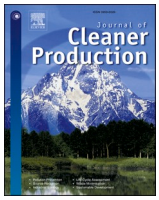
Journal of Cleaner Production 447 (2024) 141317

Contents lists available at ScienceDirect

Journal of Cleaner Production

journal homepage: www.elsevier.com/locate/jclepro



Perspectives of older people on environmental sustainability: A cross-cultural validation study between five countries

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ARTICLE INFO

Handling Editor: Giovanni Baiocchi

Keywords:
Energy conservation
Scale
Survey
Pro-environmental behaviours
Consciousness
Sustainability

ABSTRACT

The global agenda to move societies towards a more sustainable course of development also affects the lives of older people in our ageing populations. Therefore, it is important to understand the drivers, intentions and behaviours concerning sustainability among older adults. The aim of this study is to translate and cross-culturally validate an existing instrument (SustainABLE-16 Questionnaire), developed in the Netherlands, which measures how older people view the theme of environmental sustainability in their daily lives, for use in Romania, Poland, North Macedonia and Israel. The SustainABLE-16 covers three domains: 1) Pro-environmental behaviours; 2) Financial position; and 3) Beliefs. The scale was translated in Romanian, Polish, Macedonian, Albanian and Hebrew. Its 16 items were appraised for relevance by older people and experts in the field. A total of 2299 older people, including the original Dutch respondents, were included for the assessment of the level of measurement invariance across six languages, spoken in five countries. As the initial validation of the SustainABLE-16 did not meet internationally-recognised fit requirements, the shorter SustainABLE-8 was validated instead. This instrument proved valid for use in all participating countries (configural validity). Subsequently, increasingly constrained structural equation models were applied to test their fit with the data, ensuring that the fit did not deteriorate. The test results of measurement invariance across the countries indicated that items were stable, achieving partial scalar invariance, with five items demonstrating full scalar invariance. The shorter SustainABLE-8 functions uniformly across all language groups and can, therefore, be used to evaluate sustainable practices among older people. A better understanding of the drivers and practices among older citizens across Europe could, in turn, feed into more fitting public policies on sustainability in the built environment.

1. Introduction

The need for sustainable development has become a key pillar of contemporary society in an era marked by concerns about the environment around us, ranging from social inequality (Zhang et al., 2023) and urban impoverishment (Kisiała and Rącka, 2021) to climate change (Jiménez et al., 2023) and environmental degradation (Kirikkaleli et al., 2023). Human activity is pushing the environmental limits of the planet, going beyond environmental carrying capacity (Świąder, 2018), which is the sum of many daily choices such as one's diet and associated food

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https://doi.org/10.1016/j.jclepro.2024.141317
Received 20 December 2023; Received in revised form 7 February 2024; Accepted 15 February 2024
Available online 21 February 2024

waste, consumption of water and energy, production of municipal waste and sewage, selected modes of transport, or consumption of other goods and services (Świąder et al., 2020).

The complicated interplay between these challenges emphasizes the need for coordinated efforts, which also lies at the basis of the Sustainable Development Goals (SDGs) that were formulated during the United Nations Climate Change Conference in 2015 (United Nations, 2016). The concept of sustainable development serves as a beacon as we navigate a complicated landscape where the effects of our decisions are felt across generations around the world, including older people, pointing us in the direction of a future in which environmental, social, and economic components coexist seamlessly. On top of this, the World Health Organization (WHO) highlighted that 15 out of 17 SDGs are also relevant to ageing, and cities together with local stakeholders are key to implementing these goals (WHO, 2018). It is here that the WHO's agenda of age-friendly cities that was launched in nearly two decades ago (WHO, 2007) intersects with sustainability (van Hoof et al., 2021; Dikken et al., 2023a).

In recent studies by Dikken et al. (2023a, 2023b), it was explored how older people in the Netherlands view the theme of environmental sustainability in their daily lives, with a focus on the built environment. The outcomes of their survey showed a broad range of attitudes, drives and convictions that impact the way older people view sustainability in their daily lives, as well as a wide set of actions that older persons do or do not take. To date, similar representative surveys from other countries are not available. Furthermore, findings from one single country, namely the Netherlands, do not guarantee the existence of a firm basis to create European or even global policies in that regard, as perspectives on sustainability could differ greatly between cohorts of older people due to cultural differences, the level of socio-economic development and national priorities. Therefore, a valid and reliable way to measure how older people view environmental sustainability is needed, for instance, to lead to the development of evidence-informed policies for this group that has recently felt the dire consequences of the cost-of-living crises and the subsequent energy poverty stemming from sharp rises in energy prices (van Hoof, 2024). The basis for such an assessment tool was developed in recent years by an international team of scholars working in the field of gerontology, architecture and environmental sciences (Dikken et al., 2023a).

In their study, Dikken et al. (2023) introduced the SustainABLE-16 questionnaire and reported its step-by-step development following the COSMIN (COnsensus-based Standards for the selection of health Measurement INstruments) protocol. To date, this 16-item instrument is a comprehensive, reliable and valid tool for use within the Netherlands. Even though the SustainABLE-16 demonstrated a good model fit, Dikken and colleagues (2003a) also developed a version of this questionnaire which left out the culturally sensitive questions that the scholars thought were potentially invalid to use in other countries. By doing so, Dikken et al. (2023) improved the model fit indices significantly. This step led to the development of a shorter, eight-item instrument coined the SustainABLE-8 questionnaire. However, their hypothesis on cultural fit has not yet been tested using empirical data from other countries.

Therefore, the primary objective of this study is to cross-culturally validate the SustainABLE-16 instrument (using the original Dutch database from The Hague (Dikken et al., 2023a)), using datasets from four national contexts (in five additional languages) in the larger Eastern European - Mediterranean region (Poland, Romania, North Macedonia and Israel) in order to guarantee that the obtained results reflect genuine variations rather than discrepancies that result from cultural or linguistic differences. Being able to make comparisons between views and opinions of older people from various countries can help policy-makers at the level of the European Union and beyond with the development of fitting policies regarding sustainability as well as sustainable behaviours and choices.

2. Methodology

2.1. Design

Across all the languages and national contexts included in the study, the same research protocol was followed. First the items of the SustainABLE-16 were translated from English into the local language(s). In order to ensure a robust translation, we followed a forward-backward procedure as outlined by Sousa and Rojjanasrirat (2011). Subsequently, face and content validity assessments were conducted, following the approach outlined by Lynn (1986), and adjustments to the translations were made when necessary to ensure an effective cultural adaptation. Finally, a minimum of 200 participants from each language group were recruited to complete the SustainABLE-16 questionnaire (Table 1), after which the measurement invariance (MI) was assessed among the different language groups using the procedures described by van de Schoot et al. (2012). In cross-cultural assessment, the concept of MI plays a pivotal role but is often assumed or ignored by researchers when presenting results (Jeong and Lee, 2019). MI entails assessing whether different demographic groups respond to a given measurement instrument and its individual items in a similar way. Only when measurement instruments demonstrate a certain degree of MI it is allowed to legitimately compare average scores on (sub)scales across different countries and cultures, and it is allowed to draw meaningful interpretations from the results. When individuals from various countries, who speak different languages, do not interpret questionnaire items in a consistent manner, it implies a divergence in the fundamental structure of the instrument.

