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Analyzing factors influencing dairy farmers' intention to implement animal welfare practices: a case study of Germany

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In context of the growing focus on animal welfare in dairy farming, this study explores the behavioral intention to implement animal welfare (AW) practices among dairy farmers in Germany. Within this investigation, AW practices are defined as targeted practices to enhance dairy cows' well-being. A quantitative survey of 682 farmers was conducted. The results of a regression analysis revealed that striving for continuous enhancement, along with intrinsic motivation, significantly drives the intention to implement AW practices. Additional efforts and costs do not influence dairy farmers' intention. A collective, sector-wide effort is essential to ensure that farmers have the necessary freedom to navigate respective changes by providing the necessary structural backing to sustain meaningful improvements in animal welfare.

KEYWORDS

behavioral intention, dairy farming, animal welfare practices, animal welfare certification schemes, dairy sector

1 Introduction

Animal welfare in livestock farming is increasingly discussed from an ethological, veterinary, and societal perspective (Lusk and Norwood, 2012; State Institute for the Development of Agriculture and Rural Areas, 2016; Theuvsen et al., 2016; Hölker et al., 2019; de Andreia and Raymond, 2020; de Briyne et al., 2020; Vigors et al., 2021). Demands for improved husbandry conditions and animal welfare are on the rise (Winkel et al., 2020). The European Union has some of the strictest standards for animal welfare in the world (European Court of Auditors, 2018; Montanari et al., 2021). Still, European politicians actively seek to further improve animal welfare in livestock farming. As part of the Farm-to-Fork strategy, the European Commission is planning an animal welfare label for all species to enhance transparency and prevent disadvantages faced by animal products from EU Member States with stricter laws (European Commission, 2020; Montanari et al., 2021).

Germany is the largest milk producer in the European Union, producing 31.9 million tons in 2022 (Federal Statistical Office of Germany, 2022). Germany is also the world's largest exporter of unsweetened milk, accounting for 1.560 million USD and a global market share of 13.3% in 2022 (International Trade Centre, 2023). Given the economic significance of dairy production, ensuring high standards of animal welfare has become a central concern in both public discourse and agricultural policy. In Germany, animal welfare is a widely discussed and regulated issue. It is anchored in the Animal Welfare Act (TierSchG, 2006) and the Livestock Farming Ordinance (TierSchNutztV, 2006), which define requirements for the species-appropriate housing, feeding, and care. Compared to other EU member states, Germany often goes beyond the minimum requirements set by EU directives, with national regulations providing more detailed and specific provisions (Vogeler, 2019b).

Besides these extrinsic motivators—such as legal requirements and market-driven expectations—farmers can voluntarily participate in private animal welfare schemes, which are further driven by initiatives from the food retail sector (cf. Vogeler, 2019a). In 2022, German food retailers implemented animal husbandry labeling of fresh dairy products, ranging from level 1 (legal minimum standard) to level 4 (pasture-based farming and organic) (Wehner and van Rennings, 2023). The labeling levels are based on predefined criteria such as space allowance, access to outdoor areas, housing type, feeding practices, enrichment (e.g., brushes), and animal health monitoring (Haltungsform, 2024). In 2024, level 4 was further differentiated by introducing a separate level 5 for certified organic products, which are no longer included in level 4 (Klein, 2024). Since 2024, a major discount food retailer has only offered drinking milk that meets at least level 3 of the animal husbandry labeling system (Wehner and van Rennings, 2023) and has switched to German-origin milk only (Schneider and Inden, 2022). Given changing legal frameworks, such as the new animal husbandry labeling law enacted in August 2023 (TierHaltKennzG, 2023), and rising consumer and retailer demands, dairy farmers must comply with animal welfare requirements to market their milk. This necessitates strategies to implement animal welfare (AW) practices that potentially support the animals' long-term physical and psychological well-being and meet existing standards. While economic incentives may initiate change, Verplanken and Orbell (2022) emphasize that extrinsic rewards are not likely to lead to long lasting behavior changes. Owusu-Sekyere et al. (2022) further suggest that farmers are often driven by motivations beyond profit, which aligns with studies showing non-monetary drivers behind sustainability actions (cf. Darnhofer et al., 2005; Howley, 2015; Mills et al., 2018; Dessart et al., 2019). In line with this, dairy farmers also pursue animal welfare improvements based on non-use values—such as the desire to ensure animal well-being regardless of direct economic benefits (Hansson et al., 2018). At the same time, improving animal welfare can contribute to better economic farm performance by reducing production costs and increasing animal productivity (Lagerkvist et al., 2011).

