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Article - Version of Record



Suggested Citation:

Gier-Reinartz, N. R., & Harms, R. (2024). Social Acceptance Scale—development of an instrument for the differentiated measurement of social acceptance in agricultural livestock farming. *Journal of Consumer Protection and Food Safety*, 19(1 supplement), 29–47. <https://doi.org/10.1007/s00003-024-01490-z>

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Social Acceptance Scale—development of an instrument for the differentiated measurement of social acceptance in agricultural livestock farming

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Received: 12 October 2023 / Revised: 12 October 2023 / Accepted: 18 January 2024 / Published online: 16 April 2024
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Abstract

This paper presents the development and validation of the Social Acceptance Scale (SAS), an instrument designed to measure social acceptance, particularly in transformative sectors like agricultural livestock farming. Recognizing the need for a nuanced acceptance scale, various facets of acceptance across a three-level continuum were delineated, spanning from opposition to commitment, encompassing eight distinct items. The SAS's creation and validation process included the conceptual and empirical testing of four validity types: content validity, face validity, construct validity, and criterion validity. Content and face validity involved construct definition, item generation, iterative review, and pilot testing to ensure theoretical soundness. Empirical testing encompassed construct validity through statistical validation and assessments of factorial and convergent validity. Furthermore, criterion validity was explored by examining associations with related constructs, enhancing the SAS's external applicability. In conclusion, this paper introduces the SAS as a tool to measure social acceptance within transformative sectors. It underscores the necessity for a comprehensive acceptance scale, offering a detailed account of its development and validation. The discussion section acknowledges limitations and outlines potential directions for future research in this domain.

Keywords Social Acceptance Scale (SAS) · Social Acceptance · Transformative Sectors · Agricultural Livestock Farming · Measurement Instrument · Validation Process

1 Introduction

The transition towards sustainable consumption represents a pivotal sociopolitical imperative, as underscored prominently within the 2030 Agenda for Sustainable Development (United Nations 2016). This transition inherently entails a profound societal metamorphosis, necessitating the collective realization of effective strategies to fulfill all 17 Sustainable Development Goals (United Nations 2016), as evidenced by recent studies (Garcia-Cuerva et al. 2016; Baur

et al. 2022). Hence, the pivotal determinant of attaining this transformation lies in securing widespread social acceptance (Ingold et al. 2019).

In the realm of various sectors, the agricultural livestock production industry has long attracted criticism from diverse stakeholders (Christoph-Schulz et al. 2018). Presently, this industry is experiencing a transformation process, notably marked by a societal shift away from traditional meat products towards protein alternatives (European Commission 2016; Ladak and Anthiis 2022). Nevertheless, it is noteworthy that the prevailing criticism and the widely presumed discontentment with agricultural livestock farming do not consistently translate into a corresponding reduction in meat consumption among the majority of the population residing in Germany (Bundesanstalt für Landwirtschaft und Ernährung 2022). This observation underscores a noteworthy phenomenon often referred to as the “intention-behavior gap,” wherein survey respondents express disapproval of agricultural livestock farming but fail to align their everyday

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consumption behavior accordingly (Vermeir and Verbeke 2006; Statistisches Bundesamt et al. 2022).

One plausible explanation for this disparity may stem from the absence of pertinent, context-specific information at crucial points within the purchase decision-making process (Frank and Brock 2018). Nevertheless, an alternative explanation could be rooted in a constrained operationalization of the acceptance construct, both theoretically and methodologically. Notably, contemporary acceptance research reveals a noteworthy diversity in the interpretation of the concept of acceptance, with varying synonyms such as acquiescence, approval, and conditional acceptance being espoused (Lucke 1995; Sauer et al. 2005; Schäfer and Keppler 2013). Consequently, relying on single-item measurements of this construct (e.g., “I accept agricultural livestock farming”) may introduce a potential bias into the measurement process, as it fails to elucidate the specific facets of acceptance being assessed.

Nevertheless, one might inquire about the necessity for yet another acceptance scale, given the existence of numerous studies that have effectively quantified acceptance in various domains, such as policy instruments (Kammermann and Ingold 2019), climate protection strategies (Engler et al. 2021), renewable energies (Westerlund 2020; Baur et al. 2022), wastewater reuse (Faria and Naval 2022), or food (Siegrist 2008). For instance, previous quantitative research has primarily concentrated on technology or innovation acceptance (Davis 1989). However, upon closer examination of these specific application areas, it becomes evident that their primary focus pertains to usage and actionable aspects, a perspective not readily applicable to non-consumable, social acceptance, such as the acceptance of agricultural livestock farming. In this broader sense, “acceptance” seems to emerge as a multidimensional construct encompassing attitudes and actions in diverse forms (Lucke 1995; Hofinger 2001; Sauer et al. 2005; Schäfer and Keppler 2013). Consequently, a finer granularity in measurement may prove advantageous in ensuring the accurate and externally valid assessment of acceptance, particularly by discerning the different states of acceptance concerning attitudes and actions.

To address the need for a comprehensive measure of social acceptance, this study introduces the Social Acceptance Scale (SAS), aiming to encompass various dimensions of acceptance within transformative sectors, exemplified by agricultural livestock farming. The SAS employs graded statements to quantitatively assess social acceptance and offers a structured framework for evaluating acceptance across diverse dimensions.

The paper discusses the development and validation processes of the SAS, following recognized validation methods. Four validity types, as advocated by international test standards (American Psychological Association 1954), are tested to ensure the scale's robustness. At first, the content

validity (Sect. 2.1) and face validity (Sect. 2.2) are addressed by outlining the scale's development process, theoretical foundations, item generation, iterative reviews, and piloting, culminating in the final scale formulation (Sect. 3). The subsequent phase involves empirical testing to evaluate construct validity and criterion validity through statistical analyses. Within construct validity (Sect. 4.1), factorial validity is examined through statistical validation, along with measures of convergent validity. Criterion validity (Sect. 4.2) explores the scale's associations with relevant constructs, enhancing external generalizability. The paper concludes by discussing limitations encountered during the SAS's development and validation and suggests avenues for future research (Sect. 5).

2 Evaluating the validity of the theoretical framework

To evaluate the internal validity of the SAS, two distinct types of validity assessments were conducted. First, content validity was established based on the conceptual and operational decisions made during the scale's development process. Subsequently, a secondary form of validity, known as face validity, was assessed through iterative expert and consumer evaluations.

2.1 Content validity-definition and theoretical basis

Content validity pertains to the extent to which a measurement instrument or test accurately and comprehensively encompasses the content it is designed to evaluate (American Psychological Association 1954). It ensures that the items are pertinent, representative, and sufficiently comprehensive to appraise the construct or concept under consideration effectively. Content validity represents a qualitative facet of validity assessment, necessitating an evaluation grounded in formal and conceptual definitions as it cannot be quantified objectively through statistical measures (Cronbach and Meehl 1955; Moosbrugger and Kelava 2020). In the subsequent sections, we elucidate the facets contributing to content validity by defining the central construct of “acceptance” and reviewing its theoretical underpinnings as established through prior research.

2.1.1 Definition

In order to establish a robust foundation for the acceptance construct within the SAS, an extensive review of existing literature in acceptance research was undertaken. This comprehensive examination revealed individual dimensions that would form the foundational structure of the SAS.

Acceptance is a term often associated with affirmative consent and is linked to words such as accept, acknowledge, agree, affirm, approve, or endorse (Lucke 1995; Schäfer and Keppler 2013). The interchangeable use of these terms highlights the absence of a universally defined concept of acceptance in everyday language, leaving room for diverse interpretations.

To provide a theoretical underpinning for our understanding of the acceptance construct, we draw significantly from the work of Lucke (1995), who has historically and theoretically conceptualized acceptance. As such, this paper adopts a relatively broad conceptualization of acceptance, defining it as the likelihood that specific opinions, actions, proposals, and decisions will receive explicit or implicit approval from a discernible group of individuals, with the understanding that this approval can be reasonably relied upon in certain circumstances (Lucke 1995). In this context, acceptance occurs when an individual (referred to as the acceptance subject) embraces something (the acceptance object) within a defined framework or under specific initial conditions (the acceptance context; Lucke 1995).

Acceptance, being a multifaceted construct, can be divided into various forms, including attitudes, observable actions, and specific values, with the latter dimension sometimes considered a component of the attitude dimension (Schäfer and Keppler 2013). Attitude refers to the positive or negative orientation towards the acceptance object, accompanied by a specific intention to take action (Lucke 1995; Schäfer and Keppler 2013). On the other hand, action encompasses observable behaviors, which can also manifest through omission in the form of tacit approval (Lucke 1995; Sauer et al. 2005; Schäfer and Keppler 2013).

