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FULL PAPER

From Theory to Praxis: 'Go Sustainable Living' Survey for Exploring Individuals Consciousness Level of Decision-Making and Action-Taking in Daily Life Towards a Green Citizenship

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Abstract
This study aims at embedding sustainability practices by exploring sustainable actions of individuals consisting the educated workforce of Greece. A tailored questionnaire was created and sent via e-mails to 500 respondents, to identify a snapshot of participants daily buying and consuming actions. 483 responses received and analyzed using statistical tools. They respond to recommendations for enhancing sustainability consciousness at individual level, inspiring people to buy sustainable, creating new consumption attitudes that are key factors for moving towards a sustainable citizenship. The findings will further provide information for a second paper on developing the 'Go Sustainable Living' digital application to be uploaded in individuals' mobile phones, for rewarding users with points that correspond to each sustainable action and can later be used for discounts in all participating stores. The analysis showed that <30% of consumers are considered sustainability-conscious, 57.6% are in a transition phase, while 13% fell into the category of non-conscious. To make sustainable decisions and actions in every daily life, individuals need to have knowledge of sustainability, awareness, consciousness of their actions, and be active citizens. An educated workforce armed with sustainability perceptions and competencies is an asset for societies and businesses poised to respond to the sustainability call. Sustainability should not be only an 'utopia' in our societies but an 'eutopia' entailing a life with ecological and social health and prosperity at a local, regional, and global level.

Keywords Sustainable living · Survey · Actions · Individual level · Green citizenship · Questionnaire · Greece

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Introduction

The actual eco-social crisis is a perilous condition that necessitates radical changes to mitigate ecological and social hazards and disruptions [1]. The climate change-based hazards, overuse of resources, environmental degradation, social inequality, health risks, and crises associated with them, as the actual COVID-19 pandemic, are a set of concerns that are underlying the urgent need for a more sustainable and resilient life, society, and economy [2–4].

Global environmental and socio-ecological challenges are complex systems that are difficult to resolve due to existing conflicts of interest and inherent complexity. Their solution demands sustainability awareness, consciousness of actions and decision-making, transdisciplinary, participatory, and co-creation approaches that include social, ecological, technological, and economic dimensions [4–7]. Sustainability is a work in progress, a unique political process for citizens to become active members and gain a green citizenship (GC) identity. The Sustainable Development Goals (SDGs) Agenda of the United Nations adopted by world leaders in 2015 provides a framework and universally accepted goals and targets. The Agenda summarizes priority action areas to help societies achieve prosperity, justice, equality, and security [8, 9]. These goals can be achieved by institutionalizing a conscious action at individual, societal, political, economic, and cultural levels [10–14].

Sustainable development (SD) is a learning process [15]. It needs education systems to develop and strengthen the capacity of individuals, groups, communities, organizations, and countries to make choices and decisions in favor of SD, according to the United Nations Economic Commission for Europe (UNECE) [16]. Education can promote a shift in people's mindsets, enabling them to make our world safer, healthier, and more prosperous. Knowledge has an essential role in influencing pro-environmental behaviors and boost sustainability citizenship [17]. Individual behavior change is necessary for making a positive societal transition to a resource-constrained future. The planet has finite resources, so behavior change interventions need to change towards reaching a GC [18, 19]. Although SD consists of an up-and-coming solution for tackling the current socio-ecological crisis and reducing the magnitude of its catastrophic consequences, efforts have been inadequate and ineffective so far [20–22].

The economic and social progress made in the 'Anthropocene' era has been accompanied by environmental degradation that has put at risk the ecosystems on which our future survival depends. Meanwhile, alternative perspectives on capitalism and consumerism have been developed, such as the circular economy (CE) and sharing economy (SE) that are new concepts aiming to change the production and consumption patterns at all levels (individual, society, political, cultural, etc.) and scales (local, national, regional, global) worldwide. Technological innovations and collaborative consumption within the new models of CE and SE can boost closing the loop strategies [23]. SE business and individual practices are rising worldwide, and in some countries, this is a common practice among mainly young people. These practices are changing structures and patterns of customers purchasing behaviors and needs [24, 25]. SE is inspired by the SDG12: ensure sustainable consumption and production patterns and it is an economic opportunity, a more sustainable form of consumption, and a pathway to a decentralized, equitable and sustainable economy.

To take a speedy leap towards SD, there is an urgent need to increase our actions moving from 'theory to praxis' at individual, societal, political, and production levels [26–28]. Sustainability is a procedure and a process of acting towards maintaining the health of eco-social systems. Sustainable actions are required to preserve the value of both natural and social

capitals. To fully understand the concept of sustainability, three main areas of influence, the so-called three pillars of sustainability, the social, the economic, and the environmental, must be considered. If combined and put into practice, they can create a solid foundation for a sustainable world [21, 29]. To maintain the natural environment and its full functionality and usability for a long time, the environmental impact of any action or decision-making should be considered or measured [30]. Real sustainability is not only promoted when economic growth is considered or when measuring the economic value of any project or decision [31]. The 'business as usual' approach, which was used for business's decision-making until now, meant that profit was the only concern and business's primary goal [32]. Towards a sustainable world, business decision-making must integrate social and environmental aspects along with economic profitability [33].

The social dimension of sustainability supports the idea of intergenerational justice and encompasses many other societal issues, such as environmental legislation, human and labor rights, equity in health, community development through social participation, social capital, support for justice and social responsibility, cultural adequacy, social resilience, and human adaptation [34, 35]. Nobel Memorial Prize in Economic Sciences laureate Amartya Sen in 1998 already defined social sustainability as integrating diversity, social cohesion, quality of life, democracy and governance, and patterns of social behavior [36].

SD is a combination of the social, economic, and environmental pillars and cannot be achieved effectively if one of them does not 'work' properly [37]. The degree of resources used should be based on their availability, the earth's biocapacity, and people's needs. Therefore, it becomes apparent that economic growth has limits set by the planet's finite environment and earth's biocapacity [10, 38]. To control the use of resources within the earth's boundaries, environmental and sustainability indicators (quantitative and qualitative) are proposed by many researchers [30, 39–41]. The qualitative indicators describe the legal actions and their results, while the quantitative indicators deal with the numerical measurements [42–45].

To make sustainable decisions and action in every daily life, individuals need to have knowledge of sustainability, awareness, and consciousness of their actions, to be active citizens towards developing and green citizenship. The term awareness has been widely used in various research fields such as psychology, sociology, environmental, and business studies [46–49]. Environmental awareness has been researched at many levels in the previous decades. It was investigated at the marketing and business level many years ago [50] and was demonstrated that the most environmentally conscious companies make better profits [51]. Criteria that define ecologically conscious companies were developed with time [52]. Environmental awareness at the country's level was also studied [53]. Environmental awareness in consumption at the individual level was given great importance since some years ago [54], while many other environmental awareness studies, such as the 'New Ecological Paradigm' [55, 56], the 'environmental values' study [57, 58], the 'Children's Environmental Attitude and Knowledge Scale' [59], the 'Environmental Attitudes Inventory Scale' [60], and the 'Environmental Concern Scale' [61, 62], suggest measuring environmental actions.

The concept of consciousness appears with various semantic concepts in the field of psychology. According to Velmans [63], consciousness is defined as (1) self-awareness, (2) awakening state, and (3) knowledge, stating that when one is aware of something, he also knows about it. It consists of a system of beliefs, which refers to specific psychological factors related to individuals' tendency to engage in environmental activities [64, 65]. It is a multi-dimensional way of thinking, consisting of four dimensions [46, 49, 66]: (a) emotional (beliefs

and values), (b) perceptions (attitudes), (c) cognitive (information and knowledge), and (d) action-taking (environmental behavior).

