environment and want to be appreciated as good neighbours. Also, internally oriented values have higher influence on sustainable consumption behavior than externally oriented values (Sharma & Jha, 2017). Similarly, Smyczek (2020) recently has proved that consumers who value universalism, benevolence, or conservatism are more prone to sustainable consumption.

Household attitudes towards sustainable consumption are identified on the basis of the disposition to take specific actions. The different components of attitudes, including the cognitive, emotional (affective) and behavioral ones, have been the object of various investigations in research fields such as *concern for health* (A. Davies et al., 1995; Schifferstein & Oude Ophuist, 1998; Severo et al., 2020), *concern for the environment* (Albayrak et al., 2013; Borusiak et al., 2021; Fransson & Gärling, 1999; Kinnear et al., 2010; Laroche et al., 2001), *inconvenience* (Caniels et al., 2021; Laroche et al., 2001), *skepticism* (Albayrak et al., 2011; Silva et al., 2020), *perceived consumer effectiveness* (Kang et al., 2013; Roberts, 1996; Tucker, 1980), *perceived personal relevance* (Kang et al., 2013), *environmental consciousness* (Boztepe, 2012; Krause, 1993), *knowledge* (Kaiser et al., 1999; Peattie, 2010; Saari et al., 2021). As for the impact of environmental concern on sustainable consumption, research has delivered contradictory results – from a (strongly) positive impact on intentions (Albayrak et al., 2013; Chan & Lau, 2000) to a very poor impact (Fransson & Gärling, 1999; Newton et al., 2015; Tanner, 1999). Fransson and Gärling (1999) have proved that the factors that influence sustainable behavior are knowledge, the internal locus of control (consumers' conviction that things depend on them), personal responsibility and the perceived threats to personal health. Other pieces of research offer evidence for the positive relation between knowledge of environmental problems and sustainable behavior (Chan & Lau, 2000; Kang et al., 2013; Saari et al., 2021). Of special relevance are the type, depth and reliability of knowledge, as well as the awareness of the action that one can undertake towards sustainable consumption. It is important that there be awareness of what people know about the problems with the environment, what efforts they tend to make and what efforts they actually put into improving their environment-related knowledge – whether they are members of environmental associations, whether and how much they tend to read books on ecological topics (Arbuthnot, 1977), whether they are

informed of the issues related to recycling and the materials subject to recycling (Vining & Ebreo, 1990), etc.

According to some theories, consumer behavior is to some extent simply an expression of routine practices – habits (Southerton, 2013; Spaargaren & Vliet, 2000) that have taken shape under the influence of the dominant social norms (Baudrillard, 1970; Cialdini et al., 1991), laws and institutional rules (Groncow & Warde, 2001; OECD, 2008; Shove & Warde, 1997). This specifically applies to the daily consumption of products that are *invisible* (Shove & Warde, 1997) and are not connected with the individual exposure. Rather it is related to convenience, thrift and moral considerations about the impact on the environment and the wellbeing of future generations. Habit-induced behavior as an expression of the behavioral component of the propensity to a specific action "spares" some cognitive efforts in decision making with regard to routine actions and includes automated decisions about the choices made on a daily basis (Hobson, 2003; Jackson, 2004, 2005b). Such automated decisions involve actions such as the efficient use of electricity and water, the waste disposal mechanisms, the food consumption practices and the choice of transportation practices, among other things.

The behavioral component of sustainable consumption

The structure of sustainable consumption is determined by who consumes and what is consumed or what should (should not) be consumed (Jackson, 2014). At the household level sustainable consumption as the behavioral component of the attitude is related to the *lifestyle* (Jensen, 2008; Matharu & Jain, 2021; UNEP, 2011b, 2016) that is largely determined by households' *daily routine activities* (Caeiro et al., 2012).

The United Nations Environment Program offers a ranking of five key elements of the lifestyle in which sustainable consumption patterns are sought (UNEP, 2015, 2016). These include food, housing, transportation, consumer goods and leisure. The Organization for Economic Cooperation and Development (OECD, 2008) published a review of empirical evidence that characterizes the determinants of sustainable consumption in households in five basic areas of the environmental policy: the usage of electricity at home and the consumption of water (housing), the consumption of food, the personal choice of means of transportation, waste management – the generation and curbing of waste, waste separation and recycling, as well as the tendency to pay for services involving waste collection. The European Environment Agency (EEA, 2015) – in 12 basic spheres: housing; water; electricity; gas and other fuels; transportation; foods and beverages; other; recreation and culture; restaurants and hotels; furniture, household appliances and routine house maintenance; clothing and shoes; health; alcohol, tobacco and drugs; communications and education. In an international survey of National Geographic and Globescan (Greendex, 2014), the ecological sustainable consumption is measured by applying a compound indicator (index), referred to as Greendex, which measures the individual and collective consumer behavior in four categories: housing, transportation, food, goods for final consumption (fast-moving consumer goods and durable consumer goods).