In the context of societal behavior and agricultural livestock farming, it is particularly relevant to differentiate between the forms of acceptance based on attitudes and actions. As explained in the introduction, this differentiation becomes important because previous surveys consistently reveal a notable disparity between expressed attitudes towards agricultural livestock farming and actual behavioral patterns (Vermeir and Verbeke 2006; Statistisches Bundesamt et al. 2022). Given these circumstances, measuring both the attitude and action components of social acceptance regarding agricultural livestock farming is prudent. Since the definitional groundwork on acceptance and its components align with the intention-behavior gap in consumer behavior in agricultural livestock farming, we can reasonably assume the presence of content validity.

2.1.2 Theoretical basis

Having identified the constituent elements that define acceptance, it is valuable, from a theoretical perspective, to explore how this definition can be applied in contexts

similar to the broad domain of social acceptance. Acceptance is a universal phenomenon with relevance across various domains, and it serves as a subject of inquiry in numerous research areas. Consequently, a wealth of studies exists that focus on the acceptance of diverse phenomena, including policy instruments (Kammermann and Ingold 2019), climate protection strategies (Engler et al. 2021), renewable energies (Westerlund 2020; Baur et al. 2022), wastewater reuse (Faria and Naval 2022), and food (Siegrist 2008), among others.

Within this context, noteworthy contributions have emerged from studies that initially embraced the concept of acceptance based on Lucke's definition and also captured the dynamics of change towards social acceptance, especially within the context of transformative industries (Hofinger 2001; Sauer et al. 2005; Schäfer and Keppler 2013). These studies provide valuable insights into the nuances of acceptance, particularly as it evolves in response to changing societal and environmental conditions.

Building upon qualitative research, the concept of acceptance can be further elaborated by distinguishing between multiple levels of acceptance or non-acceptance (Hofinger 2001; Sauer et al. 2005). These levels encompass various manifestations of both attitude and action components. In alignment with the framework proposed by Sauer et al. (2005), these types are defined as follows:

- (1) **Opposition:** Very high non-acceptance, which is expressed, among other things, in active actions directed against the acceptance object.
- (2) **Rejection:** Strong non-acceptance, expressed, among other things, in indirect behavior in everyday life or verbal expressions.
- (3) **Indecision:** Indecisiveness results from a lack of sufficiently active engagement with the subject, so no clear classification of the acceptance object can be made.
- (4) **Indifference:** Lack of subjective concern, so there is neither opinion on the subject nor interest in it due to a lack of engagement.
- (5) **Sufferance:** Very low level of acceptance, arises due to power interventions, and thus manifests itself primarily through inactivity due to a lack of alternative actions.
- (6) **Arrangement:** Low acceptance, linked to conditions, and only arises after a substantive discussion of the issue.
- (7) **Agreement:** High acceptance based on inner conviction, with no active action taken for this purpose apart from conscious support.
- (8) **Commitment:** Very high acceptance based on inner conviction, which is expressed primarily in active actions to promote the acceptance object.

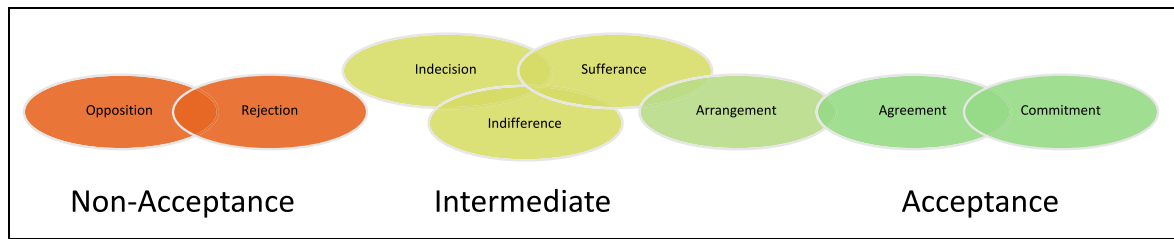


Fig. 1 Eight acceptance types along a three-level continuum

Based on a synthesis of prior foundational research (Hofinger 2001) and related constructs such as tolerance (Walzer 1998; Forst 2013; Pollack et al. 2014), the various types of acceptance can be illustrated as a three-level continuum (Fig. 1). Within this framework, the evolution of acceptance can progress in the direction of increased acceptance or non-acceptance. Intermediate levels within this continuum represent a “form of suppression” and indicate a relatively lower degree of acceptance, which can manifest at either the action or the attitude level. Given the empirical utilization of this definition in numerous studies and its ability to distinguish similar forms of acceptance, the theoretical categorization into eight acceptance types along this three-level continuum appears to be both content valid and conceptually robust.

The outermost levels, comprising opposition and rejection at one end and agreement and commitment at the other, denote the extreme points of the continuum, signifying non-acceptance and high acceptance, respectively. In contrast, levels 3 through 6, encompassing indecision, indifference, sufferance, and arrangement, situated in the middle, represent varying degrees of low acceptance. Importantly, these intermediate levels incorporate both non-acceptance and acceptance components, thus blending positive and negative aspects. Consequently, they can be interpreted as indicative of a low level of acceptance and signify transitional stages towards either higher acceptance or non-acceptance. Depending on whether the focus is on the action or attitude dimension, these stages may be arranged differently, and thus, they are not presented linearly on a continuous spectrum.

2.2 Face validity—item generation and piloting

Face validity serves as a method of evaluating the extent to which a measurement or assessment tool, on the surface, appears to measure its intended construct (American Psychological Association 1954). It relies on the judgments of experts or individuals who are likely to utilize the measurement instrument, seeking to determine whether the assessment “appears” to measure what it claims to measure.

The conceptualization of a scale with multiple types and levels offers the advantage of enabling a more nuanced and sensitive assessment of transformation processes. This approach allows for the documentation of variations within each type and shifts along the three-level continuum. According to traditional scale development processes (e.g., Brakus et al. 2009), a scale should measure a construct of interest using multiple items, which can later be aggregated into a latent variable to capture the multidimensional content comprehensively. However, in the case of acceptance, it is apparent from theoretical considerations that distinct, concrete forms of acceptance can be delineated. Consequently, adhering to the traditional scale design would require the creation of multiple subscales, each consisting of multiple items. Given the clear differentiation of the various forms of acceptance based on their action and attitude components, an alternative approach utilizing single items is also a viable consideration (Allen et al. 2022). However, in this scenario, ensuring that each type of acceptance is accurately and validly assessed with a single item becomes paramount.

While initial attempts have been made to assess acceptance tendencies using a single item (Gier and Krampe 2019), greater differentiation is still needed to align more comprehensively with the theoretical concept of acceptance. Adopting a scale featuring only one item per acceptance type would be more efficient in terms of time and, consequently, more satisfactory for the participants (Allen et al. 2022). The primary rationale behind this choice is to mitigate the risk of ambiguity, where items are associated not only with a single acceptance type but also multiple constructs or other constructs (Allen et al. 2022). This risk is relatively high, particularly because the acceptance construct overlaps with other constructs, such as tolerance. Hence, the decision was made to create only one item per type, ensuring that each type is represented by a distinct item to prevent any potential contamination of the construct.

By adopting this approach, the utmost consideration is to ensure that the items are as unambiguous as possible in their representation of the diverse types of acceptance. To evaluate this alternative approach to scale development and further enhance the content validity of the SAS, a comprehensive assessment of face validity was conducted. During

the item generation phase, based on the theoretical model, we elaborate on how face validity was assessed through distinct expert evaluations: input from experts on one hand and consumers as the primary acceptance subjects on the other hand. In the subsequent iterative revision process, items were systematically refined and adjusted based on feedback. Ultimately, the scale underwent testing in smaller- and three larger-scale surveys to identify any remaining issues pertaining to item clarity or relevance. The resolution of these issues collectively shaped the final SAS, ensuring its adequacy in accurately representing the content area under examination.

2.2.1 Expert evaluation

The initial draft, featuring one item per type and the acceptance continuum, was introduced in spring 2020 to experts and representatives from non-governmental organizations (NGOs), specializing in social perception of agricultural livestock farming. During this workshop-style gathering, a total of 15 individuals participated, including representatives from three NGOs focused on animal welfare and sustainability, two delegates from federal agencies, and various experts in the field. The primary objective of this meeting was to comprehensively gather and describe all facets of social acceptance, including those related to agricultural practices in livestock farming, to shape the survey design effectively. The aim was to explore all possible factors contributing to improvements or declines in social acceptance of agricultural livestock farming. Participants were asked to assess the alternative approach compared to traditional scale development processes and single-dimensional conceptualizations of acceptance.

The feedback strongly favored a nuanced assessment of acceptance across multidimensional levels. The rationale behind this preference was that consumer acceptance appears to evolve. Therefore, crafting questions that capture corresponding trends would be beneficial, even if these changes are initially subtle. This approach would enable the tracking of social perceptions of intermediate successes. Additionally, feedback indicated that the sentence structure should more closely align the attitude and action components in all items to maintain consistency, as one item had a different sentence structure, which could inadvertently introduce biases. Consequently, adjustments were made to the items and sentence structures in response to this feedback.

