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How to measure *perceived importance of food sustainability*: A new index development

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ABSTRACT

Despite the growing body of consumer research addressing sustainability in food choice, extant scales aiming to measure consumers' relevance of food sustainability rely on different definitions, vary in their conceptual scope, and frequently employ only selected sustainability criteria. However, valid and reliable measures are key not only to produce comparable research results but also to inform policymakers and practitioners in their actions. Against this background, we develop a novel consumer-centered measure, i.e., the *Perceived Importance of Food Sustainability (PIFS) Index* that encompasses consumers' concern for the five dimensions of ecological sustainability, animal welfare, worker welfare, health, and economic sustainability, using impact-relevant indicators. The 43-item index is validated across five EU countries, using representative samples, and shows satisfactory reliability and validity of different forms. This novel holistic index allows researchers to assess consumer relevance of food sustainability overall as well as specifically for selected facets. In sum, this work intends to contribute by advancing the measurement of consumer-focused sustainability considerations within the food context.

1. Introduction

Contemporary food systems and diets heavily impact ecological sustainability, social and animal welfare, as well as public health. Specifically, in so-called WEIRD regions (i.e., Western, Educated, Industrialized, Rich, Democratic; acronym by Henrich et al., 2010), unsustainable and unhealthy diets persist and underscore the demand-side constraint on system change. In this light, the EU's Farm to Fork strategy (FAO, 2020) under the Green Deal (European Commission, 2026a) addresses consumers' food choice as a key aspect for transforming current food systems.

Information-based strategies, such as providing Nutri Scores (Nutriscore Europe, 2026) or Planet Scores (Planet Score, 2026) on products, are considered as potential pathways to informed consumer decisions and increased market transparency (WHO, 2022). At the same time, information provision has been shown to have limited efficacy in changing consumer behavior (Lohmann et al., 2026). One potential reason for this limited efficacy may be that the provided information is not tailored to the sustainability aspects consumers consider relevant. In light of heterogenous consumer attitudes in parallel to the diverse aspects of food sustainability, consumers are likely to differ regarding their concern about specific sustainability dimensions (such as ecological, health, or animal welfare) on the one hand, and specific aspects within the dimensions (such as water use, energy use, or sea pollution resulting from food production) on the other. Consequently, aligning sustainability information provisions with consumers' sustainability information preferences might be a fruitful step forward.

Aiming at such alignment, a key prerequisite is the valid and reliable assessment of consumers' sustainability preferences in the food context (Auger et al., 2007). To date, however, there is a notable lack of consistency in how food sustainability preferences are measured across studies (Grunert et al., 2014; Verain et al., 2021). Existing measurement instruments vary widely in how they conceptualize food sustainability, often narrowing it to environmental aspects, whereas other dimensions (e.g., worker or animal welfare) are considered only sporadically or omitted altogether (e.g., Polzin et al., 2023; Sautron et al., 2015), thus contradicting more holistic established frameworks, such as One Welfare (2025) and One Health (WHO, 2021). In parallel, scales have been introduced to measure the importance consumers attach to animal welfare (e.g., Kiliç & Bozkurt, 2020) or health in food choice (e.g., Wilson-Barlow et al., 2014), resulting in a fragmentation of knowledge in this field. Moreover, extant scales operationalize sustainability with

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differing indicator breadth and depth within the focal dimension(s), reducing comparability across findings and limiting policy and managerial relevance.

In light of this conceptual heterogeneity and fragmented measurement approaches, this paper aims to consolidate fragmented measurement approaches by developing and testing the comprehensive *PIFS* (Perceived Importance of Food Sustainability) *Index*. Building on the sustainability framework of the FAO (2014), the Group of Chief Scientific Advisors (2020), One Health (WHO, 2021), and One Welfare (2025) together with existing conceptualizations in the consumer food literature, the *PIFS Index* adopts a comprehensive food sustainability perspective and comprises five distinct sustainability dimensions, namely concern for (i) ecological sustainability, (ii) worker welfare, (iii) animal welfare, (iv) health, and (v) economic sustainability. We develop a 43-item formative measurement index, which is closely aligned with sustainability indicators at a product level that allow for matching consumer preferences with producer-based sustainability information at a later stage. We empirically validate the *PIFS Index* across five EU countries to establish cross-cultural robustness, assess discriminant, known-group, and test-retest validity, and develop a nomological network linking the index to personal values (Schwartz et al., 2012) and a set of opposing sustainability beliefs.

Overall, our work aims to contribute to the research of sustainable food choice by (i) critically reviewing existing operationalizations and measurements of food sustainability from a consumer perspective, and (ii) providing a thoroughly developed and validated consumer-focused index that integrates key sustainability dimensions within the food context. This index aims to enable consumer research to assess sustainability holistically in substantive studies, as well as at a dimension level for more focused research on, for example, animal welfare. From a practical perspective, this work aims to inform both producers' and policymakers' actions from a consumer perspective, when designing information strategies to foster demand-side transition towards more sustainable food systems.

1.1. Conceptual definition of food sustainability

For the purpose of our work, we build on a system-level sustainability definition provided by the FAO (2014), which has later been refined by the Group of Chief Scientific Advisors (2020, p. 14) and reads as follows: "[…] a sustainable food system delivers food security and nutrition for all in such a way that the economic, social and environmental bases to generate food security and nutrition for future generations are not comprised. A sustainable food system should thus ensure and contribute to all elements of environmental, social and economic sustainability". Specifically, this framework suggests considering ecological, social, and economic food sustainability to transform food systems.

We advance a five-dimensional sustainability model that comprises ecological and economic sustainability as well as three social domains: labor conditions, human health, and animal welfare. While the FAO framework (2014) groups the latter three under a single social dimension, we argue they constitute distinct facets (labor, nutrition/health, and animal welfare). Aggregating them risks obscuring meaningful conceptual differences that are also well documented in empirical consumer-preference research (e.g., BEUC, 2020). Our conceptualization aligns with One Health (WHO, 2021) and One Welfare (2025), which emphasize both the interdependence and the distinctiveness of sustainability dimensions and explicitly treat human health and animal welfare as integral to sustainability.

Further, the distinct health dimension reflects the central importance of healthy food for consumer choices (EFSA, 2025) and the escalating obesity pandemic (WHO, 2025), which is partly driven by unhealthy diets. With respect to animal welfare, the distinct dimension acknowledges the substantial role of livestock farming for food production (HLPE, 2016) and recognizes animals as sentient living beings rather than commodities. Further, it relates to the interconnectedness of animal welfare with other sustainability domains (Keeling et al., 2019).

Based on the above, we formally define consumers' perceived importance of food sustainability as the extent to which individuals care about the impact of their food choices on (i) the environment, (ii) the welfare of workers, (iii) economic prosperity, (iv) human health and (v) animal welfare.

Consequently, we consider sustainable food choice a pathway to (i) minimizing negative ecological externalities, (ii) ensuring fair working conditions throughout the entire supply chain, (iii) fostering economic viability on a regional level, (iv) enabling nutritious diets and (v) reducing mistreatment and increasing the welfare of animals used for food production. Table 1 provides an overview of the conceptual scope for the five sustainability dimensions building on definitions provided by prior research (e.g., Webb et al., 2023).

1.2. Need for a new measurement instrument

Building on our conceptual definition, we conducted a literature review to offer an overview and synthesize the conceptual understanding of extant scales addressing the sustainability dimensions of food from a consumer perspective. Following methodological guidelines by Snyder (2019), we conducted our search across four major academic databases: Google Scholar, Web of Science, Scopus, and PubMed. To ensure comprehensive coverage, we developed search strings based on our conceptual definition of food sustainability (Search string used: ("scale*" OR "questionnaire*" OR "measure*" OR "index" OR "indices" OR "tool*") AND ("food*" OR "nutri*" OR "diet*") AND ("sustainab*" OR "eco*" OR "green" OR "environment*" OR "natur*" OR "conserv*" OR "organic" OR "earth*" OR "climate*" OR "carbon*" OR "planet*" OR "responsible" OR "ethic*" OR "seasonal" OR "local" OR "biodivers*") OR ("economic*" OR "afford*" OR "sensitiv*" OR "price*") OR ("health*" OR "one × health" OR "safety" OR "social*" OR "fair*" OR "lab × r condition" OR "work × condition*") OR ("animal welfare")). Separate searches were conducted at both title level (initially identified articles across sustainability dimensions: n = 5388) and keyword level (initially identified articles across sustainability dimensions: n = 4203). After excluding duplicates (n = 419 from title search and n = 1071 from keyword search) and papers that did not meet the inclusion criteria (i.e., English language, peer-reviewed publication, new scale development, food context, and a consumer-centric focus), our search ultimately resulted in the identification of 40 relevant articles that introduced novel scales, measuring particular aspects of consumers' concern for food sustainability (whereas the vast majority of the originally identified papers merely employed existing scales). For more details, see Supplementary Materials 1.

The identified papers were subsequently analyzed regarding their thematic focus, the sustainability dimensions addressed, the reported scale development process, psychometric properties of the scales (e.g., reliability and validity assessment), as well as their cultural context.

Findings from our literature review show that existing measurement instruments typically address only single or few sustainability

Table 1
Conceptual scope of the *PIFS Index*.

Food Sustainability Dimension	Scope & Definition (based on Pinillos et al., 2016; Webb et al., 2023)
Ecological Food Sustainability	Food systems that minimize negative ecological externalities, e.g., through resource conserving practices.
Worker Welfare	Food systems that ensure fair working conditions throughout the entire supply chain.
Economic Food Sustainability	Food systems that foster economic viability on a regional level.
Human Health	Food systems that enable nutritious diets.
Animal Welfare	Food systems that reduce mistreatment and increase the welfare of animals used for food production.

dimensions (e.g., health in the example of Guertin et al., 2020) Further, most scales are insufficiently validated since they have typically not been tested across independent samples, omit key validity assessments, and provide little transparency about the item generation process, overall.

At an item level, prominent scales including the *Food Choice Questionnaire* (Steptoe et al., 1995), the *Ethical Food Choice Motive Scale* (Lindeman & Väänänen, 2000) as well as its more recent versions entitled *Single-Item Food Choice Questionnaire* (Onwezen et al., 2019) and *Sustainable Food Choice Questionnaire* (Verain et al., 2021), assess consumers stance towards food sustainability based upon sustainability proxies, such as their perceived importance of food regionality, locality, or organic produce. While these are certainly relevant food characteristics for consumers' decision making, using them to assess food sustainability appears critical for three reasons. First, from a sustainability impact assessment perspective (such as lifecycle assessment), such characteristics are insufficient to capture impactful criteria along the food supply chain (Poore & Nemecek, 2018). Second, referring to such food characteristics as sustainability indicators potentially reinforces consumer misconceptions (e.g., that local food is automatically more climate-friendly, which is contingent upon other factors; Weber & Matthews, 2008). Third, the literature documents that consumers prefer local or organic food for motives beyond sustainability, such as quality considerations (Reich et al., 2018). In sum, extant scales appear to measure selected sustainability dimensions with a narrow and sometimes simplified set of indicators.