In addition to environmental awareness that relates to ecological buying behavior, which can be measured through environmental knowledge, attitudes, behaviors, and actions involved in consumer behavior [46, 67], a state of mind associated with environmentally friendly behavior is defined as ecological consciousness [49]. Ecological consciousness is the key to the relationships between people and new technologies with the ecosystems [68] and moreover can be referred to as the experience of 'Self' [13, 69]. Understanding how human consciousness is functioning can deliver societies with significant opportunities that accelerate sustainable transitions [13]. Understanding the relationships between consciousness and people's actions could bring positive societal transformations. That is why transformative sustainability learning deserves a more prominent role in education, amidst technological achievements, inventions, and innovations [4]. People need to cultivate a sustainability consciousness, which will integrate the perception of 'Unity' and 'Oneness' [4, 7, 13]. In the present study, the term consciousness is used to describe sustainability phenomena's experience or awareness. These experiences include perceptions, beliefs, feelings, decisions, and actions [63].

Environmental exposure and unsustainable patterns of life raise concerns among citizens about their health and well-being and create fears of diseases [70–77]. Exposure to a variety of environmental factors is a threat to sustainability, as it involves both direct and indirect risks to human health, public health, longevity, quality of life, and citizens' well-being [78, 79]. All the above pose risks to humans, ecosystems life, and crops while reducing workforce and productivity [80, 81]. Climate change is stressing the body due to extreme cold or heat and has severe and medium-term health effects [82, 83]. These problems are usually addressed separately in a 'top-to-bottom' approach [84]. Participatory approaches and multidisciplinary frameworks are needed to be established, requiring the combined involvement of a wide range of active citizens, various stakeholders, networks, scientific knowledge, and technological innovations. For example, 'smart cities' need 'active citizens,' who can participate in their city's daily management and are interested in improving their fellow citizens' quality of life and protecting the environment locally, regionally, nationally, and globally [85–87].

Technology alone may ease the situation but not solve the problem. Individual and collective behavior's transformation can solve problems. However, for this transformation, citizens' access to mindful information and simplified knowledge is needed [88–90]. In this context, a scientific effort is needed to provide methods that communities can implement and encourage more efficient governance through new creative methods of collaboration between citizens and other stakeholders [91, 92]. Empowerment must make citizens feel strong and confident, especially in controlling their lives, tackling social problems, and claiming their rights [93]. The concept of participatory governance recognizes that it is not sufficient to provide citizens only with lists of environmental data or reports on changes that have taken place but to replace 'top-to-bottom' approaches with 'bottom-up' ones to social orientation to deliver efficient collective pro-active efforts against disruptions of citizens' health and well-being. Achieving this challenge requires providing goals, incentives, and smart tools for citizens to make their lifestyles and behaviors more sustainable [94, 95]. Modern citizens are called upon to face various environmental pressures and climate change that are key challenges. For this reason, there is an urgent need for scientists, managers, decision-makers, and public authorities to make sustainable decisions, and individuals to be active citizens [96].

Sustainability is not a specific, consolidated idea, but an evolutionary process of improving the management of natural and human systems. It requires the recipients of this theory to have

the potential for continuous cultivation and perspicacity to correctly interpret the circumstances and benefit of them [97]. The pursuit of SD presupposes the ability to adapt and innovate in terms of ideas, technology, and actions. This effort is based on citizens who could turn their knowledge and thoughts into action [98]. Therefore, the individual must have penetrating and forward-thinking, judge the various development options and long-term planning policies, and always choose the one that will enhance sustainability.

Creating the appropriate socio-economic and business-ethical circumstances, education for SD will support the emergence of green citizenship (GC) that combines ethical, social, and ecological sustainability dimensions. GC should be considered a radical and effective solution against the extended environmental crisis [19]. Achieving GC and economic development in each sector requires particular attention to energy and natural resources consumption [99, 100], attention to the safety of activities and processes for both environment and human health [101–103], and attention to the social impacts of activities of businesses [104–106]. Furthermore, GC must convey a triple moral framework, leading to various skills and abilities. It must convey moral knowledge, judgement, and courage [107]. The GC term is formed through his willingness to protect his environment, not only because of laws and regulations but also because he recognizes and appreciates the benefits one derives from it [108, 109]. Manifestation of GC is an example of radical democracy [110].

The scope of this study is to conduct a survey for exploring sustainability perceptions and actions of Greek people with a university education via a questionnaire, and assess consumers' attitude towards a sustainable living and green citizenship.

Materials and Methods

Bibliographic Search

In this work, we started with a systematic literature according to the method of Thürer et al. [111], aiming to retrieve and select the relevant publications that refer to the current research topic. The criteria that determined the articles used were the title, the summary, the keywords, the type of document ('review' or 'articles'), and the publication year (from 2010 to 2020). The search was conducted on the platforms 'Web of Science,' 'Science Direct,' and 'Google Scholar' with the following keywords: 'sustainability AND consciousness,' 'environmental awareness AND sustainability,' 'green or sustainability citizenship,' and 'sharing economy.' It has resulted in many publications, from which 3997 were the most relative. Out of this total, 3589 publications were excluded as they were not very comprehensive to the specific research topic; thus, 408 relevant articles were chosen for a deeper study. Out of these 408 papers, 150 publications were finally used as primary literature of this study (Table 1). The finally selected 150 publications had a similar content with the main theme of this publication. They contained questionnaires on the issue of sustainability and 'green consumption,' sustainable practices applied in other EU countries, or bottom-up strategies for increasing citizens for a 'green citizenship.' Among the 150 publications, some publications were related to the statistical analysis of collected results from various questionnaires. These publications were selected as providing methodologies for statistical analysis of the results.

Figure 1 presents the evolution of the published studies regarding sustainable consciousness. As it can be noticed, there is a growing research activity and interest on this topic from 2013 and on.

Table 1 Bibliographic review for sustainable consciousness

Review steps	Number of publications
1. First sample	3,997
2. Sample after excluding irrelevant publications	410
3. Final selection of publications for research use	148

Research Questions

The bibliographic research was conducted to reveal the appropriate research questions, which would be included in the questionnaire. These questions served the author's objectives and gave all the necessary responses to assess the respondents' sustainable consciousness and form the 'Go Sustainable Living' DA.

The research questions focused on the following:

- What is the attitude of Greek citizens of university education towards sustainability and their knowledge about environmental problems?
- How do they interpret climate change, and to what extent does it affect their daily lives?
- Are they willing to change their daily routine and acquire more sustainable habits?
- How appealing the application will be for Greek society?
- Can awareness towards sustainable life be supported by practicing this digital application?

Setting and Population

The tool used to obtain the necessary information was a questionnaire listed in Appendix 1 and contained multiple-choice questions. This was a tailored questionnaire consisting of questions on sustainability issues and providing information on the respondents' sustainable

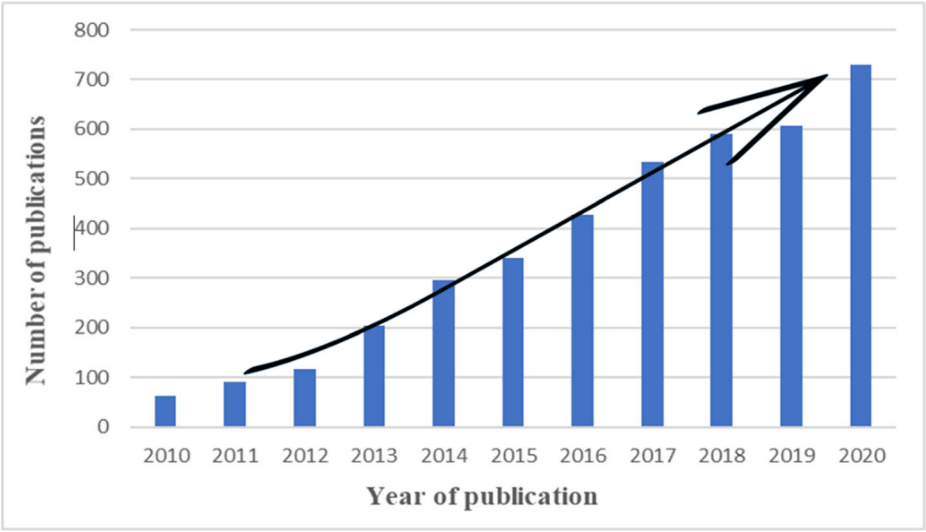

Fig. 1 Statistical analysis of publications related to sustainability awareness

consciousness. For developing the questionnaire, ideas from other questionnaires found in the literature were caught [112–114] along with authors' creativity and experience.