2.2. Instrument

The SustainABLE-16 questionnaire (Dikken et al., 2023a) is a self-assessment instrument intended to determine the beliefs, behaviours and positions of older adults regarding environmental sustainability (Appendices A and B). The questionnaire comprises items that cover three aspects of the construct. The scale serves as a quick-scan and consists of 16 items covering three domains, respectively: 1) Pro-environmental behaviours (finance and behavioural driven); 2) Financial position; and 3) Beliefs. The scores are expressed on a five-point Likert scale, ranging from: *2 = totally disagree; -1 = disagree; 0 = neutral; 1 = agree to 2 = totally agree*. Higher scores on the SustainABLE-16 indicate positive beliefs, behaviours and positions regarding environmental sustainability (see Table 2 for the included questions).

2.3. Translation of the instrument

The SustainABLE-16 was translated into five different languages for data collection within specific language-based samples, namely Polish, Romanian, Macedonian, Albanian and Hebrew. The cross-cultural validation process of the SustainABLE-16 for these languages and national contexts commenced with the utilisation of the validated Dutch version of the instrument (Appendix A) and its official translation into British English (Appendix B). To further translate items from English to the target languages, we followed a standardised procedure described in the guidelines by Sousa and Rojjanasrirat (2011). This procedure included a two-step process. In the first step, the forward translation, two independent translators conducted the translation for each of the languages. In the second step, the back translation, another expert translated the content back into English. These back translations were then compared with the original English version, and any discrepancies were thoroughly discussed with the research team in the Netherlands - as they were the original scale developers - until consensus was reached.

Table 1
Demographic data of the participants (n = 2299).

	The Netherlands (n = 336)	Poland (n = 801)	Romania (n = 424)	North Macedonia (Macedonian sample) (n = 297)	North Macedonia (Albanian sample) (n = 218)	Israel (n = 223)
Sex						
Male	155 (47.7%)	319 (39.8%)	166 (39.2%)	119 (40.1%)	78 (35.8%)	78 (35.0%)
Female	170 (52.3%)	482 (60.2%)	258 (60.8%)	178 (59.9%)	145 (64.2%)	145 (65.0%)
Age, Mean (SD)	75.04 (6.93)	–	73.46 (7.02)	71.34 (7.77)	70.98 (4.53)	70.98 (4.53)
65–74	–	449 (56.0%)	–	–	–	–
75–84	–	236 (29.5%)	–	–	–	–
85+	–	116 (14.5%)	–	–	–	–
Educational level						
ISCED 0-2	137 (41.4%)	61 (7.6%)	31 (7.3%)	4 (1.3%)	2 (0.9%)	2 (0.9%)
ISCED 3-4	29 (8.7%)	414 (51.9%)	148 (34.9%)	29 (9.8%)	23 (10.3%)	47 (21.2%)
ISCED 5-6	111 (33.5%)	65 (8.0%)	108 (25.5%)	170 (57.3%)	83 (37.3%)	124 (55.6%)
ISCED 7-8	54 (16.3%)	259 (32.5%)	137 (32.3%)	94 (31.6%)	115 (51.5%)	50 (22.4%)
Years living in Country, Mean (SD)	51.11 (24.48)	61.97 (13.22)	51.73 (19.80)	62.62 (13.69)	40.71 (23.03)	40.71 (23.03)
Type of dwelling						
Owner-occupant	192 (57.8%)	684 (85.4%)	350 (82.5%)	292(98.3%)	185 (83.0%)	185 (83.0%)
(Private) rent	130 (42.2%)	7 (0.9%)	74 (17.5%)	5 (1.7%)	38 (17.0%)	38 (17.0%)
Other	–	110 (13.7%)	–	–	–	–
Living together with a spouse or partner	153 (45.9%)	569 (72.7%)	306 (72.2%)	233 (78.5%)	166 (74.4%)	166 (74.4%)
Receiving care	81 (24.3%)	150 (18.9%)	129 (30.4%)	44 (14.8%)	64 (28.7%)	64 (28.7%)
Living with one or more chronic conditions	119 (36.0%)	483 (60.3%)	164 (38.7%)	116 (39.1%)	73 (32.7%)	73 (32.7%)
Using a mobility aid	60 (18.2%)	175 (21.9%)	181 (42.7%)	22 (7.4%)	14 (6.3%)	14 (6.3%)

Table 2
I-CVI and S-CVI/ave from older adults per country (face validity), and international academic experts (content validity). Items with I-CVI scores >0.78 by older persons or experts are shown in bold.

nr	Item	I-CVI older people (n = 48)	I-CVI experts (n = 38)
1	**I sometimes turn off lighting or equipment because of the costs.**	**0.94**	**0.90**
2	I sometimes turn off lighting or equipment for the sake of the environment.	0.58	0.66
3	**I deliberately reduce the heating in winter because of the costs.**	**0.79**	**0.90**
4	I deliberately reduce the heating in winter for the sake of the environment.	0.54	0.68
5	**When keeping my home cool during periods of heat, I am considerate of costs.**	**0.94**	**0.88**
6	When keeping my home cool during the summer or heatwaves, I am conscious of the environment.	**0.91**	0.75
7	**I can pay my energy bills.**	**0.96**	**0.89**
8	**I have the financial means to implement energy-saving measures in my home**	**0.88**	**0.89**
9	**I have sufficient financial means to live an environmentally conscious life.**	**0.86**	0.58
10	**I'm concerned about climate change.**	**0.84**	0.64
11	I separate my household waste where I can (e.g. recycling).	**0.84**	0.67
12	**I think it is important to use sustainable energy.**	**0.86**	0.76
13	**I have implemented measures myself to lead a more sustainable life.**	**0.96**	0.68
14	I am willing to eat less or no meat to improve the environment.	0.48	0.63
15	I am willing to eat seasonal foods more frequently to improve the environment.	0.36	0.53
16	**I believe that biodiversity affects my quality of life.**	**0.92**	0.57
S-CVI/ave for the SustainABLE-16		0.77	0.77

2.4. Qualitative validation

In order to establish the initial validity, both face validity and content validity of the SustainABLE-16 were evaluated using the Item Content Validity Index (I-CVI). In this study, the I-CVI represents the proportion of older adults and/or experts who rated the content as relevant for their respective language and culture.

For the assessment, older adults were contacted and asked to rate the relevance of the 16 items of the SustainABLE-16 on a four-point Likert scale: *1=not relevant, 2=somewhat relevant, 3=quite relevant, 4=highly relevant*. Participants had to be able to read and understand their respective languages, and efforts were made to include individuals with diverse educational backgrounds.

Additionally, academic experts in each of the included countries were approached to evaluate the relevance of the items in relation to the construct, study population (older adults), and the purpose of the questionnaire. This evaluation was carried out independently. The experts also used the same four-point Likert scale to evaluate relevance.

The relevance and readability of the SustainABLE-16 was evaluated by a group of 48 older adults aged 65 and over, as well as 38 academic experts in the domains of social work, gerontology, environmental and sustainability sciences, as well as architecture and urban planning from the following countries (The Netherlands (n = 5), Poland (n = 9), Romania (n = 10), North Macedonia (n = 10), United Kingdom (n = 2), Germany (n = 1), Australia (n = 1). The results from the face validity and content validity were used to interpret the outcomes of the quantitative validation of the SustainABLE-16 described later.