In this study, AW practices refer to measures that are generally associated with improved animal welfare and align with societal and market expectations, such as access to pasture, adequate housing, and herd health management. Given the growing societal interest in animal welfare, it is important to understand the underlying motivations that lead dairy farmers to consider the implementation of such practices. However, as stated by Balzani and Hanlon (2020), the responsibility for improving animal welfare should not lie with farmers alone. Achieving meaningful progress requires a shift from individual to shared responsibility. This means acknowledging the critical roles not only of farmers but also of veterinarians, advisors, researchers, policymakers, the retail sector, and consumers. All actors involved in livestock production must recognize their part and actively contribute to advancing animal welfare. In this context, the communication strategy plays a crucial role, as it not only informs farmers but also shapes their perceptions of animal welfare and their role in the process (Balzani and Hanlon, 2020). Nonetheless, farmers remain the central actors in the practical implementation of animal welfare improvements on farms. Therefore, understanding their motivations is crucial for designing effective and supportive frameworks. The aim of this study is to identify the factors influencing dairy farmers' intention to implement AW practices and to derive recommendations for supportive political and industry frameworks.

The focus on AW practices sets this study apart from previous studies that have examined farmers' intention to participate in sustainability or AW programs (e.g. Luhmann et al., 2016; Heise and Theuvsen, 2018; Heise and Schwarze, 2020; Wellner et al., 2020). Existing literature does not address if dairy farmers are willing to improve animal welfare in the long term. Müller and Gräfe (2019) note that increasing demands on animal welfare in dairy farming present challenges for farm managers, often involving high financial costs (Müller and Gräfe, 2019), time, and personnel commitment, such as documentation efforts, stress from unannounced controls, and time-consuming inspections (Schukat et al., 2019; Wellner et al., 2020). Many farm managers find these challenges burdensome and may be unwilling or unable to address them. Importantly, these challenges are not necessarily linked to the implementation of AW practices (cf. Schukat et al., 2019, 2020). Instead, they are related to participation in AW programs. Participation in an AW program is not mandatory for better animal welfare and many farmers are willing to improve animal welfare on their farms, but do not want to officially participate in AW programs for distinct reasons (e.g., high documentation effort). To explore the factors influencing the intention to implement AW practices on farms, an empirical quantitative study was conducted among 682 dairy farmers in Germany. This paper is one of two publications based on the same dataset. While the first article (Grotsch et al., 2025) introduces and examines the new construct Continuous Enhancement (CE) and focuses on its role in sustaining animal welfare improvements over time, the present study adopts a broader analytical approach by incorporating two additional constructs namely Trust in animal welfare controls and enforcement (TR) and Self-perception of own animal husbandry (OH). Additionally, it includes a wider range of control variables and places greater emphasis on practical implications and contextual interpretation within the dairy sector.

The rest of the paper is organized as follows: Initially, the theoretical and empirical framework, experimental design, and analysis procedure are elucidated; subsequently, the findings are presented, succeeded by a discussion thereof; and lastly, concluding remarks are provided, including recommendations to enhance animal welfare in the dairy sector.

2 Research framework and methodology

2.1 Theoretical framework

This study aims to comprehend dairy farmers' intention to implement AW practices on their farms. Thus, it is necessary to analyze which factors influence this intention. To conceptualize farmers' intention, which is the dependent variable in the following regression analysis, and its influencing factors, this study utilizes the Unified Theory of Acceptance and Use of Technology (UTAUT) model by Venkatesh et al. (2003) and its extension (UTAUT2) by Venkatesh et al. (2012).

The UTAUT model is a model of decision making from social psychology. It was chosen for this study as it can be expected that the behavior in question is not just a profit-maximizing issue but can also be influenced by other individuals and intrinsic motivations (Howley, 2015). The UTAUT model was initially designed for analyzing technology acceptance and usage (Venkatesh et al., 2003). The original UTAUT model contains the factors 'Performance expectancy', 'Effort expectancy', 'Social influence', and 'Facilitating Conditions' as direct determinants of both intention and behavior (Venkatesh et al., 2003). Later, the UTAUT model was modified by Venkatesh et al. (2012). Intensive investigation, drawing on a multitude of published adoption studies that referred to the original UTAUT model, prompted the introduced modifications. In specific instances, researchers expanded upon the existing constructs. Venkatesh et al. (2012) complemented the pre-existing UTAUT constructs by including 'Price value', 'Habit', and 'Hedonic motivation' as direct determinants in the expanded research model (Venkatesh et al., 2012).