From a measurement theory perspective, most extant scales are specified as reflective measurement models (e.g., Burnier et al., 2020; Fischer et al., 2017; Lyerly & Reeve, 2015; Rosas et al., 2022; Seda et al., 2021), which – in a nutshell – means that consumer concern needs to be similarly high or low for all sustainability aspects. Given that indicators are highly correlated and interchangeable in such reflective models, we argue that reflective measurement is inappropriate for consumer sustainability concern variables, as consumers might care for different sustainability aspects to a varying extent. The consequences of measurement model misspecification have been demonstrated in prior research; for brevity, we refer interested readers to the work of Jarvis and colleagues (2003).

In summary, extant literature has developed a considerable number of consumer sustainability scales, which, despite their merits, suffer from several key shortcomings. Importantly, a holistic index covering several sustainability dimensions and assessing impact-relevant indicators within these dimensions is currently missing. We thus aim to develop such a measure, while building on and extending extant measurement scales.

2. Methods

For the index development, we followed established methodological guidelines for formative scale development and validation (Diamantopoulos & Winklhofer, 2001; Hair et al., 2011; MacKenzie et al., 2011). In a step-wise procedure, we accordingly (1) specified a formative multi-dimensional conceptual model, (2) generated a comprehensive initial item pool to cover all relevant facets, (3) conducted expert interviews to ensure content validity along with consumer interviews for item comprehensibility, and (4) collected data across five studies to evaluate the index's psychometric properties and to conduct a cross-country assessment of relevant forms of reliability and validity. In addition, we investigated measurement invariance and gender-differences for the *PIFS Index*. We detail these steps in what follows.

2.1. Measurement model specification

For the purpose of developing a novel measurement instrument, we conceptualize the measurement model as a formative higher-order construct (Becker et al., 2012; Ringle et al., 2020), which allows that individual consumers perceive specific indicators more or less relevant for their food choice. This specification entails that any change on a dimension level (lower-order construct) results in a corresponding change in overall sustainability (higher-order construct). This model specification further enables empirical researchers to measure sustainability either as an aggregate across all five dimensions or by examining individual dimensions. Fig. 1 illustrates the conceptual measurement model, corresponding to a multiple indicators and multiple causes (MIMIC) model, in which "[…] the index indicators […] act as direct causes of the latent variable […] which is indicated by one or more reflective measures […]; the inclusion of reflective measures is necessary for identification purposes […]" (Diamantopoulos & Winklhofer, 2001, p. 272).

2.2. Item pool development

In line with the chosen formative measurement model specification, the item pool prioritizes content coverage and thus intends to cover all potentially relevant facets of the five sustainability dimensions, whereas – unlike in reflective models – item redundancy is not useful (Diamantopoulos & Winklhofer, 2001).

As an initial step for the development of the item pool, we considered sustainability indicators used by prior research (see Supplementary Materials 1) except for any proxies (e.g., "organic" or "seasonal") for reasons discussed above. We extended this approach by further incorporating actual sustainability impact criteria according to the most widely adopted assessment standards within the EU. This step was undertaken to ensure that the items of the new index align with the most relevant indicators according to their actual contribution on a dimension level. Specifically, we enriched the ecological sustainability dimension by using impact criteria from life cycle assessment (McClelland et al., 2018), using 12 different ecological parameters (such as concern for acidification or ozone depletion). For the health dimension, we incorporated the criteria from the Nutri Score (Nutriscore Europe, 2026), referring to the nutritional composition and value of foods. Regarding the concern for animal welfare, we built our items on the most established certification schemes (e.g., based on Certified Humane, 2026). For the worker welfare dimension, in line with our conceptual dimension definition, we incorporated worker rights standards according to the EU minimum rights (European Commission, 2026b) and Fairtrade standards (Fairtrade, 2026). Lastly, for economic sustainability, we focused on aspects related to the viability of food environments (e.g., the extent to which food systems contribute to regional prosperity), while also considering individual food affordability as a proxy for consumer inclusion (Webb et al., 2023).

This procedure resulted in an initial pool of 50 non-interchangeable indicators in English language, including short descriptions for all indicators. These descriptions were developed in light of the complex nature of some indicators (such as acidification in the ecological domain or the execution of body-altering procedures of farm animals) to provide future respondents with explanations when required (e.g., description of the ecological indicator overfertilization reads as follows: "nutrient pollution of soil and water from food production, negatively affecting plants and animals.").

To refine and validate the indicator pool, we subsequently engaged in a stepwise procedure. First, we conducted five semi-structured expert interviews (May 2025) with researchers across bioeconomics; sustainable innovation and impact assessment; agricultural, environmental, and regional economics; development studies; and livestock science. The interviews assessed indicator coverage of each sustainability dimension and evaluated content validity. In parallel, three marketing and psychology researchers assessed the indicator pool for understandability, clarity, and relevance, ensuring that all items were comprehensible and meaningful to the target audience.

This procedure led to the introduction of five novel indicators, i.e.,

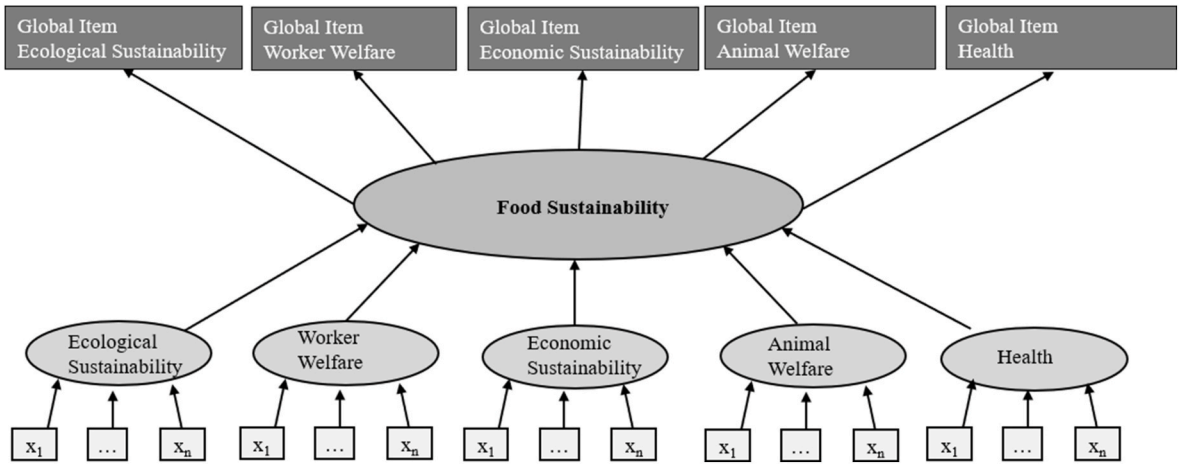

Fig. 1. Conceptual measurement model.

corporate misconduct, fair housing practices and fair income (relating to the worker welfare dimension) as well as cognitive care (for the animal welfare dimension) and the usage of fossil fuels (for the ecological dimension). Ten indicators were excluded (i.e., mental distress of farm animals, human toxicity, respiratory inorganics, profit share allocated to supply chain partners, stakeholder value, photochemical ozone formation, radiation, price, degree of processing and ecosystem functionality), as they were judged to misalign with the conceptual scope of the index (e.g., "mental distress of farm animals" was excluded since it was judged to be a consequence of other indicators, such as too little space available per animal). Further, on two occasions, two indicators were merged into one (i.e., (1) value and job creation were combined into the single indicator economic prosperity as well as (2) land and water eutrophication into the single indicator eutrophication).

Next, we subjected the remaining pool of 43 indicators (and the corresponding descriptions) to an evaluation of item comprehensiveness from a consumer perspective. For this purpose, we recruited 21 Austrian consumers for personal in-depth interviews, focusing on individuals with low self-reported food literacy (Rosas et al., 2022) to ensure understandability across diverse consumer segments. Austria was chosen as the first EU country for data collection, which is characterized by high share of organic produce (Willer et al., 2025) and animal welfare standards (European Commission, 2023), both signaling market relevance of food sustainability. Interviewees were provided with the items and their descriptions and were asked to rate their perceived understanding and relevance on each sustainability indicator, followed by an item-sorting task in which respondents allocated each item to one of the five sustainability dimensions. Further, interviewees were given the opportunity to mention other relevant sustainability criteria that were not presented to them. Based on the feedback obtained from the consumer interviews, minor linguistic adaptations were made to improve clarity and alignment with consumer perspectives (e.g., indicator framing "use of minerals and metals" instead of "use of natural resources"). With regard to additions to the item pool, we received twelve suggestions (i.e., trying something new, taste, promotions, staff assistance, regionality, seasonality, organic, food waste, labels, food packaging, harmful substances, and plant-based options/reduced meat consumption), which we carefully considered and decided to not integrate for various reasons. Since our focus was on measurable, point-of-sale, item-level purchase criteria, we excluded four suggestions that were not sustainability criteria (trying something new, taste, promotions, staff assistance). We did not incorporate regionality, seasonality, and organic as they represent proxies that risk reinforcing misconceptions, as discussed earlier in the paper (Weber & Matthews, 2008). Further, we did not include food waste, which occurs mainly at the post-purchase stage and is out of scope for our pre-purchase context. In addition, quality labels are information carriers and do not represent impact criteria. Food packaging concerns a secondary layer and depends on external recycling infrastructure. The content of harmful substances is governed by EU food-safety regulations (European Commission, 2026c), so non-compliant products should not reach consumers. Finally, plant-based options/reduced meat consumption reflect dietary patterns that might result from sustainability concerns. Hence, in sum, the consumer interviews did not reveal any relevant item omissions, so that we kept the item pool unchanged while adapting semantical aspects to enhance comprehensibility.

Consequently, the final item pool used for quantitative empirical testing comprised 43 sustainability indicators across the five focal sustainability dimensions (i.e., eleven indicators each for ecological sustainability and concern for animal welfare, ten indicators for worker welfare, eight indicators for concern for health and three indicators for economic sustainability). All indicators and their corresponding descriptions are listed in Table 2.