For both older people and experts, the I-CVI was calculated for each of the 16 items using the following equation (Eq. 1):

$$I-CVI = \frac{Number\ of\ Experts\ Rating\ the\ Item\ as\ Content\ Valid}{Total\ Number\ of\ Experts} \quad \text{(Equation 1)}$$

In this equation, the "number of experts rating the item as content valid" represents the count of experts who agree that a specific item is relevant and clear (scoring a 3 or 4 on the Likert scale), and the "total number of experts" is the total number of experts participating in the content validity assessment. According to Lynn (1986) and Polit et al. (2007), an item is considered 'excellent' when the I-CVI value ≥ 0.78. Thereafter, the Scale Content Validity Index/Average (S-CVI/ave) was calculated, using the following equation (Eq. 2):

$$S-CVI\Big/ave = \frac{Sum\ of\ I-CVI\ values\ for\ all\ items}{Total\ number\ of\ items} \quad \text{(Equation 2)}$$

In the formula, the "sum of I-CVI values for all items" refers to the I-CVI scores of items that experts agree on, and the "total number of

items" is the overall number of items in the scale. Researchers suggest that a scale demonstrating excellent content validity should consist of an S-CVI/ave scoring 0.9 or higher (Shi et al., 2012). Finally, older people and experts were asked whether the items covered the entire construct. Data analysis was conducted using SPSS version 27.0 (IBM Corp., Armonk, NY, USA).

2.5. Recruitment of participants for the quantitative validation

For gathering survey data among older people in all countries, participants were recruited through written invitations, online channels, or by telephone contact. Participants were recruited in Wrocław and Kraków (Poland), Bucharest (Romania), Skopje (North Macedonia) and Tel Aviv-Jaffa, Herzliya, Kfar Saba and Jerusalem (Israel) (Fig. 1). In order to be eligible for participation, individuals had to be aged 65 years or older. In the Netherlands, data had been collected by a research bureau by post (Dikken et al., 2023a; van Hoof et al., 2024). In Poland, data were collected by a national research company via telephone (57.3%) and in-person interviews (42.7%). In Romania, a local company performed face-to-face interviews collecting the data (Ivan et al., 2024). In North Macedonia, data collection involved direct interviews, conducted by two teams; one from a local company recruiting mostly Macedonian speaking older people and second a team of trained students from Mother Teresa University to recruit the Albanian-speaking sample who lived in the same municipality as the students themselves. In Israel, data were collected by a research bureau via an online survey. Data collection for the entire cross-cultural validation project took place from September 2022 to September 2023. See Table 1 for an overview of demographic data of the participants for each of the countries.

2.6. Ethics

Before completing the SustainABLE-16 questionnaire, all participants received information about the study's objectives and the approximate time required for completion (approximately 20 min). Participants were assured of the confidentiality and anonymity of their responses, and informed consent was obtained from each participant before their participation in the study. The Institutional Review Board of the authors' institution approved the cross-cultural research project, and it adhered to the principles of the Declaration of Helsinki. For partners in The Netherlands, Poland and Romania, certification of Ethical Acceptability for Research Involving Human Subjects was obtained collectively from the director of the Ethic Committee at the National University of Political Studies and Public Administration (SNSPA), associate professor Ion Stavre, on 23 May 2022. For North Macedonia, certification of ethical acceptability for research involving human subjects was obtained from the Head of Quality Assurance and Management Office at the Mother Teresa University in Skopje on 13 January 2023 (certificate number 03–29/1). For Israel, approval was obtained on 8 May 2023 from the School of Social Work of Bar Ilan University (number 042303).

2.7. Quantitative validation

In order to ensure valid comparisons between various diverse groups of older people, it is essential that the SustainABLE-16 measures the same constructs with identical structures. When this condition is met, the SustainABLE-16 is considered to be measurement invariant. As stated before, MI refers to the consistency of responses across different groups. When MI does not hold, it suggests that groups respond differently to the questionnaire items, making it unreliable to compare factor means between them. Van de Schoot et al. (2012) provided a detailed step-by-step approach for testing MI, which was followed in this study.

The first step after data collection among older people involved deleting cases with missing values. Additionally, the data were carefully screened for respondents exhibiting an implausible answer pattern, which is important to identify and address any bias resulting from deviant answer patterns in the distinct groups, as this can affect factor loadings (discrimination parameter), intercepts (difficulty parameter), and error variances, all of which are used in assessing MI (van de Schoot et al., 2012).

Thereafter, the configural invariance was tested. This involved conducting a confirmatory factor analysis (CFA), aligning the model with the theoretical operationalization of the construct used by Dikken et al. (2023). The aim of this step was to test whether the same CFA structure remained consistent across all language groups. Once configural invariance was established, the next step involved testing the metric invariance. In this step, it was determined whether respondents from different groups assigned the same meaning to the latent construct under study. Initially, a model was constructed in which only the factor loadings were constrained in order to be equal across groups, while allowing the intercepts to vary. This allowed for an assessment of whether the groups attributed consistent interpretations to the underlying construct while allowing for variations in item levels. Subsequently, another model was explored in which the intercepts were constrained in order to be equal between groups. In this model the factor loadings were permitted to differ. This analysis aimed to evaluate whether the groups exhibited consistent understanding of the item levels while accounting for potential variations in the way they loaded onto the construct. Finally, when metric invariance was established, scalar invariance was tested, which enables meaningful comparisons of group scores on the latent variable. In order to assess scalar invariance, a model was constructed in which both the factor loadings and intercepts were constrained to be equal between the groups.

To evaluate the adequacy of the increasingly restricted models, the Comparative Fit Index (CFI) and the Tucker Lewis Index (TLI) were assessed, which should attain values of 0.9 or higher to signify a strong fit (Hu and Bentler, 1995). Moreover, the root-mean squared residual (SRMR) was considered for the analysis, for which the value is recommended to be below 0.08 (Hu and Bentler, 1999). Finally, the root-mean square error of approximation (RMSEA) was examined. Following the recommendations by MacCallum et al. (1996), the RMSEA should ideally be 0.01 or lower for an excellent fit, or 0.05 or lower for a good fit, or 0.08 for a moderate fit. Hu and Bentler (1999) concluded that RMSEA values between 0.05 and 0.1 represent a moderate fit.

2.8. Composite reliability testing

The internal consistency of the model was assessed through the calculation of the composite reliability, a crucial measure for determining the reliability of the constructs within the model. According to the guidelines set by Hair et al. (2014), composite reliability values exceeding 0.70 are considered appropriate for ensuring reliability in the measurements.

3. Results

3.1. Outcomes of the translation procedure

The translations from English to the target languages underwent minor adjustments by the responsible researcher at the national level in order to ensure consistency in language used for the final version of the national instrument. The back translation closely resembled the original items, although there were a few instances where the translation was not an exact fit or a loose translation was used. After reaching consensus among the international research team, it was determined that no further changes were required in the final versions of the back translations (Appendices C to G).