Bagozzi (2007) criticized the UTAUT model for being overly complex. In contrast, the Theory of Planned Behavior by Ajzen (1985), which was considered for application in this study as well, is less complex and extensive, yet more general in explaining behaviors. Despite its specific technology-oriented theory, the UTAUT model by Venkatesh et al. (2012) proves adaptable to various contexts, as evidenced by its successful application in studies related to farmers' acceptance of animal welfare (Schukat et al., 2019; Wellner et al., 2020) or to farmers' acceptance of sustainability practices (Faridi et al., 2020). The model, tested in various geographical contexts (Ronaghi and Forouharfar, 2020), has been effectively utilized within the agricultural technology context as well (e.g. Wu, 2012; Beza et al., 2018; Ronaghi and Forouharfar, 2020; Grothkopf and Schulze, 2021). The UTAUT model's more detailed distinction of constructs provides a more precise identification of factors influencing individuals' behavior. This enables more concrete recommendations for action. Therefore, the UTAUT model serves as the foundation for the conceptual framework of this study.

In total, 12 constructs were incorporated into the theoretical research model of this study: eight from Venkatesh et al. (2003) and Venkatesh et al. (2012), two from other studies with a similar research question (Heise and Theuvsen, 2016, 2018), and two supplementary (Yi et al., 2006; Beza et al., 2018). Figure 1 illustrates the theoretical model and the hypotheses (H1–H11) tested in this study. It combines the UTAUT framework with additional constructs relevant to animal welfare and serves as the conceptual basis for the analysis. Table 1 provides an overview of all constructs used in the study, including their abbreviations, theoretical origin, and the sources from which the respective survey items were derived. A short description of each construct is provided below.

The first construct Performance expectancy (PE) describes the economic benefits that dairy farmers expect from the implementation of higher standard AW practices. Effort expectancy (EE) describes the additional time, financial, and cognitive effort that dairy farmers expect by implementing AW practices. Social influence (SI) describes the influence of media, politics, and consumer behavior on dairy farmers' intention to adopt AW practices. Facilitating Conditions (FC) assesses AW practice implementation feasibility for dairy farmers. Hedonic Motivation (HM) outlines the intrinsic motivation for implementing AW practices, which—unlike extrinsic motivators such as financial incentives—is driven by personal satisfaction and conviction (see also Morris et al. (2022), on the distinction between intrinsic and extrinsic motivation). Price Value (PV) evaluates dairy farmers' financial efforts related to AW practice implementation compared to the benefits. Habit (HA) describes the extent to which dairy farmers already consider it a habit to continuously improve animal welfare on their farms.

The four additional constructs that are included in the theoretical research model are as follows: Innovativeness (INV) reflects farmers' intention to try higher standard AW practices. Mastery-approach Goal (MAG) reflects dairy farmers' ambition to achieve as many competences as possible in the field of AW practice implementation and animal welfare improvement. TR displays dairy farmers' confidence in the detection of animal welfare guideline violations during inspections. A robust control system benefits all farmers by detecting non-compliance early and thereby mitigate potential damage to the dairy sector's reputation. OH captures farmers' own evaluation of their animal welfare.

The relationships between these constructs and farmers' intention to implement AW practices are summarized in the hypotheses presented in Table 2.

2.2 Empirical framework and analysis procedure

Between October and December 2022, while milk prices were relatively high but already trending downwards, a standardized