We used the Google Forms tool to create an online form questionnaire. We sent the questionnaire via e-mail to 500 people (all age groups of university-educated people, from undergraduate and postgraduate students to employed and unemployed scientists and engineers), consisting networks where the authors participate.

We limited our target group to the above category of people because it was not easy to reach random consumers due to COVID-19 lockdowns, (e.g., we could not visit marketplaces, etc.). We took back 483 responses and ensured the complete confidentiality of the information collected by avoiding collecting contact details such as surname, first name, and e-mail address of the respondents.

Sampling and Data Collection

People who volunteered to participate in the study have completed the one-time 10-min online survey. They gave their consent to participate in the study by completing the survey. No personally identifiable information was collected. However, we asked respondents to provide some demographic data (gender, age, place of origin, and employment). The responses to these questions were considered vital for the study, as they allowed us to assess the impact of these factors on the respondents' sustainable consumption patterns.

All these data remain confidential according to the Regulation (EU) 2016/679 of the European Parliament and the Council, the European Union's ('EU') new General Data Protection Regulation ('GDPR'), regulating the processing by an individual, a company, or an organization of personal data [115].

Variables and Measurement

The questionnaire comprised forty-one (41) questions of multiple-choice, closed, and open-ended, and Likert scale questions (ranging from 'not at all' to 'too much' and from 'never' to 'very often'), grouped in three domains (see questionnaire in Appendix 1). The questionnaire consisted of 3 domains of information:

a. Personal information
b. Sustainability awareness and actions
c. Technological and digital skills

These domains consisted of various variables. The first domain included six items related to the demographic variables, such as gender, age, employment, and origin. The second domain consisted of twenty-seven items including educational, social, economic, and political variables. More specifically, it examined how the above factors affect the sustainable practices in the respondents' daily lives. The third domain had seven items and included information and communication variables, as it examines the relation of respondents to technology and the proper way to communicate by using 'Go Sustainable Living' digital application.

The questionnaire surveyed the views of the respondents in the following thematic areas:

- Knowledge of environmental problems and attitudes towards sustainability (items 8–16)
- Daily habits and willingness to replace them with more sustainable ones (items 17–34)

- Interest in using a 'Go Sustainable Living' digital application (items 35–40)

Statistical Analysis

The IBM SPSS statistical software (Statistical Package for Social Sciences), version 25.0, was used for the data analysis. The data collected in Google Forms were exported to SPSS. By using the 'bivariate correlations,' we found the p value of the thirty-four items (questions 8–41) and correlated them with the six independent variables (gender, age, employment, origin, student groups, and environmental hobbies). Then, we used the 'chart builder' and presented the questionnaire's responses in bar and line charts.

Study Limitations

Due to COVID-19, the questionnaire was distributed only through e-mail to networks of people where authors participate that could easily be reached. These people are members of scientific or professional networks. For this reason, the number of participants was confined. Most of the respondents were young; the percentage of scientists with age over 50 who participated in the study is low (4.6%).

Results

Correlation of the Questions with the Independent Variables

The correlation variables of the questionnaire are divided into the following categories:

1. Demographic variables: gender, age, employment, origin, environmental hobbies, and student groups (items 1–7).
2. Education variables: the examination of the respondents' knowledge about the issue of sustainability and other environmental problems is achieved with items 8–15.
3. Social, economic, and political variables: these factors affect the presence of sustainable practices in the respondents' daily lives, and they are found in a variety of questions (items 16–34).
4. Information and communication variables: these variables appear in items 35–41, where the technological skills and respondents' willingness to participate in a sustainable digital application are examined.

Table 2 shows the correlation of the items with the six independent variables, based on the p value indicated in parentheses. When you perform a statistical test, a p value helps you determine your results' significance in relation to the null hypothesis. The null hypothesis indicates that there is no relationship between the two variables being studied (one variable does not affect the other). It states the results are due to chance and are not significant in terms of supporting the idea being investigated. In cases where the type of correlation is statistically significant ($p<0.05$), there is the symbol * next to the parentheses. In instances where $p>0.05$, the question is characterized as nonstatistically significant [116, 117].

Table 2 Correlation of the questionnaire questions with the independent variables, based on the p value

Question	Gender	Age	Employment	Origin	Environmental hobbies	Student groups	% statistically significant
	p value (indicates statistically significant differences, i.e., p<0.05)						
8	(0.404)	(0.012)*	(0.344)	(0.106)	(0.000)*	(0.001)*	50.0 (3*/6)
9	(0.020)*	(0.279)	(0.244)	(0.147)	(0.000)*	(0.007)*	50.0 (3*/6)
10	(0.000)*	(0.019)*	(0.213)	(0.068)	(0.134)	(0.361)	33.3 (2*/6)
11	(0.000)*	(0.193)	(0.016)*	(0.013)*	(0.006)*	(0.323)	66.6 (4*/6)
12	(0.011)*	(0.189)	(0.127)	(0.052)	(0.045)*	(0.046)*	50.0 (3*/6)
13	(0.275)	(0.000)*	(0.003)*	(0.027)*	(0.002)*	(0.000)*	83.3 (5*/6)
14	(0.109)	(0.009)*	(0.434)	(0.108)	(0.000)*	(0.041)*	50.0 (3*/6)
15	(0,014)*	(0.109)	(0.482)	(0.206)	(0.237)	(0.278)	16.6 (1*/6)
16	(0.097)	(0.100)	(0.049)*	(0.047)*	(0.029)*	(0.031)*	66.6 (4*/6)
17	(0.098)	(0.167)	(0.318)	(0.494)	(0.088)	(0.280)	0.0 (0*/6)
18	(0.001)*	(0.125)	(0.361)	(0.092)	(0.007)*	(0.026)*	50.0 (3*/6)
19	(0.000)*	(0.002)*	(0.002)*	(0.010)*	(0.209)	(0.010)*	83.3 (5*/6)
20	(0.370)	(0.046)*	(0.006)*	(0.102)	(0.266)	(0.042)*	50.0 (3*/6)
21	(0.407)	(0.000)*	(0.036)*	(0.048)*	(0.002)*	(0.007)*	83.3 (5*/6)
22	(0.048)*	(0.006)*	(0.070)	(0.321)	(0.001)*	(0.003)*	66.6 (4*/6)
23	(0.253)	(0.004) *	(0.300)	(0.315)	(0.008) *	(0.001) *	50.0 (3*/6)
24	(0.016) *	(0.285)	(0.154)	(0.437)	(0.003) *	(0.050)	33.3 (2*/6)
25	(0.000) *	(0.000) *	(0.000)*	(0.002) *	(0.001) *	(0.362)	83.3 (5*/6)
26	(0.028) *	(0.237)	(0.262)	(0.095)	(0.000) *	(0.000) *	50.0 (3*/6)
27	(0.055)	(0.343)	(0.352)	(0.204)	(0.001) *	(0.014) *	33.3 (2*/6)
28	(0.038) *	(0.000) *	(0.005) *	(0.485)	(0.005) *	(0.485)	66.6 (4*/6)
29	(0.000) *	(0.001) *	(0.000) *	(0.029) *	(0.014) *	(0.001) *	100.0 (6*/6)
30	(0.023) *	(0.002) *	(0.060)	(0.487)	(0.002) *	(0.226)	50.0 (3*/6)
31	(0.084)	(0.006) *	(0.028) *	(0.058)	(0.006) *	(0.000) *	66.6 (4*/6)
32	(0.042) *	(0.000) *	(0.000) *	(0.134)	(0.042) *	(0.217)	66.6 (4*/6)
33	(0.000) *	(0.003) *	(0.005) *	(0.123)	(0.000) *	(0.001) *	83.3 (5*/6)
34	(0.000) *	(0.141)	(0.167)	(0.065)	(0.462)	(0.009) *	33.3 (2*/6)
35	(0.012) *	(0.000) *	(0.005) *	(0.002) *	(0.000) *	(0.129)	83.3 (5*/6)
36	(0.115)	(0.325)	(0.414)	(0.085)	(0.034) *	(0.022) *	33.3 (2*/6)
37	(0.197)	(0.009) *	(0.034) *	(0.421)	(0.058)	(0.000) *	50.0 (3*/6)
38	(0.006) *	(0.000) *	(0.001) *	(0.026) *	(0.005) *	(0.070)	83.3 (5*/6)
39	(0.033) *	(0.031) *	(0.094)	(0.028) *	(0.166)	(0.012) *	66.6 (4*/6)
40	(0.008) *	(0.053)	(0.142)	(0.037) *	(0.365)	(0.000) *	50.0 (3/6)
41	(0.069)	(0.063)	(0.412)	(0.363)	(0.489)	(0.029) *	16.6 (1*/6)
% statistically significant	63.6 (21*/33)	60.0 (20*/33)	45.5 (15*/33)	33.3 (11*/33)	72.7 (24*/33)	69.7 (23*/33)	78.7 (114*/145)

