



# The Validation of Sustainable Clothing Measurement Scale in Romania

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Sustainable Clothing Measurement Scale (SCMS); Sustainability; Sustainable clothing; Scale development



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**Abstract:** This study endeavors to provide empirical support for the validity and reliability of the Sustainable Clothing Measurement Scale (SCMS). The scale, which comprises general sustainability and sustainable clothing, encompasses two subdomains within the sustainable clothing domain, namely knowledge and attitudes towards sustainability and sustainable clothing consumption. The study engaged a sample of 1,250 Romanian participants. To assess reliability, Cronbach's alpha coefficients were computed for the thirteen-item scale, the general sustainability and sustainable clothing domains, and their respective subdomains. Furthermore, to investigate construct validity, both exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) were employed, utilizing commonly applied indices such as the Chi-square, comparative fit index (CFI), Tucker-Lewis Index (TLI), root mean square error of approximation (RMSEA), and other well-known indicators. Findings exhibit strong reliability and validity of the scale, with high internal consistency and significant correlations between the identified dimensions. This research offers a tool for assessing sustainability and sustainable clothing knowledge and attitudes, in the context of consumer behavior studies, and industry practices.

## 1. INTRODUCTION

The concept of sustainability has emerged as a significant concern on a global scale in the last two decades. An official definition was given in 1987 when the Brundtland Report “Our Common Future” (World Commission on Environment and Development, 1987) brought to life the concept of sustainability, also referred to as sustainable development, through the following statement “Sustainable development is development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs”. Many scholars have criticized the Brundtland Report for its vague conceptualization of sustainability and extensive research has been conducted on diverse approaches to understand and predict this broad field (Balderjahn et al., 2013; Costanza & Patten, 1995).

Numerous efforts have been made to establish a more specific interpretation of sustainability within the business context and amidst this extensive field of investigation, there has been a growing emphasis on sustainable consumption, embracing practices like green consumption (Peattie, 2010), political consumption (Halkier, 2004), and ethical consumption (Devinney et al., 2010; Newholm & Shaw, 2007). Nevertheless, these approaches frequently concentrate on specific facets or determinants of sustainable behavior, resulting in deficiencies in comprehending the broader scope of sustainable consumption (Balderjahn et al., 2013).

Several measurement instruments have been devised to assess the various dimensions of sustainability (Balderjahn et al., 2013; Gilg et al., 2005; Iwata, 2006; Pepper et al., 2009). Many initiatives have led to the designing of scales that measure sustainable consumption behavior (Fischer et al.,

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2017; Geiger et al., 2018) as well as awareness of the same topic (Balderjahn et al., 2013). There most known measurement tools are: the Sustainable Apparel Consumption Scales which comprise different dimensions of sustainable clothing consumption, such as eco-fashion consumption, post-acquisition consumption, and environmental consciousness (Zhang, 2014), the Sustainable Clothing Consumption Scale focuses on measuring the cognitive, affective, and behavioral dimensions of sustainable clothing consumption (Park & Lee, 2021), and the Sustainable Fashion Awareness Scale that evaluates consumers' awareness and knowledge about sustainable fashion practices and products (Shen et al., 2013).

Although substantial progress has been made, there remains a gap in one's ability to evaluate individuals' comprehension and perspectives on sustainability and sustainable clothing choices. This study intends to address the identified lack of theoretical frameworks that measure both the notion of sustainability as a broad concept and sustainable clothing consumption. To complete this objective, we developed a reliable and valid measurement scale, the Sustainable Clothing Measurement Scale (SCMS), that evaluates respondents' attitudes and knowledge towards sustainability and sustainable clothing consumption. Contrary to other sustainability measures, this proposed scale does not specify particular behaviors or situations. It instead concentrates on individuals' general views of sustainability and perceptions of sustainable clothing consumption. Moreover, this instrument aims to measure respondents' core understanding and attitudes toward sustainability in the fashion industry, avoiding specific topics and focusing only on elements that are beneficial to the measurement tool.