Throughout the development of the scale, considerable effort was invested in formulating the items in a way that allows for the interchangeability of the acceptance object. However, it is crucial to ensure that when selecting the terms to be used in this scale, there is a precise understanding of what respondents associate with the term meant to represent the acceptance object. This critical aspect was also brought

to light by experts during the initial evaluation session, where it became evident that the acceptance object lacked a clear definition. It remained unclear how respondents would interpret the term used, resulting in uncertainty in evaluating the items. This central concern in the development of the SAS prompted an exhaustive examination of terminologies and a comprehensive understanding of what respondents have in mind when confronted with specific terms. Results regarding these crucial preparatory investigations can be found in Mukhamedzyanova et al. (2021). Therefore, it is imperative that when utilizing this scale in other domains, the acceptance object is rigorously defined and, above all, a comprehensive understanding is reached regarding what respondents perceive when confronted with the term used.

The selection of terminology plays a pivotal role in contributing to the validity and credibility of a scale. This aspect was particularly underscored during the second round of evaluation involving experts in October 2022. Eleven participants were involved in the workshop, including four representatives from different NGOs, distinct from those in the initial round, yet still with a shared focus on animal welfare and sustainability within the food sector. Once again, representatives from politics and academia were in attendance. The central focus remained on the ethical assessment of the survey strategy and the content related to public attitudes towards agricultural livestock farming.

Extensive deliberations centered around the labels assigned to different types of acceptance and whether some types might imply socially desirable avoidance options. These discussions once again underscored the variability in how acceptability is interpreted. This reaffirmed the decision to adopt a nuanced concept of acceptability during the development process. Furthermore, it became evident that, for future reports utilizing the scale, the term “acceptance” carries a strong semantic impact. For instance, the term “conditional acceptance” used by Sauer et al. (2005) was modified, as the original label for the acceptance type invoked such a robust understanding of acceptance that it overshadowed the actual content of this type, which denotes low acceptance of the current state, maintained only under specific conditions. To enhance face validity, the term “arrangement” was selected instead. All labels for the types and levels and the initially formulated items underwent a thorough review to prevent potential bias from socially desirable phrasings.

2.2.2 Consumer pretest and piloting

In addition to expert evaluations, the comprehension of the scale was also assessed among consumers as primary acceptance subjects and subsequent respondents of this scale. Qualitative methods were initially employed to delve into consumers' interpretations of the scale. In a qualitative pretest involving $n = 15$ participants (male $n = 4$; $M_{\text{age}} = 30.73$;

SD = 12.38; vegetarian/vegan $n = 2$), various cognitive pre-testing techniques were applied to assess the comprehensibility and validity of the items and terminology. In total, four methods were employed (Lenzner et al. 2015):

1. The “think-aloud method” is a cognitive technique employed to gain insights into an individual's thought process as they undertake the survey. In this method, participants are instructed to vocalize their thoughts and articulate their cognitive processes while answering the items of the SAS. The objective was to capture the participants' inner thoughts and decision-making procedures in real-time. Each item was read aloud to the participants with the following directive: “In the following question, please tell me everything that you are thinking about or that is on your mind before answering the question. Please also say things that may seem unimportant to you.” The verbalizations revealed that participants already possessed an understanding of the various gradations, and differences between the types of acceptance were intuitively recognizable.
2. To assess whether participants could roughly assign the items to the acceptance levels, the “sorting technique” was employed. Participants were instructed to categorize the individual statements based on the strength of acceptance level, from non-acceptance to acceptance. Most participants were successful in ordering levels 1 and 2, as well as levels 7 and 8, to the first and last two levels of acceptance, respectively ($n = 9$ correct on item; $n = 4$ correct on level). However, the intermediate acceptance types posed more ambiguity. Depending on the criteria utilized for sorting (action or attitude), different sequences emerged. Only item 6 was most often sorted at the suggested position according to the theory ($n = 7$). This finding reinforced the three-level continuum outlined in the theoretical conceptualization.
3. In order to delve further into participants associated with specific terms, a “comprehension probing” exercise was carried out. This method is employed to assess an individual's comprehension of a particular word or text part and is intended to elicit thoughtful responses that provide insight into a deeper understanding of concepts. During the comprehension probing, critical and distinguishing aspects between the levels were examined separately to gain a linguistic understanding of participants' interpretations.
4. A similar objective was pursued through the use of “paraphrasing,” which was employed to explore the conceptualizations of the individual levels and differences between them (Lenzner et al. 2015). Participants were tasked with rephrasing the statements in their own words. Following this, participants were prompted to enumerate the points of differentiation between each statement.

This exercise aimed to reconfirm the clarity of differences between the levels and types and identify the central distinguishing features emphasized by participants.

These cognitive pretests primarily served to acquire a better understanding and insight into consumers' perspectives. Formulations and terminologies could be adjusted and refined based on the insights garnered from these tests.

To quantitatively assess the scale and explore various analytical possibilities, two preliminary quantitative studies were conducted in 2020 ($n = 396$; $M_{age} = 35.8$; $SD = 15.05$) and 2021 ($n = 391$; $M_{age} = 26.8$; $SD = 7.45$). The results of these studies were previously presented at an international conference (Mukhamedzyanova and Gier 2021) and helped to evaluate the performance of the scale in real-world survey settings. The international perspective was particularly valuable for gaining insights into potential variations in the interpretation of acceptance on an international scale and for considering cultural factors.

It seems crucial to acknowledge that while acceptance is a universal concept, the differentiation of acceptance types may pose challenges when applied internationally due to potential terminological ambiguities. Therefore, it is imperative to underscore that the scale was originally developed for European and, more specifically, German language usage. Further efforts and research are warranted to explore cultural intricacies and validate the scale in other languages and cultural contexts. Lastly, throughout three extensive survey waves conducted in May and June 2021 ($n = 2000$; $M_{age} = 49.3$; $SD = 14.52$), February and April 2022 ($n = 2000$; $M_{age} = 48.3$; $SD = 14.34$), and July and September 2022 ($n = 2004$; $M_{age} = 48.3$; $SD = 14.26$), the eight items comprising the SAS underwent various adjustments until the final items were chosen for the comprehensive validity assessment.

3 Social Acceptance Scale

In the subsequent section, we will present the final scale items of the SAS and provide instructions for their administration. Please note that the original items are in German, and the English items are translated-retranslated but not yet validated translations (Table 1). The individual statements within the scale are rated independently in randomized order. Each statement is assessed on an 11-point scale, ranging from 0, denoted as “Does not apply to me at all,” to 10, denoted as “Applies to me completely.” An 11-point scale was chosen to capture distinctions within individual acceptance types better. During the scale development process, the smallest scale point was designated as zero (0 to 10) based on feedback from respondents who did not agree at all with certain statements to encompass their complete disagreement.

Table 1 Items of the SAS

Please answer to what extent each of the following statements applies to you personally. You can indicate your answer on an 11-point scale from 0 = “Does not apply to me at all” to 10 = “Applies to me completely”. In the following statements, the term “agricultural livestock farming” should be understood to mean: primarily practiced agricultural livestock farming according to legal minimum standards
Original German instruction: Bitte beantworten Sie, inwieweit jede der folgenden Aussagen auf Sie persönlich zutrifft. Sie können Ihre Antwort auf einer 11-Punkte-Skala angeben von 0 = “Trifft überhaupt nicht auf mich zu” bis 10 = “Trifft voll und ganz auf mich zu”. In den nachfolgenden Aussagen soll unter der Bezeichnung “landwirtschaftliche Nutztierhaltung” Folgendes verstanden werden: vorrangig praktizierte landwirtschaftliche Nutztierhaltung nach gesetzlichem Mindeststandard