Items 1–7 are not investigated in Table 2 because they include the demographic data. From Table 2 below, we conclude that 78.6% of the questions are statistically significant, as 114 out of 145 questions had p<0.05. Statistically important questions will be the basis for further commentary and for drawing useful conclusions.

Demographic Variables

The respondents' demographic data are presented in Table 3. More specifically, 47.8% were women, while 52.2% were men. Gender did not affect the answers given to the questionnaire. This finding is consistent with similar results from other studies on the equality of sexes to environmental concerns [118].

Although most respondents' place of origin was urban (61.7% were grown up in the city, while 38.3% in a village), the findings showed that the respondents' place of origin (variable

Table 3 Demographic data of respondents

Gender		Age		Employment		Origin	
Male (%)	52.2	18–22 (%)	16.1	Undergraduate (%)	34.6	City (%)	61.7
		22–26 (%)	26.5	Postgraduate (%)	17		
		26–30 (%)	17.4				
Female (%)	47.8	30–40 (%)	18.2	Employee (%)	32.3	Village (%)	38.3
		40–50 (%)	17.2				
		>50 (%)	4.6	Unemployed (%)	16.1		

based on position) does not significantly impact their perceptions. Urban and rural areas are interconnected by various types of flows (energy, food, wastes, pollution, etc.) and links, including two-way relations and cooperation between municipalities and regions.

Regardless of the region of origin, the largest percentage of respondents (32.5%) was informed about environmental issues, and 29.2% of them were aware of the ecological problems of their city. Regarding climate change, almost all respondents answered that they believe in its existence (88.8%), and 43.7% believe that it has a significant impact on their daily life.

Regarding environmental hobbies and volunteering activities, 79.5% stated they did not have any, while 20.5% have. The respondents' hobbies/volunteer activities are listed in Table 4, where it is observed that recycling, hiking, and garbage collection occupy the largest percentage.

Variables Related to Awareness and Conceptions

The majority (60.2%) of the respondents have a positive attitude towards sustainability. However, their awareness of sustainability is not satisfactory as only 27.3% seem to be aware. Of the respondents, 51.8% gain their knowledge on sustainability from the Internet, followed by university (24.6%), press (7.7%), and media (7%) and finally by seminars-lectures (6.6%) (Fig. 2). The Internet has always been a powerful global force, as a source of objective scientific knowledge, especially among young people who are familiar with its use.

In general, citizens' knowledge about sustainability is not high; this may be translated differently, which citizens are not sufficiently inspired or motivated. However, most respondents (about 80.5%) want to change their habits to more sustainable ones.

Regarding the question concerning the 'essential advantage that sustainability will bring,' 51.3% answered environmental protection, 23.6% answered the defense of human health,

Table 4 Types of environmental hobbies and volunteer activities the respondents take

Environmental hobbies	Percentage of respondents
Recycling	9.9%
Climbing/hiking	4.8%
Scouting	0.2%
Garbage collection	2.5%
Fishing	0.4%
Tree planting/gardening	1.6%
Bioclimatic design	0.2%
Volunteering in environmental organizations	1%
Creation of fertilizers from organic waste	0.2%
Study of natural disasters	0.6%
Reuse	0.6%

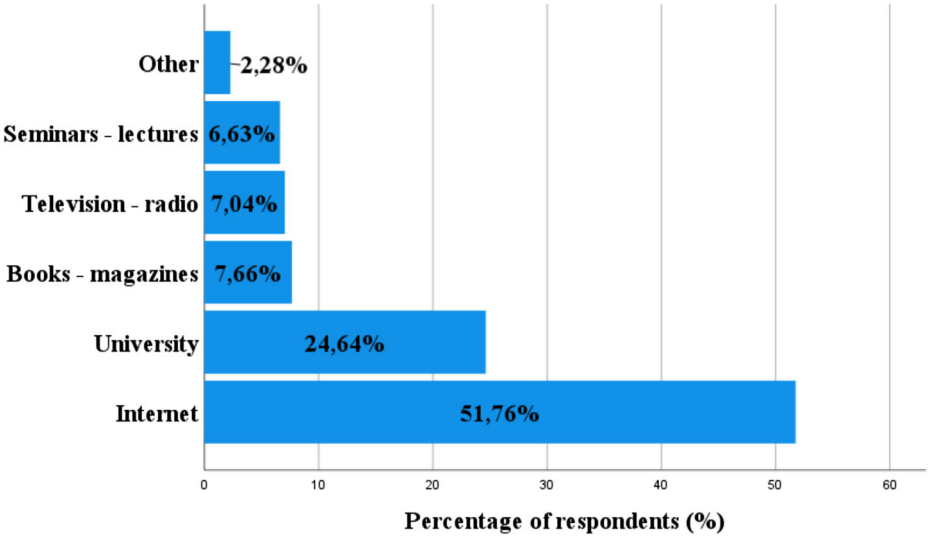

Fig. 2 Respondents' sources of sustainability awareness (cognitive parameter)

20.1% answered economic development, 2.9% answered eradicating poverty, and 2.1% gender equality (Fig. 3).

The answer to the question 'When people are involved in solving environmental problems, how often do they help to improve things?,' where 47.6% answered 'most of the time,' shows a positive predisposition of Greek citizens to sustainability and interest to help in its promotion by personal actions because sustainability can offer new opportunities with a policy tailored to the current socio-technical system and citizens' needs.