Regarding the Romanian context, there is a significant research gap concerning the existence of a comprehensive assessment instrument designed to evaluate Romanian consumers' knowledge and attitudes towards sustainability and sustainable clothing consumption. Based on prevailing literature on sustainability, sustainable consumption, and measurement tools, the present study proposes to address this void through the development of a scale specific to the Romanian context.

The present tool goes in contrast with prevailing scales that evaluate attitudes towards corporate, governmental, or educational actions (Michalos et al., 2011), while other scenarios concentrate on personal behaviors that are correlated to particular lifestyles (Milfont & Duckitt, 2004), since it outlines participants' personal views on sustainability in the context of fashion, without prescribing a particular path.

The findings of this study contribute to our understanding of sustainability and sustainable clothing consumption and propose practical interventions that could be implemented in Romania to encourage the consumption of sustainable clothes.

This study has the following structure: the following section outlines the research methodology, the key findings are summarized in the third section, the fourth section opens a discussion based on the results while highlighting the key implications, and the conclusion, limitations, and future research directions of the study are presented in the final section.

## **2. RESEARCH METHODOLOGY**

The data collection process occurred in Romania from November to December 2023. An online self-administrated questionnaire was shared on several platforms like Facebook, LinkedIn, WhatsApp, and other social media networks where respondents could have accessed the designated form. The

sample consists of responses from 1,250 participants who voluntarily and anonymously engaged in this study's survey. They consented to participate in the study and were informed of its objective. The questionnaire employed a combination of convenience sampling (Baltar & Brunet, 2012) and snowball sampling methods (Browne, 2005; Heckathorn, 2011).

## 2.1. Data Collection Tool

For this study on sustainable clothing consumption, we first conducted a thorough review of relevant literature on the concept of sustainability, sustainable clothing, and the development of measurement scales for sustainable clothing consumption. Based on these findings, we created a thirteen-item scale to measure respondents' understanding of sustainability from a general perspective, and sustainable clothing specifically. The Sustainable Clothing Measurement Scale (SCMS) assesses dimensions such as the definition of sustainability, attitudes towards sustainability in the context of clothing, and knowledge about sustainable clothing practices.

**Table 1.** Sustainable Clothing Measurement Scale Constructs

Dimension	Items	Abbreviation
Sustainable Clothing Measurement Scale	Sustainability means carrying out activities in a qualitative way that doesn't damage the environment or deplete resources	SCMS1
	Sustainability means finding a balance between economic growth and environmental protection.	SCMS2
	Sustainability means finding alternative resources while still being able to provide for future generations.	SCMS3
	The principles of sustainability are reduction, reusing, and recycling.	SCMS4
	A sustainable attitude means taking into account the need to preserve the planet for present and future generations, while also considering economic, environmental, and social factors.	SCMS5
	Sustainable fashion means not changing our clothes based on the ongoing trend, but adapting fashion to protect the ecological footprint.	SCMS6
	Sustainable clothing uses fabrics derived from environmentally friendly resources, like sustainably grown fiber crops, or recycled materials.	SCMS7
	Sustainable clothing is special since it is processed in a way that is less harmful to the environment.	SCMS8
	Sustainable clothing reduces the harmful effects of agrochemicals on the environment.	SCMS9
	Using sustainable clothes can help reduce the amount of clothing discarded in landfills.	SCMS10
	Having a sustainable attitude towards clothing often includes buying second-hand clothes.	SCMS11
	Having a sustainable attitude towards clothing means donating or recycling clothes so they can be reused or resold.	SCMS12
	Having a sustainable attitude means owning fewer items but ensuring they are of high quality.	SCMS13

**Source:** Own research

The elements used in this suggested scale seek to capture the essential concepts for understanding sustainability, such as the need for environmental preservation and resource conservation. We included items that reflect the general concept of sustainability, for example, "Sustainability means finding a balance between economic growth and environmental protection". We also incorporated items that addressed attitudes towards sustainability and sustainable clothing, such as the statement "A sustainable attitude means considering the need to protect the planet for current and future generations, while also taking into account economic, environmental, and social factors".

Furthermore, the SCMS aims to measure individuals' familiarity with sustainable clothing by evaluating their understanding of topics such as reducing the environmental impact of agrochemicals and sourcing materials in an environmentally responsible way.