The results from the research made by Lorek and Spangenberg (2001b, 2001a), as well as by Spangenberg and Lorek

(2002) show that the structure of general consumption basically contains ten consumption areas that comprise about 95% of the general consumption. These areas are the following: education (kindergartens, schools and universities); healthcare (hospitals, rehabilitation centers); social life; housing (construction, maintenance, heating); food (production, preparation, restaurants); transportation; recreation (without transport); clothing; personal hygiene; cleaning. Three of these areas fall within the scope of public consumption: healthcare, education/ training and social life. In the authors' view, the areas of recreation without transport, clothing, personal hygiene and cleaning may be influenced by households, yet in each area less than 5% of the general consumption of resources is taken into account, which makes their weight in general consumption relatively small.

The areas that transpire as priority ones in the analysis of sustainable consumption with a view to changing the consumption patterns are *housing*, *food* and *transportation*. According to the findings in some pieces of research, in these areas more than 70% of the resource extraction, 70% of electricity consumption and more than 90% of the appropriated land (Holden, 2004; Lorek & Spangenberg, 2001b; Tukker, 2006) are used. It has been proved that these consumption areas also have the most serious imprint on greenhouse emissions, on the oxidizing and ozone-depleting substances, as well as the usage of resources and energy (EEA, 2005, 2010, 2019; Tukker, 2006; Tukker et al., 2010b, 2010a; UNEP, 2011a). What further transpires as a priority area is waste management and recycling (OECD, 2008). What also falls within the scope of the *waste management* concept is waste generation and waste reduction and the propensity to pay for waste collection services.

In the description of the sustainable consumption patterns provided in the United Nations Environment Program (UNEP, 2015, 2016), in the papers of E. Hertwich and Katzmayr (2004), of Salo et al (2016), of Schröder et al (2019), of Holden (2004), of Zacarias-Farah and Geyer-Allély (2003), of Jan Noorman et al (1999), of Jensen (2008) are suggested indicators for the measurement of sustainable consumption in two basic areas: (1) actions related to consumption – use/or non-use, reduction, etc.; (2) securing the conditions for sustainable consumption. This is the overall picture by consumption areas:

- Housing: actions related to the quantities of consumed electricity and water (behavior pertaining to the use of heating and cooling devices, lighting, cooking, hygiene, maintenance, etc.); securing conditions of the environment that are technologically appropriate for sustainable consumption – air conditioners, lighting, heating, devices for maintaining hygiene (washing machines, dishwashers, clothes dryers, boilers), cooking devices (ovens and microwave ovens, mixers, robotic kitchens), devices for food storage (refrigerators and freezers), leisure devices (TV set, radio, -stereo systems, personal computers), energy-efficient construction (type of construction works, building and window insulation), heated area per household member, living area per household member.
- Food: actions related to the type and quantities of consumed or thrown away food (the consumption of organic food, fresh, seasonal or locally produced food bought within the vicinity of the housing

estate, mainly vegetable-based food, food prepared in a conventional way, the reduction of food waste).

- Transportation: actions related to ecological (environment-friendly) transportation such as walking on foot, cycling, using public transport, using energy-efficient cars, shared travel using different vehicles, reduction of the daily distance covered with own automobiles, reduction of the use of own automobiles in city centers; securing the conditions for ecological transport (the purchase of bicycles, electric cars, reduction of the number of vehicles per household, reduction of the size of the vehicles, etc.).

Household sustainable consumption behavioral index

As demonstrated in the previous parts of the literature review, the concept of sustainable consumption is multifaceted and includes dimensions of values, attitudes, knowledge and behavior. The sustainable behavior is largely measured by specific occasional actions or habits (routine actions). At present, there is a gap in the literature related to the behavioral compoment of the attitude – what the households tend to do in terms of securing housing conditions for sustainable consumption and putting efforts into conscious actions towards sustainable consumtion.

Most of the research so far is dedicated to the investigation of the link between the different dimensions of the sustainable consumption concept, while very few apply a comparative approach to track the performance of households from different countries, regions, settlements. As Bartolj et al. (2018) assert, there is a lack of composite indexes for measuring sustainable consumption, which enable regional comparisons over time. Previous research reveals that the construction of a composite Household Sustainable Consumption Index (HSCI) is either based on existing (secondary) data from official institutions (Bartolj et al., 2018) or on primary data collected through panel surveys among consumers (Greendex, 2014). These are large scale international or regional projects with methodologies that are not always applicable for comparisons at a local level because of their complexity and irrelevance to the local conditions.

In this regard, a simplified evaluation framework for empirically comparing the sustainable consumption of households from different cities and for measuring the progress over time is needed. Therefore, the main contribution of this paper is to fill the literature gap by constructing a Composite Behavioral Index (CBI) as a measurement tool comprising four indexes: (1) Housing Index (provision of the housing with conditions for sustainable consumption); (2) Electricity and Water Index; (3) Food Index; (4) Transportation Index. While most studies focus on occasional or habitual behavior, this study exlopres what households tend to do in terms of sustainable consumption and what conditions they create at home to secure sustainable consumption.

Research methodology

Brief overview of the methodology

The examination of the sustainable consumption at the household level conceptually includes the study of: (1) households' *values* towards sustainable consumption (what the household believes to be correct and decent in terms of consumption; what are its guidelines in assessing their own consumption or the consumption of others);

(2) households' *attitudes* interpreted as a propensity to take action. The measurement of attitudes is based on the assumption that they encompass three aspects - cognitive, emotional (affective) and behavioral. In other words, the questions under examination are the following: *What people know about SUC*, *how people feel about SUC* and *what they consciously tend to do in terms of SUC*.