3. Results

3.1. Overview of validation studies

After the conceptual development of the set of food sustainability indicators, we pursued quantitative testing according to the disjoint two-stage approach (Sarstedt et al., 2019). The first stage encompassed reliability, validity, and multicollinearity testing of the lower-order constructs. For this purpose, we estimated a model comprising the lower-order constructs (i.e., the five sustainability dimensions measured by their respective indicators), which we linked to a global reflective variable represented by five global items corresponding to the dimensions. For the second stage, which concerns the assessment of the model fit of the structural model, we specified the higher-order construct (i.e., perceived importance of food sustainability) by using the latent variable scores of the lower-order constructs as its indicators and re-estimated the model, again including the global variable measured by its reflective global items. Fig. 2 provides an overview of the five studies conducted across European countries and all variables measured as part of the nomological network for index validation.

We selected Austria, Germany, the Netherlands, Greece, and Estonia as the countries for data collection. These countries were chosen to capture diverse consumer, cultural, and market contexts, since they vary in income levels (Eurostat, 2026), food cultures (Mennell, 2017) and sustainability policies (European Commission, 2024), while operating in the same regulatory and legal system of the European Union. Further, these countries also differ in their cultural value orientations (The Culture Factor Group, 2026a), shaping norms, priorities and moral

Table 2
Indicator list of *PIFS Index*.

Sustainability dimension	Indicator*	Indicator description provided to respondents
Ecological Sustainability	Use of fossil fuels	The amount of fossil fuels (such as coal, oil, and natural gas) that is required for food production.
	Use of minerals and metals	The amount of minerals (e.g., for the production of fertilizers) and metals (e.g., for the production of aluminum for agricultural equipment) used in food production.
	Water use	The amount of water that is required for food production.
	Land use	The area of land that is required for food production.
	Biodiversity	The impact of food production on the variety of life on Earth and the extinction of plant and animal species.
	Toxic water pollution	The pollution of water through toxic chemicals from food production.
	Overfertilization	Nutrient pollution of soil and water from food production, negatively affecting plants and animals.
	Acidification (decrease in pH)	An increase in acidity of rain, soil, and water due to pollution from food production, negatively affecting plants and animals.
	Ozone depletion	The destruction of the ozone layer caused by chemicals from food production.
	Air pollution	Airborne contaminants that are released by food production, harming air quality and creating smog.
	Climate change	The emission of greenhouse gases from food production that make the planet hotter.
Worker Welfare	Inclusion and equality at work	Fair treatment of workers in the food sector based on factors like gender, heritage, age, or disability.
	Health and safety at work	Protection of workers in the food sector from physical harm (e.g., pesticide exposure, extreme weather conditions or radiation).
	Transparent working conditions	Disclosure of working conditions in the food sector such as pay, working hours, and responsibilities before contract signing.
	Fair wages	Fair compensation of workers (e.g., seasonal workers) in the food sector for their labor.
	Fair income	Fair compensation of farmers and other self-employed individuals in the food sector for their labor.
	Compatibility of work and personal life	An employment approach that ensures workers in the food sector can balance their work as well as their leisure time.
	Union rights	A labor right that allows workers in the food sector to form and join unions in order to collectively negotiate for better working conditions and wages.
	Health care coverage	Provision of medical insurance to enhance health and wellbeing of workers in the food sector (especially in countries that do not have mandatory insurance practices).
	Avoidance of corporate malpractice	Avoidance of unethical corporate activities in the food sector, such as misleading advertisements.
	Fair housing	The provision of decent housing arrangements for workers in the food sector who are accommodated on the premises of their employers, such as e.g., seasonal farm workers.
Economic Sustainability	Affordability of foods	Food prices that are accessible for most consumers and do not severely strain their budget.
	Regional economic prosperity	The extent to which food production contributes to the economic development of a specific region, such as by the preservation or creation of jobs.
	Food security	The economic ability of regional food systems to withstand crises (e.g., pandemics, wars or natural catastrophes) and to continuously supply people with food.
Concern for Health	Mineral content	Micronutrients like calcium, iron, zinc and potassium that the body needs for vital functions, including building bones and supporting nerve and muscle function.
	Vitamin content	Micronutrients that the body needs for maintaining various physiological functions, such as metabolism, growth, and immunity.
	Calorie content	Units of energy that the body needs for basic functions such as breathing and movement, and that can lead to nutrient deficiencies when consumed in too small amounts or to weight gain when consumed in excess.
	Sugar content	A type of carbohydrate that provides quick energy but can contribute to health issues like obesity or diabetes when consumed in excess.
	Salt content	A source of sodium that plays a vital role in body functions like hydration and muscle contractions, but high intake is linked to elevated blood pressure and heart strain.
	Saturated fat content	A type of fat that can increase the risk of heart diseases when consumed in excess.
	Content of fiber	A type of carbohydrate that occurs e.g., in fruits, vegetables or whole grain produce, supports digestion and helps regulate the cardiovascular system.
	Protein content	Amino acid chains that play a key role in many body functions, such as tissue repair.
Concern for Animal Welfare	Social contact	Farming practices that allow animals to have social contact with their kind.
	Sufficient space	Farming practices that do not confide animals to cramped pens.
	Free-range	Farming practices that allow animals to roam outdoors on pastureland or other natural terrain.
	Mother-infant relationship	Farming practices that do not separate the mother animal from its offspring but allow for mother-infant bonding (e.g., for cattle).
	Avoidance of body-altering procedures	Farming practices that do not involve altering an animal's body, such as beak trimming or tail docking.
	Species-appropriate diet	Farming practices that provide animals with a diet that closely resembles what they would naturally eat.
	No over-/misuse of veterinary medicine	Farming practices that do not administer drugs to animals in

(*continued on next page*)

Table 2 (*continued*)

Sustainability dimension	Indicator*	Indicator description provided to respondents
		excess or without a clear medical need as a form of disease prevention.
	Minimal transport routes	Farming practices that transport animals only over the shortest possible distances.
	Distress-reduced slaughtering	Farming practices that slaughter animals in a way that reduces fear and pain (e.g., with the proper use of anesthesia).
	Cognitive care	Farming practices that provide animals with cognitive stimulation to avoid boredom and underchallenge (e.g., chew toys).
	No animal labor exploitation	Farming practices that do not use animals as a labor force to carry out specific tasks (e.g., monkeys kept on chains for harvesting coconuts).

*Respondents were asked to indicate on a scale from 1 to 5 how important the individual aspects are for them personally when selecting foods (1 = not at all important; 5 = highly important).

trade-offs, which are also likely to affect sustainability perceptions among consumers.

To minimize the risk of fraudulent or automated responses (i.e., bot infection), data collection in all countries was conducted via Talk Online GmbH, an ESOMAR-certified online panel provider adhering to internationally recognized standards for data quality, respondent verification, and fraud prevention. In Austria, the Netherlands, Greece, and Estonia, the consumer samples were designed to be representative according to gender, age, education and habitat, distinguishing between rural and urban surroundings. In Germany, we focused on comparing non-meat-eaters to meat-eaters (see further below), rendering sociodemographic representativeness non-relevant. Within each country, the sample size was determined based on the "10 × rule" (Hair et al., 2012), resulting in a minimum of 43 indicators x 10 = 430 respondents. Details on exact sample sizes are presented below for each country.

All country questionnaires followed a similar structure: respondents received some preliminary information about the purpose of the survey and had to provide informed consent to take part. We first assessed the developed *PIFS Index*, before also collecting information on the consumer assessment of five global items, each relating to one focal sustainability dimension as a technical necessity for identification in smartPLS (i.e., the perceived importance of each respective sustainability dimension on an aggregate level; we also queried some additional variables that are not focal to our work and are thus not included in the analyses). All items were measured on a five-point Likert scale (for a full list of measures, see Supplementary Materials 2). In each country, questionnaires were provided in the local language, using a back-translation procedure (see e.g., Cha et al., 2007; Douglas & Craig, 2007).

Data analysis for all country studies was conducted based on structural equation modelling, using smartPLS version 4.1.1. Further details on measures, samples, and analytical approaches are provided for each study in the following.

3.2. Study 1a: discriminant & predictive validity (Austria)

The purpose of Study 1a was threefold. First, Study 1a intended to examine psychometric characteristics of the developed index. Second, Study 1a aimed to test discriminant validity on a dimension level, which means that the *PIFS Index* is empirically distinct from conceptually related measures. Third, Study 1a set out to establish nomological validity for each dimension by examining the structural links between existing variables conceptualized as drivers of the new sustainability dimensions.

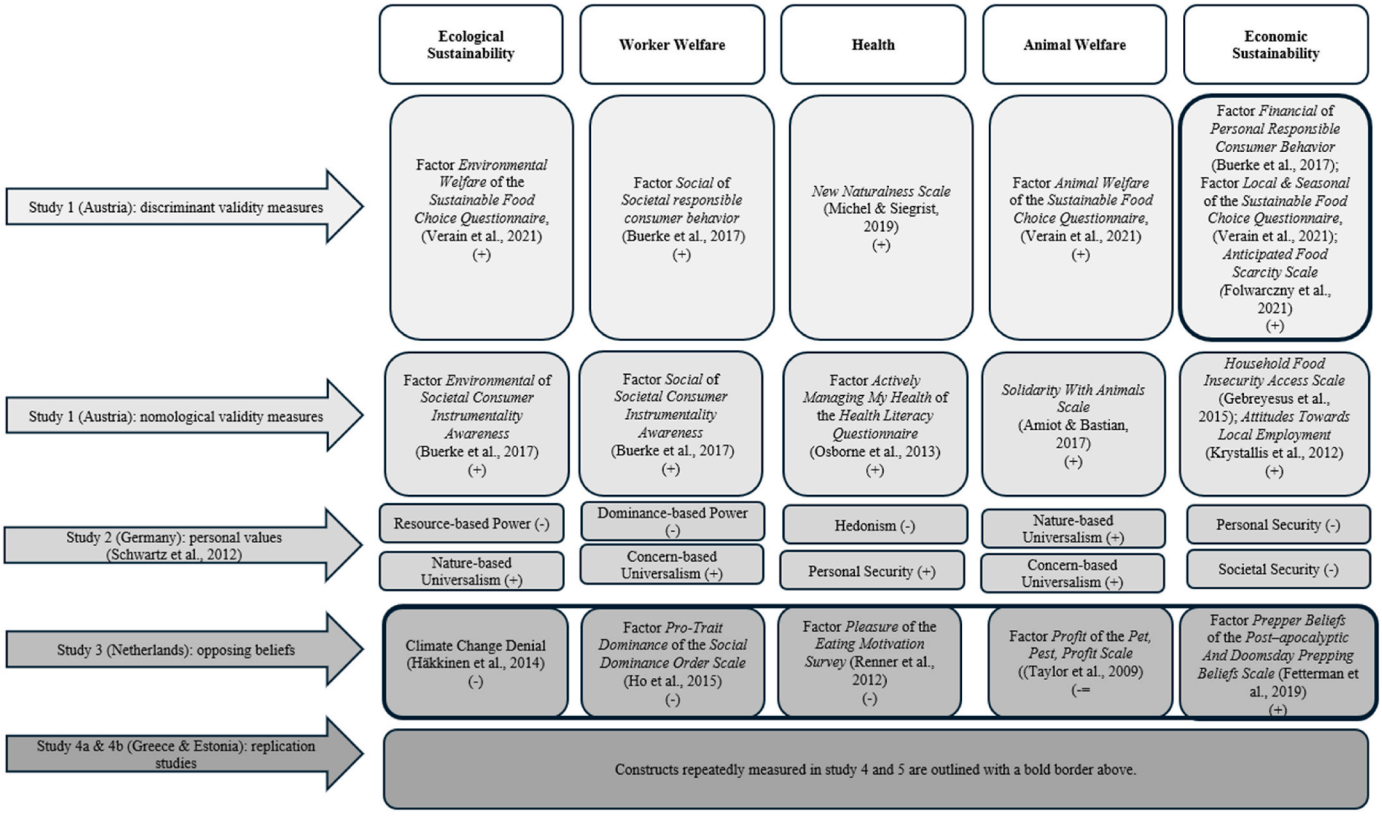

Fig. 2. Nomological Network of *PIFS Index*. Expected empirical relations between the focal constructs and the individual sustainability dimension of the *PIFS Index* are indicated with (+)/(−), depending on the direction of the anticipated effect.