	0	1	2	3	4	5	6	7	8	9	10
Item for opposition:											
Since I am an opponent of agricultural livestock farming, I actively act against it not only privately but also publicly	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<i>Original German item (Gegnerschaft): Da ich Gegner der landwirtschaftlichen Nutztierhaltung bin, handle ich nicht nur privat, sondern auch öffentlich aktiv dagegen</i>											
Item for rejection:											
Since I oppose agricultural livestock farming, I express this opinion through my everyday actions	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<i>Original German item (Ablehnung): Da ich die landwirtschaftliche Nutztierhaltung ablehne, äußere ich diese Meinung durch mein alltägliches Handeln</i>											
Item for indecision:											
Since I have heard various things about agricultural livestock farming, I am undecided, how I should act in this context	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<i>Original German item (Unentslossenheit): Da ich Verschiedenes über die landwirtschaftliche Nutztierhaltung gehört habe, bin ich unentschlossen, wie ich mich in diesem Zusammenhang verhalten soll</i>											
Item for indifference:											
Since I basically have little contact with agricultural livestock farming, I have no opinion about it	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<i>Original German item (Gleichgültigkeit): Da ich im Grunde kaum Berührungspunkte mit der landwirtschaftlichen Nutztierhaltung habe, habe ich auch keine Meinung dazu</i>											
Item for sufferance:											
Since I feel I can do little to change agricultural livestock farming, I will take it as it is	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<i>Original German item (Duldung): Da ich das Gefühl habe, wenig an der landwirtschaftlichen Nutztierhaltung verändern zu können, nehme ich sie so hin wie sie ist</i>											
Item for arrangement:											
Since I perceive a change in agricultural livestock farming, I come to terms with it as long as this is the case	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<i>Original German item (Arrangement): Da ich eine Veränderung der landwirtschaftlichen Nutztierhaltung wahrnehme, arrangiere ich mich mit ihr, solange dies der Fall ist</i>											
Item for agreement:											
Since I think agricultural livestock farming is good, I express this opinion through my everyday actions	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<i>Original German item (Zustimmung): Da ich die landwirtschaftliche Nutztierhaltung gut finde, äußere ich diese Meinung durch mein alltägliches Handeln</i>											
Item for commitment:											
Since I am a proponent of agricultural livestock farming, I actively advocate for it not only privately, but also publicly	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<i>Original German item (Engagement): Da ich Befürworter der landwirtschaftlichen Nutztierhaltung bin, setze ich mich nicht nur privat, sondern auch öffentlich aktiv dafür ein</i>											

The items are displayed in random order. The term “agricultural livestock farming” can be replaced by other acceptance objects

The items within the SAS are deliberately formulated generically, allowing the acceptance object (in this case, “agricultural livestock farming”) to be interchangeable. This design ensures that the SAS can be applied to measure a wide range of socially relevant topics (e.g., energy policy). To clarify the reference object, the following information has been included in the question wording: “In the following statements, the term ‘agricultural livestock farming’ should be understood to mean: primarily practiced agricultural livestock farming according to legal minimum standards.” This terminology and definition were extracted from preliminary investigations (Mukhamedzyanova et al. 2021), and its addition ensures that respondents evaluate the same acceptance object.

3.1 Validation sample

To empirically evaluate the validity of the scale (Table 1), a comprehensive survey was conducted in April and May 2023, with the participation of a total of $n = 2000$ individuals. A market research institute facilitated the survey process. The participants were selected within the age range of 18–70 years, with specific quotas established to ensure representation across various demographic factors, including gender, age, regional origin, net household income, educational attainment, employment status, and dietary habits. These quotas were designed to align with the demographics of the German population. Minor deviations from the quotas were allowed when precise adherence was challenging.

Given the potential for socially desirable responses on the research topic, an additional sample purification process was implemented to mitigate potential biases. A social desirability scale (Kemper et al. 2012) was employed to identify individuals who provided excessively positive responses in a socially desirable manner (i.e., all items scored at the highest scale point). These individuals were excluded from the final sample, resulting in the removal of $n = 130$ cases. Additionally, individual cases were excluded to ensure the questionnaire's anonymity, particularly when there were fewer than five cases per response category (Sweeney 2002) for the demographic variables of gender and age ($n = 2$).

The revised sample consisted of $n = 1,868$ participants, with 48.8 % male and 51.2 % female respondents (self-assigned gender), and an average age of 47.88 years ($SD = 14.45$). Detailed information regarding the other demographic variables can be found in Table 2. During the survey, the sample was stratified into four subcategories, each designed to collect specific information about a particular type of livestock (pig, cow, chicken, and chicken for egg production). The allocation of participants to these groups was conducted randomly. Additional details regarding the composition of the samples in each subsample can also be found in Table 2.

3.2 Descriptive statistics

The descriptive analysis of the scale is presented, first for the acceptance object “agricultural livestock farming,” as defined earlier, and then separately for the four livestock categories: pig, cow, chicken, and chicken for egg production. This includes individual descriptions of the scale items, and the formation of factors based on theoretical and conceptual considerations.¹ The descriptive analysis of the SAS (Fig. 2) suggests some interesting findings:

In the context of the overall SAS evaluation of agricultural livestock farming, noteworthy distinctions among the SAS items ($F(5.223, 9750.552) = 164.347$, $p < 0.001$, $\eta^2 = 0.081$)² and components ($F(2.877, 5371.021) = 174.409$, $p < 0.001$, $\eta^2 = 0.085$) emerge. Notably, SAS 6 attains the highest mean score, and post-hoc analysis reveals its statistical superiority compared to SAS 1, 2, 4, 7, and 8 ($M_{\text{Diff}} = 0.353$ to 1.96 ; $p < 0.001$) and the three SAS components ($M_{\text{Diff}} = 0.406$ to 1.468 ; $p < 0.001$). Nevertheless, it is essential to note that SAS 6 does not exhibit a statistically significant difference in comparison to SAS 3 and SAS 5. These 3 SAS items collectively signify that a substantial portion of respondents manifests a limited degree of acceptance, being trapped in a status quo situation due to various factors, such as a shortage of alternative behavioral options, ambivalence stemming from conflicting attitudes, or a temporary deferral of active non-acceptance granted in anticipation of an upcoming change. However, all three SAS items underscore a disposition characterized by diminished acceptance levels and a propensity to await forthcoming modifications.

Comparative analysis of the different livestock categories reveals that the agricultural livestock category focusing on chickens for egg production is the one with the most decreased acceptance component among all livestock categories studied (SAS acceptance: $F(3, 135.4) = 1035.228$, $p = 0.014$; $\eta^2 = 0.006$).³ More specifically, the livestock category of chickens for egg production has significantly lower acceptance than the

¹ The item SAS 6 is not included in the intermediate component, as explained below in the factorial validation.

² Differences between the eight SAS items and SAS components were analyzed separately with a repeated-measures ANOVA, being robust against normality violations due to the large sample size (Schmider et al. 2010). Since the sphericity assumption could not be assumed (items: Mauchly's $W = 0.353$, $\chi^2(27) = 1942.79$, $p < 0.001$; components: Mauchly's $W = 0.935$, $\chi^2(5) = 125.978$, $p < .001$) a Greenhouse–Geisser correction was applied. The post-hoc pairwise comparisons were adjusted with Bonferroni correction.

³ Differences between the livestock categories were analyzed with Welch's ANOVA per SAS item and component.

Table 2 Descriptive statistics on sample demographics

Variable	Sample (n = 1,868)	Sub-sample pig (n = 462)	Sub-sample cow (n = 470)	Sub-sample chicken (n = 469)	Sub-sample chicken (egg) (n = 467)	Germany ¹
	%	%	%	%	%	%
Gender*						
Female	51.2	51.3	50.4	50.7	52.2	50.7
Male	48.8	48.7	49.6	49.3	47.8	49.3
Age (in years)						
Mean (Std. Dev.)	47.88 (14.45)	48.06 (14.13)	46.88 (14.57)	48.33 (14.5)	48.26 (14.57)	9.1
Regional origin in Germany						
North ^a	15.4	15.4	15.1	14.1	16.9	16.2
South ^b	29.4	30.3	29.8	27.7	30	29.2
West ^c	36	35.9	35.3	39.2	33.6	35.2
East ^d	19.2	18.4	19.8	19.0	19.5	19.4
Net household income						
Up to 1,499 €	21	20.8	21.9	20.3	21	17.8
1,500–2,599 €	32.8	33.1	32.8	33.3	31.9	25.3
2,600 or more	46.2	46.1	45.3	46.4	47.1	56.7
Educational attainment						
Low Education ^e	16.1	16.2	14	16.8	17.3	36.0
Middle Education ^f	41.9	41.6	43.9	42.3	40.1	30.0
High Education ^g	42	42.2	42.1	40.9	42.6	34.0
Employment status						
Employed	68.1	68.2	67.4	71	65.7	46.5
Non-Employed	31.9	31.8	32.6	29	34.3	53.5
Dietary habits						
Vegetarian/Vegan	6.4	6.9	6.2	5.8	6.6	5.0
Non-Vegetarian/Vegan	93.6	93.1	93.8	94.2	93.4	95.0

n=sample size and sub-sample size; Std. Dev.Standard Deviation; ¹Source: Own calculation; BPB Bundeszentrale für politische Bildung (2020); Bundesministerium für Ernährung und Landwirtschaft (2020), Destatis Statistisches Bundesamt *2019a; b; 2020)

*In the gender category “diverse,” there were no cases included after data cleansing

^aBremen, Hamburg, Lower Saxony, Schleswig-Holstein

^bBavaria, Baden-Württemberg

^cHesse, North Rhine-Westphalia, Rhineland-Palatinate, Saarland

^dBrandenburg, Berlin, Saxony, Saxony-Anhalt, Thuringia, Mecklenburg-Western Pomerania

^eNo formal education; still in school; elementary school graduation

^fPolytechnic school graduation; secondary school graduation / middle school diploma

^gTechnical college entrance qualification or general university entrance qualification (Abitur)

category of chickens for meat consumption ($M_{\text{Diff}} = -0.48239$; $p = 0.031$). Purely at the descriptive level, the highest score for this livestock category is found in SAS item 5, “sufferance,” in which the apparent acceptance of agricultural livestock farming with chickens for egg production appears to be based on the fact that there are no viable alternatives. This observation underscores a critical social attitude towards the acceptance of this particular livestock category.