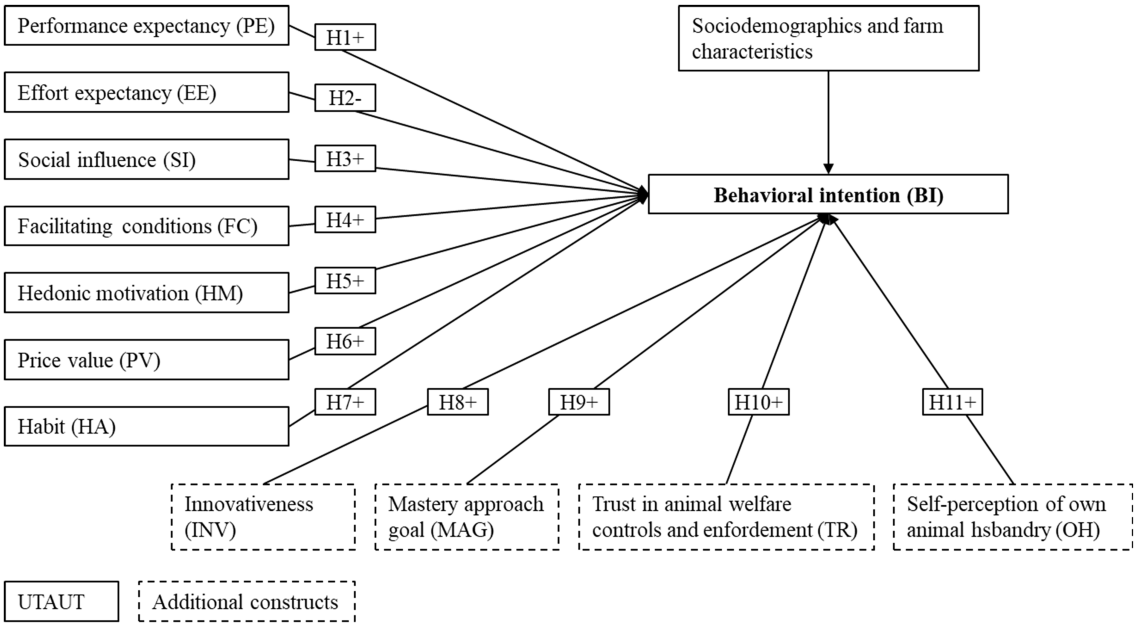

FIGURE 1
Hypothesizes model.

web-based and in-person survey was conducted with 1,401 farming related persons in Germany. During data cleaning, 719 respondents were removed, including 302 who did not operate a dairy farm, resulting in a final sample of 682 dairy farmers. Additional exclusions included minors, individuals without decision-making authority (e.g., interns or part-time workers) and straightliners. In addition, certain statements in the questionnaire were used as control questions to exclude more respondents. The sample is a convenience sample. The data (n = 682) was collected online (59.1%) and in-person (40.9%) using TIVIAN's web-based survey software Unipark. The survey was distributed via social media, farmers' and rural women's associations, and email. University students conducted the in-person interviews as part of a course. The questionnaire contains seven questions on the respondent's socio-demographics, twelve on dairy farms and farm structures, and four on animal welfare standards. In addition, four matrices derived from previous studies with a total of 54 statements were included. The statements utilized a five-point Likert scale, ranging from 1 = 'Fully disagree' to 5 = 'Fully agree'. Respondents were partly or fully responsible for the dairy farms, so it can be assumed that they are involved in decisions about the implementation of higher standard AW practices. The data was analyzed using IBM SPSS Statistics 27 (version 27.0.0.0) and Microsoft Excel 2016 (version 16.0).

To classify the sample, as well as to be able to derive initial conclusions, descriptive analyses were first examined. Subsequently, all statements were included in a principal axis factor analysis (PAF) with varimax rotation to reduce the dimensions of the data. The Kaiser-Meyer-Olkin criterion (KMO ≥ 0.6; c.f. Backhaus et al. (2016)), Bartlett's test for sphericity (must be significant; (cf. Field, 2018)), and reliability analysis (Cronbach's alpha Cα ≥ 0.7; (cf. Schmitt, 1996)) were used as quality criteria. Variables with a factor loading below 0.4 were excluded (Peter, 1999). To examine the impact of factors derived from PAF and other potential influencers on dairy farmers' intention to adopt AW practices, a multivariable linear regression analysis was conducted. The dependent variable, a factor from PAF, is based on the following three statements: (1) 'I am generally willing to participate in new animal welfare programs.', (2) 'I intend to implement new animal welfare practices on my farm in the future.', (3) 'I plan to improve animal welfare of the cows I keep on my farm', derived from Heise and Theuvsen (2016). The statement (1) was included because participation in an AW program is consistently linked with implementing practices for animal welfare improvement. It reflects a general intention to participate rather than actual participation.

Quality criteria, such as the Durbin-Watson statistic (ideally near 2), variance inflation factor (< 10), analysis of standardized residuals for outliers (values < -3 and > 3, a maximum of 5% of values < -2 or > 2), and tests for normal distribution, linearity, and homoscedasticity of residuals were employed (cf. Field, 2018).

3 Results

3.1 Descriptive statistics

Table 3 provides an overview of the survey and sample.