This conceptual model determined the structural content of the questionnaire used as a tool to conduct the quantitative study: one section measures the values with regard to SUC; another section measures the cognitive component; another section measures the emotional component; yet another section measures the behavioral component. The sections on values, and the cognitive and emotional components of attitudes were measured in the classical manner – using the Likert scale, whereas the behavioral component included questions about "things": what households *consciously tend to do* by using the *pick any* technique.

On the measurement of the behavioral component

The *pick any* technique. As aforementioned, the choice was made that the behavioral component of attitudes in this project should be measured with the *pick any* technique. This technique opens up the opportunity for the respondent to select the options of answering a question that are valid. Here is an example from our questionnaire:

Q-14. Which of the things listed below do you have at home? (Select as many answers as you deem necessary!)

14_1	Devices that are energy efficient in terms of electricity and water consumption
14_2	Devices that use renewable energy resources
14_3	Energy efficient appliances for cooking and food storage
14_4	Devices that reduce the amount of used tap water
14_5	Devices that have a controlling mechanism for the used amount of water, depending on the work
14_6	Energy efficient lighting
14_7	Solar panels used for water heating and electricity generation
14_8	Thermal wall and floor insulation
14_9	Aluminum, PVC or wooden window frames with double-glazed windows
14_10	External plaster or tiling of the building

This technique has an advantage over the Likert scales (Driesener & Romaniuk, 2006) in terms of efficiency, given that the respondent spends far less time in providing the answers. In a case of a questionnaire overloaded with questions and answer options, this is essential for data quality. Imagine how much time and how many efforts the respondent will spend answering whether he agrees or disagrees with the 10 assumptions under the above question alone:

Q-14. How much do you agree or disagree with the statements about your housing? Please answer, you fully agree (1), generally agree (2), neither agree, nor disagree (3), generally disagree (4) or fully disagree (5)?

14_1	We have devices that are energy efficient in terms of electricity and water consumption
14_2	We have devices that use renewable energy resources
14_3	We have energy efficient appliances for cooking and food storage
14_4	We have devices that reduce the amount of used tap water
14_5	We have devices that have a controlling mechanism for the used amount of water, depending on the work
14_6	We have energy efficient lighting
14_7	We have solar panels used for water heating and electricity generation
14_8	We have thermal wall and floor insulation
14_9	We have aluminum, PVC or wooden window frames with double-glazed windows
14_10	We have external plaster or tiling of the building

A second advantage compared to the Likert scales is that this technique delivers *easy to interpret* and *comprehensible* results. How would one interpret or understand the answer *I generally disagree* or the statement *We have energy efficient lighting*? Should it be interpreted as if only a third of the light bulbs are energy efficient?! Should it be interpreted as if there are few energy efficient light bulbs?! Yet if, with the help of the pick any technique, the respondent has selected the answer *energy efficient lighting*, then the situation is fairly clear, even though the options are measured along the weak nominal scale – they have or do not have such lighting.

The third advantage of the pick any technique is that when *indexes* should be compiled, for instance the housing has secured the conditions for SUC, this technique is convenient to resort to, as we will see in the description below. It is evident that the households with the highest provision of conditions for SUC are those that have reached 10 points, given that one answer is attributed one point, while a missing answer is attributed zero points. The households that have chosen 5 of the possible 10 answers will get 5 points. It is at this stage that through a simple transformation these points can be translated into indexes from 0 to 100%.

Indicators of the behavioral component. It is the behavioral component that reflects the essence of *attitude* as a concept to the highest degree – the propensity to take action. A person may have a lot of knowledge about the meaning of sustainable urban consumption and, for instance, the relevance of separate waste collection in terms of what happens to the waste when it is thus collected, or what benefits are gained from such waste collection, etc. However, if this person is provided the opportunity of such waste collection at his housing estate but proves to be too lazy to take advantage of this opportunity, this knowledge will never give rise to action. Another person may be very concerned that humans are polluting the nature if they do not collect waste separately, they worsen the living conditions in the settlements where the landfills are, they do not properly educate children by not training them in separate collection of waste, but on the other hand – if these attitudes do not turn into actions, then they are worthless.

In this piece of research we have adopted two indicators of the behavioral component: (1) *the conscious tendency to* take or avoid some action, for instance, the propensity to turn off the lights when there are no people in the room or the propensity not to overheat your house (2) securing the conditions for sustainable consumption, for instance, the provision of water efficient appliances (it is a separate question whether such appliances are used).

Sample type and size. Quota sampling was used and the quota attributes were *size of the household* (two- three-, four-, five-member households or bigger ones) and *age of the head of the household* (18-24, 25-34, 35-44, 45-54, 55-64 and 65+ years of age), and the information about the distribution of these attributes in the cities was taken from the national statistics. Even though the preliminary estimates included 950 households, the sample encompassed 1,049 households in total, which were distributed by city as follows: Sofia (403 households), Varna (342 households) and Svishtov (304 households).

Data collection method. Given that the fieldwork was performed amid the Covid 19 pandemic and that the means to perform fieldwork were very restricted, the only possible data collection method was the online survey based on a structured questionnaire containing 43 closed questions. The time to answer the questionnaire was between 20 and 35 minutes.