The items of the scale were included as an introductory component in a more complex study that aimed to explore the consumption of sustainable clothes in Romania. Thus, all statements were written in Romanian to guarantee cultural relevance and accessibility for our participants. The main purpose of the measurement tool is to assist in identifying respondents' views and attitudes towards sustainable clothing practices.

All responses were measured on a seven-point Likert scale, where 1 is for complete disagreement and 7 for complete agreement. Table 1, offers a detailed description of the specific wording of the scale items, facilitating transparency and reproducibility in our methodology.

## 2.2. Research Methods

The statistical procedure was conducted using the R software, version 4.3.0 (R, 2024). We began our analysis by first focusing on the reliability of the measurement scale, as well as the correlation matrix and the adequacy test. Afterward, to identify potential underlying factors within the SCMS dimension, we assessed through an exploratory factor analysis (EFA) the construct validity of the scale. For the present study, we used the 'psych' package in R that provides the functions necessary for performing EFA. Thus, we used the "varimax" rotation and the principal axis as an extraction method. Based on the literature, exploratory factor analysis is a valuable tool for developing a model before validating it with confirmatory factor analysis (Gerbing & Hamilton, 1996). Following the extraction of factors, we conducted a confirmatory factor analysis (CFA) to examine the model's performance (Schreiber et al., 2006). The functions for this procedure can be found in R's 'lavaan' package (R, 2024).

## 3. RESULTS

Our final sample comprises 1,250 participants (77.2% female), aged 14 to 77, with an average age of 35.73 (median =35, SD = 12.44). The majority of the respondents reported a monthly income exceeding 5,000 RON (35.6%), and 77.4% had completed higher studies. We organized the results section into three subsections: the first one focuses on the reliability and consistency of the instrument, followed by the one detailing the exploratory factor analysis findings, and then the confirmatory factor analysis. We chose this approach for a more comprehensive summary of the data.

### 3.1. Exploratory Factor Analysis

We initiated the analysis by checking the reliability and homogeneity of our instrument. The tools we used are the Cronbach's Alpha reliability index, the Kaiser-Meyer-Olkin (KMO) coefficient, and the Bartlett test for controlling if the data is appropriate for further analysis. A KMO coefficient exceeding the threshold of 0.60, combined with a significant Bartlett's test result, suggests that data is suitable for factor analysis (Çelikler & Aksan, 2016). Moreover, Cronbach's alpha showed satisfactory results, exceeding the 0.7 threshold (Cortina, 1993).

The Bartlett's test, which evaluated the data stability for factor analysis on our thirteen-item scale, the significant statistic chi-square, the KMO coefficient, and Cronbach's alpha, provide sufficient evidence to support the data's suitability for factor analysis. The findings are summarized in Table 2.

**Table 2.** The results of the reliability and homogeneity tests

Measurement index	Value	
Cronbach's alpha	0.88	
KMO measure of sample adequacy	0.93	
Bralette's test approximate Chi-square value	1099.1	Df = 12, p-value <2.2e-16

Source: Own research (Software: R)

After conducting the exploratory factor analysis (EFA), three factors were extracted with a cut-off point of 0.4. The cumulative variance registered by them was 51%, and for each factor, the variance calculated was 21%, 17%, and 13%. The EFA standard methodology states that item factor loading should be 0.30 or greater. Meanwhile, studies on scale development and adaptation suggest a threshold of 0.30 for acceptable item factor loadings in this field of interest. Our estimations concluded that all thirteen items met the required limit. Thus, the primary criterion for assessing factor analysis results is factor loading, which in essence is represented through the correlation between variables and factors (Çelikler & Aksan, 2016).

