



# Measuring Sustainability Literacy: Adaptation and Factor Analysis of the Sustainability Consciousness Questionnaire among Greek Adults

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## Abstract

*Sustainable Development (SD) is an important concept of the modern era whose accomplishment poses major challenges to policy makers worldwide. The holistic and complex nature of SD which is most usually thought as being deployed in three main dimensions (environmental, social and economic) and at the same time is expressed in both the cognitive and attitudinal/behavioral domains, poses severe difficulties with regard to the empirical evaluation of people's perceptions related to it. The Sustainability Consciousness Questionnaire (SCQ) is a recently developed and empirically validated instrument among Swedish young adults (18-19 years old) which aims at evaluating sustainability literacy by taking into account the holistic nature of SD via investigation of people's cognitive and affective views of the concept [Gericke et al. (2019). Sustainable Development 27, 35-49]. In the current work, the SCQ was adapted in the Greek language and subsequently its reliability and structure were evaluated by statistical analysis of the responses provided by 631 adults serving in the Greek public sector. The Greek version of the instrument (SCQ-GR) showed an overall excellent reliability by maintaining all 50 items of the original instrument (Cronbach's  $\alpha = 0.970$ ). Factor analysis after applying Varimax rotation with Kaiser normalization led to the extraction of four main components (with individual Cronbach's  $\alpha$  values ranging between 0.807 and 0.974) which account in total for 65.84% of the whole sample variability. Detailed examination of the individual items of each component led to the following assignments regarding the nature of the assessment provided by the SCQ-GR: Component 1 is comprised of 23 items which refer collectively to "attitudes and behavior" towards SD. Component 2 is comprised of 18 items which refer to "knowledge" regarding SD. Component 3 is comprised of 4 items which refer to "social-environmental activism", and finally Component 4 is comprised of the remaining 5 items which refer to the feeling of "detachment" from the notion of sustainability. The good psychometric qualities of SCQ-GR provide strong evidence for the valid use of the instrument for assessing sustainability literacy among adults of a wide age range within the Greek cultural context.*

**Keywords:** sustainability consciousness, sustainable development, questionnaire instrument, Greek adults

## 1. Introduction

Sustainable Development (SD) is an important concept of the modern era whose accomplishment poses major challenges to policy makers worldwide. The first and most widely known definition of SD as a "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" was provided in the report of the World Commission on Environment and Development (Brundtland Report) [1]. Another definition of SD, which gives additional emphasis on importance of the natural environment, is the one that was provided in a common publication of The World Commission Union (IUCN), the United Nations Environment Program (UNEP) and the World Wide Fund For Nature (WWF) and in which the term has the meaning of "improving the quality of human life while living within the carrying capacity of supporting ecosystems" [2]. These definitions are, however, general and broad statements that may not grasp the complex nature of SD. In fact, as a concept, SD is "dynamic and evolving with many dimensions and interpretations" [3] as it is embraced by a variety of stakeholders (e.g. governments, business, environmentalists, social reformers) who hold different worldviews and therefore exert diverse influence on "how issues are formulated and actions proposed" [4].



The action plan for SD was established in the United Nations Summit in Rio (1992) and it is deployed in the form of a dynamic program known as Agenda 21 [5]. In Agenda 21, the three dimensions of SD, the environmental, the economic and the social, were recognized as the three main perspectives which have to be taken into account during discourse and implementation of SD. The most commonly used model of SD presents these dimensions as three interconnected and partially overlapping circles of equal size, thus implying that effort should be made in order to bring them together in a balanced manner by reconciling their in-between conflicts [4]. This model has been criticized as overly simplistic as it promotes the approach towards sustainability in a very compartmentalized manner. As a result, the complex connections and interdependencies between economy, society and the environment are undervalued and the same applies for the holistic nature of the SD concept. Despite the criticism, the three-ring model of SD remains as a good basis in the field of sustainability practice and research. In fact, the new integrated 2030 Agenda for SD adopted in 2015 [6] points out the need and commitment of the global community for “achieving sustainable development in its three dimensions – economic, social and environmental – in a balanced and integrated manner” and goes further by explicating the 17 Sustainable Development Goals (SDGs) accompanied by 169 relevant targets. Taking into account the fact that issues associated with SD are expected to play an increasingly important role in people’s lives, the need for promoting sustainability literacy via education for sustainable development (ESD) is becoming crucial. The same applies for the need to be able to empirically assess sustainability literacy achieved, via valid and reliable instruments. Such a psychometric instrument should cover all three dimensions of SD and at the same time take into account that, as in the case of environmental literacy, sustainability literacy is expressed in both the cognitive and the affective domains [3, 7]. It is thus necessary to probe people’s knowledge, attitudes and behaviors with regard to the three dimensions of SD. The concept of sustainability consciousness has been developed in order to describe the result of ESD [8] it is used as alternative to the term sustainability literacy.