Behavioral indexes for sustainable consumption. Based on the behavioral variables of attitudes, a total of five behavioral indexes are calculated: four indexes (Housing Index, Electricity and Water Index, Food Index, Transportation Index) and one composite index (Composite Behavioral Index). The Composite Behavioral Index sums up the four indexes. It should be noted that the four indexes expose the situation with four basic topical areas of the questionnaire's behavioral section even though the questionnaire contains more variables, which, regrettably, cannot be translated into indexes, considering the variables' controversial nature. For instance, the possible option in answering the question of *What did you do with your old car*?, i.e. *We sold it to a person* is seen as more in line with sustainable consumption than *We abandoned it in the street*; in the first case, if the car is in bad shape it will continue to emit gases, while in the second scenario, it will not be in motion but will nevertheless be an obstacle to street washing or will occupy a parking lot.

The algorithm for calculating the indexes involves two steps:

1. Calculating the values of each household from the sample by area: providing the housing with the conditions for SUC; the use of electricity and water; food consumption; transport.
2. Transforming these values into percentages.

Let us consider the case with calculating the Housing Index. Let us assume that household X has given the following answer to question 14 (Q-14). By assigning every checked option per answer one point and every non-answered option 0 points, we will arrive at the conclusion that this household has the conditional value of 5 points (given that it has checked 5 options).

Q-14. Which of the things indicated below do you have in your housing? (Select as many answers as you deem necessary!)

14_1	Devices that are energy efficient in terms of electricity and water consumption	x
14_2	Devices that use renewable energy resources	
14_3	Energy efficient appliances for cooking and food storage	
14_4	Devices that reduce the amount of used tap water	x
14_5	Devices that have a controlling mechanism for the used amount of water, depending on the work	x
14_6	Energy efficient lighting	
14_7	Solar panels used for water heating and electricity generation	
14_8	Thermal wall and floor insulation	x
14_9	Aluminum, PVC or wooden window frames with double-glazed windows	x
14_10	External plaster or tiling of the building	

During the second step the values are converted in percentages (indexes). In our case the households with values of 10 have an index of 100%, because (10/10)*100=100, those with 5 points have an index of 50% because (5/10)*100=50, etc. Converting values into percentage points makes it possible to achieve the following:

1. The comparability of households along the separate indexes (along the Housing Index the household has an index of 50%, yet along the Electricity and Water Index it has a mere 20%). Is it the case that the households with a high Housing Index are also with high Electricity and Water indexes?
2. The comparability of households according to the settlement type – Sofia, Varna and Svishtov (a very big city, a big city, a small city).
3. The comparability of households according to the separate demographic features: size, incomes, age of the household head, employment, etc.

The other three indexes are constructed in the same way, which makes it unnecessary to explain the same technical details. The indicators, from which these indexes are formed, can be seen below in the section on the discussion of the results.

The creation of a Composite Behavioral Index that comprises four indexes, where the values of the four indexes are summed and averaged, is calculated as follows: **Composite Behavioral Index = (Housing Index + Electricity and Water Index + Food Index + Transportation Index)/4.**

Discussion of the results by indexes

The provision of the housing with conditions for sustainable consumption

The first section of the questionnaire, examining housing as a "territory" of households' sustainable consumption, aims to explain the availability of electrical devices and other conditions that presumably reduce the costs on electricity, heating and water at home. Table 1. presents the indexes per sub-samples (last row) and per the overall sample of the survey (last cell on the right). For example, the value of the Housing Index for Sofia is 37%, for Varna it is 47%, and for Svishtov it is 47%. For the whole sample the value of the index is 41%.

The last column of Table 1. shows what share of the households in the whole sample

have provided the housing with conditions for sustainable consumption of electricity and water. For example, 80% of the studied households from Sofia have provided their housing with aluminum, PVC or wooden window frames with double-glazed windows, and the share of the studied households from Varna and Svishtov with the same energy-saving conditions is 93,8% and 89,1% respectively. For the whole sample the share of these households is 87.2%. (The data in the table are sorted in a descending order for better readability and this leads to the rearrangement of the answer codes in the first column.)

As it becomes evident from the data, the biggest distribution in all three cities goes to five of the ten patterns of the housing's sustainable structure that have been specified in the questionnaire:

1) The availability of aluminum, PVC or wooden window frames with double-glazed windows (87,2% of the households in the entire sample have provided such conditions);
2) Energy efficient lighting (74,0% of the households in the entire sample have provided such conditions);
3) External plaster or tiling of the building (62,9% of the households in the entire sample have provided such conditions);
4) Devices that are energy efficient in terms of electricity and water consumption (61.0% of the households in the entire sample have provided such conditions);
5) Thermal wall and floor insulation (53,6% of the households in the entire sample have provided such conditions).

What is least distributed in the households from the sample are the relatively modern conditions providing for sustainable consumption: devices and systems that use renewable energy resources (7,0%) and solar panels used for water heating and electricity generation (5,3%). The conclusion can be made that what is predominantly distributed in the housings are the conventional appliances and conditions providing for the lower costs of electricity, heating, water. What is also worth noting is that the average number of checked options is relatively low – 4,1 (before the last row), being the lowest in Sofia (3,7). What becomes evident from Table 1. is that Varna is ahead of (according to specific areas far ahead of) the other two cities with regard to the housing's provision with appliances and conditions that secure sustainable consumption.