In the context of all other forms of agricultural livestock farming, the analysis did not reveal any statistically significant differences in the SAS scores. Consequently, these distinctions must be examined and elucidated primarily at a descriptive level. Notably, some conspicuous variations emerge within agricultural livestock farming involving pigs, although they lack statistical significance. These differences manifest primarily in SAS 2 and SAS 7, which encapsulate expressions of (non-)acceptance in daily life, particularly in consumer choices such as pur-

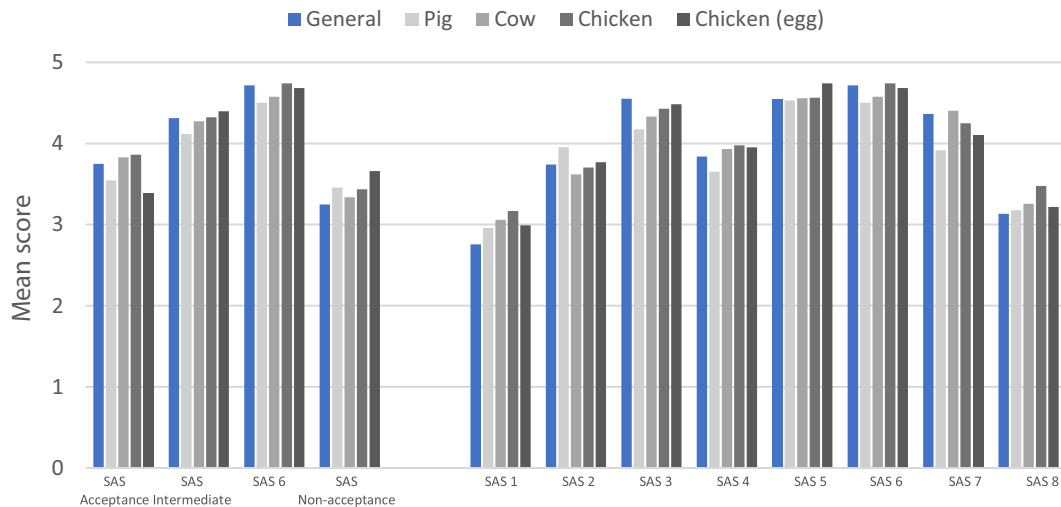


Fig. 2 Mean values for the SAS components and items for agricultural livestock farming in general and per livestock category

chase decisions. Such observations may indicate a critical acceptance status, suggesting that a considerable number of individuals have already moved beyond a mere transitional stance in their opinions and have opted for reduced consumption within this livestock category. Furthermore, agricultural livestock farming involving cows appears to exhibit the least critical acceptance status during the assessment period. Its acceptance component garners relatively high scores, with SAS 7 recording the highest mean score among all the assessed livestock categories. Nevertheless, it is imperative to emphasize that these interpretations remain exclusively descriptive, signifying no statistically significant deviations compared to the other livestock categories under investigation.

These findings provide valuable insights into the public's perception of different types of agricultural livestock farming, with agricultural livestock farming with chickens for egg production and pigs appearing to face more significant challenges in terms of social acceptance.

Additionally, the assessment of the SAS for agricultural livestock farming was analyzed descriptively in relation to gender and age groups⁴ (Figs. 3 and 4). The independent sample t-test analysis of gender groups revealed noteworthy patterns in respondents' levels of acceptance and non-acceptance⁵:

1. Generally, male respondents displayed significantly higher levels of acceptance of agricultural livestock farming acceptance compared to female respondents.

⁴ A differentiation per regional origin can be found in the Supplementary Information (Fig. S1).

⁵ Only significant differences are discussed.

This observation is supported by their significantly higher scores on both the acceptance component ($t(1866) = -5.207$, $p < 0.001$, $d = -0.241$) and the corresponding individual items (SAS 7: $t(1866) = -3.887$, $p < 0.001$, $d = -0.18$; SAS 8: $t(1866) = -5.198$, $p < 0.001$, $d = -0.241$).

2. However, it is essential to clarify that the higher rating of acceptance items among male respondents does not necessarily indicate a favorable view of agricultural livestock farming. Instead, it suggests a greater reluctance to non-acceptance, with the most pronounced agreement at the SAS 6 level. The additional significant preference for SAS 5 ($t(1866) = -2.66$, $p = 0.004$, $d = -0.123$) compared to female respondents implies a willingness to tolerate the prevailing status quo due to a perceived lack of viable alternatives.
3. Female respondents, on the other hand, appear to be more critical and decisive in their positions and behavior regarding non-acceptance. They achieved significantly higher scores on SAS 2 ($t(1866) = 2.013$, $p = 0.022$, $d = 0.093$) than male respondents. This suggests that they are more inclined to adjust their behavior in response to non-acceptance. Similar to male respondents, female respondents seem to await a change before granting a minimum level of acceptance.

Overall, female respondents tend to exhibit a more critical and discerning assessment of social acceptance. In contrast, male respondents may be more accepting of the status quo or less likely to envision alternatives for change.

The analysis of age groups reveals distinctive patterns among different generational cohorts, highlighting significant intergenerational differences. Specifically, individuals

Fig. 3 Mean values for the components of SAS and items for agricultural livestock farming stratified by gender

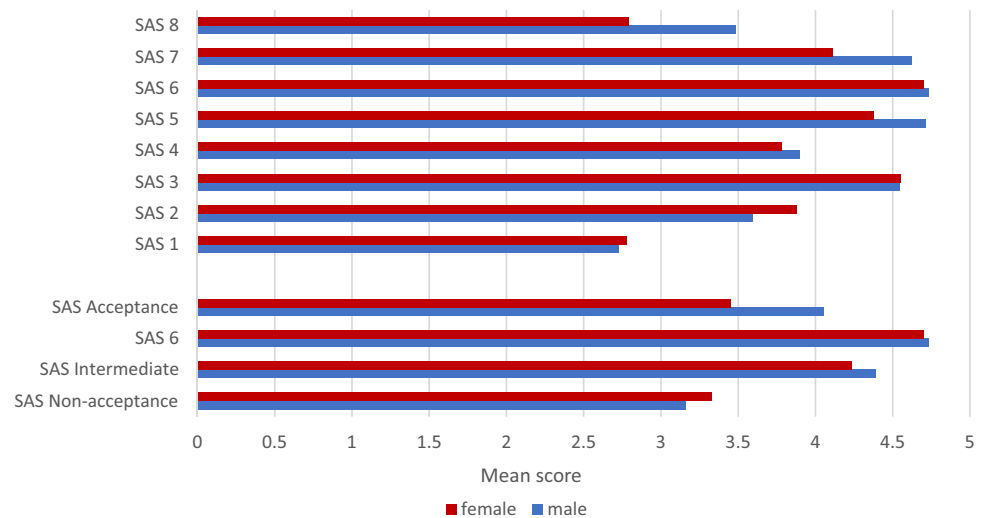
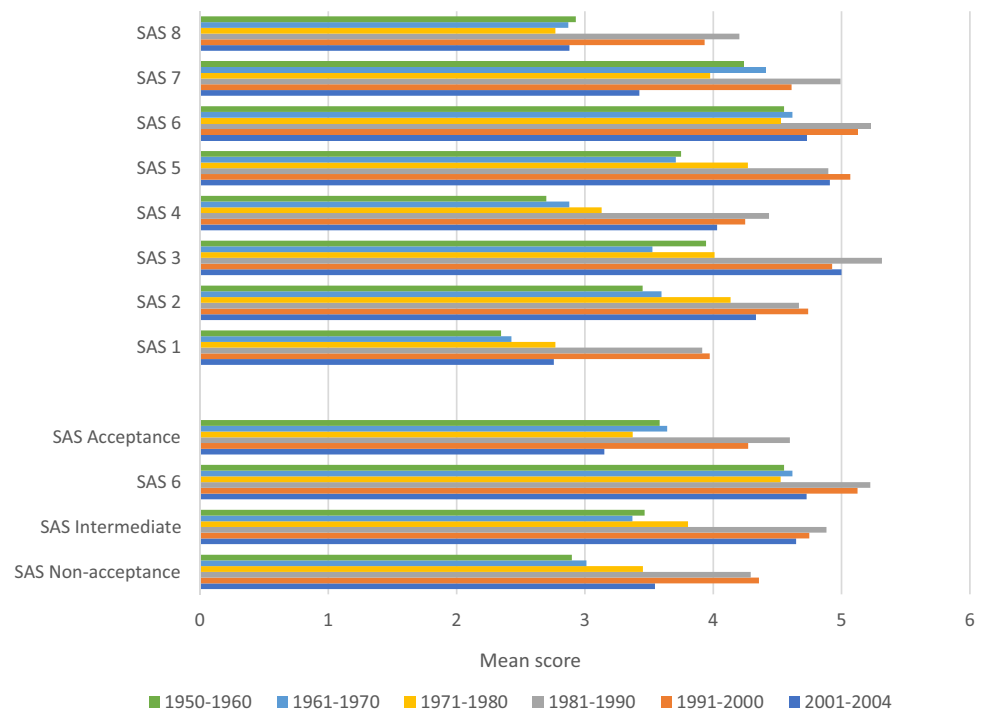