**Table 3.** Sustainable Clothing Measurement Scale Constructs

Dimension	Items	Factor 1 0.21	Factor 2 0.17	Factor 3 0.13
<b>General Sustainability</b> 0.85	SCMS1: Sustainability means carrying out activities in a qualitative way that doesn't damage the environment or deplete resources	0.65		
	SCMS2: Sustainability means finding a balance between economic growth and environmental protection.	0.64		
	SCMS3: Sustainability means finding alternative resources while still being able to provide for future generations.	0.66		
	SCMS4: The principles of sustainability are reduction, reusing, and recycling.	0.63		
	SCMS5: A sustainable attitude means taking into account the need to preserve the planet for present and future generations, while also considering economic, environmental, and social factors.	0.64		
<b>Sustainable clothing</b> 0.84	SCMS6: Sustainable fashion means not changing our clothes based on the ongoing trend, but adapting fashion to protect the ecological footprint.		0.40	
	SCMS7: Sustainable clothing uses fabrics derived from environmentally friendly resources, like sustainably grown fiber crops, or recycled materials.		0.60	
	SCMS8: Sustainable clothing is special since it is processed in a way that is less harmful to the environment.		0.75	
	SCMS9: Sustainable clothing reduces the harmful effects of agrochemicals on the environment.		0.66	
	SCMS10: Using sustainable clothes can help reduce the amount of clothing discarded in landfills.		0.50	
<b>Sustainable attitude</b> 0.66	SCMS11: Having a sustainable attitude towards clothing often includes buying second-hand clothes.			0.68
	SCMS12: Having a sustainable attitude towards clothing means donating or recycling clothes so they can be reused or resold.			0.63
	SCMS13: Having a sustainable attitude means owning fewer items but ensuring they are of high quality.			0.44

Source: Own research (Software: R)

To distribute the items across three distinct factors, the “varimax” rotation technique was used (R, 2024). Factor loading values ranged from 0.40 to 0.75. An evaluation of the content showed that the items were clustered into good predictors with good internal consistency, which allowed us to name them according to the latent variable they represented. Furthermore, we analyzed Cronbach’s Alpha to assess the reliability of each new dimension. The results for the first, second, and third factors were computed as 0.85, 0.84, and 0.66. Thus, the determined values for these factors demonstrated their reliability for further statistical procedures. The identified values for the SCMS items, their latent variable name, and reliability index are found in Table 3.

### 3.2. Confirmatory Factor Analysis

We continued the statistical procedure with the Confirmatory factor analysis (CFA) to evaluate the structural validity of the model obtained during the EFA stage. In this part of the analysis, we employed as model fit indices the Root Mean Square Error Approximation (RMSEA), the Standardized Root Mean Square Residuals (SRMR), the Comparative Fit Index (CFI), and the Tucker-Lewis Index (TLI). We compared the values of these indices to the guidelines found in the literature. Universally accepted cut-offs are RMSEA below 0.06, SRMR below 0.08, CFI above 0.9, and TLI above 0.9. In our case indices were registered: RMSEA = 0.058, SRMR = 0.038, CFI = 0.961, and TLI = 0.950. Given the satisfactory results, we then investigated a second-order model with a four-factor solution. In this case, we used two different statistical methods to assess the goodness-of-fit indicators. First, we employed the “marker” method within the “lavaan” package (R, 2024) that yielded the following results: RMSEA = 0.059, SRMR = 0.046, CFI = 0.959 and TLI = 0.950. For the second method, we used from the same library, the “var std” procedure to evaluate the discussed model, and in return, we found the following values: RMSEA = 0.058, SRMR = 0.031, CFI = 0.961, and TLI = 0.951. All of the results for the CFA are presented in Table 4.

**Table 4.** Confirmatory Factor Analysis Goodness of Fit Indices

	<b>RMSEA</b> (* < 0.06)	<b>SRMR</b> (* < 0.08)	<b>CFI</b> (* > 0.9)	<b>TLI</b> (* > 0.9)
<b>Three-factor model</b>	0.058	0.038	0.961	0.950
<b>Second-order model 1</b>	0.059	0.046	0.959	0.950
<b>Second-order model 2</b>	0.058	0.031	0.961	0.951

**Source:** Own research (Software: R)

The confirmatory factor analysis indicates that the three-factor and four-factor models are well-performing, suggesting they measure the same concept. Moreover, in the cases of the second-order models, both hint at an overarching construct, namely the fundamental concept of sustainability.