Figure 2 illustrates the response patterns of dairy farmers concerning their intention to implement AW practices. These statements, as described earlier, form a factor that serves as the dependent variable in the multivariable regression analysis conducted in this study. The findings indicate a notably high

TABLE 1 Constructs used in the study and their theoretical foundations.

Construct		Theoretical Origin	Sources of Items
Performance expectancy	PE	UTAUT (Venkatesh et al., 2003)	Heise and Theuvsen (2018); Luhmann et al. (2016); Wellner et al. (2020)
Effort expectancy	EE	UTAUT (Venkatesh et al., 2003)	Wellner et al. (2020); Luhmann et al. (2016); Enneking et al. (2007)
Social influence	SI	UTAUT (Venkatesh et al., 2003)	Wellner et al. (2020)
Facilitating conditions	FC	UTAUT (Venkatesh et al., 2012)	Wellner et al. (2020); Luhmann et al. (2016); Venkatesh et al. (2012)
Hedonic motivation	HM	UTAUT (Venkatesh et al., 2012)	Venkatesh et al. (2012)
Price value	PV	UTAUT (Venkatesh et al., 2012)	Wellner et al. (2020)
Habit	HA	UTAUT (Venkatesh et al., 2012)	Beza et al. (2018); Grothkopf and Schulze (2021); Yi et al. (2006)
Innovativeness	INV	Personal Innovativeness in IT (Yi et al., 2006)	Yi et al. (2006); Beza et al. (2018)
Mastery-approach goal	MAG	Beza et al. (2018)	Beza et al. (2018) and Grothkopf and Schulze (2021)
Trust in animal welfare controls and enforcement	TR	Schulze et al. (2008)	Schulze et al. (2008)
Self-perception of own animal husbandry	OH	Heise and Theuvsen (2016)	Heise and Theuvsen (2016)

Full item wordings and corresponding sources are provided in the Supplementary Material.

intention among dairy farmers to enhance animal welfare on their farms, with a mean value (MV) of 4.29 on a scale of 1 = 'Fully disagree' to 5 = 'Fully agree'. Additionally, there is a substantial intention to adopt higher standard AW practices (MV = 3.87) and to participate in AW programs (MV = 3.79). Still, it is noteworthy that 86% of the respondents express a desire to enhance the welfare of their dairy cows, but only 66% are generally willing to participate in an AW program. This difference highlights the importance of examining farmers' behavioral intention to implement AW practices and thereby enhance animal welfare, independently of formal program participation.

3.2 Factor identification

In this study, a PAF (see Supplementary Table 1) was employed to reduce the complexity of the data. Almost all quality criteria are fulfilled, except for the following: The Cα-values of EE, FC and PV are slightly below the threshold of 0.7. Yet, these factors were not excluded from further analysis, as they are plausible in context and according to Schmitt (1996), Cα-values below 0.7 can also be considered reliable. The factor model explains a total variance of 53.79%.

In all, 28 variables were included, from which nine factors were derived. These factors partially differ from the underlying constructs outlined in the original studies: The first factor Continuous enhancement (CE) consists of statements that are assigned to the constructs HA and INV. This amalgamation suggests that the implementation of higher standard AW practices (INV) has already become habitual (HA) and routine among dairy farmers. Hence, CE describes the dairy farmers' attitude towards continuously enhancing animal welfare on their farm. The construct MAG, proposed in the theoretical model (see Figure 1), did not emerge during the factor analysis.

TABLE 2 Hypotheses for the proposed model.

H1+	There is a significant positive influence from PE to the farmers' Behavioral intention.
H2-	There is a significant negative influence from EE to the farmers' Behavioral intention.
H3+	There is a significant positive influence from SI to the farmers' Behavioral intention.
H4+	There is a significant positive influence from FC to the farmers' Behavioral intention.
H5+	There is a significant positive influence from HM to the farmers' Behavioral intention.
H6+	There is a significant positive influence from PV to the farmers' Behavioral intention.
H7+	There is a significant positive influence from HA to the farmers' Behavioral intention.
H8+	There is a significant positive influence from INV to the farmers' Behavioral intention.
H9+	There is a significant positive influence from MAG to the farmers' Behavioral intention.
H10+	There is a significant positive influence from TR to the farmers' Behavioral intention.
H11+	There is a significant positive influence from OH to the farmers' Behavioral intention.

TABLE 3 Sample description.