Fig. 4 Mean values for the components of SAS and items for agricultural livestock farming stratified by age groups



born in 1971 and later tend to place a higher value on the intermediate component of acceptance. In contrast, individuals from the older generation, born between 1950 and 1970, exhibit higher mean scores on the acceptance component, indicating a greater inclination towards accepting practices in agricultural livestock farming. On the other hand, younger generations, especially those belonging to the millennial cohort (born between 1981 and 2000), display a more discerning and polarized attitude towards acceptance, as further elaborated below.

It is worth noting that the majority of generational cohorts show the highest mean score in scale item SAS 6, indicating a tendency towards anticipatory acceptance. However,

younger cohorts demonstrate a level of critical ambiguity, as evidenced by the highest average scores in the 1981–1990 and 2001–2004 cohorts for scale item SAS 3. Additionally, within the millennial generation, there is a notable dichotomy and polarization, reflected in their high mean scores in both the non-acceptance and acceptance components, particularly in scale items SAS 1 and SAS 8. These specific items represent an active orientation characterized by either a strong rejection stance or a steadfast commitment to the object of acceptance (i.e., agricultural livestock farming).

4 Empirical validation of the scale

4.1 Construct validity

To empirically evaluate the validity of the SAS, the first step involves assessing its construct validity. Construct validity refers to the extent to which a measurement instrument accurately and effectively measures the theoretical construct or concept it intends to assess (American Psychological Association 1954). In this context, convergent construct validity was examined to assess how well the SAS aligns with other measurement instruments designed to measure the same underlying construct or concept, and whether they yield similar results or scores. Essentially, it explored whether different measures of the same construct demonstrate a strong positive correlation (Cronbach and Meehl 1955). In the case of the social acceptance construct, this study used three measures (a single-item acceptance measure, animal attitude, and political mobilization) to demonstrate that the various items and components within the construct reflect theoretically related constructs.

In addition to establishing relationships with other related constructs, the assessment of construct validity also involves exploring dimensionality. When individual items within the measurement instrument can be empirically linked to their respective subdimensions, this is known as achieving factorial validity. In the following analysis, the examination by evaluating factorial validity was initiated. Subsequently, the construct validity was assessed by examining its correlation with three constructs closely linked to the underlying dimension.

4.1.1 Factorial validity

To test whether the theoretical structure of social acceptance can be replicated with the SAS, an exploratory factor analysis (EFA) was conducted using the statistical software package SPSS version 29. EFA was chosen as it is a data-driven approach that does not assume a priori the number of factors. The principal axis factoring with promax rotation with Kaiser normalization was applied to identify underlying factors. Factor loadings, eigenvalues, scree plots, and the cumulative variance explained were examined to determine the appropriate number of factors to retain.

The results of the assumption testing indicated that the data met the requirements for conducting EFA. The sampling adequacy was sufficient, as evidenced by the Kaiser-Meyer-Olkin measure for analysis (KMO=0.716) and individual items (KMO > 0.609), and the correlation between items was suitable for factor analysis, as indicated by Bartlett's test ($\chi^2=4174.53$, $df=28$, $p<0.001$).

Table 3 Factor loadings and communalities for the SAS (on agricultural livestock farming in general)

	Factor Loading			Communality
	1	2	3	
SAS 1	0.891			0.838
SAS 2	0.755			0.508
SAS 3		0.493		0.346
SAS 4		0.779		0.593
SAS 5		0.743		0.503
SAS 6			0.528	0.308
SAS 7			0.877	0.639
SAS 8			0.577	0.554

Factor loadings below 0.3 are not reported

The obtained eigenvalues reveal three components above Kaiser's criterion of 1 and, in combination, explained 53.62% of the variance. The scree plot also shows an inflexion that justifies three components, leading to the final three component structure. Table 3 shows the factor loadings after rotation and communalities. The items that cluster on the same component suggest approximately the three-level continuum as theoretically proposed, except for item 6, which falls under the purview of the third component. A closer examination of its content reveals a comparatively lower degree of acceptance, conditional in nature. Consequently, it is less aptly categorized alongside the unequivocal acceptance items 7 and 8.

The unique positioning of item 6 within the SAS is implied by the results of four separate factor analyses conducted for each livestock category (Table 4). A three-component structure, as suggested by the scree plot, was consistently identified in all livestock categories. However, within the subsample of chickens used for egg production, the factor loading pattern of item 6 exhibited a distinctive characteristic. Specifically, it displayed simultaneous factor loadings on both the acceptance and intermediate components.

Based on the measures of factorial validity employed in our analysis, we have decided to treat item 6 as a distinct and specialized category. It represents a form of transformative acceptance in which the acceptance object is not unequivocally embraced but rather conditionally accepted, contingent upon the acceptance object undergoing desired changes to maintain acceptance.

4.1.2 Convergent validity—single-item measurement of acceptance

Our initial step in assessing convergent construct validity involved examining the correlations of individual social acceptance items and components with a single-item measurement of acceptance. This single-item measure asked participants a straightforward question: "To what extent do

Table 4 Factor loadings and communalities for the SAS (per livestock category)

	Pig			Cow			Chicken			Chicken (egg)		
	Factor Loading			Factor Loading			Factor Loading			Factor Loading		
	1	2	3	1	2	3	1	2	3	1	2	3
SAS 1			0.871	0.821	0.926	0.894		0.936	0.912		0.869	0.807
SAS 2			0.831	0.627	0.845	0.66		0.806	0.594		0.787	0.561
SAS 3	0.759			0.61	0.638	0.502	0.655		0.54	0.608		0.441
SAS 4	0.748			0.565	0.794	0.587	0.798		0.619	0.669		0.458
SAS 5	0.7			0.507	0.723	0.516	0.87		0.694	0.835		0.63
SAS 6		0.55		0.341	0.552	0.349	0.433		0.344	0.315	0.315	0.316
SAS 7		0.823		0.6	0.828	0.577	0.988		0.817		0.823	0.594
SAS 8		0.761		0.71	0.681	0.634	0.664		0.628		0.798	0.694

Factor loadings below 0.3 are not shown

Pig: KMO=0.73; KMO>0.562; $\chi^2=1321.92$, df=28, $p<0.001$;

Cow: KMO=0.715; KMO>0.574; $\chi^2=1357.88$, df=28, $p<0.001$;

Chicken: KMO=0.757; KMO>0.648; $\chi^2=1606.05$, df=28, $p<0.001$;

Chicken (egg): KMO=0.716; KMO>0.573; $\chi^2=1172.27$, df=28, $p<0.001$

you agree with the following statement: I accept agricultural livestock farming?" Participants responded on a 7-point Likert scale, with the endpoints labeled as "Do not agree at all (1)" and "Fully agree (7)."

This analysis had two primary objectives. First, we aimed to investigate whether the two components, acceptance and non-acceptance, showed positive or negative correlations with participants' general perception of straightforward acceptance. Second, we sought to demonstrate that strong correlations existed at the item level with various facets of social acceptance differentiation. Such findings would suggest that a single-item acceptance measure would provide only a diluted representation of acceptance, potentially overlooking crucial nuances inherent in this multifaceted construct.

Our results revealed a significant, negative correlation between the single-item acceptance measure and the non-acceptance component ($r=-0.243$, $p<0.001$), as well as its constituent items, SAS 1 ($r=-0.111$, $p<0.001$) and SAS 2 ($r=-0.321$, $p<0.001$), indicating a negative association. What is particularly significant, however, is that all other SAS items exhibited significant positive correlations with the single-item acceptance measure. This suggests that the single-item acceptance measure aggregates multiple acceptance concepts, despite some of them carrying distinct and contextually nuanced meanings. Both the acceptance ($r=0.351$, $p<0.001$) and intermediate ($r=0.338$, $p<0.001$) components demonstrated positive correlations with the single-item acceptance measure, as well as with all SAS items separately (Table 5). The strongest correlation was observed with SAS 7 ($r=0.396$, $p<0.001$), with a notable correlation also evident with SAS 5 ($r=0.323$, $p<0.001$). Nevertheless,

it is essential to acknowledge that SAS 5 represents a lower degree of acceptance, primarily due to its lack of alternatives and failure to convey the same level of acceptance as SAS 7.