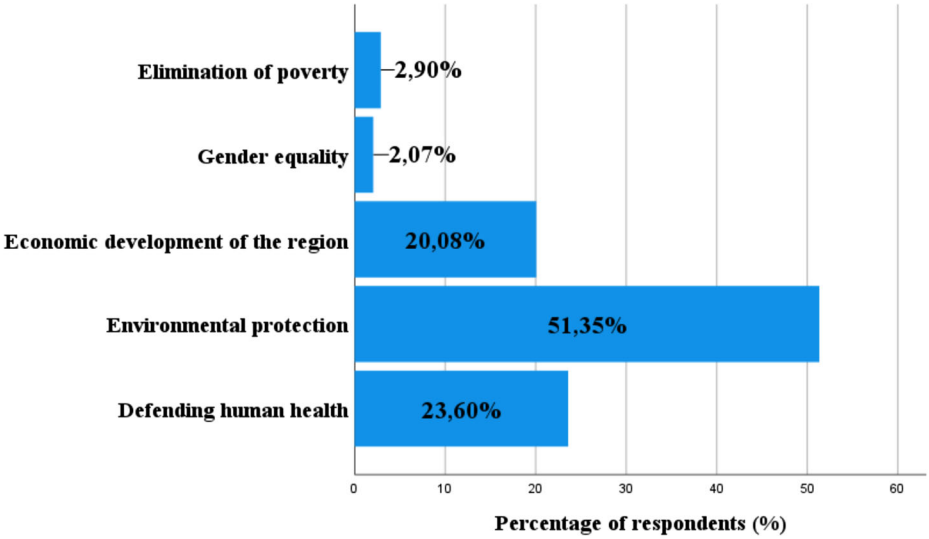

Fig. 3 Respondents' conceptions of sustainability (personal perceptions)

Variables Related to Society, Economy, and Politics

The results of 'sustainable actions' are categorized below. More specifically, the questionnaire examined citizens' daily habits, whether they are sustainable, and their willingness to replace them with more environmentally friendly actions.

It seems that the sociopolitical beliefs of Greek society directly influence the actions of the citizens.

Organic Food

Of the respondents, 39.3% replied that sometimes they would pay more money to buy organic products (Fig. 4), and 33.3% replied that they would often participate in food sharing through an application, so their food would not end up in the trash. The economic factor, therefore, has a prominent position as a criterion for purchasing a product.

Repairing and Recycling Clothes

When it comes to buying clothes, the largest percentage (32.1%) never purchase secondhand clothes and prefer to buy products from 'fast fashion' stores. Besides, the percentages of those who often borrow (29.4%) or repair their clothes and belongings (34.2%) or recycle their clothes (30.4%) or donate their clothes to immigration centers (24.4%) are relatively small (Fig. 5).

However, the optimistic part is that 42.4% consider that the companies' environmental policy they support with their markets is crucial.

Sustainable Mobility Means

In the question about their mobility options in everyday life, 31.7% stated that they prefer to walk instead of using their car or other transportation means around once or

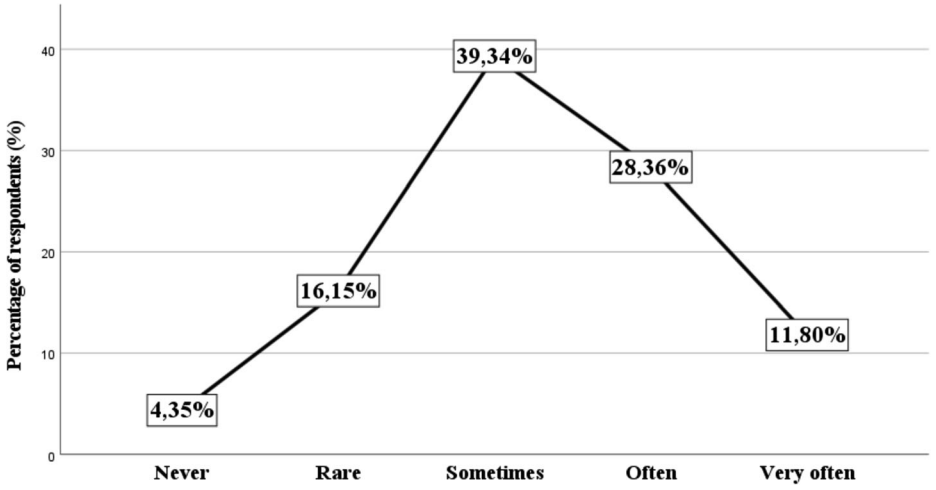

Fig. 4 Purchase of organic products

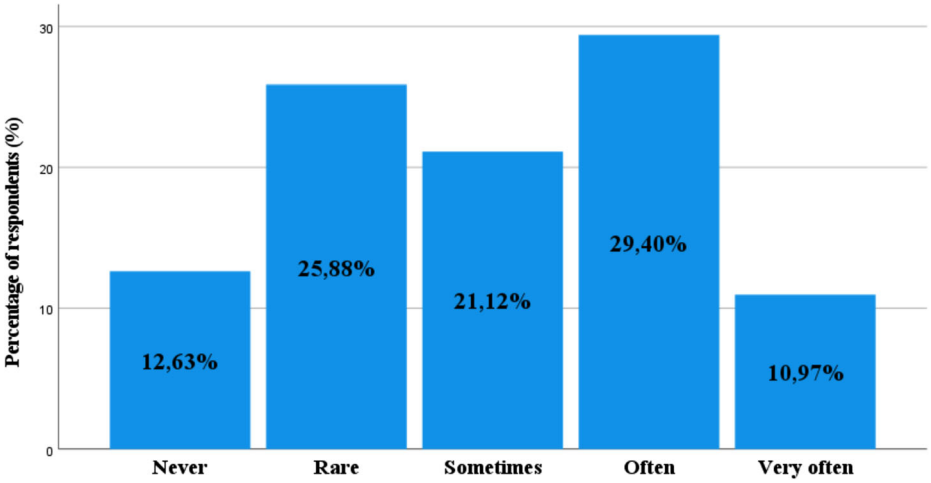

Fig. 5 Repairing and recycling clothes

twice a week, while 18.4% prefer to use their bicycle. Of the respondents, 25.1% stated that they would be willing to share a car for going to work or travel more than twice a week (Fig. 6).

This small percentage of those using a bicycle to move might be explained to difficulties encountered due to the lack of bicycle infrastructure in Greece.

Plastics

Regarding the consumption of plastic, 40% of the respondents agree that plastic reduction is an urgent need (Fig. 7). However, the practices that follow are not in line with this view, as only 27.5% carry a hermit crab with them, so they do not buy a plastic water bottle every time they are thirsty. This situation is more aggravated since those who recycle plastics are only (9.9%).