Table 1: Data and indexes of sustainable housing conditions

Answer codes	Indicators of sustainable housing conditions	Sofia sub-sample (%)	Varna sub-sample (%)	Svishtov sub-sample (%)	Total sample (%)
14_9	Aluminum, PVC or wooden window frames with double-glazed windows	80.0	93.8	89.1	87.2
14_6	Energy efficient lighting	66.0	83.3	74.0	74.0
14_10	External plaster or tiling of the building	61.0	73.9	53.0	62.9
14_1	Devices that are energy efficient in terms of electricity and water consumption	60.5	67.7	53.9	61.0
14_8	Thermal wall and floor insulation	43.3	66.3	53.0	53.6

Answer codes	Indicators of sustainable housing conditions	Sofia sub-sample (%)	Varna sub-sample (%)	Svishtov sub-sample (%)	Total sample (%)
14_3	Energy efficient appliances for cooking and food storage	28.3	40.5	28.9	32.4
14_5	Devices that have a controlling mechanism for the used amount of water, depending on the work	12.0	17.9	16.4	15.2
14_4	Devices that reduce the amount of used tap water	10.8	12.0	3.3	9.0
14_2	Devices that use renewable energy resources	6.0	12.6	2.0	7.0
14_7	Solar panels used for water heating and electricity generation	4.3	7.0	4.6	5.3
	Average (How many indicators have been checked on average)	3,7	4,8	3,8	4,1
	Housing Index	37	47	38	41

The Pearson correlation coefficient was used in order to reveal the similarity / difference between the profiles of the three cities. As it becomes evident from the performed correlation analysis:

(1) There is a *very high correlation between the profiles of the three cities*: the correlation between Sofia and Varna is r = 0.988; between Sofia and Svishtov is r = 0.977; between Varna and Svishtov is r = 0.985. This means that *there are no significant differences between the three cities in terms of sustainable housing conditions*.

(2) After all, *the households in Sofia and Varna are a little closer in terms of the provision of appliances and conditions for sustainable consumption.*

Households' sustainable behavior in terms of electricity and water consumption

Table 2. presents data and indexes of households' behavior with regard to the energy efficient electricity and water consumption.

Table 2: Data and indexes of households' behavior with regard to the energy efficient electricity and water consumption

Answer codes	Indicators of sustainable electicity and water consumption	Sofia sub-sample (%)	Varna sub-sample (%)	Svishtov sub-sample (%)	Total sample (%)
16_1	We tend NOT to leave the lights turned on when there is no one in the room	75.1	83.2	78.4	78.8
16_4	We tend NOT to leave the windows open for a long time when the heating is switched on	63.9	77.3	67.8	69.6
16_2	We tend NOT to leave the TV set turned on when there is no one in the room	60.2	79.6	68.8	69.3
16_7	We tend NOT to use the washing machine when it is not full of clothes	51.6	67.0	54.8	57.7

Answer codes	Indicators of sustainable electicity and water consumption	Sofia sub-sample (%)	Varna sub-sample (%)	Svishtov sub-sample (%)	Total sample (%)
16_6	We tend NOT to leave the water running as we wash our teeth	51.3	57.2	37.0	49.2
16_11	We tend NOT to leave the water running as we do the dishes	41.7	60.5	44.9	49.0
16_3	We tend NOT to leave the PC switched on for a long time if it is not in use	38.0	60.5	47.6	48.4
16_8	We tend NOT to ignore the use of energy at night	31.3	54.0	63.7	48.4
16_5	We tend NOT to maintain an unreasonably high air temperature in winter (of above 22 degrees)	43.0	46.9	42.1	44.1
16_10	We tend NOT to use washing machine programs involving high temperature	30.5	52.8	48.3	43.2
16_12	We tend NOT to use the dishwasher when it is not full	33.4	51.0	15.1	34.0
16_9	We tend NOT to leave the shower running as we rub soap into our skins	18.2	33.9	16.1	22.9
16_13	We tend NOT to use the bathtub every time we are taking a bath	23.8	27.4	12.7	21.8
	Average (How many indicators have been checked on average)	5,9	7,6	6,1	6,5
	Electricity and Water Index	40	57	44	47

The indexes of the behavior with regard to electricity and water consumption for all three samples exceed the indexes pertaining to the development of a sustainable housing (Table 1.). This gives us the grounds to assume that, *in their frame of mind, Bulgarian households are mainly focused on their current costs/ bills in the short run rather than on investing in modern housing appliances and conditions, i.e. on cutting these costs in the long run*. It is also worth noting that in this case the average number of checked options is bigger (6,5 out of 13 options).

Among the most widely spread patterns of cutting electricity and water costs are the following:

1) Lights are never left switched on if there is no one in the room (78,8% of the households in the entire sample practice such an activity);
2) Windows are never left open for a long time if the heating is on (69,6% of the households in the entire sample practice such an activity);
3) The TV set is never left switched on if there is no one in the room (69,3% of the households in the entire sample practice such an activity);
4) The washing machine is never used unless it is full with clothes (57,7% of the households in the entire sample practice such an activity).