4.1.3 Convergent validity—attitude and action dimension

To assess the convergent validity of the SAS, we selected two measures designed to evaluate its fundamental components: the attitude and action dimensions. In our analysis, we computed the average scores of the scale items of animal attitude and political mobilization for each participant and subsequently correlated them with the SAS components and individual SAS items.

For measuring the attitude component, we employed a modified version of the Animal Attitude Scale (AAS) (Herzog et al. 1991), focusing exclusively on items related to agricultural livestock farming.⁶ This scale assessed individuals' attitudes towards agricultural livestock farming using a fully labeled 5-point agreement scale. Sample items included statements such as "I find people too sentimental who are against keeping animals for meat" and "The production of cheap meat, eggs, and dairy products justifies the keeping of animals in agricultural livestock farming under intensive conditions."

⁶ To assess the applicability and reliability of the scale, we evaluated internal consistency reliability using Cronbach's alpha coefficient, with the coefficients for each scale indicating satisfactory levels ($\alpha>0.7$). To further validate the single-factor structure underpinning the scales, an exploratory factor analysis (EFA) was conducted. The results confirmed a single-factor structure with a proportion of average explained variance exceeding 0.5 and factor loadings greater than 0.5.

Table 5 Pearson correlation of the components of SAS and items for agricultural livestock farming with a single-item measure of acceptance

	SAS 1	SAS 2	SAS 3	SAS 4	SAS 5	SAS 6	SAS 7	SAS 8	SAS Acceptance	SAS Intermediate	SAS Non-acceptance
Single-Item Acceptance	-0.111**	-0.321**	0.196**	0.287**	0.323**	0.176**	0.396**	0.219**	0.351**	0.338**	-0.243**
M = 4.6											
SD = 1.69											

** $p < 0.001$; M = Mean; SD = Standard Deviation

To approximate the action component, we used a political mobilization scale (Moskalenko and McCauley 2009) designed to measure activism as a construct. Participants indicated their level of agreement on a fully labeled 5-point Likert scale with items assessing activism behaviors related to agricultural livestock farming. Examples included “It would be likely that I would donate money to an organization that advocates for agricultural livestock farming” and “It would be likely that I would volunteer for an organization that opposes agricultural livestock farming.”

Regarding attitude correlation, we hypothesized that, except for the non-acceptance component and its associated factors, all elements and components within the SAS would exhibit a positive correlation with assessments of attitude towards agricultural livestock farming. We based this hypothesis on the assumption that only the non-acceptance items overtly convey a negative perspective towards the acceptance object, which in this context is agricultural livestock farming. Therefore, we anticipated positive correlations for all other SAS items. Our correlation analysis confirmed significant positive correlations between the attitude assessment and both the acceptance and intermediate SAS components, as well as their individual items (SAS 3 to 8; Table 6). Notably, robust positive correlations were observed between AAS and SAS 4 ($r = 0.395$, $p < 0.001$) and SAS 5 ($r = 0.419$, $p < 0.001$). It is essential to note that the attitude scale displayed a negative correlation with the non-acceptance component of the SAS ($r = -0.102$, $p < 0.001$). However, within their respective subcomponents, only a significant negative correlation was identified with the item of SAS 2 ($r = -0.193$, $p < 0.001$).

The political mobilization scale was designed to capture the action component within the broader acceptance scale. We expected that the strong non-acceptance and acceptance components of the SAS would exhibit notably high correlations with the mobilization component. As anticipated, the most robust correlations were identified at the extreme ends of the SAS (SAS 1: $r = 0.609$, $p < 0.001$; SAS 8: $r = 0.519$, $p < 0.001$), as well as within the non-acceptance ($r = 0.619$, $p < 0.001$) and acceptance ($r = 0.475$, $p < 0.001$) components (Table 6).

It is noteworthy that all other items and the intermediate component also displayed significant positive correlations with the mobilization scale, although not as strong as those observed at the extremities of the SAS. This observation suggests that, specifically, the extreme cases could potentially serve as indicative markers for political mobilization and activism, whether in favor of or against the acceptance object.

Table 6 Pearson correlation of the components of SAS and items for agricultural livestock farming including the attitude and action dimension

	SAS 1	SAS 2	SAS 3	SAS 4	SAS 5	SAS 6	SAS 7	SAS 8	SAS Acceptance	SAS Intermediate	SAS Non-acceptance
Animal Attitude M = 3.19 SD = 0.91	0.016	− 0.193**	0.210**	0.395**	0.419**	0.141**	0.335**	0.275**	0.349**	0.430**	− 0.102**
Political Mobilization M = 2.24 SD = 0.9	0.609**	0.514**	0.256**	0.221**	0.076**	0.281**	0.311**	0.519**	0.475**	0.231**	0.619**

** p < 0.001; M = Mean; SD = Standard Deviation

4.2 Criterion validity and its relation to relevant measures

Criterion validity, an essential metric for evaluating the effectiveness of a test or assessment tool in predicting an individual's performance or behavior in a specific criterion or desired outcome (American Psychological Association 1954), quantifies the degree to which test scores are related to scores on a designated criterion. Ideally, a test demonstrates criterion validity when it can accurately predict “criterion” behavior, which refers to actions or outcomes outside the test setting.

In this study, due to the use of a comprehensive survey, we were limited to assessing concurrent validity exclusively. Concurrent validity, a subset of criterion validity, evaluates the extent to which scores obtained from a scale align with a relevant criterion measured simultaneously. The only criterion in this study that allows extrapolation to actual behavior outside the survey context relates to self-reported dietary habits, specifically whether individuals identify as vegetarian/vegan or not. To assess the concurrent validity of the SAS, a significance test was conducted to determine whether these two groups could be meaningfully differentiated based on their scores on the SAS.

With substantial sample sizes within each criterion category (non-vegetarian/non-vegan $n = 1,749$; vegetarian/vegan $n = 119$), a Welch's t-test was performed on each component and item of the SAS. The sample sizes provide a reasonable basis to assume the robustness of the underlying Welch's t-test, including independence, random sampling, and normality. Significant and practically meaningful differences between the vegetarian/vegan and non-vegetarian/non-vegan groups were observed (Table 7), particularly regarding the non-acceptance component ($F(1, 133.99) = 130.92$, $p < 0.001$, $\eta^2 = 0.067$), as well as its two specific SAS items (SAS 1: $F(1, 129.69) = 63.74$, $p < 0.001$; $\eta^2 = 0.044$; SAS 2: $F(1, 135.4) = 139.63$, $p < 0.001$; $\eta^2 = 0.067$). In these cases, the vegetarian/vegan group displayed significantly higher scores than the non-vegetarian/non-vegan group. All other observed differences did not reach statistical significance or were associated with an effect size (η^2) of less than 0.01, indicating negligible practical relevance.

During the validation process, it would have been ideal to directly assess the predictive validity of the SAS concerning actual behavior. However, such an assessment was beyond the scope of the validation study. Nevertheless, the survey successfully captured certain pertinent constructs that may hold significance for acceptance among individuals and policymakers. Even though these constructs primarily reflect stated behaviors or attitudes, they have the potential to offer preliminary insights into the predictive capabilities of the SAS with regard to behavior.

Table 7 Welch's t-test results comparing the non-vegetarian/non-vegan with the vegetarian/vegan group on the SAS components and items for agricultural livestock farming

	Group	n	M(SD)	Welch statistic	df	p	η^2
SAS 1	Non-V V	1749 119	2.6(2.77) 5.06(3.28)	63.740	129.690	< 0.001**	0.044
SAS 2	Non-V V	1749 119	3.53(2.97) 6.78(2.9)	139.626	135.397	< 0.001**	0.067
SAS 3	Non-V V	1749 119	4.59(2.66) 3.91(3.25)	5.081	128.947	0.026	0.004
SAS 4	Non-V V	1749 119	3.88(2.9) 3.24(3.35)	4.072	130.303	0.046	0.003
SAS 5	Non-V V	1749 119	4.58(2.75) 4.01(3.29)	3.420	129.446	0.067	0.003
SAS 6	Non-V V	1749 119	4.71(2.58) 4.82(3.03)	0.160	129.925	0.690	< 0.001
SAS 7	Non-V V	1749 119	4.41(2.81) 3.75(3.49)	4.055	128.590	0.046	0.003
SAS 8	Non-V V	1749 119	3.13(2.88) 3.09(3.19)	0.020	131.387	0.888	< 0.001
SAS Acceptance	Non-V V	1749 119	3.77(2.48) 3.42(3.05)	1.498	128.769	0.223	0.001
SAS Intermediate	Non-V V	1749 119	4.35(2.18) 3.72(2.94)	5.28	126.965	0.023	0.005
SAS Non-acceptance	Non-V V	1749 119	3.07(2.59) 5.92(2.64)	130.918	133.989	< 0.001**	0.067

**Significance bold values are $p, < 0.001$; Non-V, non-vegetarian/non-vegan, V, vegetarian/vegan, n, sample size, M, Mean, SD, Standard Deviation, df, degrees of freedom, p, significance level, η^2 , effect size

In this context, three constructs were measured using validated scales, which could serve as approximations for relevant consumer behavior. These included perceived urgency (Weigel and Weigel 1978; Cruz and Manata 2020), ambivalence against meat consumption (Berndsen and Pligt 2004), and satisfaction with the government's performance concerning agricultural livestock farming (Proner and Proner 2011). To investigate whether the SAS can effectively distinguish between these constructs, we conducted median split Welch's t-tests for each SAS construct and its items. Significance levels and effect sizes were employed to assess the potential criterion validity of the SAS in approximating these constructs. The results tables are presented in the Supplementary Information (Tables S1–S3).