The Sustainability Consciousness Questionnaire (SCQ) is a recently developed and empirically validated instrument among Swedish young adults (18-19 years) which aims at evaluating sustainability literacy by taking into account the holistic nature of SD via investigation of people’s cognitive and affective views of the concept [9]. For the development of the SCQ instrument, the researchers used the scale developed by Michalos et al. [10-11] for measuring knowledge, attitudes and behavior concerning SD among teenage students (15-16 years) in Canada. The SCQ instrument was tested among Swedish students of different ages and specifically 12-13 years [12], 15-16 years [12] and 18-19 years [8]. The final SCQ version [9] consists of a total of 50 items which aim at probing three psychological constructs, namely knowingness (K - 19 items, No 1-19 in the instrument), attitudes (A - 14 items, No 20 – 33 in the instrument) and behavior (B – 17 items, No 34 – 50 in the instrument) with regard to sustainable development. Each psychological construct (K, A, B) contained items that were related to all three dimensions of SD namely environment (6 in K, 4 in A, 7 in B), society (5 in K, 4 in A, 4 in B) and economy (8 in K, 6 in A, 6 in B). The content of the SCQ items was designed in such way so that it includes the fifteen subthemes of SD proposed by the UNESCO framework for the United Nations Decade of Education for Sustainable Development [3, 7] and which are related to the environmental (5 subthemes), social (7 subthemes) and economic (3 subthemes) dimensions of SD. It is interesting to note that the final validated version of SCQ via confirmatory factor analysis consists of 49 (instead of 50) items, since one item (specifically K1: “*Economic development is necessary for sustainable development*”) “was identified as problematic, with a non-significant factor loading” [9].

In order to probe the sustainability consciousness of a population belonging to a different cultural content and/or age group, it is first necessary to examine the psychometric properties of the SCQ instrument *ex novo*. In this way, it may be assured that the new version of the instrument in a language different from the original and in addition in a different age group, will provide valid measurements which may be subsequently exploited by all interested parties [13]. In this work, the final version of SCQ which was validated for the age group of young adults (18-19 years) in Sweden [9], was adapted in the Greek language to produce the Greek version of the original instrument, called SCQ-GR. Then, the SCQ-GR questionnaire was handed out to adults who serve in the Greek public sector and statistical analysis was conducted in order to answer the following research question:

What are the psychometric properties of the Sustainability Consciousness Questionnaire within the adult population of the Greek cultural context, as revealed via exploratory factor analysis?

## 2. Methodology



The long version of the sustainability consciousness questionnaire comprised of 50 items and available in the English language [9] is the original instrument that was translated into the Greek language. A team of three translators comprised by the authors of this publication was employed for the forward (English to Greek) translation of the SCQ. In addition, a professional Greek-English translator (Greek native) was involved in the back translation (Greek to English). The three translators worked independently in order to produce three separate initial versions of the SCQ-GR and subsequently met in order to review the translation products, identify and discuss possible conflicts and discrepancies and reach a mutual agreement on the most appropriate translation of the items. The product of the back translation from was examined by the team of the three translators for comparability of meaning with the target language and clarity of wording.

The final version of SCQ-GR was administered and filled in electronically and anonymously (via Google forms) by adults who serve in the Greek public sector, between October and December 2021. The specific adult group (public servants) was chosen because it is more easily accessible for ensuring an increased response rate and in addition because it presents a large variability with respect to factors such as educational background, age and geographic location. The respondents marked their level of agreement with each of the 50 statements (items) of the instrument using a five-point Likert-scale (1-5), ranging from “Strongly disagree” (=1) to “Strongly agree” (=5). For the 19 items referring to knowingness, a “Don’t know” option was also available. for each item. Finally, it is noted that one small change in the wording of SCQ-GR relative to the original instrument was adopted for item 46 (B13 by using the notation of the Gericke et al. [9]). More specifically, taking into account that the SCQ-GR would be tested among adult (and not student) population, the original item “*I work on committees (eg. the student council, my class committee, the cafeteria committee) at my school*” was changed into “*I work on different committees (eg. at my work, at my community, etc)*”.

Exploratory factor analysis (EFA) via the principal components method and varimax rotation with Kaiser normalization was conducted in order to examine the factors that exist among the 50 items of the SCQ-GR questionnaire. The SPSS software was employed.

### 3. Results and Discussion

A total of 631 filled-in questionnaires were collected during the time period between October-December 2021. With regard to gender, the sample consisted of 310 and 320 participants who identified as female and male respectively, while one respondent did not report any gender. With regard to age, the respondents presented the following distribution: 124, 227, 188 and 92 in the 20-39, 40-49, 50-59 and 60-69 year groups, respectively.