3.2.1. Measures

In addition to the *PIFS* item pool, Study 1a included a series of variables for examining discriminant validity of individual dimensions towards conceptually related but distinct measurement instruments. Specifically, to test discriminant validity for the *PIFS* dimensions of ecological sustainability and concern for animal welfare, Study 1a included the *Environmental* and the *Animal Welfare Factor* of the *Sustainable Food Choice Questionnaire* (Verain et al., 2021). Regarding concern for health, we assessed the *New Naturalness Scale* (Michel & Siegrist, 2019) and concerning worker welfare, we measured the *Social Factor* of the *Societal Responsible Consumer Behavior Scale* (Buerke et al., 2017). Lastly, we included the *Financial Factor* of the *Personal Responsible Consumer Behavior Scale* (Buerke et al., 2017), items based on the *Anticipated Food Scarcity Scale* (Folwarczny et al., 2021) and the *Local and Seasonal Factor* of the *Sustainable Food Choice Questionnaire* (Verain et al., 2021) to establish discriminant validity of the economic sustainability domain. Minor linguistic adaptations were made to these measures to fit the purpose of Study 1a. A complete list of the items employed across all studies can be found in Supplementary Materials 2.

Turning to nomological validity of individual dimensions with reference to antecedent variables, Study 1a further included variables that should show positive relationships to specific *PIFS* dimensions: regarding ecological sustainability and concern for animal welfare, we used the *Environmental Factor* of the *Societal Consumer Instrumentality Awareness Scale* (Buerke et al., 2017) and the *Solidarity with Animals Scale* (Amiot & Bastian, 2017). For the health dimension, we employed the *Health Literacy Questionnaire* (Osborne et al., 2013), and regarding worker welfare, we measured the *Social Factor* of the *Societal Consumer Instrumentality Awareness Scale* (Buerke et al., 2017). Finally, for economic sustainability, we employed the *Household Food Insecurity Access Scale* (Gebreyesus et al., 2015) and the *Attitudes Towards Local Employment Scale* (Krystallis et al., 2012).

3.2.2. Data collection & participants

Data were collected in Austria in October 2025. Prior to the main study, a pretest with 32 participants reassessed item comprehensibility. Based on participant feedback, minor revisions were implemented to improve clarity and to ensure that items were understandable to the target audience. For the main study, the final cleaned sample comprised 514 respondents (52.1% female, mean age = 49 years, SD = 16.87). Ethical approval for this study was granted by the authors' ethical committee.

3.2.3. Assessment of measurement model & structural model

In the first phase, we modelled the individual dimensions to test for indicator relevance. Following formative measurement guidelines (e.g., Sarstedt et al., 2019), for statistical identification, each sustainability dimension was linked to its corresponding global sustainability item. Regarding indicator maintenance/exclusion, we followed the methodological guidelines of Sarstedt et al. (2017). They suggest investigating the outer weights and outer loadings, and to only consider dropping an indicator if both parameters are insignificant and (the latter) below 0.5. Since all indicators showed satisfactory weights and loadings, all items were retained. Details on the measurement model assessment can be found in Supplementary Materials 3 and details on the correlations between the dimensions in Supplementary Materials 4.

In the second phase, we proceeded with testing the structural paths between the lower-order constructs (i.e., dimensions) and the higher-order construct (specified as a MIMIC Model, see Fig. 1) according to the disjoint two-stage approach (Sarstedt et al., 2019). Since PLS-SEM is a variance-based approach aimed at explanation and prediction rather than reproducing the sample covariance matrix, typical covariance-based SEM fit indices (e.g., Chi^2, RMSEA, CFI) are not used for model evaluation (Hair et al., 2021). Instead, model assessment in PLS-SEM focuses primarily on path coefficient metrics and explanatory (e.g., R^2, f^2) and predictive metrics (Q^2) (Hair et al., 2011, 2021; Henseler et al., 2009; Sarstedt et al., 2017). The model showed satisfactory explanatory power ($R^2 = 0.401$), a large effect size ($f^2 = 0.671$) and predictive power ($Q^2 = 0.382$) as well as acceptable fit (SRMR = 0.059). Further, there were no signs of multicollinearity (VIF < 3). Concerning the structural paths, ecological sustainability ($\beta = 0.239$, $p < 0.001$) and worker welfare ($\beta = 0.340$, $p < 0.001$) as well as health ($\beta = 0.235$, $p < 0.001$) and animal welfare ($\beta = 0.300$, $p < 0.001$) significantly contributed to the higher-order construct, whereas the economic domain showed a positive but insignificant path ($\beta = 0.150$, $p = 0.069$), based on bootstrapping using 5000 subsamples.

Thus, taken together, both the first-order and second-order assessment show high empirical fit of the conceptual model on both an indicator and dimension level.

3.2.4. Testing for discriminant validity

In the next step, we assessed discriminant validity at a dimension level, since other scales measure specific sustainability aspects rather than the holistic sustainability conceptualization of the *PIFS Index*. For formative measures, classical tests of discriminant validity (such as Fornell-Larcker or HTMT) are inappropriate (Henseler et al., 2015), as their indicators are not required to correlate (Diamantopoulos & Winklhofer, 2001; Hair et al., 2011). For this reason, we followed MacKenzie et al. (2005, p. 728), who proposed that "[o]ne way to assess discriminant validity that works for both formative and reflective measures is to test […] whether the construct intercorrelation is less than 0.71." As shown in Table 3, all correlations were below 0.71, supporting discriminant validity empirically. At the same time, the observed correlations are substantial enough to also provide support for convergent validity, i.e., that they are similar (yet not identical) to established constructs, capturing related sustainability aspects. Consequently, the five *PIFS* dimensions empirically behave as conceptually expected; they positively and significantly relate to similar measures but do not share too much variance with them.

3.2.5. Testing for nomological validity (antecedents)

In the last step of Study 1a, we assessed nomological validity on a dimension level by modelling the anticipated drivers onto the corresponding sustainability dimensions in PLS. As Table 4 shows, all path coefficients were positive and significant as expected. In addition, satisfactory explanatory power (R^2) and predictive relevance (Q^2) were achieved for all sustainability dimensions.

Table 3
Assessment of discriminant validity.

Sustainability Dimension	Discriminant Measure	Correlations
Ecological Sustainability	Environmental Factor of Sustainable Food Choice Questionnaire (based on Verain et al., 2021)	0.669
Worker Welfare	Social Factor of Societal Responsible Consumer Behavior Scale (based on Buerke et al., 2017)	0.591
Economic Sustainability	Financial Factor of Personal Responsible Consumer Behavior Scale (based on Buerke et al., 2017)	0.398
	Local and Seasonal Factor of Sustainable Food Choice Questionnaire (based on Verain et al., 2021)	0.498
	Anticipated Food Scarcity Scale (based on Folwarczny et al., 2021)	0.474
Concern for Health	New Naturalness Scale (based on Michel & Siegrist, 2019)	0.512
Concern for Animal Welfare	Animal Welfare Factor of Sustainable Food Choice Questionnaire (based on Verain et al., 2021)	0.695

Table 4
Assessment of nomological validity.

Sustainability Dimension	Nomological Measure	R^2	Q^2	Path Coefficients	P-Value
Ecological Sustainability	Environmental Factor of Societal Consumer Instrumentality Awareness Scale (based on Buerke et al., 2017)	0.268	0.239	0.518	< 0.001
Worker Welfare	Societal Consumer Instrumentality Awareness (based on Buerke et al., 2017)	0.271	0.247	0.521	< 0.001
Economic Sustainability	Household Food Insecurity Access Scale (based on Gebreyesus et al., 2015)	0.195	0.182	0.441	< 0.001
	Attitudes Towards Local Employment Scale (based on Krystallis et al., 2012)	0.188	0.178	0.434	< 0.001
Concern for Health	Health Literacy Questionnaire (based on Osborne et al., 2013)	0.266	0.248	0.516	< 0.001
Concern for Animal Welfare	Solidarity with Animals Scale (based on Amiot & Bastian, 2017)	0.310	0.279	0.557	< 0.001

3.3. Study 1 b: assessment of test-retest reliability

Study 1 b aimed to assess test-retest reliability as a measure of internal consistency (Gruijters et al., 2021; Willoughby et al., 2017). For this purpose, all respondents who completed Study 1a were re-invited in January 2026 to complete the *PIFS Index* for a second time. In total, 343 out of 514 respondents participated in this retest (52.2% female, mean age = 52 years, SD = 16.33).

Results of a paired-samples *t*-test showed no significant mean differences in the perceived importance of the sustainability dimensions between t1 and t2. Further, correlations among the dimensions were satisfactory (see Table 5). Consequently, temporal stability of the *PIFS Index* was supported.

3.3.1. Discussion of study 1

The results of the Austrian consumer sample indicate high satisfactory model performance at a dimension level while also showing empirical evidence of discriminant and nomological validity. There is one relevant aspect to highlight. The economic dimension did not significantly relate to the overall perceived food sustainability construct. In other words, while economic sustainability depicts a relevant dimension of food sustainability at a conceptual level, empirically, this dimension did not relate to the overall concept. In light of the formative model specification where "[f]ormative indicators with nonsignificant weights should not automatically be removed from the measurement model, since this step may compromise the content validity of the construct" (Hair et al., 2021, p. 96), we decided to keep the economic dimension and its indicators as conceptualized.