What should be taken heed of is the fact that among the most frequently checked patterns of electricity and water efficiency (1 - 4 of the ones listed above), the value of the indicators

for Sofia is the lowest, i.e. *the households in Sofia to the greatest extent tend to waste these resources compared to the households in the other cities*. The only case in which the share of the sustainable household consumption in Svishtov (63,7%) is significantly ahead of those of the other two cities (54,0% for Varna and 31,3% for Sofia) is the one pertaining to the use of electricity at night. The patterns of efficient water consumption that lag behind in the ranking are the following: non-use of the bathtub at every bath taking; turning off the shower during soaping; avoiding the use of the dishwasher unless it is full, among other. The low value for each of the given indicators (by sub-sample and for the sample as a whole) can be explained also with the fact that in some of the households such appliances are not available/are not used.

Comparing the Electricity and Water indexes in the separate sub-samples, we have established that the city of Varna stands out as the excellent performer compared to the other two cities – Varna's index is 57,0%, given that Svisthov's is 44,0% and Sofia's - 40,0%. The Electricity and Water Index for the overall sample stands at 47,0%.

The correlation analysis at this point also shows that *the highest degree of similarity between the households' profiles is between Varna and Sofia* (r = 0,910), compared to Varna and Svishtov (r = 0,876) and to Sofia and Svishtov (r = 0,780).

Households' sustainable behavior with regard to food consumption

In this section of questions, it is through indexes that the degree of households' sustainable behavior with regard to food, is determined. Table 3. presents the data per each of the assessed indicators of behavior for the sub-samples and for the sample as a whole. In this section of questions, Varna once again shows the highest index of 49,0%, given that 42,0% is the index for Svishtov, while 40,0% is the index for Sofia.

The most common sustainable practices in the three cities are eating home-cooked food, more fruits and vegetables, locally produced and fresh food, avoiding food stocks, and reusing food shopping bags.

Among the households in Varna, the most common practices of sustainable consumption are the collection and recycling of food waste and the use of eco-friendly packaging.

It is worth noting that the consumption of food by local producers is highest among the households in Svishtov, which can be explained by specific cultural practices in Bulgaria. Most of the households in the small towns and villages in Bulgaria produce their own basic food like fruits, vegetables, milk and dairy products, meat, honey, etc. Consumption of fish and seafood is also high in Svishtov, which is related to its geographical location (close to the Danube River) and households' habits to consume fresh fish.

Table 3: Data and indexes for households' sustainable behavior with regard to food consumption

Answer codes	Indicators of sustainable food consumprion	Sofia sub-sample (%)	Varna sub-sample (%)	Svishtov sub-sample (%)	Total sample (%)
17_5	Consuming more food prepared at home	76.5	83.3	78.6	79.4
17_11	Consuming more fruits and vegetables	65.1	78.4	67.4	70.1
17_3	Consuming more domestically produced food (made in Bulgaria)	52.8	61.7	64.1	59.1
17_7	Consuming mostly seasonal fruit and vegetables	57.9	69.3	49.0	59.1
17_16	The repetitive use of plastic carriers when shopping	56.1	56.1	55.6	56.0
17_14	The regular usage of multiple-use carries when purchasing foods	52.3	61.7	47.0	53.9
17_8	The avoidance of the consumption of semi-fabricated products	50.8	57.6	47.0	51.9
17_15	Not storing redundant food provisions	48.0	57.0	51.0	51.8
17_4	Consuming foods and products (fruit, vegetables, meat and meat products, dairy products or other) that are own production (produced personally or by relatives)	43.6	60.5	40.8	48.4
17_12	Consuming more grain or bean foods	29.8	53.2	46.1	42.3
17_2	Purchasing more foods directly from the producer	30.6	45.9	48.4	40.8
17_13	Paying attention to the types of preservants (E-s) when purchasing foods	33.7	35.7	38.8	35.8
17_17	The avoidance of plastic carrier bags when shopping	39.5	38.3	25.0	34.9
17_10	Consuming more fish and seafood	29.6	34.8	34.9	32.9
17_9	The avoidance of the daily consumption of meat	25.0	27.8	33.6	28.4
17_1	Consuming more bio-foods that are certified and sold in shops (without artificial additives, chemical preservants, coloring, flavours, GMOs, antibiotics, hormones and other non-natural ingredients)	22.2	27.2	17.1	22.4
17_6	Consuming more foods wrapped up in biodegradable/ recycable packaging	15.1	20.2	7.9	14.6
17_18	Transforming biodegradable waste into bio-fertilizers (composting)	6.6	9.1	3.3	6.5
	Average (How many indicators have been checked on average)	7,4	8,8	7,6	7,9
	Food Index	40	49	42	43

Based on the results from the correlation analysis the conclusion can be made that:

(1) There is a *high correlation between the profiles of the three cities*: the correlation between Sofia and Varna is r = 0.951; between Sofia and Svishtov is r = 0.900; between Varna and Svishtov is r = 0.923. This means that *there are no significant*

differences between the three cities in terms of sustainable food consumption.