The preliminary statistical measure Kaiser-Meyer-Olkin (KMO) was calculated equal to 0.979 which well above the lowest acceptable limit of 0.50 [14], indicating the sampling adequacy for the EFA analysis. In addition, the Bartlett’s test of sphericity was shown to be statistically significant ( $p < 0.001$ ) indicating the appropriateness of the factor model for the specific data set.

EFA resulted in four factors (components) with eigenvalues larger than 1 (Kaiser’s criterion) and the four-factor solution was confirmed by the scree-plot as well, as shown in Figure 1. It is noted that the term factor is used interchangeably with the term component.

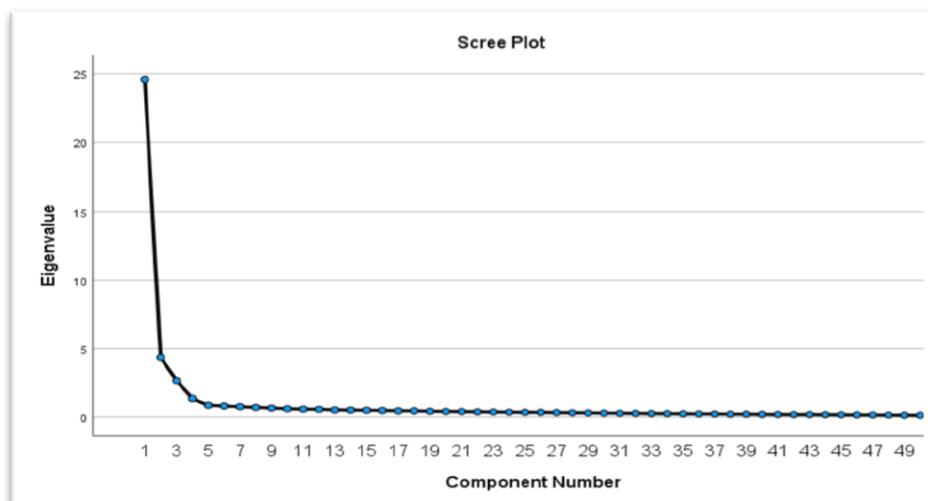


Figure 1: Scree-plot supporting the four-factor solution



The complete component matrix resulting after varimax rotation with Kaiser normalization is shown in the following table (Table 1).

Table 1: Rotated Component Matrix

Item Number in SCQ-GR (Item in original SCQ in [9]) – Dimension of SD*	Component 1	Component 2	Component 3	Component 4
25 (A7) – Eco	<b>0,780</b>	0,369		
32 (A18) – Soc	<b>0,780</b>	0,379		
27 (A10) – Env	<b>0,776</b>	0,351		
30 (A14) – Soc	<b>0,773</b>	0,374		
20 (A1) – Soc	<b>0,764</b>	0,429		
22 (A3) – Eco	<b>0,762</b>	0,347		
37 (B4) – Soc	<b>0,760</b>	0,359		
50 (B17) – Soc	<b>0,760</b>	0,378		
26 (A8) – Eco	<b>0,756</b>	0,324		
28 (A11) – Soc	<b>0,737</b>	0,312		
21 (A2) – Soc	<b>0,730</b>	0,397		
47 (B14) – Soc	<b>0,729</b>	0,336		
31 (A16) – Eco	<b>0,719</b>	0,337		
36 (B3) – Env	<b>0,714</b>			
24 (A6) – Env	<b>0,709</b>	0,319		
29 (A13) – Soc	<b>0,681</b>	0,338		
34 (B1) – Env	<b>0,659</b>	0,305		
45 (B12) – Env	<b>0,656</b>		0,440	
44 (B11) – Eco	<b>0,627</b>		0,369	
35 (B2) – Env	<b>0,565</b>			
43 (B10) – Env	<b>0,562</b>		0,513	
39 (B6) – Eco	<b>0,551</b>		0,434	
49 (B16) – Eco	<b>0,485</b>		0,477	
8 (K9) – Soc	0,350	<b>0,777</b>		
9 (K10) – Soc	0,388	<b>0,759</b>		
7 (K8) – Soc	0,331	<b>0,753</b>		
10 (K11) – Soc	0,390	<b>0,752</b>		
11 (K12) – Eco	0,362	<b>0,748</b>		
2 (K2) – Soc	0,355	<b>0,747</b>		
14 (K16) – Eco	0,328	<b>0,744</b>		
6 (K7) – Env	0,410	<b>0,723</b>		
13 (K15) – Soc	0,393	<b>0,718</b>		
12 (K14) – Env	0,429	<b>0,715</b>		
5 (K5) – Soc	0,318	<b>0,714</b>		
16 (K18) – Env	0,432	<b>0,705</b>		
19 (K21) – Env		<b>0,703</b>		
17 (K19) – Eco		<b>0,700</b>		
15 (K17) – Eco	0,355	<b>0,684</b>		
1 (K1) – Eco		<b>0,679</b>		
18 (K20) – Soc		<b>0,645</b>		
3 (K3) – Env	0,310	<b>0,632</b>		
46 (B13) – Soc	0,316		<b>0,722</b>	
42 (B9) – Eco			<b>0,717</b>	-0,381
48 (B15) – Soc	0,402		<b>0,672</b>	
40 (B7) – Env	0,477		<b>0,508</b>	
41 (B8i) – Env				<b>0,804</b>
23 (A5i) – Env				<b>0,797</b>
4 (K4i) – Env		0,388		<b>0,698</b>
38 (B5i) – Soc				<b>0,672</b>
33 (A19i) – Env			-0,317	<b>0,660</b>