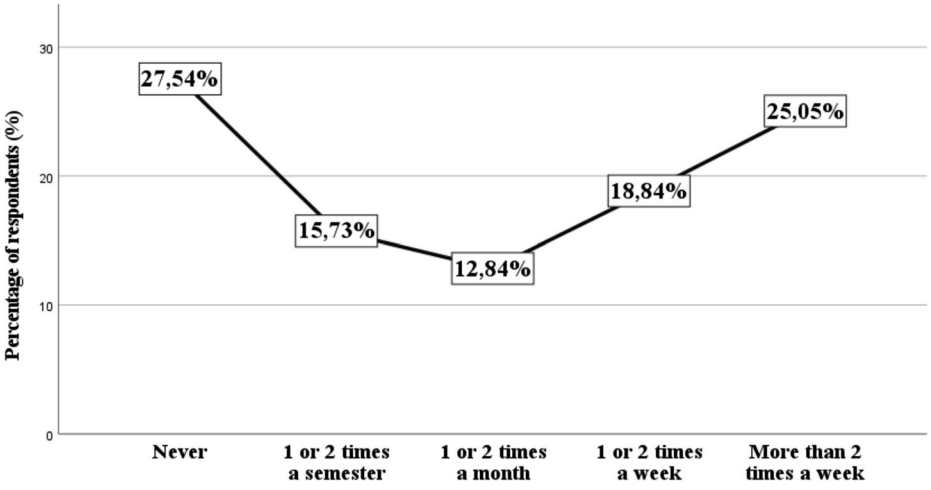

Fig. 6 Car-sharing

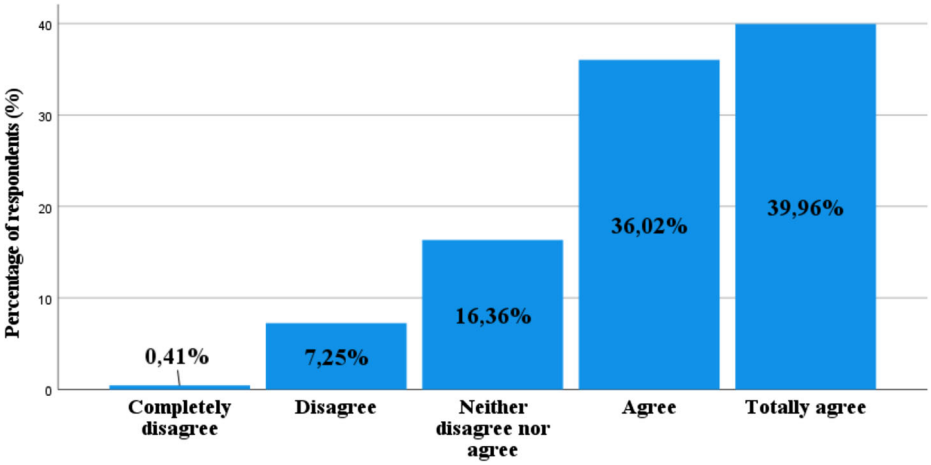

Fig. 7 Reduction of plastics

Volunteering and Active Participation

Of the respondents, 41.4% have never been involved in volunteer activities, such as cleaning the beaches from plastic or any other environmental projects; 32.9% of the respondents stated that they contribute a little to sustainability with their daily actions (Fig. 8).

Readiness to Sustainable Living

While 44.1% accuse that there is no proper public awareness for the establishment of a more sustainable reality in Greek society, 30.6% are very willing to replace their daily routines with more sustainable ones (they are in transition) and 49.1% appear ready to change their habits with more sustainable ones if there is an award for this (Fig. 9).

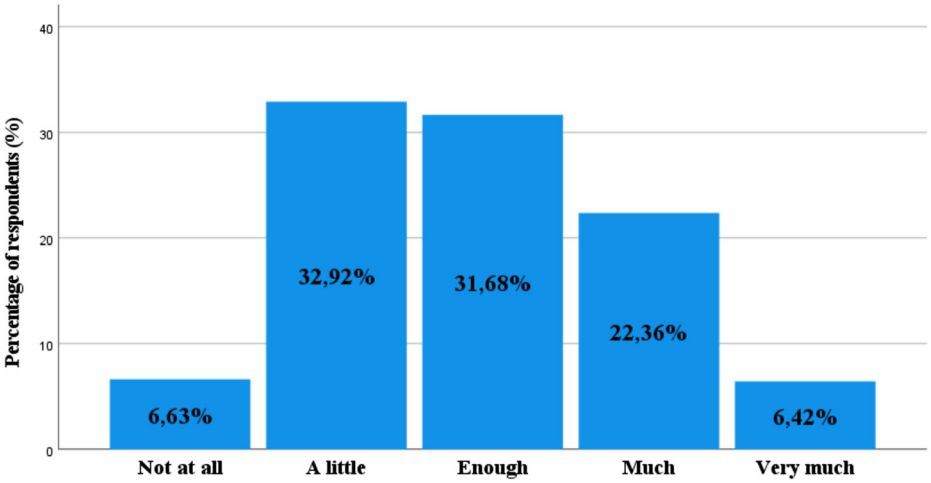

Fig. 8 Volunteering and active participation

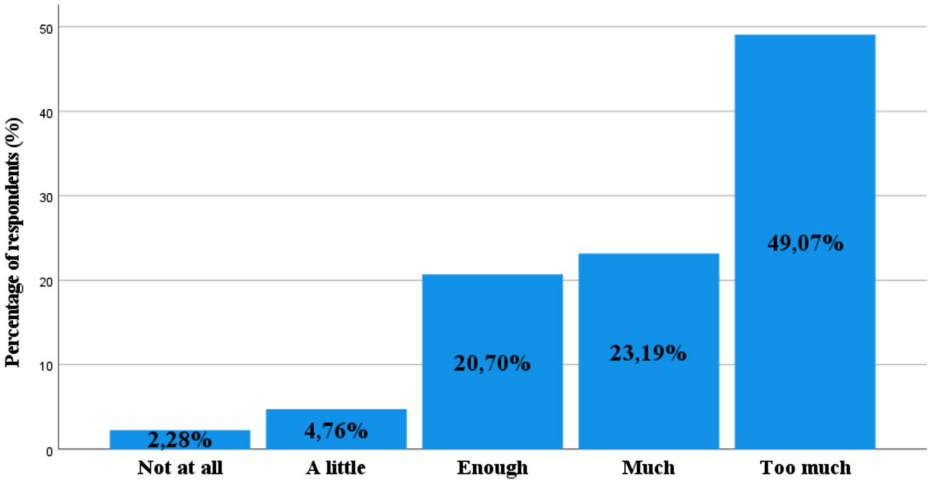

Fig. 9 Readiness to sustainable living

Technology-Related Variables

Almost all respondents (90.1%) answered positively to the question 'Would you use a digital application to measure your daily sustainable actions?' Of the respondents, 45.1% responded that they are very familiar with the digital technology. However, they were skeptical whether a digital application will be able to make their way of life more sustainable and whether it will impact Greek society's habits.

Regarding the operation of a digital application and the posting of photos, 51.1% of the respondents answered negatively to whether they would upload photos for reporting their daily

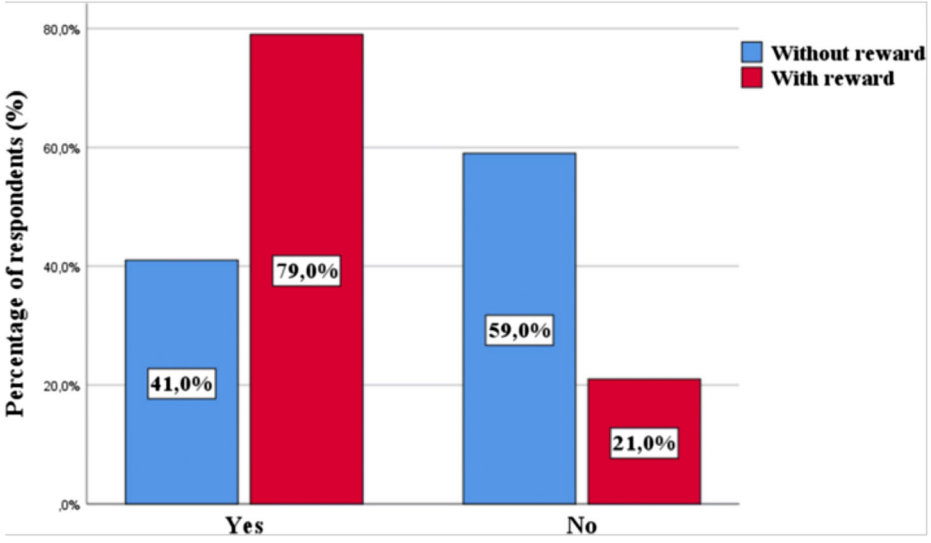

Fig. 10 Williness to uploading photos in a digital application for reporting sustainable daily actions without and with rewards

sustainable actions. However, this picture has changed completely, as 79.3% are finally willing to upload images if there is a reward (Fig. 10). Ninety-four percent would recommend it to other friends.

Discussion and Recommendations

The challenges to SD are heterogeneous and complex depending on national context and ecosystem diversity and characteristics. Meeting the above challenges requires the development of innovation skills, which are the cornerstones of sustainable economic growth.

The understanding and application of sustainability in our daily actions is complex too. That is why a deep understanding of this concept requires intellectual cultivation and skills and awareness. This can be achieved through easier access to knowledge for all and adopting a policy that effectively addresses social needs and obstacles [119].