Survey, participants, and general farm information		Dairy cows' and husbandry parameters	
Survey period: October – November 2022		Lactating cows per farm (MV)	183.2
Number of participants	682	Milk yield of cows (kg, MV)	9,530.1
Average age (in years, MV)	35.9	Grazing available (%)[2]	37.0
		Tethered housing (%)[3]	5.3
Sex (%)[1]		**Succession (%)**	
Male	78.4	Planned to occur before 2032	55.8
Female	20.8	Planned to occur before 2032 and farm succession secured	42.2
Region (%)		**Farm vision (%)**	
North	68.5	Invest and expand production	44.1
East	5.0	Maintain production	48.4
South	18.5	Reduce or abandon production	7.5
West	6.7		
Type of farming (%)			
Conventional	93.3		
Organic	6.5		
In conversion to organic	0.3		
		Number of employees (MV)	4.6

The sample size is 682; MV, mean value; [1]remainder: not specified; [2]at least 120 days a year for at least six hours a day; [3]for lactating cows, dry cows, or young animals.

3.3 Analysis of factors influencing dairy farmers' intention to implement animal welfare practices

A multivariable linear regression analysis was conducted to analyze dairy farmers' intention to implement AW practices. Figure 3 visually summarizes the estimated model, which includes 15 variables: the factors of the PAF, two individual statements, three dummy variables, and one additional metric variable. It displays all included variables, their standardized regression coefficients, and significance levels, thereby highlighting which factors significantly influence farmers' intention (significant coefficients are displayed in bold). The dummy variable D1 is included in the model as it is assumed that farmers who intend to expand their production are more likely to adopt higher standard AW practices to meet future consumer and food retailer expectations. Moreover, dairy farmers with an agricultural degree (D2) are likely to have a greater understanding of the advantages of adopting higher standard AW practices, leading to improved animal well-being. D3 was integrated due to the importance of providing pasture access for cows in numerous AW programs, a criterion frequently emphasized by the public. Farmers who already meet this requirement are presumed to have a higher intention to adopt AW practices. Besides, two individual statements (S1, S2) were included in the regression analysis in addition to the factors as they are crucial in content but did not align with any specific factor during the PAF.

The regression analysis fulfills all of the quality criteria. The Durbin-Watson statistic is 1.840. This leads to the assumption of uncorrelated residuals. Multicollinearity can also be ruled out (VIF values < 1.384; largest condition index = 17.01). After exclusion of eight cases, the case-by-case diagnosis shows no outliers of the standardized residuals (standard residuals between −2.675 and

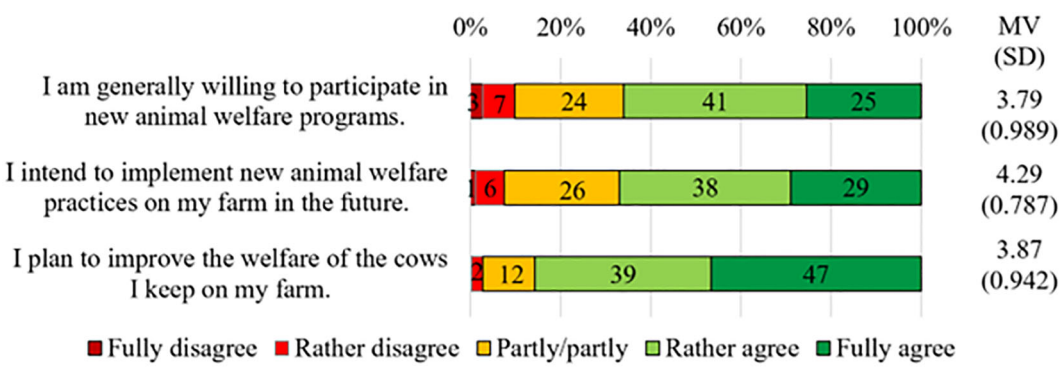

FIGURE 2
Intention to implement animal welfare pratices. The sample size is 682; MV, mean value; SD, standard deviation.