3.4. Study 2: replication, nomological validity & known-group validity (Germany)

Study 2 pursued three aims: (1) replicating the measurement model using a fresh data set, (2) assessing further aspects in the nomological network of the new index, and (3) testing known-group validity (Rodrigues et al., 2019).

Table 5
Assessment of test-retest reliability.

Sustainability Dimension	Means of original test sample (Study 1a)	Means of test-retest sample (Study 1 b)	Mean differences	p-Value (significance of mean difference)
Ecological Sustainability	3.773	3.811	−0.038	0.269
Worker Welfare	3.854	3.894	−0.040	0.314
Economic Sustainability	4.108	4.153	−0.045	0.268
Concern for Health	3.767	3.782	−0.015	0.691
Concern for Animal Welfare	4.106	4.161	−0.055	0.164

3.4.1. Background & hypotheses

For the second aim, we extended the nomological network to examine relationships of the new *PIFS Index* to personal values (Schwartz et al., 2012). Existing studies have repeatedly linked personal values to sustainable food attitudes and behavior (see e.g., Jacobs et al., 2018; Lindeman & Sirelius, 2001; Nordlund & Garvill, 2002; Sneddon et al., 2022; Steg & De Groot, 2012; Thøgersen & Ölander, 2002). We based our assumption upon selected values of the refined theory by Schwartz et al. (2012), which distinguishes between 19 values and has been developed "[…] to provide greater heuristic and explanatory power than the original theory of 10 values" (Schwartz et al., 2012, p. 663). For our work, we were interested in exploring the structural relationships between a subset of these values (i.e., concern- and nature-based universalism, personal and societal security, resource-based and dominance-based power as well as hedonism) and individual sustainability dimensions based on conceptual expectations. For empirical testing, we formulated five hypotheses on a sustainability dimension level (see Fig. 2) that have been pre-registered at osf. io. We briefly elaborate on these hypotheses in the following.

First, regarding the health dimension of the *PIFS Index*, the value of hedonism describes individuals' pursuit of "pleasure and sensuous gratification" (Schwartz et al., 2012, p. 669). Given that consumers often judge unhealthy foods as tastier and more rewarding (Kunz et al., 2023), hedonic eating motives are expected to favor indulgence over health. We therefore expect a negative relationship with the index's health dimension. By contrast, personal security values, defined as "safety in one's immediate environment" (Schwartz et al., 2012, p. 669), might steer individuals towards healthy foods as a risk-avoidance strategy. Consistent with previous findings that prevention-focused consumers are especially responsive to loss-framed health communication (Uskul et al., 2009), we expect a positive relationship between security values and the health dimension of the new sustainability dimension. Thus, we formally hypothesize that.

H1a. Hedonism negatively relates to the perceived importance of health.

H1b. Security (personal) positively relates to the perceived importance of health.

Second, with respect to the ecological dimension of the *PIFS Index*, the endorsement of resource-based power values, i.e., "power through control of material and social resources" (Schwartz et al., 2012, p. 669), might align with over-consumption behavior (Crompton, 2010) and human dominance beliefs (Milfont & Duckitt, 2010). Accordingly, we expect a negative relationship with the ecological sustainability dimension. Further, the value of nature-based universalism, defined as the "preservation of the natural environment" (Schwartz et al., 2012, p. 669), captures individuals' perceived importance of environmental wellbeing. Accordingly, we expect a positive relationship with ecological sustainability, consistent with prior evidence (e.g., Sneddon et al., 2022; Thøgersen & Ölander, 2002). Based on the above, we summarize as follows.

H2a. Resource-based power negatively relates to the perceived

importance of ecological sustainability.

H2b. Nature-based universalism positively relates to the perceived importance of ecological sustainability.

Third, with respect to the worker welfare dimension of the *PIFS Index*, endorsement of dominance-based power, defined as "power through exercising control over people" (Schwartz et al., 2012, p. 669), reinforces hierarchical beliefs (Ho et al., 2015). We therefore expect a negative relationship with the perceived importance of worker welfare, which includes aspects such as worker rights. By contrast, concern-based universalism, which describes individuals' "commitment to equality, justice, and protection for all people" (Schwartz et al., 2012, p. 669), should positively relate to social sustainability. This expectation is consistent with evidence from fair trade consumption (e.g., Doran, 2009). Consequently, we postulate the following hypotheses.

H3a. Dominance-based power negatively relates to the perceived importance of worker welfare.

H3b. Concern-based universalism positively relates to the perceived importance of worker welfare.

Fourth, with respect to the economic sustainability of the *PIFS Index*, personal security values (as defined above) should strengthen support for stable economic conditions that protect individual well-being. Similarly, societal security needs, which describe individuals' concern for "safety and stability in the wider society" (Schwartz et al., 2012, p. 669), are also expected to relate positively to economic sustainability. This is the case as weak economic performance might threaten both personal welfare and societal functioning (Helliwell et al., 2024; OECD, 2020). Accordingly, we expect a positive association with economic sustainability. In light with this argumentation, we propose the following hypotheses.

H4a. Personal security positively relates to the perceived importance of economic sustainability.

H4b. Societal security positively relates to the perceived importance of economic sustainability.

Finally, both nature-based and concern-based universalism reflect individuals' care for the wellbeing of others, humans and non-human species alike (Schwartz et al., 2012, p. 669). Building on previous research (e.g., Cembalo et al., 2016), we therefore expect both forms of universalism to be related positively to the animal welfare dimension of our new index.

H5a. Concern-based universalism positively relates to the perceived importance of animal welfare.

H5b. Nature-based universalism positively relates to the perceived importance of animal welfare.

For the third aim of Study 2, i.e., assessing know-group validity of the new index, we expected that vegetarians and vegans would score higher on the new index than meat-eaters, because individuals who abstain from eating meat tend to show stronger sustainability concerns related to ecology, animal welfare, and health, based on prior literature (Graça et al., 2015; Rosenfeld, 2018). Further, we hypothesized that consumers who self-identify as more left-leaning (right-leaning) in their political orientation would score higher (lower) on the new index because political beliefs have been repeatedly associated with the perceived importance of (ecological) sustainability (Hornsey et al., 2016; McCright & Dunlap, 2011).

3.4.2. Participants & measures

Before collecting data in Germany, we made some minor linguistic changes to the German *PIFS* version. Specifically, for data collection in Austria (Study 1), the indicators overcrowding, medication misuse, body-altering procedures, and animal labor exploitation were phrased without negations, mirroring the qualitative pretest in which comprehension was unproblematic. However, to ensure linguistic alignment with our construct (i.e., the importance of avoiding these practices), we revised these four items to avoidance formulations (e.g., "avoidance of body-altering procedures") for all subsequent country studies to ensure conceptual and linguistic consistency. Since the *PIFS* indicators were already available in German from the preceding Austrian study, only the nomological variables had to be translation for Study 2, which was done by the native-speaking author team.

Data collection was completed in December 2025. All measures are listed in Supplementary Materials 2. We used a quota sample that allowed us to perform statistical tests for sub-groups of meat-eating behavior as well as political orientation, while still aiming for a well-balanced distribution based on demographic criteria (for gender and age). The cleaned sample of Study 2 consists of 761 respondents (55% female, 45% male, mean age of 49 years (SD 15.00)). 478 individuals identified as meat-eaters and 283 respondents as non-meat-eaters (i.e., vegans or vegetarians). Ethical approval for this study was granted by the authors' ethical committee.

3.4.3. Assessment of measurement model & structural model

First, we aimed to replicate the proposed measurement model on the new dataset. Similar to Study 1a, none of the indicators showed signs of multicollinearity (VIF < 3.30). When evaluating item maintenance/exclusion (Sarstedt et al., 2017), the indicator calorie content of the health domain did not meet the criteria, whereas all remaining index indicators showed again satisfactory weights and loadings, as documented in Supplementary Materials 3.

When assessing the structural model, we again observed satisfactory explanatory ($R^2 = 0.541$) and predictive ($Q^2 = 0.532$) power as well as a large effect size ($f^2 = 1.180$) and an acceptable model fit (SRMR $= 0.054$). In the structural model, there were no signs of multicollinearity (VIF < 3). Concerning the structural paths, ecological sustainability ($\beta = 0.407$, $p < 0.001$), worker welfare ($\beta = 0.200$, $p < 0.001$) and economic sustainability ($\beta = 0.111$, $p < 0.01$) as well as health ($\beta = 0.181$, < 0.001) and animal welfare ($\beta = 0.369$, < 0.001) significantly contributed to the higher-order construct, based on bootstrapping using 5000 subsamples.

3.4.4. Assessment of nomological validity (schwartz values)

To assess nomological validity, Study 2 examined simultaneously the postulated relationships between the specific sustainability dimensions and relevant consumer values (see Fig. 2) within a structural equation model ($R^2 = 0.609$, $Q^2 = 0.316$, SRMR $= 0.186$). As reported in Table 6, most hypotheses (7 out of 10) were supported. Specifically, the concern for health and economic sustainability dimensions significantly positively related to the selected Schwartz values of security and universalism, as expected. For the other three dimensions, we also find support for the expected relationships to these two values, whereas relationships to Schwartz' values of hedonism and power were not supported.

3.4.5. Assessment of known-group validity

Next, we assessed known-group validity based on meat-eating habits, using a series of independent -samples t-tests. In line with expectations, results show that dietary identity significantly predicted respondents' perceived importance of ecological sustainability (mean importance among meat-eaters: 3.563, mean importance among non-meat-eaters: 3.996; $t(759) = 6.572$, $p < 0.001$), worker welfare (mean importance among meat-eaters: 3.665, mean importance among non-meat-eaters: 3.851; $t(759) = 2.774$, $p < 0.01$), health (mean importance among meat-eaters: 3.556, mean importance among non-meat-eaters: 3.864; $t(759) = 4.648$, $p < 0.01$), and animal welfare (mean importance among meat-eaters: 3.944, mean importance among non-meat-eaters: 4.320; $t(759) = 5.784$, $p < 0.01$), indicating that vegans and vegetarians found these dimensions more important than meat-eaters. Further, as expected, dietary habits were unrelated to perceived importance of

Table 6
Assessment of nomological validity.

Hypothesis	Path	Path Coefficient	P-Value	Supported
H1a (−)	Hedonism → concern for health	β = 0.182	p < 0.001	No
H1b (+)	Personal security → concern for health	β = 0.192	p < 0.001	Yes
H2a (+)	Nature-based universalism → ecological sustainability	β = 0.404	p < 0.001	Yes
H2b (−)	Resource-based power → ecological sustainability	β = −0.019	p = 0.759	No
H3a (+)	Concern-based universalism → worker welfare	β = 0.514	p < 0.001	Yes
H3b (−)	Dominance-based power → worker welfare	β = 0.016	p = 0.653	No
H4a (+)	Personal security → economic sustainability	β = 0.206	p < 0.001	Yes
H4b (+)	Societal security → economic sustainability	β = 0.274	p < 0.001	Yes
H5a (+)	Concern-based universalism → concern for animal welfare	β = 0.390	p < 0.001	Yes
H5b (+)	Nature-based universalism → concern for animal welfare	β = 0.152	p < 0.001	Yes

economic sustainability (mean importance among meat-eaters: 3.978, mean importance among non-meat-eaters: 3.881; t (508,224) = −1.490, p = 0.137).