Despite the multifaceted complexities of sustainability, communication about sustainability must be simple. Scientific knowledge must be provided in a simplified way using precise language to be understood by the public, regardless of age and scientific training level [120, 121]. This will raise public awareness and directly affect social acceptance.

National Context

National economies are complex systems that need to adapt to ever-evolving innovation models to meet the sustainability challenges. Like many countries in the Balkans and the Mediterranean, Greece is already in a transitional phase towards the modernization of its economy through GC practices to establish a more sustainable economy to comply with the EU's commitments, although the country continues recovering from the economic crisis, and faces the COVID-19 disruption as all nations do.

Although Greece is a member of the European Green Agreement, it ranks very low in terms of its progress so far [122]. The country's performance on the broader index of cyclical use of materials is 2.4% of the materials consumed compared to 11.2% on average in the EU [123]. Deficiencies in energy efficiency are accompanied by the country's relatively high dependence on imported energy [124], highlighting the need for energy savings and more vigorous renewable energy sources [125], although the country has enormous renewable energy sources biological wealth [126].

Improving the above performance requires coordinated action. In December 2018, the national strategy for CE was presented. This strategy aims to upgrade the institutional framework, link entrepreneurship with technological innovation, and create financial tools to waste better management and the economy's circularity [127]. In December 2019, Greece published the renewed National Plan for Energy and Climate (ESEK), which sets ambitious targets for 2030 [122].

Why the Survey Action Research Is of Value?

In this study, we used a survey action research methodology which is based on sampling that is the statistical practice of selecting a random number of observations from a statistical population. This type of research aims to collect data to investigate, describe, and interpret various issues [128]. Sampling surveys have the advantage of

using closed-ended questions that are relatively simple, although they have the disadvantage if an error occurs in the initial design or drafting of the questionnaire, to be not able to correct it posteriorly.

The sampling can be random, systematic, stratified sampling, or group sampling [129]. In this study, we used random sampling. This was deemed appropriate as the relatively small sample size (483 participants) ensuring a satisfactory representation of the population with a university education in the city of Thessaloniki.

Initially, the sample collection period was set at 3 weeks, from 10 December 2020, to 3 January 2021. After collecting the responses (the total number of completed questionnaires was 483), the statistical analysis was performed to explore the research's most critical conclusions.

A Valid Questionnaire Can Bring Useful Insights

The main tool used to obtain the necessary information was a questionnaire that contained multiple-choice questions [130].

A valid questionnaire characteristic is good organization, clarity, and brevity [131, 132]. The questionnaire of this study was created in Google Forms, and the link was sent via e-mail. This had as main advantages the zero cost and short time required for filling in. The criteria for choosing the questions' format were the efficiency, flexibility, interest, homogeneity, and suitability in the data processing.

For the design of the questionnaire in this study, the appropriate question format was selected. The questions were of two types:

a) Closed type, where the respondent is asked to choose between specific answers
b) Open type, where the respondent answers the question by filling in the blank space provided to enter his answer

Closed-ended problems outweigh the ease of data analysis, while open-ended ones allow the respondent to unfold their thoughts [133, 134].

The questions were constructed in such a way as to help the researcher achieve his goal to gain an idea of the daily actions of Greek citizens, whether they are sustainable and whether they are willing to try the 'Go Sustainable Living' application, which aims to enhance sustainability in Greek society.

In the formulation of the questions, short sentences with simple vocabulary were used. The short and straightforward sentences give the feeling that the questionnaire is easier to complete than anyone. Care was taken that the questionnaire was relatively small and to keep the respondent's interest so that he answers it all and does not leave it unfinished by using various types of questions. Keywords were emphasized in each sentence, and related questions were placed in categories to have a continuous and smooth flow [129].

Attention was put to promoting the truth and not ask aggressive questions, ask for an answer in a single dimension to extract information, provide all possible answers with multiple-choice questions, provide exclusive options, provide pluralism in the grading of the answers, do not presuppose a specific situation, do not ask for specialized answers, do not imply a desired reply, and do not use emotionally charged words or vaguely defined words [135].

Requirements of Statistical Analysis

The number of participants was 483 (male and female) and had limitations, so it was not representative of the national context. However, n = 483 meets the statistical analysis criterion [117] according to which the sample must be at least equal to ten times the number of variables involved [136]. Only then can the validity and stability of the results be ensured [137, 138]. The questionnaire included 39 variables, so the required minimum sample size is 390 responses (which results if 39 is multiplied by 10). So, the 483 responses far exceed the desired minimum limit.

The collected data were analyzed using the statistical software program IBM SPSS (Statistical Package for Social Sciences), version 25.0. The conclusions drawn from the research were presented in detail in diagrams created in the SPSS environment. Besides, the factors leading to the acceptance or rejection of adopting a more sustainable lifestyle, the main obstacles that may arise, and the results of promoting the application are evaluated.

The responses were processed and evaluated based on the p value, which characterizes the statistical significance of a result and the degree to which the result is 'true' (in terms of 'representation of the population'). The p value represents an indicator of the results' reliability, and in most surveys, the result is considered 'statistically significant' when $p < 0.05$. For parametric analysis, when it comes to a normal distribution, the Pearson correlation with a significance level of 0.05 is used [116]. More specifically, a correlation test was performed between the dependent and independent variables to verify the possible result of each independent variable from the dependent and interpret their possible causal relationship [117].

Independent variables (VI) were gender, age, employment, place of origin, environmental hobbies, and student groups (items 1–7). The dependent variables (XXXIII) emerged from the questionnaire's next questions, which were related to environmental awareness, Greeks' daily habits, and the GSL application (items 8–41).

Finally, it was checked whether the respondents answered the different questions, but which were related to each other, in the same way, to ensure reliability and validity [136, 139]. For example, the question 'What is your attitude towards SD?' is included in the questionnaire to ensure validity. If a respondent answered 'Positive' to the above question, then in the next question, 'How willing would you be to change your habits to be more sustainable?', it was used to check for power convergence.

Assessing the Respondents' Sustainability Consciousness Level

To assess the conscious sustainable living of respondents, we tried to explore the level of their engagement in taking sustainable actions and making change decisions in a daily life, by comparing their own assessment and their actions, as depicted in the results of the survey.

For this reason, we designed Fig. 11 by using the scales: 1 for the answers reaching 20%, 2 for the answers reaching 40%, 3 for the answers reaching 60%, 4 for the answers reaching 80%, and 5 for the answers reaching 20%, 100%.

The assessment of the questionnaire's results (Fig. 11) showed that even though respondents seem to believe that they are aware (point 3 in Fig. 11), and their contribution to sustainability is significant (point 1.8 in Fig. 11), their daily practices do not agree with their perceptions (see in Fig. 11: 0.8 for volunteer activities, 1.5 for sustainable mobility means, 1.0 preference for firms following environmental policies, ~0.0 for the used secondhand clothes,

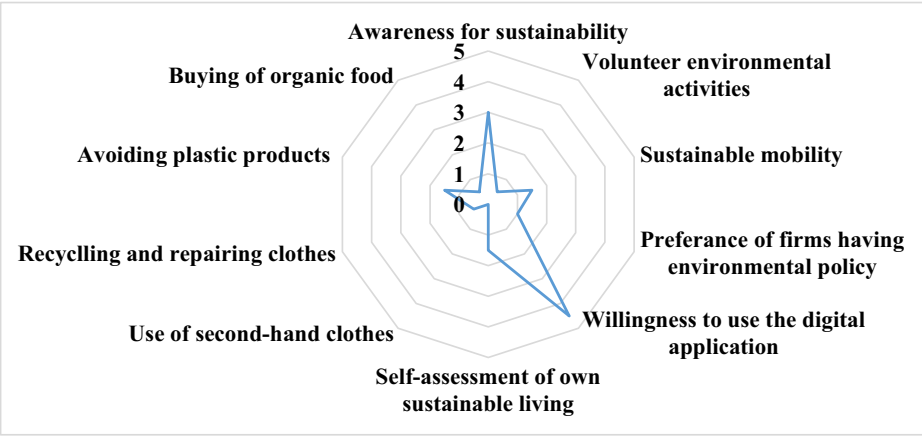

Fig. 11 Assessing the respondents' sustainability consciousness level (scales: 1 for 20%, 2 for 40%, 3 for 60%, 4 for 80%, 5 for100%)

0.5 for repairing clothes, 1.5 for avoiding plastics, 0.7 for buying organic foods, and all <1.8 points that correspond to their perception about their sustainable living).