3.2. Outcomes of the qualitative validation

The relevance of the SustainABLE-16 was evaluated by older people and experts. Variations between countries existed between ratings of

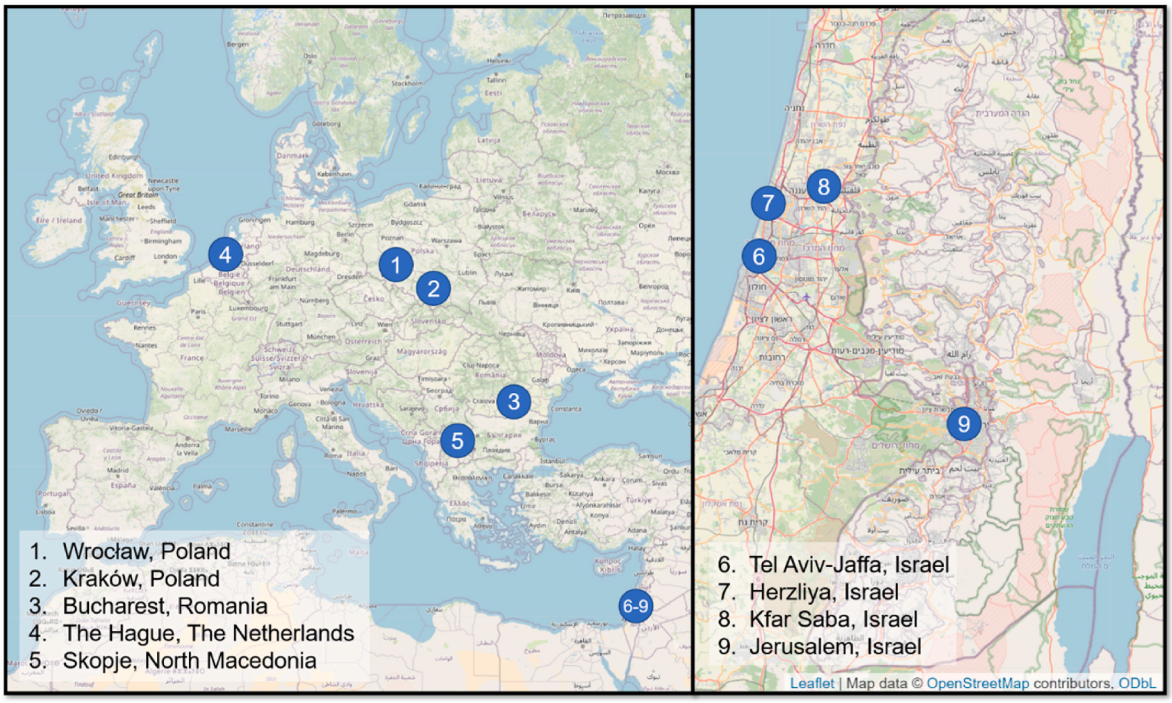

Fig. 1. Map of the cities where participants were recruited.

older people and experts (Table 2). Moreover, results showed that several questions on the domain of "Beliefs" could be culturally sensitive as scores of older people were different for each country/culture, leading to lower I-CVI scores.[1] The S-CVI/ave score did not meet the threshold of 0.90. None of the older people and experts made suggestion about measuring the construct. In this phase, no items were excluded or modified, as (1) cultural differences would also be revealed through the MI analysis and (2) the choice was made to use these qualitative results to explain possible outcomes, not for item reduction in this stage.

3.3. Outcomes of the quantitative validation

A total of 2299 older adults, who participated in this study, had no missing values. This group was made up of 801 respondents from Poland, 424 from Romania, 515 from North Macedonia (both Macedonian and Albanian language samples), 223 from Israel, and 336 from the Netherlands. As previously mentioned, for a valid comparison of groups with diverse languages and cultures, it is essential that any instrument measures identical constructs with consistent structures across these groups.

3.3.1. Measurement invariance of the SustainABLE-16

First, a CFA was conducted to test whether the structure remained consistent across all groups. This was not the case (configural model fit of the total sample: CFI = 0.859; TLI = 0.817; RMSEA = 0.042). This meant that the SustainABLE-16 could not be considered valid for cross-cultural validation (Table 3). This is in line with the results of the qualitative validation (face and content validity) (Table 2, Appendix H).

Therefore, we continued to test the SustainABLE-8 that was presented by Dikken et al. (2023), which was (largely) supported by older people and academic experts in the face and content validity phase.

[1] This was already mentioned in the original paper by Dikken and colleagues (2023a) on the development of the SustainABLE-16, in which the scholars presented a fifth model. They considered this model, coined the SustainABLE-8, to be more adequate for cross-cultural validation purposes, as fit indices were well over the needed thresholds.

Table 3
Goodness-of-fit statistics for the estimated models relating to the SustainABLE-16.

	χ^2	df	CFI	TLI	RMSEA [90% CI]
Configural model fit total sample	2825.6	552	0.859	0.817	0.042 [0.041 - 0.044]
The Netherlands	343.4	92	0.918	0.893	0.090 [0.080 - 0.101]
Poland	484.6	92	0.894	0.862	0.073 [0.067 - 0.080]
Romania	1177.8	92	0.798	0.737	0.167 [0.159 - 0.176]
North Macedonia (Macedonian sample)	352.9	92	0.842	0.795	0.098 [0.087 - 0.109]
North Macedonian (Albanian sample)	160.6	92	0.928	0.906	0.059 [0.043 - 0.074]
Israel	308.7	92	0.844	0.796	0.103 [0.090 - 0.116]

3.3.2. Measurement invariance of the SustainABLE-8

For the SustainABLE-8, full metric invariance was established, indicating that the balance between model fit and complexity did not significantly deteriorate in comparison to the configural model (Metric model: ΔCFI = 0.010; ΔRMSEA = 0.001; ΔSRMR = 0.0191) (Table 4). Subsequently, partial scalar invariance was achieved, allowing the intercepts of item 2: *"I deliberately reduce the heating in winter for the sake of the environment"* (Pro-environmental behaviours), item 4: *"I'm able to afford my energy bills"* (Financial position), and item 8: *"I have taken measures myself to lead a more sustainable life"* (Beliefs) to be freely estimated (i.e., the intercepts being unconstrained). This meant that there is a presence of certain cultural differences (Partial scalar model: ΔCFI = 0.014; ΔRMSEA = 0.002; ΔSRMR = 0.0003).

It is worth noting that despite the partial scalar invariance on these three items, meaningful comparisons of latent mean scores can still be made, as the literature suggests that full scalar invariance is not a prerequisite for substantive analysis, provided that at least two items remain invariant (Steenkamp and Baumgartner, 1998; Vandenberg and Lance, 2000; Robitzsch and Lüdtke, 2023).

Table 4
Measurement invariance of the SustainABLE-8 for all language-groups.