\*Env: Environment, Soc: Society, Eco: Economy



In Table 1, the factor loadings of the items which are assigned to each specific component are shown in bold. It is important to note that none of the 50 items is excluded from the factor structure. In the case that some item loads to more than one factor, it is assigned to the factor for which it presents the highest loading. The four-factor structure accounts for 65.84% of the total variance in the data, which is in fact a significant amount.

For the whole SCQ-GR instrument the value of Cronbach's  $\alpha$  is calculated equal to 0.970 which indicates an excellent overall scale reliability [14]. The individual Cronbach's  $\alpha$  values which correspond to the item groups that make up each separate factor are also quite high ( $>0.80$ ) and more specifically equal to 0.974, 0.966, 0.825 and 0.807 for components 1, 2, 3 and 4 respectively. This indicates good reliability for all four individual factor scales [14].

By examining the content of the items comprising each component (factor), the following remarks and assignments can be made:

a) Component 1: It possesses the highest eigenvalue (= 24.581) and accounts for 49.16% of the total variance. It consists of 23 items of which 12 refer to attitudes and 11 to behavior. In addition, all three dimensions of SD are represented: Environment – 7 items, Society– 9 items and Economy – 7 items. Thus, this factor could be entitled as “Attitudes and behavior toward SD”. The fact that attitudes and behavior are equally present under the same component, is in accordance with the documented reciprocal relationship of the two constructs [15].

b) Component 2: It possesses the second highest eigenvalue (= 4.35) and accounts for 8.7% of the total variance. It consists of 18 items which all refer to the construct of knowingness, a term which is adopted in the publication of the original instrument instead of the term knowledge [9]. All three dimensions of SD are represented: Environment - 5 items, Society – 8 items, Economy – 5 items. The term knowledge is often associated with facts that may either be true or not while the term knowingness is used to express what the respondents recognize as important in order to accomplish SD and has both a cognitive and an affective component [8, 9]. In this work, it was decided to adopt the most widely used term “Knowledge” as a title for this factor.

c) Component 3: It possesses the third highest eigenvalue (= 2.625) and accounts for 5.25% of the total variance. It consists of 4 items which all refer to behavior. As in the first two components, all three dimensions of SD are represented: Environment – 1 item, Society – 2 items, Economy – 1 item. The items of this component refer to behaviors that are more closely associated with activism (eg. Item 48: *I support an aid organization or environmental group*). Thus, this factor is entitled “Social-Environmental Activism”.

d) Component 4: It possesses the fourth highest eigenvalue (= 1.364) and accounts for 2.73% of the total variance. It consists of 5 items one of which refers to knowingness, two to attitudes and two to behavior. They are related with the environmental and social dimensions of SD via 4 and 1 items respectively. All 5 items contain negative aspirations (eg. Item 4: *Preserving nature is not necessary for sustainable development*, or Item 38: *I often make lifestyle choices which are not good for my health*) and therefore this factor could be entitled as “Detachment from SD”.

All four identified components of the SCQ-GR instrument are made up of items that are related to more than one dimensions of SD. This fact is in line with the criticism that the three SD pillars should not be treated separately as distinct compartments and in accordance with the holistic and complex nature of the SD concept [4].

#### 4. Conclusions

The Greek version of the Sustainability Consciousness Questionnaire (SCQ-GR), applied in adult population, was shown to be an instrument with strong psychometric properties, as probed via exploratory factor analysis. It contains a structure of four factors, all of which with high reliability and which in total explain a very large part (ca. 65%) of the variance.

The content of the four identified factors refers to the following themes regarding SD: a) Attitudes and behavior, b) Knowledge, c) Social-Environmental Activism and d) Detachment.

The availability of SCQ-GR provides the possibility for valid measurement of the different aspects of sustainability literacy among the adult Greek population. Therefore, it is expected to serve as a valuable tool for assessing the effectiveness of different policies and educational initiatives related to sustainable development and thus contribute to its further advancement.



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