## 4. DISCUSSION AND FUTURE RESEARCH DIRECTIONS

The Sustainable Clothing Measurement Scale (SCMS) is a thirteen-item scale that broadly evaluates various aspects of sustainable clothing consumption. The scale was developed aligned with the core principles of sustainability; thus, it incorporates dimensions such as one’s understanding of sustainability, attitudes towards sustainable clothing, and knowledge of sustainable clothing practices.

Both the exploratory factor analysis (EFA) and the confirmatory factor analysis (CFA) supported the SCMS’s reliability and validity. The EFA revealed three distinct factors for the scale developed in this study: general sustainability, sustainable clothing, and sustainable attitude. For these

predictors, Cronbach's alpha values exhibited strong internal consistency. Furthermore, the structural validity of the scale was supported by the CFA, since the three-factor and four-factor models showed good fit indices.

During the statistical procedures, a potential overarching latent construct was discovered, namely the fundamental concept of sustainability. Through the scale's holistic perspective on sustainability, we can transcend its specific dimensions and emphasize the complementary nature of economic, environmental, and social predictors in driving sustainable behaviors.

Through this study, we offer significant implications for both academic research and practical efforts to advocate for sustainable clothing consumption practices in Romania. The development of the SCMS adds to the academic literature by providing a new instrument that can measure individuals' understanding and attitudes toward sustainable clothing consumption and enable future empirical investigations in this research area. Moreover, based on this study's findings, several programs and policies could be designed to foster sustainable behavior among Romanian consumers. On this note, the fashion industry is one of the key actors that can significantly benefit from the SCMS findings. Using the scale to identify and understand consumers' perceptions and preferences could be valuable in addressing the group of interest's offerings to meet the needs of sustainable fashion. Also, this tool can provide businesses with helpful insights that can be used to improve their marketing strategies and product offerings to align with their consumers' needs and values. These actions will ultimately benefit the advancement of the sustainable fashion ecosystem.

## 5. CONCLUSION

This study successfully developed and validated the Sustainable Clothing Measurement Scale (SCMS) to address the identified research gap in measuring consumers' understanding and attitudes toward sustainable clothing consumption, especially in the context of Romania. We created a comprehensive tool specifically designed and tested for Romanian consumers, by integrating the found notions from existing literature with the well-discussed principles of sustainability.

The SCMS is a thirteen-item instrument and serves as a comprehensive tool for evaluating multiple dimensions of sustainable clothing consumption. The newly developed instrument was measured using a seven-point Likert scale. We ensured the scale was culturally appropriate and accessible to our 1,250 Romanian respondents who have evaluated it. All thirteen items were validated with different statistical procedures as EFA and CFA, and took part in the formation of the three predictors: general sustainability, sustainable clothing, and sustainable attitude. The same statistical methods were employed to test the validity and reliability of the instrument, both returning great results that encourage future research in the fields of tool development and sustainable clothing consumption.

As for the limits of this research, one limitation is the potential for different biases that can occur due to using an online survey method and relying on self-reported data. These biases could limit the generalizability of our findings. Another limitation is the demographic characteristic of having a large percentage of female respondents. This specific part of the sample could bias our results in favor of a particular characteristic of understanding sustainability. Future research could overcome this limitation and employ different methods of data collection that would increase the study's generalizability and include a demographically balanced group. Additionally, the design and conceptualization of the scale were based especially on the existing literature and no other

specialized perspective was given on the final version that was used. Thus, there is a high possibility that during their crafting process, the instrument's items may not have fully covered all of the relevant aspects of sustainability and sustainable clothing. Moreover, the statistical procedures that have been employed may have limited the exploration process in identifying the tool's statistical characteristics. Future studies should be carried out to identify and rectify these shortcomings and enhance the scale's effectiveness. Recognizing these limitations serves as a foundation for future research directions aimed at contributing to sustainable clothing consumption.

To conclude, the development and validation of the Sustainable Clothing Measurement Scale seeks to be a pioneering effort in understanding sustainability and sustainable clothing consumption in Romania. Also, we consider this study to be a step towards fostering a more sustainable future for fashion and other industries. The value of the research stands in the importance of the analyzed sector and the novelty it brings in addressing the identified gap within the specialized literature, especially in the Romanian context.

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