	χ^2	df	$\chi^2\Delta$	Sig.	CFI	CFIΔ	RMSEA [90% CI]	RMSEAΔ	SRMR	SRMR Δ	TLI
Configural	390.473	96	–		0.954	–	0.037 [0.033 - 0.040]	–	0.0704	–	0.919
Metric	478.998	121	88.525	0.000	0.944	0.010	0.036 [0.033 - 0.039]	0.001	0.0895	0.0191	0.922
Scalar	938.757	146	459.759	0.000	0.876	0.068	0.049 [0.046 - 0.052]	0.013	0.0887	−0.0008	0.857
Partial scalar[a]	514.830	131	35.832	0.000	0.940	0.004	0.036 [0.033 - 0.039]	0.000	0.0891	0.0004	0.923

[a] Partial scalar invariance model: intercept for items 2 (Pro-environmental behaviours), 4 (Financial position), and 8 (Beliefs) freely estimated across groups.

3.4. Reliability of the SustainABLE-8

The composite reliability scores ranged from 0.24 (Albanian language for the domain of Beliefs) to 0.93 (Romanian language for the domain of Pro-environmental behaviours). The entire domain of Pro-environmental behaviours scored well above the 0.70 benchmark and can be considered reliable (Hair et al., 2014). For the domain of Financial position, the range was small, from 0.65 to 0.84. Therefore, we concluded that this domain is reliable, too. The domain of Beliefs proved to be unreliable in this dataset as scores ranged from 0.24 to 0.75 with the lowest scores found in the smallest language samples (Table 5).

3.5. Initial survey results of the SustainABLE-8

Table 6 presents the initial findings derived from the six languages in this validation study. As languages can be compared (SustainABLE-8 being partial scalar invariant and full metric invariant), the analyses unveiled some disparities in SustainABLE-8 scores and domains, pinpointing specific areas for countries where targeted interventions can be implemented and where countries can learn from each other.

The SustainABLE-8 demonstrated a relatively substantial item variance, indicating a wide spectrum of response patterns, while its mean remained closer to the midpoint of the scale, which is the preferred outcome. Romanian and Dutch older people demonstrated the most positive set of Pro-environmental behaviours (2.19 and 2.05 respectively) and Israeli older people scored the lowest (0.72), even though this particular group had the highest scores for Financial position (3.01). The domain of Beliefs does not show large differences between languages and cultures.

4. Discussion

This study demonstrated that the MI of the SustainABLE-16 across diverse countries in the greater European-Mediterranean region with distinct languages and cultures revealed inconsistencies in the structure across all groups, thus invalidating its suitability for cross-cultural validation. This finding aligns with the outcomes of the qualitative validation (face and content validity), emphasizing the lack of coherence necessary for cross-cultural application. Moreover, Dikken et al. (2023) foresaw that several items might be too culturally sensitive and too specific for the Dutch context, and therefore proposed the SustainABLE-8 as an alternative model demonstrating a better model fit. This shortened version of the SustainABLE-16 exhibited full metric invariance, indicating stability in the model fit across diverse cultural groups, maintaining a balance between complexity and model fit. Finally, also partial scalar invariance was achieved, allowing specific item intercepts to vary across cultures, suggesting subtle cultural differences in a select set of items related to Pro-environmental behaviours, Financial position, and Beliefs but meaningful comparisons of latent mean scores remain viable (Steenkamp and Baumgartner, 1998; Vandenberg and Lance, 2000). The qualitative results for each of the language groups of the SustainABLE-8, i.e., of the face and content validity, align with the results of the quantitative validation (Appendix H).

Table 5
Composite reliability per factor of the SustainABLE-8 per language.

Language	Pro-environmental behaviours	Financial Position	Beliefs
Polish	0.74	0.72	0.55
Romanian	0.93	0.76	0.55
Macedonian	0.81	0.69	0.66
Albanian	0.84	0.65	0.24
Hebrew	0.81	0.69	0.52
Dutch	0.86	0.84	0.75

The identification of inconsistencies in the structure of the SustainABLE-16 across cultural groups resonates with prior studies emphasizing the challenges in achieving cross-cultural measurement equivalence, especially on the European continent, where both cultures and languages differ greatly between its regions. This also shows the heterogeneity in attitudes, drivers, intentions and behaviours among the people of Europe. Studies often highlight the necessity of rigorous validation processes, including CFA and qualitative assessments, to ensure that constructs measure the same underlying concepts across diverse cultural contexts (Foley et al., 2023; Supreeyaporn et al., 2023). However, this rigorous procedure is often neglected or structure equivalence is simply assumed (Steinmetz et al., 2009). Without establishing MI, conducting group comparisons can yield meaningless, erroneous, and non-replicable results. Variations among groups might not truly reflect actual differences but rather stem from the instrument functioning differently across these groups. Consequently, the theoretical and practical implications of a study may be limited, ambiguous, or entirely misleading for one group compared to another (Jeong and Lee, 2019). Overlooking this crucial step could result in constructing an unsound theory and basing the practices of, for example, policymakers on false and inaccurate information. Therefore, achieving MI is imperative before drawing any conclusions from group comparisons.

The successful establishment of full metric invariance for the SustainABLE-8 indicates stability in the model fit across cultural groups. The partial scalar invariance achieved suggests that while the overall structure remains consistent, certain item intercepts might vary across cultures, aligning with the notion that strict scalar invariance might not always be attainable or necessary for substantive analysis (Byrne et al., 1989; Vandenberg and Lance, 2000).The variation in reliability across domains, especially the inconsistencies in the domain of Beliefs across different language samples, means that results should be interpreted with caution when making cross-cultural comparisons. Also, the reliability of the included samples should be assessed every time as it proved challenging to achieve high reliability equivalence across cultural groups. Overall, our findings underline the complexity of conducting cross-cultural validation of measurement instruments, emphasizing the need for meticulous validation processes and acknowledging nuanced cultural variations while interpreting results across diverse populations. At the same time, the SustainABLE-8 demonstrated promising validity results and can be used to make comparisons between cultures and languages across the continent, spanning countries with cultures based in the three Abrahamic Faiths, and with languages from the Germanic, Slavic and Albanian groups of the Indo-European language family and one Semitic language of the Afro-Asiatic language family. Countries included three generations of European Union member states, one membership candidate country and one associated state.

One reason for the promising cross-cultural validity results is the step-wise procedure that was followed, starting with the translation

Table 6
Initial results using the SustainABLE-8.

Language	Pro-environmental behaviours (mean and SD) Range -6 to +6	Financial Position (mean and SD) Range -6 to +6	Beliefs (mean and SD) Range -4 to +4
Polish (n=801)	0.89 (2.858) (+)	1.24 (2.552) (++)	1.95 (1.478) (++)
Romanian (n=424)	2.19 (2.779) (++)	0.83 (2.993) (+)	1.35 (1.521) (++)
Macedonian (n=297)	1.06 (2.404) (+)	0.18 (2.529) (+)	1.33 (1.268) (++)
Albanian (n=218)	1.48 (3.075) (+)	0.31 (2.885) (+)	0.85 (1.700) (+)
Hebrew (n=223)	0.72 (2.710) (+)	3.01 (2.027) (++++)	1.39 (1.463) (++)
Dutch (n=336)	2.05 (2.523) (++)	1.40 (2.608) (++)	1.48 (1.504) (++)

process. By conducting two independent forward translations, the study fulfilled the requirements of reconciliation (Koller et al., 2014). Additionally, a further step also included the forward-backward translation, which is commonly used in other studies (Lee et al., 2019; Afsahi et al., 2023). By merging both elements of independent translation and forward-backward translation we aimed to increase the reliability of the obtained items. A strength of this study was that sample sizes in each country used for this purpose surpassed the sample sizes used in other studies to determine psychometric properties of a test in that aspect (Alves Faria et al., 2022; Bazhan et al., 2023). However, it was observed that in countries having relatively smaller sample sizes, reliability scores were lower too, leading to the assumption that fit indices were influenced by sample size (Cohen, 1992). Therefore, future replication for these specific countries and languages is encouraged.