(2) Yet again, *there is the highest degree of similarity between the households' behavior in Varna and Sofia* (0,951) *in terms of the sustainable food consumption.*

Sustainable behavior with regard to transportation

Table 4. presents the data and the indexes for the three sub-samples and the sample as a whole in this piece of research in terms of sustainable behavior in transportation. Expectedly, in this section of the study, walking on foot has a distinctly high penetration (67,7%), given that it is the possibly most sustainable option. Understandably (for reasons such as relatively short distances to cover; underdeveloped public transport), the city of Svishtov has the highest penetration of this practice (72,4%), it is significantly higher than the one for the whole sample (67,7%). Expectedly, it is again Svishtov that has the lowest proportion among all those measured - 1,6% for using mainly public transport, considering that this type of transport is poorly developed, as was mentioned above. It is again Svishtov that has higher share for practices pertaining to ecological transportation that have been gaining speed worldwide – the rarer use of one's own car for transportation within the settlement and the increased use of a bicycle.

Unlike the previous three sections of the study, in the transportation section Sofia stands out with higher share compared to Varna and Svishtov for the following elements: visiting nearby commercial properties in order to avoid using one's own car; avoiding the use of one's own car to get to the city center (parking problems); preference to use public transport (a significantly higher index compared to the other sub-samples); preference to avoid driving a car when there is only one person in the car.

Table 4: Data and indexes for sustainable behavior with regard to transportation

Answer codes	Indicators for sustainable transportation	Sofia sub-sample (%)	Varna sub-sample (%)	Svishtov sub-sample (%)	Total sample (%)
20_4	We tend to walk on foot more often	60.2	72.1	72.4	67.7
20_6	When shopping for food, personal hygiene and home cleaning products we tend to go to commercial properties near our home so as to avoid using some other means of transportation	56.6	52.7	49.6	53.3
20_8	We tend to avoid using our own car when going to the city center	36.7	34.4	23.6	32.2
20_7	We tend to use our own car on increasingly rare occasions as a means of transportation in our city	27.4	25.5	30.0	27.5
20_2	We prefer to use mainly public transport	41.9	28.2	1.6	25.8
20_1	We tend to avoid driving along (only one person in the car)	21.7	21.4	15.6	19.9

Answer codes	Indicators for sustainable transportation	Sofia sub-sample (%)	Varna sub-sample (%)	Svishtov sub-sample (%)	Total sample (%)
20_3	We tend to use the bicycle more as a means of transportation	11.4	15.0	22.8	15.9
20_5	We tend to use motorcycles or scooters as a means of transport	3.6	5.8	5.2	4.8
	Average (How many indicators have been checked on average)	2,6	2,6	2,2	2,5
	Transportation Index	27	27	23	26

As it becomes evident from Table 4, the Transportation Indexes for Sofia and Varna are equal and exceed the average index for the whole sample.

The correlation analysis of the data in the transportation section exposes *the high degree of similarity between Sofia and Varna* (r = 0.940); the relatively lower degree of similarity between Varna and Svishtov (r = 0.890), and *the lowest degree of similarity between Sofia and Svishtov* (r = 0,713).

Based on the indexes identified above, Table 5. sums up the situation according to the particular indexes and the three sub-samples.

Table 5: Indexes by sub-sample (%)

	Sub-samples indexes			Whole sample indexes
	Sofia	Varna	Svishtov	
Housing Index	37	47	38	**41**
Electricity and Water Index	40	57	44	**47**
Food Index	40	49	42	**43**
Transportation Index	27	27	23	**26**

As it becomes clear from Table 5, the Electricity and Water Index for the sample has the highest value (47%) of the four indexes, which shows that *households' sustainable behavior is best developed with regard to their efforts towards the efficient consumption of electricity and water*. By comparing the sub-sample, it should yet again be noted that the city of Varna stands out with an index 57% compared to Svishtov (44%) and Sofia (40%).

Next in the sample for households' sustainable behavior is the Food Index, which is lower than the previous one by four percentage points. In this case the households in Varna have the highest sustainability (49%), followed by those in Svishtov (42%) and Sofia (40%).

With regard to the Housing Index (41), the ranking by sub-sample is preserved – this index has the highest value in Varna, followed by Svishtov (38%) and Sofia (37%), the indexes of which are fairly close in value.

It turned out that *consumer behavior with regard to transportation is the least sustainable*

one – the index for the sample is a mere 26%. In this case, Varna and Sofia have equal positions (27%), followed by Svishtov (23%).

Based on the four indexes, pointed above, the average values of the Composite Behavioral Index (CBI) for households' sustainable behavior for each sub-sample and for the sample as a whole are arrived at Table 6.

Table 6: Composite Behavioral Index by sub-sample and for the whole sample

Composite Behavioral Indexes by city	Value of the index (%)
Sofia	36
Varna	45
Svishtov	37
Composite Behavioral Index for the whole sample	39

What can be drawn as a conclusion from the data presented in Table 6. is that *the highest degree of sustainable behavior is observed among the households in Varna*. What is more, the Composite Behavioral Index for the specified sub-sample (45%) by far exceeds the value of the index for the sample as a whole (39%). Contrary to preliminary assumptions, the *Composite Behavioral Indexes for Sofia and Svishtov are close in value* (36% and 37% respectively), which shows that *no significant difference with regard to household behavior (in terms of sustainability) has been found between a big city/megapolis as Sofia and a smaller city.* This conclusion was reaffirmed also in the analysis of the household's distribution in all three sub-samples according to the value of their Composite Behavioral Index (Table 7.). As it becomes evident from the table, *the cities of Sofia and Svishtov have a similar household distribution in terms of their Composite Behavioral Index*.