Turning to consumers' political self-identity, in line with expectations, results showed that individuals who self-identify more with left-leaning politics reported significantly higher perceived importance of animal welfare (mean left-leaning affiliation = 4.113, mean right-leaning affiliation = 3.775; t (361) = −3.340, p = 0.001), ecological sustainability (mean left-leaning affiliation = 3.865, mean right-leaning affiliation = 3.295; t (361) = −5.899, p < 0.001) and worker welfare (mean left-leaning affiliation = 3.812, mean right-leaning affiliation = 3.400; t (361) = −4.267, p < 0.001), whereas perceived importance of health (mean left-leaning affiliation = 3.616, mean right-leaning affiliation = 3507; t (361) = −1.221, p = 0.223) and economic sustainability (mean left-leaning affiliation = 3.799, mean right-leaning affiliation = 3.978; t (361) = 1.941, p = 0.053) did not differ across the two groups.

3.4.6. Discussion of study 2

The new index was satisfactorily replicated in Study 2. Both the measurement model and the structural model again yielded good model fit. In contrast to Study 2, the economic sustainability dimension significantly related to the overall construct, thus supporting the original conceptual decision to retain this dimension.

Known-group validity regarding eating habits and political orientation was also supported. This finding builds on previous research that links meatless diets to heightened concerns for health, animal welfare, and ecological sustainability (Moosburger et al., 2023) as well as more ethical consumerism in general (Beck & Ladwig, 2021; Hackert & Voeth, 2022). In a similar manner, our findings show that respondents who self-identified as more left-leaning scored higher on the dimensions of ecological sustainability, worker welfare, and animal welfare than individuals with right-leaning political orientations. This pattern aligns with the results of prior studies (Caviola et al., 2019; Dhont & Hodson, 2014; Hornsey et al., 2016; McCright & Dunlap, 2011; Watkins et al., 2015), associating political ideology with everyday consumer choice. Summarizing, the findings of Study 2 support known-group validity of the new index.

The nomological index validation was extended by examining empirical relationships of selected sustainability dimensions and relevant Schwartz values. In line with prior research (Cembalo et al., 2016; Doran, 2009; Sneddon et al., 2022; Thøgersen & Ölander, 2002), we find support for most of our formulated hypotheses, relating security and universalism to different aspects of sustainability. Against our expectations, power had no significant association with the ecological or worker welfare dimensions, suggesting that neither control over people (dominance) nor control of material and social resources (resources) explain differences in respondents' perceived importance for these sustainability aspects. We consider that this finding might be country specific. Arguably, in countries with lower egalitarianism, typically characterized by higher power distance and greater social inequality (Hofstede, 2001), power is likely to carry more weight through greater social privileges and heightened economic autonomy. Consequently, power may directly translate into ecological and labor-related outcomes in such national contexts. Since Germany is "[h]ighly decentralised and supported by a strong middle class, Germany is not surprisingly among the lower power distant countries (score 35). Co-determination rights are comparatively extensive and have to be taken into account by the management" (The Culture Factor Group, 2026b). Consequently, the relationships of power to ecological sustainability and worker welfare dimensions warrant additional research in other national contexts.

Concerning hedonism, against expectations, Study 2 revealed a positive relationship with perceived importance of health. This finding is noteworthy because it suggests that eating for pleasure and self-indulgence is not necessarily tied to unhealthy choices (e.g., foods high in sugar or fat). Recent evidence likewise shows that consumers increasingly seek "healthier indulgence," combining sensory pleasure with nutritional benefits (EIT Food, 2025). This initial finding also warrants further research, as will be done in this series of studies.

3.5. Study 3: replication & extended nomological validity (Netherlands)

Study 3 built upon the two previous studies and aimed to (1) replicate the new index on a new data set, and (2) extend nomological validity testing with a focus on the index's relationship to consumer dispositions. In this vein, Study 3 examined consumer beliefs that might contradict (or reinforce) sustainability preferences and thus might function as a barrier (or driver) to perceiving specific sustainability dimensions as relevant (see Fig. 2).

3.5.1. Background & hypotheses

To extend the nomological network, we selected relevant consumer beliefs for the five *PIFS* dimensions. With regard to the ecological dimension, studies have repeatedly shown that climate change beliefs lead to more ecologically sustainable consumer behavior (e.g., Han et al., 2022; Perera et al., 2022), whereas climate change denial effectuates the opposite (e.g., Wullenkord & Reese, 2021). For our work, we build on this finding and assume that denying human-induced climate change constitutes a key barrier to caring for the environment, so that consumers high on this denial belief should score lower on the ecological dimension of the *PIFS Index*.

H6. Climate change denial relates negatively to the perceived importance of ecological sustainability.

Concerning worker welfare and health, we build on the preceding insights of Study 2, in which neither power nor hedonism related to worker welfare and health as anticipated. Thus, to investigate the robustness of these findings, we aimed to re-assess how consumer beliefs similar to these personal values, i.e., social dominance orientation and pleasure as an eating motivation, relate to the perceived importance of these sustainability aspects in a different consumer market. Social dominance orientation, i.e., convictions about social group status and hierarchy (Ho et al., 2015), is associated with the endorsement of oppression, inequality and the "[…] support for group-relevant social policies that uphold the hierarchical status quo […] and opposition to

humanitarian practices, social welfare, and affirmative action" (p. 5), which has also been documented in an interspecies context extending to animals (e.g., Dhont et al., 2014). Based on the above, we assume that individuals who score high on social dominance orientation care less about the welfare of food system workers in the *PIFS Index*.

H7. Social dominance orientation negatively relates to the perceived importance of worker welfare.

Further, pleasure as an eating motivation concerns "[…] motives related to please oneself through food […]" (Renner et al., 2012, p. 124). Whereas eating out of pleasure was unrelated to health interests in early studies (Roininen et al., 1999), other researchers link such eating motivations to weight problems (Lowe & Butryn, 2007). Considering the continuously increasing number of calories available per individual (FAO, 2025), we assume that eating for pleasure instead of hunger relates to consumers' perceived importance of the health dimension in the *PIFS Index*.

H8. Eating out of pleasure negatively relates to the perceived importance of health.

Concerning animal welfare, the economic commercialization of livestock has intensified in recent years (Buller & Roe, 2012), leading meat-eaters to adopt mental strategies of normalization and legitimization (Piazza et al., 2015). Thus, we assume that the justification of this practice and the acceptance of industrialized animal husbandry will negatively relate to the perceived importance of animal welfare in the *PIFS Index*.

H9. The acceptance of using animals for profit negatively relates to the perceived importance of animal welfare.

Lastly, regarding economic sustainability, resource scarcity for a growing world population has been discussed as a key issue throughout the past decades (Hanjra & Qureshi, 2010). Since it is to be expected that "[…] social groups other than low-income populations may also perceive that food resources are becoming scarcer" (Folwarczny et al., 2021, p. 9), consumers today consider food insecurity as one of the biggest global concerns (FSC, 2025). Based on the above, it is a key prerequisite that individuals recognize this challenge and, within their sphere of agency, adopt measures to secure their own food supply. Accordingly, we expect a positive association between prepping beliefs, i.e., individuals' tendencies to prepare for an economic breakdown (Fetterman et al., 2019), and economic sustainability.

H10. Prepping beliefs positively relate to the perceived importance of economic sustainability.

3.5.2. Participants & measures

In addition to the core variables repeatedly assessed across studies, we measured *Climate Change Denial* (based on Häkkinen & Akrami, 2014) as a variable potentially contradicting concern for ecological sustainability. For the animal welfare dimension, we employed the factor *Profit* of the *Pet, Pest, Profit Scale* (based on Taylor & Signal, 2009). Regarding health, we employed the factor *Pleasure* of the *Eating Motivation Survey* (based on Renner et al., 2012). Concerning worker welfare, we collected respondents' beliefs about *Social Dominance Orientation* (based on Ho et al., 2015). Finally, regarding the economic dimension, we used selected items of the *Post-apocalyptic and Doomsday Prepping Beliefs Scale* (based on Fetterman et al., 2019). For more details, please see Supplementary Materials 2.

A native speaking consortium member translated the English *PIFS Index* into Dutch, which was then back translated to English with the usage of *academic. ai*. This procedure was followed by a pretest ($n = 36$) that showed that respondents had no difficulty in understanding and answering the questionnaire. Data collection was completed in December 2025. The cleaned sample comprised 503 respondents, of which 251 were male and 252 were female, with an average age of 46 years old (SD: 15.86). Ethical approval for this study was granted by the authors' ethical committee.

3.5.3. Assessment of measurement model & structural model

Regarding the replication of the measurement model, all indicators of the *PIFS Index* again showed satisfactory weights and loads (i.e., above 0.5 and $p < 0.05$, see Supplementary Materials 3). Further, VIF was below the threshold of 3 regarding all indicators, so that there were no signs of multicollinearity in the dataset. The structural model showed decent explanatory ($R^2 = 0.271$) and predictive ($Q^2 = 0.248$) power as well as a decent effect size ($f^2 = 0.372$), no signs of multicollinearity (VIF < 3), and a satisfactory fit (SRMR $= 0.064$). Referring to the paths in the structural equation model, only the two dimensions of ecological sustainability ($\beta = 0.585$, $p < 0.001$) and animal welfare ($\beta = 0.270$, $p < 0.05$) significantly contributed to the higher-order sustainability construct, whereas dimensions of worker welfare ($\beta = 0.191$, $p = 0.064$), economic sustainability ($\beta = 0.066$, $p = 0.586$), and health ($\beta = 0.082$, $p = 0.440$) did not show significant structural paths to the second-order concept.

3.5.4. Assessment of nomological validity (consumer beliefs)

Regarding nomological validity, the correlations within the structural model were largely consistent with expectations: *Climate Change Denial* was negatively associated with the ecological sustainability dimension ($\beta = -0.404$, $p < 0.001$). Endorsement of using animals for *Profit* was negatively associated with the animal welfare dimension ($\beta = -0.313$, $p < 0.001$). *Prepping Beliefs* were positively associated with the economic sustainability dimension ($\beta = 0.334$, $p < 0.001$). In contrast, *Social Dominance Orientation* was not significantly related to the worker welfare dimension ($\beta = -0.085$, $p = 0.237$), while *Pleasure* as food motivation was related positively to the health dimension ($\beta = 0.172$, $p = 0.001$). Thus, except for the latter two relationships, all measures showed the theoretically expected relations with the corresponding *PIFS Index* dimensions, providing additional support for the index's nomological validity.