There are a few strengths and limitations to note in this study. For the first time, a cross-cultural study is conducted to validate the use of an instrument measuring older generations' behaviours, financial position and beliefs regarding environmental sustainability, which can now be used in the contexts of the countries included in this validation study. This study presents a rigorous method for cross-cultural validation of questionnaires and surveys, which is very much needed in Europe as a pluricultural continent which also has a rather high density of different languages. The outcomes can serve as an example for European policymakers of how important it is for instruments to undergo a rigorous validation process before their results can actually be worked with. This means, making the right interpretations of study findings without potentially drawing wrong conclusions, which entails all kinds of consequences. A potential limitation of this study lies in the different sample sizes across the different countries and languages. Even though the minimum sample size of 200 respondents was met for each of the languages, we did observe reliability issues in languages having a smaller sample size (i.e., the Albanian language sample from North Macedonia) and replication is, therefore, encouraged. Also, the domain of Beliefs demonstrated lower reliability scores in all countries, and making cross-cultural comparisons with outcomes in this domain should be done with caution.

The initial analysis of the SustainABLE-8 revealed disparities in scores and domains among the six languages studied. These findings suggest nuanced cultural variations in certain aspects of sustainability perceptions and practices among older adults, highlighting specific areas for targeted interventions across different countries while indicating potential opportunities for mutual learning among these regions. This study further adds to the wider notions of the need to connect the age-friendly agenda with that of sustainability and environmental management (Szewrański et al., 2018; van Hoof et al., 2021; Dikken et al., 2023a; Dabelko-Schoeny et al., 2023). It provides another step to the comparability of age-friendly research data from the greater WHO European Region that comprises of 53 countries (Marston et al., 2024). For instance, the newly-validated SustainABLE-8 questionnaire could also be used for distinguishing between subgroups of older people. New survey research from the Netherlands (Dikken et al., 2023b) using the original SustainABLE-16 questionnaire identified a total of six unique personalities, ranging from people who are actively engaged in trying to make their lives more sustainable to groups who are willing to but lack financial resources and a cluster who is not willing to change their lifestyles. It is suggested that sustainability-related policies should ideally focus on groups who score high in terms of pro-environmental behaviours but who have shortcomings in knowledge in order to scale up or lack the necessary financial means. Similar research, looking at distinct personas throughout the various countries that were included in this validation study, should be tried now that the SustainABLE-8 has been demonstrated to be a valid tool for use across the continent. Such a study, which explores the differences in detail, could help policy-makers with making evidence-informed policies and sustainability action programmes.

On a broader scale of things, such focussed policies could also help the implementation of the SDGs, which necessitates the collective engagement as well as proactive and unstigmatized participation of all generations, including older people themselves (Ayalon et al., 2023; Roy and Ayalon, 2023; Ayalon and Roy, 2023). However, older people may present different approaches to face environmental challenges compared to their younger counterparts. For instance, in the case of energy transformation younger people seem to be more open to radical change in energy systems, while older people are more sceptical about this idea (Stephens, 2019). Many older individuals may have grown up in times when environmental awareness was not as prominent or ingrained in public consciousness; though many post-war generations in Europe grew up in large families with a widespread sense of not wasting due to a lack of resources. As a result, older people might perceive contemporary environmental issues as a departure from their familiar worldviews, leading to a sense of detachment. Nonetheless, Boerenfijn et al. (2018) showed that there is great potential for energy conservation in the field of housing for older adults, in which the occupants can play a major role to achieve environmental goals. Additionally, certain environmental issues, such as the consequences of climate change or resource depletion, might appear to have longer-term effects that older people perceive as less likely to directly impact them. This temporal disconnection could contribute to a sense of distance from the urgency of

environmental concerns. Finally, some investments in eco-friendly solutions are being promoted from the perspective of a return-on-investment period, which in some cases could exceed their perspective of planning (Ryszawska et al., 2021). However, at the same time the wisdom and experience of older generations offer invaluable insights into historical contexts, policy-making, and long-term planning.

5. Conclusion

This cross-cultural validation study successfully adapted and validated the SustainABLE-8 instrument, offering a concise and robust tool for assessing views on environmental sustainability among older adults in Romania, Poland, North Macedonia, Israel, and the Netherlands. The refined instrument demonstrated its reliability and validity, achieving measurement invariance across diverse linguistic and cultural contexts. The SustainABLE-8, with its demonstrated uniform functionality across language groups, emerged as an effective means of evaluation among older populations in these five countries.

The validated SustainABLE-8 provides a valuable resource for capturing insights into pro-environmental behaviours, one's financial position and beliefs across different cultural backgrounds. This comprehensive understanding could serve as a foundation for informed policymaking tailored to the unique needs and perspectives of ageing populations, ultimately contributing to more fitting and effective public (European) policies on sustainability in the built environment. Therefore, other countries are invited to follow the same route towards cross-cultural validation for their specific contexts.

Looking forward, future research efforts could delve deeper into specific cultural nuances and variations in sustainable views and practices among older adults. Additionally, exploring the impact of these views and practices on the built environment and identifying potential interventions to promote sustainable behaviours in this demographic group would be valuable avenues for further investigation. As societies continue to grapple with the challenges of achieving environmental sustainability, the insights gained from this study pave the way for more targeted and impactful strategies in the realm of public policy and ageing populations.

Funding

This research is a deliverable of the project City&Co: Older Adults Co-Creating a Sustainable Age-friendly City (JPI project number 99950200). This project was funded by the Taskforce for Applied Research (UTC.01.1), National Science Centre (UMO-2021/03/Y/HS6/00213), and Executive Agency for Higher Education, Research, Development and Innovation Funding (UEFISCDI) (Contract nr: 298 / 2022), as part of ERA-NET Cofund Urban Transformation Capacities (ENUTC), co-funded by the European Union's Horizon 2020 research and innovation programme under Grant Agreement No. 101003758. The collaboration with North Macedonia was initiated through COST Action CA1936 "International Interdisciplinary Network on Smart Healthy Age-friendly Environments (NET4Age Friendly)", which is supported by COST (European Cooperation in Science and Technology). This COST Action supported Prof Daniel Pavlovski with an STSM grant E-COST-GRANT-CA19136-16362332. The data collection in Israel was funded by the Research Group of Ageing of The Hague University of Applied Sciences.

Availability of data and materials

The data and supporting files are available upon request.