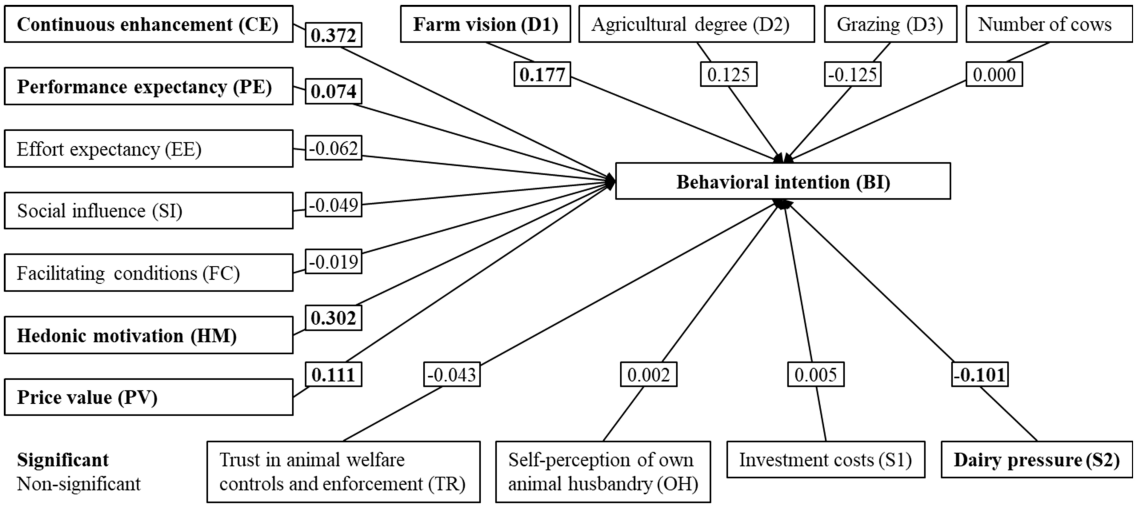

FIGURE 3
Determinants on the intention to implement animal welfare practices. The sample size is 674; The metric values correspond to the non-standardized beta coefficients; Bolded beta coefficients indicate a significant impact within the regression model, with a significance level of $p < 0.05$.

2.531). The assumptions of normal distribution, linearity, and homoscedasticity of the residuals are fulfilled. The regression analysis is highly significant. The estimated regression model explains 36.8% of the total variance.

To measure dairy farmers' intention to implement AW practices, a factor from the three statements (1) 'I am generally willing to participate in new animal welfare programs.', (2) 'I intend to implement new animal welfare practices on my farm in the future.', and (3) 'I plan to improve animal welfare of the cows I keep on my farm.' was formed as the dependent variable in the regression model (CA = 0.612). Out of a total of nine factors, four have a significant influence on the dairy farmers' intention to implement AW practices. Additionally, one out of three dummy variables and one out of two individual statements have a significant influence (see Figure 3).

4 Discussion

There is a growing demand for improved livestock conditions, which poses major challenges for farmers. To fulfil market requirements, dairy farmers must implement increased requirements to continuously improve animal welfare on their farms. This enables farmers to participate in AW programs. Still, many farmers are willing to improve animal welfare on their farms, but do not want to officially participate in AW programs for various reasons. This studies' results highlight this discrepancy, as illustrated in Figure 2. Consequently, this paper investigates the intention of dairy farmers in Germany to implement AW practices. The study distinguishes itself from the existing literature by focusing on the intention to implement AW practices, rather than examining the factors influencing only the intention to participate in AW programs. So far, only a few studies (Luhmann et al., 2016; Heise and Theuvsen, 2018; Schröter and Mergenthaler, 2021) that examine the intention of dairy farmers to participate in AW programs exist. Studies analyzing the behavioral intention of dairy farmers in relation to the implementation of higher standard AW practices could not be identified in the literature. For this reason, the present study provides new insights that can contribute to further animal welfare improvements in dairy farming.

The surveyed sample (n = 682; see Table 3) is not representative for the population of dairy farmers in Germany. With an average farm size of 183 cows per farm, which is considerably above the national average of 73 cows, the results are more representative of larger, forward-looking farms with young managers. In addition, it is important to consider that the sample includes responses from participants who were surveyed as part of a student course. Therefore, it is a convenience sample. This aspect introduces a potential selection bias, since these participants may not fully represent the broader population of dairy farmers, as evidenced by the non-representativeness of the sample. Moreover, the characteristics of the sample—such as a higher share of younger, growth-oriented farmers—may have influenced the strength of certain relationships observed in the model. It seems plausible that younger farm managers are more receptive to digital solutions and more willing to adopt new practices—especially on farms that are expected to expand in the future, where digitalization is often seen as essential. This may have led to a more favorable assessment of digital solutions than would be expected in a more diverse sample. While the convenience sample allows for practical data collection, future research could benefit from a more diverse and representative sample to enhance the generalizability of the findings. Another limitation of the study lies in the use of farmers' intentions rather than actual behavior as the dependent variable. While intentions provide valuable insights, the behavior intention gap, the difference between what people intend to do and what they actually do, must be acknowledged. Especially in sensitive topics, such as animal welfare, there is a risk that respondents may answer based on social desirability. In several studies (Väre et al., 2005;