4.2.1 Perceived urgency

To gain early insights into potential issues and identify critical acceptance objects in their development, it is valuable to consider perceived urgency as a criterion that the SAS could effectively differentiate. Perceived urgency was assessed using a fully labeled 5-point Likert scale, where participants were asked to rate their perceived urgency concerning agricultural livestock farming on three items (Weigel and Weigel 1978; Cruz and Manata 2020). Sample items included statements such as “The federal government will have to take tough measures to change agricultural livestock

farming because few people will adjust their consumption patterns to do so” and “I would be willing to make personal sacrifices to change agricultural livestock farming, even if the immediate results of doing so are not directly apparent.”

During the reliability checks, one item had to be removed to ensure adequate internal consistency (Cronbach's alpha coefficient $\alpha > 0.7$; average explained variance proportion > 0.5 ; and factor loadings > 0.5). The scale items were then averaged for each participant to construct the perceived urgency factor and facilitate the subsequent median split analysis (Median = 4).

The results of the Welch's t-test indicated that, despite small effect sizes, the non-acceptance and intermediate components of the SAS can effectively and significantly distinguish differences in perceived urgency concerning agricultural livestock farming. Notably, SAS 5 appears particularly effective in discriminating between individuals who perceive high or low urgency regarding agricultural livestock farming, with individuals perceiving lower urgency scoring higher on this specific item. Therefore, when perceived urgency regarding the acceptance object is high, the tolerance or acquiescence (SAS 5) tends to be lower.

4.2.2 Ambivalence against meat consumption

As discussed in the introduction, we explored the disparity between self-reported meat consumption and actual

meat purchases. The criterion of vegetarian/vegan dietary already demonstrated that the SAS can effectively differentiate between vegetarian/vegan groups and meat consumers. However, an early indicator of a potential shift in meat consumption may be the perception of conflict experienced by consumers during meat consumption. To measure this perceived conflict, participants were asked to express their attitude towards eating meat on a 7-point scale, ranging from “Feel no conflict at all (1)” to “Feel maximum conflict (7).”

In analyzing the results of the median split on this item (Median = 5) using Welch's t-test, it became evident that the non-acceptance component, and more specifically, SAS 2, played a significant role in differentiating individuals in relation to this factor. Those who reported feeling a greater conflict with meat consumption scored significantly higher on these components of the SAS, and this differentiation was associated with a substantial effect size.

4.2.3 Satisfaction with the government performance in agricultural livestock farming

A critical aspect for policy considerations is the assessment of respondents' satisfaction with the government's performance in the context of agricultural livestock farming. This assessment was conducted at the beginning of this survey, with participants asked to express their level of satisfaction with the federal government's current performance regarding agricultural livestock farming using a 5-point Likert scale. However, a substantial number of respondents provided ratings at the midpoint of the scale (point 3). To ensure a more distinct analysis, cases falling within this midpoint were excluded, and the extreme cases, specifically those who rated their satisfaction at scale points 1, 2, and 4, 5, were exclusively analyzed.

Subsequently, a Welch's t-test was conducted to compare these two groups based on their satisfaction levels with government performance concerning agricultural livestock farming. The results revealed that the acceptance and indifference components of the SAS, along with their respective items, were effective in distinguishing between individuals who reported satisfaction and those who did not regarding the government's performance in this domain. Specifically, individuals who expressed satisfaction tended to score higher on the indifference and acceptance items within the SAS. However, it is noteworthy that the effect size for the SAS 6 item was less substantial compared to the intermediate and acceptance items. This implies that these particular items, particularly those within the acceptance and indifference components, hold specific relevance for policymakers aiming to assess the current satisfaction levels of respondents in the context of agricultural livestock farming and government performance.

5 Discussion

The introduced SAS of this study represents a pioneering methodology for quantifying distinctions in acceptance, offering valuable insights into the early identification of pivotal developments. This paper has elucidated the comprehensive process undertaken to develop the scale, highlighting how each phase significantly enhanced its content validity. Subsequent construct validation procedures have substantiated the scale's capacity to categorize its constituent elements in alignment with its theoretical underpinnings.

Of paramount significance for the prospective utility of the scale is the examination of criterion validity, which, within the scope of this contribution, could only be approximated using pertinent constructs. Our analysis underscores that it is chiefly the extremities of the scale that may unveil preliminary indications of critical developments, often associated with the propensity for mobilization. Particularly noteworthy in this context is the non-acceptance component, which appears to be especially relevant. We posit that longitudinal or panel surveys may facilitate the detection of critical developments or acceptance objects that may pose challenges over time.

Conversely, the intermediate component of the scale appears to denote contentment with the prevailing circumstances. Notably, the assessment of SAS 6 seems less aligned with this contentment. It may, instead, indicate a decline in satisfaction when a perceptible change is underway but has yet to translate into activism. This observation is consonant with the content of the respective scale item, suggesting a temporal divergence between the perception of change and the onset of activism.

6 Future research and limitations

Nevertheless, to affirm the applicability and predictive capability of the SAS, additional validation studies are indispensable, with a particular emphasis on scrutinizing criterion validity beyond the confines of survey responses. Unfortunately, this investigation could not be pursued within the current survey's scope, and the evaluation of potential criteria was confined to assessments conducted within the same testing session. A prospect research lies in conducting empirical behavioral studies, incorporating variables pertinent to purchasing behaviors, participation in organizational affiliations, or engagement in demonstrations against acceptance objects.

Moreover, it is imperative to explore the converse perspective, encompassing an assessment of engagement in

activities aimed at fostering an understanding of agricultural livestock farming. Ideally, the SAS should find routine application in survey monitoring, thereby demonstrating its efficacy in the early detection of pivotal developments and discerning which acceptance objects carry particular social significance. This entails comparative evaluations across diverse acceptance objects in the context of agricultural livestock farming and extending the scale's utility to alternative application domains. Such a strategy permits the investigation of socially relevant thematic areas undergoing transformative processes, for instance, the energy market transformation, with the SAS serving as a tool for measuring acceptance dynamics during these transformations.

Furthermore, the SAS demonstrates its versatility by enabling the detection of changes both within scale levels and across constituent components. While the scale predominantly assesses enduring general attitudes that exhibit at least moderate stability over time, a pertinent avenue for future research resides in probing its capacity to capture short-term fluctuations, such as those observed during interventions. It is conceivable that future research may consider and validate using a shorter scale point length, potentially substituting the current 11-point scale with a 5- or 7-point scale division. To date, the scale has solely undergone evaluation based on average values aggregated across various studies; however, alternative analytical methods warrant exploration in forthcoming research endeavors. This includes exploring potential relationships between levels of acceptance and non-acceptance to detect potential imbalances that could signal shifts in social sentiment.

In conclusion, the continued validation and broad adoption of the proposed SAS within the scientific community represent critical steps towards its refinement and broader applicability, with research outcomes poised to enrich its future development and utility.

Supplementary Information The online version contains supplementary material available at <https://doi.org/10.1007/s00003-024-01490-z>.

Acknowledgements The elucidations presented herein have benefited significantly from extensive dialogues and exchanges with our colleagues, whose insights and contributions we sincerely appreciate. We extend our gratitude to all the collaborators involved in the collaborative initiative “SocialLab II – Akzeptanz durch Innovation” with special recognition for our supervisor, Prof. Dr. Peter Kenning, and our colleagues at the Rheinische Friedrich-Wilhelm-Universität Bonn, in particular, Dr. Johannes Simons.

Funding Open Access funding enabled and organized by Projekt DEAL.

Declarations

Conflict of interest This research received financial support from the Federal Ministry of Food, Agriculture, and Consumer Protection (Bundesministerium für Ernährung und Landwirtschaft), based on a

resolution of the Deutsche Bundestag. The authors declare that they have no conflict of interest.

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