CRediT authorship contribution statement

Jeroen Dikken: Writing – review & editing, Writing – original draft, Validation, Supervision, Software, Resources, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Jan K. Kazak:** Writing – review & editing, Writing – original draft, Supervision, Funding acquisition, Conceptualization. **Loredana Ivan:** Writing – review & editing, Writing – original draft, Supervision, Project administration, Methodology, Investigation, Funding acquisition, Data curation, Conceptualization. **Liat Ayalon:** Writing – review & editing, Writing – original draft, Supervision, Project administration, Methodology, Investigation, Data curation, Conceptualization. **Daniel Pavlovski:** Writing – review & editing, Writing – original draft, Supervision, Project administration, Methodology, Investigation, Funding acquisition, Data curation, Conceptualization. **Jolanta M. Perek-Białas:** Writing – review & editing, Writing – original draft, Supervision, Project administration, Methodology, Investigation, Funding acquisition, Data curation, Conceptualization. **Joost van Hoof:** Writing – review & editing, Writing – original draft, Supervision, Project administration, Methodology, Investigation, Funding acquisition, Data curation, Conceptualization.

Declaration of competing interest

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Data availability

Data will be made available on request.

Acknowledgments

The older people and experts of the face and content validity, and the respondents of the surveys in all participating countries are thanked for their contribution. Lilian Bosten and Fabian van Schetsen of Dimensus, and Ingrid Meijering of GetOud, are thanked for their role in data collection in The Hague. Ceronne Kastelein of the Municipality of The Hague is thanked for her role in the data processing agreement. From Kraków, Paulina Skórska, Milena Maj, Natalia Krygowska-Nowak and Aleksandra Trybalska are thanked, as well as Anna Okońska-Walkowicz and Bożena Opach of gmina Kraków. Kamila Polańska, Robert Pawliszko and Jarosław Bałuka of gmina Wrocław are thanked too. The Polish research company Realizacja, Romanian research company Cult Market Research and Israeli research company iPanel are thanked for their role in the data collection. From Bucharest, we thank George Tudorie for the help in the dissemination of information. Elisabeta Bajrami Ollogu is thanked for her role in data collection for the Albanian sample in Skopje.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jclepro.2024.141317.

References

Afsahi, F., Alimehdi, M., Sharif-Nia, H., 2023. The translation and psychometrics Persian version of irrational food belief scale. BMC Psychiatr. 23, 435. https://doi.org/10.1186/s12888-023-04909-3.

Alves Faria, A.d.C., Martins, M.M., Ribeiro, O.M.P.L., Ventura-Silva, J.M.A., Teles, P.J.F.C., Laredo-Aguilera, J.A., 2022. Adaptation and validation of the individual lifestyle profile scale of Portuguese older adults living at home. Int. J. Environ. Res. Publ. Health 19 (9), 5435. https://doi.org/10.3390/ijerph19095435.

Ayalon, L., Roy, S., 2023. The role of ageism in climate change worries and willingness to act. J. Appl. Gerontol. 42 (6), 1305–1312. https://doi.org/10.1177/07334648221130323.

Ayalon, L., Roy, S., Aloni, O., Keating, N., 2023. A scoping review of research on older people and intergenerational relations in the context of climate change. Gerontol. 63 (5), 945–958. https://doi.org/10.1093/geront/gnac028.

Bazhan, M., Shafiei Sabet, F., Borumandnia, N., 2023. Development and validation of a questionnaire to examine determinants of consumer intentions to purchase organic food. BMC Nutrition 9, 74. https://doi.org/10.1186/s40795-023-00731-y.

Boerenfijn, P., Kazak, J.K., Schellen, L., van Hoof, J., 2018. A multi-case study of innovations in energy performance of social housing for older adults in The