3.5.5. Discussion of study 3

Study 3 satisfactorily replicated the measurement model of the five sustainability dimensions and its indicators. For the structural model, results diverged from the preceding country results, as only two sustainability dimensions made significant contributions to the higher-order construct (i.e., ecological sustainability and animal welfare). This finding highlights cross-market heterogeneity, suggesting that distinct sustainability facets may be more or less relevant to consumers across national contexts.

Regarding the nomological network extension, *Climate Change Denial* (Häkkinen & Akrami, 2014), *Using Animals for Profit* (Taylor & Signal, 2009), and *Prepping Beliefs* (Fetterman et al., 2019) related to the respective sustainability domains as expected, strengthening the nomological validity of the newly developed index and demonstrating that this instrument empirically operates as theoretically intended.

Social Dominance Orientation (Ho et al., 2015) was not found to weaken worker welfare concerns. However, our study was conducted in a Western, industrialized country, where respondents are typically socially and geographically distant from food-system workers along global supply chains. Thus, endorsing social hierarchy in such a sociocultural context may not translate into attitudes toward the wellbeing of supply-chain employees. As a result, the lack of salience may help explain why we did not observe an empirical association between the endorsement of social dominance and the perceived importance of worker wellbeing in this context.

Likewise, *Pleasure* as an eating motivation (Renner et al., 2012) did not negatively relate to the perceived importance of health. This result aligns with the insight from Study 2, where hedonism was also not negatively associated with health. Together, these findings suggest that consumers do not perceive pleasure and indulgence as incompatible with a healthy lifestyle; rather, they view them as integral to it. Further

research is needed to examine the extent to which eating for pleasure is typically associated with unhealthy (e.g., high calorie) foods, and to what extent healthy foods are also consumed for indulgent reasons. Clarifying these patterns would help contextualize our findings and better delineate their implications for nutrition and public health.

3.6. Study 4a + b: replication in different sociocultural food environments (Greece & Estonia)

After the completion of data collection in Austria, Germany, and the Netherlands, we proceeded with collecting data in Greece (Study 4a) and Estonia (Study 4b). Since the preceding studies documented mixed evidence on the contribution of the economic sustainability dimension to the overall *PIFS Index*, we specifically aimed to gain more understanding of the economic dimension in the final two studies. For this purpose, we selected two European countries (Greece and Estonia) that systematically differed in their socio-cultural food environments from the country settings above, e.g., regarding lower average income levels (Eurostat, 2026), which suggests that financial constraints may more strongly shape consumers' perceptions of food sustainability in these consumer markets. Besides similarities, Greece and Estonia also diverge from each other along several relevant dimensions, such as the share of organic farmland (higher in Estonia; Willer et al., 2025) or Greek consumers' greater support for stricter animal-welfare protection (European Commission, 2023).

3.6.1. Background & hypotheses

To extend the nomological validation of the *PIFS Index*, we investigated how consumers' financial and food availability concerns relate to consumers' perceived importance of economic sustainability in these two structurally different consumer markets. Based on the conceptual scope of the economic sustainability domain of the *PIFS Index*, individuals with less financial security and greater perceived food scarcity are expected to place higher importance on this domain. Accordingly, we hypothesized that.

H10. Higher levels of financial concern are positively associated with the perceived importance of economic sustainability.

H11. Higher levels of food insecurity are positively associated with the perceived importance of economic sustainability.

We tested these relationships not only within the economic dimension but also at the higher-order composite to explore whether these drivers shape sustainability salience also more broadly on an aggregate level.

3.7. Study 4a: participants & measures

In addition to the standard list of variables, Study 4a remeasured the *Financial Factor* of the *Personal Responsible Consumer Behavior Scale* (Buerke et al., 2017) and items based on the *Food Scarcity Scale* (Folwarczny et al., 2021), which had already been employed in the nomological network of Study 1a. The questionnaire was translated into Greek by a native-speaking consortium member, which was then back translated back to German and English with the assistance of an AI language model to ensure linguistic accuracy. Following the procedure of the previous studies, we also conducted a pretest ($n = 33$) to assess the understandability of the sustainability indicators. The results of the pretest showed that respondents could understand the sustainability indicators and descriptions provided. All measures are listed in Supplementary Materials 2.

We collected a quota sample of Greek consumers aiming at a representative sample of the overall population. The cleaned sample consists of 516 respondents (mean age: 47,34, SD: 14,13, 50,97% female). Data collection was completed in February 2026.

3.7.1. Assessment of measurement model & structural model

Regarding the evaluation of the measurement model, all indicators displayed satisfactory weights and loadings (i.e., above 0.5 and $p < 0.05$), providing further empirical evidence for maintaining all items. Further, VIF was below 3.20 regarding all indicators, so there were no signs of multicollinearity in the dataset. More details on the measurement model are provided in Supplementary Materials 3. The structural model showed decent explanatory ($R^2 = 0.403$) and predictive ($Q^2 = 0.382$) power as well as a large effect size ($F^2 = 0.674$), no signs of multicollinearity (VIF < 3) and a satisfactory fit (SRMR $= 0.050$). Concerning the structural paths, only the three dimensions of ecological sustainability ($\beta = 0.352$, $p < 0.001$), worker welfare ($\beta = 0.184$, $p < 0.05$), and animal welfare ($\beta = 0.473$, $p < 0.001$) significantly contributed to the higher-order sustainability construct, whereas economic sustainability ($\beta = 0.059$, $p = 0.477$) and health ($\beta = 0.152$, $p = 0.073$) did not yield significant structural paths.

3.7.2. Assessment of nomological validity

To test H10 and H11, we explored the structural relationships between financial and food security concerns and the perceived importance of economic sustainability in structural equation modelling. Results show that these relationships were positive and significant (financial concerns: $\beta = 0.406$, $p < 0.01$, food security concerns: $\beta = 0.373$, $p < 0.01$), supporting the two hypotheses. In a similar vein, results demonstrate that financial concerns ($\beta = 0.374$, $p < 0.01$) as well as food security concerns ($\beta = 0.380$, $p < 0.01$) also significantly relate to the higher-order construct of sustainability, demonstrating that economic concerns also function as drivers for the perceived importance of food sustainability on an aggregate level.

3.8. Study 4b: participants & measures (Estonia)

For Study 4b, we used the identical questionnaire from Study 4a. The questionnaire was translated by a professional translator, which was then translated back to English with the assistance of an AI language model to ensure linguistic accuracy. Further, we also conducted a pretest ($n = 33$) to assess the understandability of the sustainability indicators in Estonia. The results of the pretest showed that respondents could understand the sustainability indicators and descriptions provided.

We collected a quota sample aiming at a representative sample of the overall population. The cleaned sample of Estonian respondents consists of 530 respondents (mean age: 50,13, SD: 16,18, 51,70% female). Data collection was completed in February 2026.

3.8.1. Assessment of measurement model & structural model

Concerning measurement model assessment in Estonia, two indicators showed loadings below the desirable threshold of > 0.5, i.e., affordability of the economic domain as well as calories from the health domain. The second-order model again showed satisfactory model fit (SRMR $= 0.066$), explanatory ($R^2 = 0.389$) and predictive ($Q^2 = 0.371$) power, a large effect size ($F^2 = 0.638$) and no signs of multicollinearity (VIF < 3).

Concerning the structural paths, all five dimensions significantly contributed to the higher-order sustainability construct (namely ecological sustainability ($\beta = 0.870$, $p < 0.001$), worker welfare ($\beta = 0.715$, $p < 0.011$), and economic sustainability ($\beta = 0.579$, $p < 0.011$), as well as health ($\beta = 0.460$, $p < 0.001$) and animal welfare ($\beta = 0.845$, $p < 0.05$)).

3.8.2. Assessment of nomological validity

Nomological testing in Estonia showed positive and significant relationships between financial concerns ($\beta = 0.271$, $p < 0.001$) and food security concerns ($\beta = 0.346$, $p < 0.001$) with economic sustainability, mirroring the findings from the Greek consumer sample in Study 4a. In a similar vein, results also repeatedly indicate that both dispositions significantly related to the higher-order sustainability construct

(financial concerns: $\beta = 0.299$, $p < 0.001$, food security concerns: $\beta = 0.352$, $p < 0.001$).

3.8.3. Discussion of studies 4a & 4b

Overall, the results from Study 4a and Study 4b confirm the observed structural patterns from the preceding studies, except for a few notable differences. While all five dimensions significantly related to the higher-order construct in Estonia, only three of them, i.e., ecological sustainability and worker welfare as well as concern for animal welfare, showed to be relevant facets of overall food sustainability in Greece. These observed differences are consistent with underlying structural discrepancies between Estonia and Greece across relevant dimensions, such as distinct price concerns (European Commission, 2026d) and total consumption of ultra-processed foods (Mertens et al., 2022). Thus, these results again suggest that distinct sustainability aspects might be more or less salient in different consumer markets, as already mentioned in the results of Study 3.

At the same time, at an individual level, the positive correlations between financial and food security concerns and perceived importance of economic sustainability in both countries underline that individuals translate personal scarcity and risk perceptions of monetary and material resources into support for affordable food that fosters regional resilience (in line with Margalit, 2013, showing that economic insecurity raises support for general welfare policies).

In sum, these findings suggest that markets differ in their understanding of economic and health aspects as dimensions of food sustainability, while – as expected – economic sustainability aspects per se are particularly relevant for purchase decisions among consumers who face financial restrictions or are concerned about potential food scarcity crises.

3.9. Assessment of measurement invariance

In the final step of the index development process, using data from all five studies, we engaged in measurement invariance testing for the new *PIFS Index* to assess whether comparisons of results across the different country datasets are valid. For this purpose, we followed methodological guidelines of Henseler et al. (2016) to assess (i) configural invariance, (ii) compositional invariance, and (iii) equal mean values and variances. First, configurational invariance had already been established by replicating the same measurement model with the identical data analysis procedure across the different country samples. Second, compositional invariance "[…] is established when a composite's scores are created equally across groups" (Henseler et al., 2016, p. 414) and was examined by using permutation multigroup analysis in smartPLS for the five consumer samples. Results show that compositional invariance could be assumed, except for the animal welfare dimension in comparison between Austria and all other countries as well as regarding the ecological sustainability dimension between Greece and Estonia. Third, equal means and variances were assessed (i.e., by step 3a and 3 b of the MICOM algorithm in smartPLS) but were only confirmed for isolated cases. Thus, in conclusion, partial invariance was established, so that most structural paths can be compared across the different consumer samples (but not means or variances among them). Detailed results of the assessment of measurement invariance can be found in Supplementary Materials 5.