Table 7: Distribution of households by Composite Behavioral Index (CBI)

Indexes	Households with a low CBI value (up to 24.99%)	Households with an average CBI value (25 up to 49.99%)	Households with a high CBI value (50 up to 74.99%)	Households with a very high CBI value (75 up to 100%)
Sofia	26.8%	53.1%	19.4%	0.7%
Varna	11.7%	50.0%	35.7%	2.6%
Svishtov	24.0%	56.6%	19.1%	0.3%
Total	**21.1%**	**53.1%**	**24.6%**	**1.2%**

As it becomes clear from the data presented in the Table 7, a *mere quarter of the households included in the sample can be defined as households with sustainable behavior* (25,8%). The biggest share in the sample is gained by the households with an average CBI (53,1%), followed by the households with a high CBI (24,6%), a low CBI (21,1%) and a very high CBI (1,2%).

In all three sub-samples there is a relatively even distribution of the households with an average CBI, ranging from 56,6% of the households in Svishtov to 50,0% of the households in Varna.

With regard to the distribution of the households with a high CBI, Varna has gained a significantly bigger share among these households (35,7%), whereas Sofia and Svishtov have come close in terms of share – 19,4% and 19,1% respectively.

The households with a low CBI value comprise a small share of the households in Varna (11,7%), their share in Sofia stands at 26,8%, while in Svishtov it is 24,0%.

The households that in effect show a sustainable behavior (with a very high CBI) comprise 2,6% of the households in Varna, 0,7% of the households in Sofia and 0,3% of the households in Svishtov.

Conclusions

This article has presented a conceptual model and indexes have been constructed and calculated to measure sustainable urban consumption. The focus has been placed on the behavioral component of attitudes, in particular on *what actions people consciously tend to take with regard to SUC*. The values of the five behavioral indexes, namely the Housing Index, the Electricity and Water Index, the Food Index, the Transportation Index and the Composite Behavioral Index reveal the level of sustainable consumption of the households in the three cities - Sofia, Varna and Svishtov, as well as the existing differences between them:

- Only a quarter of the households in the sample can be qualified as households with sustainable consumption, and an extremely small portion of only 2.6% of all households in Varna, 0.7% of households in Sofia and 0.3% of households in Svishtov are highly devoted to sustutainable consumption practices.
- The highest value of the Composite Behavioral Index has the city of Varna, followed by the cities of Svishtov and Sofia with approximately the same values.
- The Housing Index, Electricity and Water Index and Food Index have the highest values for the city of Varna and relatively lower values for the cities of Sofia and Svishtov. As to the Transportation Index, Sofia and Varna have equal values, slightly higher than the value of the index for Svishtov.
- As to the sustainable consumption practices in all of the households from the three cities, the most common are related to electricity and water consumption, followed by food consumption, provision of favorable housing conditions for sustainable consumption, and the least common ones are related to sustainable transportation practices.
- Regarding the provision of housing conditions for sustainable household consumption in the three cities, the prevalent ones are conventional appliances and conditions for ensuring lower costs of electricity, heat, water. The city of Varna is ahead (in some cases - significantly) of the other two cities by the values of the different indicators for the Housing Index.
- The city of Varna is ahead of the other two cities by the values of the different indicators for the Electricity and Water Index, and the city of Sofia has the lowest values, which means that households there are the least frugal.
- As long as the Food Index is concerned, the city of Varna is ahead of the other two cities by the values of most indicators. The most common practices in the three cities are eating home-cooked food, more fruits and vegetables, locally produced and fresh food, avoiding food stocks, and reusing food shopping bags.

- In terms of sustainable transportation, the most common alternative in all the three cities is walking on foot. The indicator for this practice has the highest value in the town of Svishtov. Among the most widespred transportation practices in this town are the less frequent use of private cars and increased use of bicycles. The households in the city of Sofia mostly avoid the use of personal cars and individual travels (one person), and they prefer to use public transport. In Varna the values of the indicators are higher than in the other cities for practices such as walking on foot, riding a motorcycle or scooter.

In conclusion it should be highlighted that a relatively small portion of the households in the cities of Sofia, Varna and Svishtov tend to have sustainable consumption lifestyles. Such a disposition is most strongly expressed among the households in Varna, while the households in the cities of Sofia and Svishtov have an approximately equal level of SUC, each city being ahead of the other with regard to some type of action taken in the separate consumption areas. In all three cities there is a stronger disposition towards the efficient use of electricity and water compared to the conscious tendency to invest in sustainable housing conditions. This exposes the dominant orientation towards cutting current costs in the short run and a smaller orientation towards making investments with a view to their reduction in the long run. Households are least oriented towards sustainable practices in terms of transportation, and almost no differences between the cities have been found along this indicator. Sustainable food consumption is normally related to preparing at home fresh and locally produced food of mainly vegetable origin. In this respect, the cities of Varna and Svishtov have taken the lead in the ranking.

In summary, no significant differences have been established in the sustainable consumption of the households in cities that differ in size, namely the capital city (Sofia), a big regional city (Varna) and a small city (Svishtov).

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