While 60.2% of respondents have a positive attitude towards sustainability, only 6.4% prove sustainability living through their everyday actions, such as the purchase of organic food (11.8%), secondhand clothes shopping (1.4%), recycling and repairing of clothes (11%), use of means of public transportations (33.7%), and participation to environmental volunteer activities (12%). This means that either their perception differs from their reality, or they are not conscious of their real actions, or they do not really understand what really sustainable living means. Therefore, it is evidenced that they need awareness for consciousness development towards a sustainable citizenship.

Table 5 Bottom-up approach for increasing the number of active citizens

What is needed	Justification
Empowerment	Approaches that will empower citizens and enable them through participation and interaction to adopt individual and collective behaviors and a lifestyle that promotes sustainability [140]
Collective awareness	Collective Awareness Platforms for Sustainability and Social Innovation (CAPS) facilitate decision-making by establishing transparency and opportunities for empowering citizens to collaborate and promote better-informed decision-making processes [97]
Sharing knowledge	Engage citizens and share knowledge and expertise to improve their quality of life. A typical example is a collective online activity in which an individual, an institution, a non-profit organization, or a company proposes to a group of individuals with diverse knowledge, heterogeneity, and number, through an open invitation, to volunteer a job [141]
Co-creation	Obtaining citizens' views, willingness, and knowledge about alternative behaviors/possible solutions [142]
Role models	Demonstration of a model of ideal social behavior
ICT	Inclusion of solutions using ICT (Information and Communication Technologies) for social networking and collaboration technologies [97]
Opportunities	Creation of opportunities by the state so that the citizens become active members [143]
Transparency	Ensure improved transparency of information related to environmental policies' impact [98]

The optimistic part is that most of the respondents are willing to participate in the digital application (they are confident of using technology), which may help them indirectly to increase their sustainability living by measuring the level of their daily sustainable decisions/actions as consumers and estimating the level of their consciousness.

We hope Greek university-educated people, familiar with technology and the theory of sustainability, pass from theory to the 'praxis' and figure out what it really means to be sustainable.

Recommendations

As can be seen from the answers, Greeks do not pay much attention to the company's environmental policy they support and buy commodities. Besides, most of them do not include sustainable practices in their daily lives, showing great reluctance to change them. Therefore, some recommendations are made.

How to Increase the Number of Active Citizens?

Tools are needed to motivate citizens and turn them into 'active citizens' [91, 92]. A bottom-up approach requires measures, as depicted in Table 5.

How to Enhance Sustainable Decision-Making?

To enhance individuals' sustainable decision-making in everyday actions, the following strategic activities are recommended (Table 6).

Conclusions

This study explored Greek citizen's perceptions and readiness to replace their daily practices with more sustainable ones. Less than 30% of consumers were considered sustainability-conscious in 2021, according to the survey. Most respondents (57.6%) are considered in a transition phase, while 13% fell into the category of nonconscious.

Greeks with university education are quite informed about environmental issues and show interest in resolving their city's environmental challenges. They do believe in the existence of

Table 6 Strategies to enhance sustainable decision-making and actions of individuals

What is needed	Justification
Voluntary participation	Enhancing voluntary participation in community projects offering environmental work [113]
Multifaceted Intelligence	Creating social, moral, economic, and environmental intelligence [144]
Practices	Disclosure of sustainable practices by each company [99]
Mindset	Awakening about the destructive consequences caused by daily unsustainable human actions [145]
Social responsibility	Consumers need to be exposed to different experiences to understand and assume the importance of social responsibility [146]
Skills	Creativity, innovation, flexibility, positivity, adaptability, collaborative spirit, and transparency are some of the skills that should distinguish modern conscientious consumers [147]

climate change and its hazards. They have a positive attitude towards sustainability. Respondents attach great importance to the companies' sustainability policy they buy products, commodities, and services. Also, they seem to believe in the power of collective effort as they state that when people are involved in problem-solving, the outcome is positive most of the time. They are willing to change their behaviors to be led towards sustainable living. Most are willing to spend more money on organic products or even participate in food-sharing applications. When it comes to clothing and shopping, few people support secondhand shopping. The percentage of those who recycle, repair, and donate their clothes is satisfactory. A particular problem appears in their everyday mobility as they do not often use a bicycle and are rarely enrolled in car-sharing. Concerning plastic use, the positive and optimistic issue is that the majority recognizes the need to reduce plastic in everyday life and limit plastic items' purchase. The percentage of people who voluntarily participate in plastic recycling activities in public places and beaches is low.

However, their daily actions do not confirm their perceptions about their own attitudes. This makes evident that there is a need for higher sustainability consciousness towards a green citizenship. The majority believes that there are no suitable collective and political foundations for establishing a more sustainable reality (lack of trust in policymakers). A significant challenge is the effective dissemination of knowledge and raising public awareness for sustainability and its opportunities.

Although the study's findings cannot be generalized, the analysis can provide insights into the Greeks' perceptions of sustainability, especially those with university education.

Supplementary Information The online version contains supplementary material available at https://doi.org/10.1007/s43615-021-00046-9.

Abbreviations *CE,* Circular economy; *DA,* Digital application; *GC,* Green citizenship; *ICT,* Information and communications technology; *SD,* Sustainable development; *SDGs,* Sustainable Development Goals; *SE,* Sharing economy; *UNECE,* United Nations Economic Commission for Europe

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Authors' Contributions A.Z: Anastasia Zabaniotou, professor, Dr Chem Eng
E.T: undergraduate student Chem Eng
Both authors contributed to several aspects of the study, specifically Conceptualization, E.T and A.Z; Methodology, A.Z; Formal analysis, E.T and AZ; Investigation, resources, and data curation, E.T; Visual representation, E.T; AZ; Original draft preparation, E.T; Review and editing, A.Z; and Supervision, A.Z.

Data Availability The authors confirm that the data supporting the findings of this study are available within the article and/or its supplementary materials. All data related to respondents remain confidential according to the Regulation (EU) 2016/679 of the European Parliament and the Council, the European Union's ('EU') new General Data Protection Regulation ('GDPR'), regulating the processing by an individual, a company, or an organization of personal data.

Declarations

Ethics Approval Both authors mentioned in the manuscript have agreed for authorship, read, and approved the manuscript, and given consent for submission and subsequent publication of the manuscript.

Consent to Participate Consent to participate in the study was obtained from participants. All data related to respondents' name and demographics remain confidential according to the Regulation (EU) 2016/679 of the European Parliament and the Council, the European Union's ('EU') new General Data Protection Regulation ('GDPR'), regulating the processing by an individual, a company, or an organization of personal data.

Consent for Publication Consent to publish this study was obtained from participants. All data related to respondents' name and demographics remain confidential according to the Regulation (EU) 2016/679 of the European Parliament and the Council, the European Union's ('EU') new General Data Protection Regulation ('GDPR'), regulating the processing by an individual, a company, or an organization of personal data.

Conflicts of Interest On behalf of all authors, the corresponding author declares no competing interests.

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