3.10. Assessment of sex differences

As an additional step, because gender is known to shape food sustainability choices (Vuciterna et al., 2025) and thus may influence consumers' *PIFS* scores, we examined sex-based group differences using permutation multigroup analysis in SmartPLS. First, we estimated the *PIFS'* lower-order dimensions for each country. Results indicate significant sex differences in Germany for the perceived importance of ecological sustainability (mean female: 3.811, mean male: 3.619) and animal welfare (mean female: 4.255, mean male: 3.878), in Greece for animal welfare (mean female: 4.100, mean male: 3.848), and in Estonia for worker welfare (mean female: 3.632, mean male: 3.338), whereas no significant sex-based structural differences were observed for the remaining dimensions or in the other countries (i.e., Austria and the Netherlands). Second, when estimating the second-order formative composite, no statistically significant sex differences emerged across the different samples ($p > 0.05$). Thus, taken together, these findings suggest that sex-related variation is dimension- and country-specific and does not translate into overall differences in the perceived importance of food sustainability at the composite level. Detailed results of the assessment of sex differences can be found in Supplementary Materials 6.

4. Discussion

A transition toward more sustainable diets is increasingly necessary given food systems' impacts on ecological deterioration, social inequalities, economic dependencies, animal exploitation, and public health crises (HLPE, 2017; WOAH, 2024). Information-based strategies dominate behavior-change interventions, but their effectiveness is limited due to insufficient personalization and the neglect of heterogeneity in consumers' sustainability concerns, priorities, knowledge, and information needs. Against this background, we aimed to align sustainability information provision with consumers' sustainability information preferences. We therefore developed the *PIFS Index*, a holistic measure covering five sustainability dimensions, which is operationalized with impact-relevant indicators (e.g., life-cycle assessment metrics), instead of employing heuristic cues that have predominately guided prior research (such as "local" or "organic" sustainability proxies).

Results of our work demonstrate that the new *PIFS Index* is a reliable psychographic measurement instrument that shows good model fit indices across five distinct countries. Both test-retest reliability and known-group validity were established. Further, tests of nomological validity, including analyses of antecedents, discriminant validity, and other related constructs, indicate that the newly developed index behaves empirically as theorized. Since the *PIFS Index* is specified as a formative higher-order model, this structure allows analysis at both the composite and dimension levels and supports personalization by revealing which indicators consumers consider more or less relevant for food choice.

Substantively, the results across countries show heterogeneity in consumers' perspective of food sustainability, which is reflected in diverse patterns of statistically significant paths from the five dimensions to the overall construct. The two dimensions that consistently relate to overall food sustainability are those of ecological sustainability and animal welfare, respectively. This finding suggests that consumers across the sample EU countries associate environmental issues and animal welfare with food sustainability. In contrast, healthy food, worker rights, and economic prosperity are considered as sustainability dimensions in some countries while not in others. This inconsistent pattern hints to different dimension salience across EU markets, which is also mirrored by the findings of prior research: a cross-country study from 2014 shows that the strongest sustainability associations relate to the ecological domain (Grunert et al., 2014), which was confirmed by more recent work, also suggesting that the top association of food sustainability among European consumers concern ecological impact (BEUC, 2020). This report further shows that fair farmer reimbursement is particularly salient in the Netherlands, whereas minimally processed foods (a proxy for health) are especially relevant in Greece (BEUC, 2020). Within Germany, animal welfare and health considerations were prioritized in the context of animal products over price concerns (Schütz et al., 2023), whereas another study conducted in Czechia, Spain, Sweden, Switzerland, and the UK finds that price and health are more important than animal welfare and ecological sustainability

considerations (Ammann et al., 2024). These results clearly show that consumers' sustainability associations and preferences vary substantially across countries. To this end, it is noteworthy that they use different operationalizations and largely rely only on selected sustainability criteria, which limits cross-study comparability (apart from pursuing distinct research questions and employing different dependent variables). In contrast, the *PISF* measure provides a more holistic and systematic assessment across the relevant impact criteria of the five focal sustainability domains. Future research will thus be necessary to replicate the observed association patterns of this work for robustness by using fresh datasets.

Since not all facets of sustainability were implicitly recognized as such throughout the different consumer studies, the necessity for public awareness campaigns increasing the saliency of distinct sustainability aspects within food systems becomes obvious. Administering the index to large, representative samples in future studies would thus help pinpoint educational needs on a dimension level.

Since the results from nomological testing further indicate that specific consumer groups (e.g., individuals who do not eat meat, self-identify with left-leaning politics and endorse specific personal values) are more receptive to food sustainability topics than others, policy communication might consider different messaging approaches for distinct segments, depending on the amount of information that is necessary for educational purposes. To this end, it is noteworthy that all hypothesized negative relationships of Study 2 were unsupported while the positive ones were observed, raising the possibility of acquiescence bias, which has been previously discussed in values research (e.g., Lechner et al., 2019; Sagiv & Schwartz, 2022). To establish the validity of these relationships, future research is needed to replicate them and rule out acquiescence bias as an alternative explanation.

4.1. Conclusion & future research

Building on the results of our work, we now discuss the practical implications of the *PIFS Index* and outline avenues for future research. We envisage numerous opportunities to use the *PIFS Index* to advance consumer research on food sustainability. First, researchers might conduct simulated supermarket studies – or ideally field studies – assessing consumers' *PIFS* scores to explain actual food choices (using scanner data or loyalty card data). Such approaches would allow to better understand to what extent sustainability concerns for specific dimensions translate into purchase behavior. Such studies might be further extended by testing moderating effects such as consumer dispositions (e.g., resistant consumers, vulnerable consumers) or situational factors (e.g., stressful shopping situations). Second, since the *PIFS* indicators are closely aligned with sustainability impact assessment criteria (e.g., based on LCA or Nutri Score), linking consumers' *PIFS* scores to product-level sustainability impact would enable matching stated preferences with objective impact performance of selected products. Accordingly, future studies might use individual *PIFS* scores to inform consumers about a product's alignment with their personal preferences (for example, using a color schema from green to red), and assess whether consumers use this personalized information to make more informed choices. Third, this rationale of individualized matching might be taken one step further by not only informing consumers about their current choice but also making preference-based product recommendations. For example, for consumer A, high in animal welfare concerns, alternative products higher in animal welfare standards might be recommended, while for consumer B, high in economic sustainability concerns, other relevant recommendations might be provided. Taken together, such recommendation mechanisms might examine the effectiveness of matching consumer preferences with objective food sustainability indicators to foster demand-side changes in current food systems. From a methodological perspective, such in-person (field) studies would further enhance external reliability and minimize bot-related threats, which were mitigated in this work using the certified panel provider Talk Online GmbH for online data collection (see point 3.1).

From a managerial perspective, the *PIFS Index* might be used in retailer apps or online shops to better understand consumers' sustainability preferences. These preferences might be a valuable segmentation basis for direct marketing activities of food retailers, such as segment-based sales promotions or product recommendations. For food producers, more informed knowledge about consumer relevance of specific sustainability dimensions and/or specific indicators might assist relevant efforts of undergoing certifications for e.g., fair working conditions or animal welfare, aiming to achieve competitive advantage in relevant consumer segments.

From a policy perspective, the *PIFS Index* provides a tool to reveal blind spots of consumer concern along with impactful food sustainability indicators and dimensions. Such knowledge might inform consumer education initiatives to raise awareness of relevant but less salient food sustainability issues (such as salt content, which was among the sustainability indicators perceived the least important in Austria) in the context of e.g., the EU policy objective of public health (European Commission, 2026e). The *PIFS Index* provides common language descriptions of all indicators, which might be used for such educational campaigns to explain complex aspects (such as biodiversity) in brief and understandable terms.

Despite the merits of the new *PIFS Index*, we acknowledge a number of limitations in its development, which warrant attention in future studies. First, it is important to note that our conceptualization of *PIFS* was grounded in well-established scientific and policy frameworks (e.g., FAO, 2014; Group of Chief Scientific Advisors, 2020; One Health/WHO, 2021; One Welfare, 2025) but remains ultimately normative. Thus, alternative theorizations are possible, e.g., merging animal and worker welfare as well as health to a combined social sustainability domain, which could alter model estimates. Second, the *PIFS Index* is a self-reported measure, which comes with all its well-known shortcomings, so that stated preferences might not be expected to directly relate to actual behavior. Third, the set of indicators is closely aligned to relevant product-related impact criteria for provided reasons. Over time, such indicators might further develop, rendering some items obsolete or missing, thus requiring a revised version of the *PIFS Index* in the future. Finally, sustainable food choices are closely interlinked with public health goals since e.g., high consumption of red and processed meat is associated with increased risks of certain cancers (Farvid et al., 2021) and type 2 diabetes (Aune et al., 2009) as well as that inadequate husbandry practices (e.g., overcrowding) can facilitate the spread of zoonotic diseases (Dhont et al., 2021; Jones et al., 2013). While the *PIFS Index* implicitly considers the relevance of food sustainability for public health, this linkage could be addressed more explicitly and systematically in future work by empirically testing the structural relationships between public health concerns and selected sustainability facets.

5. Ethics approval and consent

Ethics approval, as indicated in the main text of the manuscript, was granted by the Ethics Committee of BOKU University (reference numbers: BOKU-2025/019, BOKU-2025/026, BOKU-2025/027). All procedures were conducted in accordance with all relevant institutional, project-related and national regulations.

6. Informed consent

Participants provided informed consent prior to taking part. Participation was voluntary and could be withdrawn at any time without penalty. Individuals below the age of 18 were not permitted to participate.

7. Compensation

Participants were reimbursed for the time and effort spent taking part in our studies. The compensation was provided directly by the professional panel provider Talk Online GmbH.

8. Data protection and storage

Only anonymized data was collected and is stored in compliance with the research project's data-protection regulations on osf. io.

9. Studies in animals

Not applicable.

10. Research data availability

Research data concerning the new index development and questionnaire copies are stored in an OSF repository that can be accessed under osf.io/dw7y3.

11. Declaration of generative AI and AI-assisted technologies in the manuscript preparation process

During the preparation of this work the authors used academic. ai and chatGPT as a search engine (similar to the usage of other databases such as e.g., Google Scholar) as well as for language polishing purposes and questionnaire translations. After using this tool/service, the authors reviewed and edited the content as needed and take full responsibility for the content of the published article.

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CRediT authorship contribution statement

Leonore Lendl-Lewisch: Conceptualization, Data curation, Methodology, Writing – original draft. **Petra Riefler:** Conceptualization, Methodology, Supervision, Writing – review & editing.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supplementary data

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