Netherlands. Energy Build. 158, 1762–1769. https://doi.org/10.1016/j.enbuild.2017.10.101.
Byrne, B.M., Shavelson, R.J., Muthén, B., 1989. Testing for the equivalence of factor covariance and mean structures: the issue of partial measurement invariance. Psychol. Bull. 105 (3), 456–466. https://doi.org/10.1037/0033-2909.105.3.456.
Cohen, J., 1992. A power primer. Psychol. Bull. 112 (1), 155–159. https://doi.org/10.1037//0033-2909.112.1.155.
Dabelko-Schoeny, H., Dabelko, G.D., Rao, S., Damico, M., Dogerty, F.C., Traver, A.C., Sheldon, M., 2023. Age-friendly and climate resilient communities: a grey–green alliance. Gerontol. https://doi.org/10.1093/geront/gnad137 gnad137.
Dikken, J., Kazak, J.K., Soebarto, V., van Hoof, J. Views of older people on environmental sustainability: development of the SustainABLE-16 Questionnaire. Build. Environ. 242:110514 doi:10.1016/j.buildenv.2023.110514.
Dikken, J., van Staalduinen, W.H., van Hoof, J., 2023. Onderzoek Den Haag Seniorvriendelijke Stad 2022. Integrale Rapportage Ouderenpanel. The Hague University of Applied Sciences, The Hague, The Netherlands. ISBN: 978-90-832491-5-5 [in Dutch].
Foley, S., Ronchi, L., Lecce, S., Feng, X., Chan, M.H.M., Hughes, C., 2023. Cross-cultural equivalence of parental ratings of child difficulties during the pandemic: findings from a six-site study. Int. J. Methods Psychiatr. Res. 32 (1), e1933 https://doi.org/10.1002/mpr.1933 hdoi:
Hair, J., Hult, C., Ringle, C.M., Sarstedt, M., 2014. A Primer on Partial Least Squares Structural Equation Modelling (PLS-SEM). Sage, Thousand Oaks, CA.
Hu, L.T., Bentler, P.M., 1995. Evaluating model fit. In: Hoyle, R.H. (Ed.), Structural Equation Modelling: Concepts, Issues, and Applications. Sage, pp. 76–99.
Hu, L.T., Bentler, P.M., 1999. Cutoff criteria for fit indexes in covariance structure analysis: conventional criteria versus new alternatives. Structural Equation Modelling: A Multidiscip. J. 6 (1), 1–55. https://doi.org/10.1080/10705519909540118.
Ivan, L., Dikken, J., van Hoof, J., 2024. Unveiling the experienced age-friendliness of older people in Bucharest: a comprehensive study using the validated Romanian age-friendly cities and communities questionnaire and cluster analysis. Habitat Int. 143, 102973 https://doi.org/10.1016/j.habitatint.2023.102973.
Jeong, S., Lee, Y., 2019. Consequences of not conducting measurement invariance tests in cross-cultural studies: a review of current research practices and recommendations. Adv. Develop. Hum. Resour. 21 (4), 466–483. https://doi.org/10.1177/1523422319870726.
Jiménez, O.R., Bornemann, A.C., Medina, Y.E., Romero, K., Juan, R., Bravo, J.R., 2023. Prospects of biological inputs as a measure for reducing crop losses caused by climate change effects. Journal of Agriculture and Food Research 14, 100689. https://doi.org/10.1016/j.jafr.2023.100689.
Kirikkaleli, D., Addai, K., Castanho, R.A., 2023. Energy productivity, financial stability, and environmental degradation in an Eastern European country: evidence from novel Fourier approaches. Heliyon 9 (7), e18073. https://doi.org/10.1016/j.heliyon.2023.e18073.
Kisiała, W., Rącka, I., 2021. Spatial and statistical analysis of urban poverty for sustainable city development. Sustainability 13 (2), 858. https://doi.org/10.3390/su13020858.
Koller, M., Kantzer, V., Mear, I., Zarzar, K., Martin, M., Greimel, E., Bottomley, A., Arnott, M., Kuliś, D., The ISOQOL TCA-SIG (2012) the process of reconciliation: evaluation of guidelines for translating quality-of-life questionnaires, Expert Rev. Pharmacoecon. Outcomes Res. 12(2):189-197 doi:10.1586/erp.11.102.
Lee, W.L., Chinna, K., Abdullah, K.L., Abidin, I.Z., 2019. The forward-backward and dual-panel translation methods are comparable in producing semantic equivalent versions of a heart quality of life questionnaire. Int. J. Nurs. Pract. 25 (1), e12715 https://doi.org/10.1111/ijn.12715.
Lynn, M.R., 1986. Determination and quantification of content validity. Nurs. Res. 35 (6), 382–386. https://doi.org/10.1097/00006199-198611000-00017.
MacCallum, R.C., Browne, M.W., Sugawara, H.M., 1996. Power analysis and determination of sample size for covariance structure modeling. Psychol. Methods 1 (2), 130–149. https://doi.org/10.1037/1082-989X.1.2.130.
Marston, H.R., van Hoof, J., Yon, Y., 2024. Digitalising the built environment for all generations: a new paradigm for equity and inclusive age-friendly cities and communities. Indoor Built Environ. 33 (2), 213–217. https://doi.org/10.1177/1420326X231176621.
Polit, D.F., Beck, C.T., Owen, S.V., 2007. Is the CVI an acceptable indicator of content validity? Appraisal and recommendations. Res. Nurs. Health 30 (4), 459–467. https://doi.org/10.1002/nur.20199.
Robitzsch, A., Lüdtke, O., 2023. Why full, partial, or approximate measurement invariance are not a prerequisite for meaningful and valid group comparisons. Struct. Equ. Model. 30 (6), 859–870. https://doi.org/10.1080/10705511.2023.2191292.
Roy, S., Ayalon, L., 2023. Intergenerational perceptions about climate change in Australia. Int. J. Environ. Stud. https://doi.org/10.1080/00207233.2023.2284531.
Ryszawska, B., Rozwadowska, M., Ulatowska, R., Pierzchała, M., Szymański, P., 2021. The power of Co-creation in the energy transition—DART model in citizen energy communities projects. Energies 14 (17), 5266. https://doi.org/10.3390/en14175266.
Shi, J., Mo, X., Sun, Z., 2012. [Content validity index in scale development]. Zhong nan da xue xue bao yi xue ban (中南大学学报(医学版)). J. Cent. S. Univ. Med. Sci. 37 (2), 152–155. https://doi.org/10.3969/j.issn.1672-7347.2012.02.007 [in Chinese] doi:
Sousa, V.D., Rojjanasrirat, W., 2011. Translation, adaptation and validation of instruments or scales for use in cross-cultural health care research: a clear and user-friendly guideline. J. Eval. Clin. Pract. 17 (2), 268–274. https://doi.org/10.1111/j.1365-2753.2010.01434.x.
Steenkamp, J.E., Baumgartner, H., 1998. Assessing measurement invariance in cross-national consumer research. J. Consum. Res. 25 (1), 78–107. https://doi.org/10.1086/209528.
Steinmetz, H., Schmidt, P., Tina-Booh, A., Wieczorek, S., Schwartz, S.H., 2009. Testing measurement invariance using multigroup CFA: differences between educational groups in human values measurement. Qual. Quantity 43 (4), 599–616. https://doi.org/10.1007/s11135-007-9143-x.
Stephens, J.C., 2019. Energy democracy: redistributing power to the people through renewable transformation. Environment 61 (2), 4–13. https://doi.org/10.1080/00139157.2019.1564212.
Supreeyaporn, N., Watson, R., Damrongpanit, S., Orchard, F., Reynolds, S., Jenkins, P.E., 2023. Factor structure and measurement invariance of the Mood and Feelings Questionnaire: a cross-cultural study among Thai and British adolescents. Eur. Child Adolesc. Psychiatr. https://doi.org/10.1007/s00787-023-02268-8.
Świąder, M., 2018. The implementation of the concept of environmental carrying capacity into spatial management of cities: a review. Management of Environmental Quality 29 (6), 1059–1074. https://doi.org/10.1108/MEQ-03-2018-0049.
Świąder, M., Lin, D., Szewrański, S., Kazak, J.K., Iha, K., van Hoof, J., Belčáková, I., Altiok, S., 2020. The application of ecological footprint and biocapacity for environmental carrying capacity assessment: a new approach for European cities. Environ. Sci. Pol. 105, 56–74. https://doi.org/10.1016/j.envsci.2019.12.010.
Szewrański, S., Świąder, M., Kazak, J., Tokarczyk-Dorociak, K., van Hoof, J., 2018. Socio-environmental vulnerability mapping for environmental and flood resilience assessment: the case of ageing and poverty in the city of Wrocław, Poland. Integrated Environ. Assess. Manag. 14 (5), 592–597. https://doi.org/10.1002/ieam.4077.
United Nations, 2016. Transforming Our World. The 2030 Agenda for Sustainable Development. A/RES/70/1, 2016. https://sustainabledevelopment.un.org/content/documents/21252030%20Agenda%20for%20Sustainable%20Development%20web.pdf.
Vandenberg, R.J., Lance, C.E., 2000. A review and synthesis of the measurement invariance literature: suggestions, practices, and recommendations for organizational research. Organ. Res. Methods 3 (1), 4–70. https://doi.org/10.1177/109442810031002.
van de Schoot, R., Lugtig, P., Hox, J., 2012. A checklist for testing measurement invariance. Eur. J. Dev. Psychol. 9 (4), 486–492. https://doi.org/10.1080/17405629.2012.686740.
van Hoof, J., 2024. Older people going green out of financial necessity: environmental sustainability and age-friendly cities. Indoor Built Environ. 33 (1), 3–7. https://doi.org/10.1177/1420326X231156672.
van Hoof, J., Marston, H.R., Kazak, J.K., Buffel, T., 2021. Ten questions concerning age-friendly cities & communities and the built environment. Build. Environ. 199, 107922 https://doi.org/10.1016/j.buildenv.2021.107922.
van Hoof, J., van Staalduinen, W.H., Dikken, J., 2024. A multi-year quantitative study of the experienced age-friendliness in The Hague: A tale of four personas. Soc. Sci. Med. 340, 116362 https://doi.org/10.1016/j.socscimed.2023.116362.
World Health Organization, 2007. Global Age-Friendly Cities: A Guide. World Health Organization, Geneva, Switzerland. ISBN 978-92-4-154730-7.
World Health Organization, 2018. The Global Network for Age-Friendly Cities and Communities: Looking Back over the Last Decade, Looking Forward to the Next. World Health Organization, Geneva, Switzerland.
Zhang, S., Zhu, D., Li, L., 2023. Urbanization, human inequality, and material consumption. Int. J. Environ. Res. Publ. Health 20 (5), 4582. https://doi.org/10.3390/ijerph20054582.