Lefebvre et al., 2014; Hennessy et al., 2016) the gap between intention and behavior has been examined, leading to the conclusion that only around half of farmers' behaviors align with their initial intentions. However, theoretical behavior models like the UTAUT model by Venkatesh et al. (2003) and its extension by Venkatesh et al. (2012) highlight the alignment between intention and actual behavior. Furthermore, Bagozzi and Yi (1989) contend that thoroughly formulated intentions have a comprehensive impact on behavior. This supports the notion that studying intentions alone can provide valuable insights, especially when practical constraints limit direct assessment of actual behavior. To minimize the risk for answers based on social desirability, the following measures were taken: Participants were assured that their answers would remain anonymous and could not be traced back to them. The randomized statements used in the questionnaire were neutrally formulated, avoiding direct reference to the sensitive topic and any implied judgment. Additionally, implausible responses were carefully addressed, such as instances of 'straightlining'. While the questionnaire was not formally pre-tested in a separate pilot study, it was critically reviewed and revised as part of a university statistics course at an agricultural university. The students, most of whom had a farming background, completed the questionnaire using their own farms as examples and provided feedback on item clarity and comprehensibility. Based on these discussions, several adjustments were made. Furthermore, the constructs were based on the well-established UTAUT framework (Venkatesh et al., 2003, 2012), which has been widely applied in agricultural contexts and offers a strong theoretical foundation. Nevertheless, this process cannot fully replace a structured cognitive pretest with the target population. Interpretation differences—especially regarding abstract constructs such as TR—may still have occurred. In addition, some constructs showed slightly reduced internal consistency, which may further limit the precision of measurement. In the case of EE and PV, this may reflect the multidimensional nature of the constructs. For FC, the lower consistency may be due to the limited number of items, as reliability is known to be sensitive to scale length.

The main driver for the implementation of higher standard AW practices is the factor CE (B = 0.372), indicating that animal welfare-oriented dairy farmers maintain a high intention to implement additional AW practices. The aim should therefore be to promote farmers' commitment to CE of animal welfare. This could be achieved, for instance, by showcasing best practice examples, from farmers who have successfully implemented AW practices. Additionally, mentoring programs could offer a means for experienced individuals to pass on their knowledge of successfully implementing AW practices to less experienced or younger colleagues. Platforms should be created for farmers to exchange their insights. It is also essential to extend training and continuing education not only to farm managers but to all employees involved in animal care—such as milkers and stockpersons—since numerous studies show that personnel's attitudes and animal handling affect animal welfare (cf. Daigle and Ridge, 2018; Vieira et al., 2023). This is in line with findings from a semi-systematic review by Balzani and Hanlon (2020), who emphasize the importance of knowledge, skills and abilities as important driver of animal welfare improvements. The control variable Agricultural degree (D2), distinguishing between respondents with and without an academic agricultural education, showed no significant effect on the intention to implement AW practices. However, this does not imply that agricultural education is irrelevant. Educational background may still influence how farmers approach AW practices—for example, by providing knowledge that helps translate intention into targeted and sustainable actions.

Motivation (HM; B = 0.302) is the second most crucial factor influencing intention. As highlighted by Morris et al. (2022), it is important to distinguish between intrinsic and extrinsic motivation. In the dairy sector, change is often promoted through extrinsic motivators such as financial incentives or regulatory requirements. An over-reliance on extrinsically motivated policy measures risks crowding out intrinsic motivation (Mergenthaler and Schröter, 2020). The findings of the present study show that intrinsic motivation is a key driver for farmers' intention to implement AW practices. In this regard, milk processors, policymakers, certification bodies, and retailers have a crucial role beyond merely monetizing animal welfare. They should implement measures that actively support farmers in translating their intrinsic motivation into intentions. Nonetheless, the findings should be interpreted in light of the intention behavior gap. Despite the strong influence of HM, actual implementation may be hindered by time, labor, or technical constraints—even though FC showed no significant effect (see below). Unfavorable structural conditions may also reduce farmers' intrinsic motivation. Limited feasibility could lower their enthusiasm and willingness to pursue animal welfare improvements. Thus, adequate framework conditions are essential—without them, even highly motivated farmers may be unable to act on their intentions.

Although farmers show a strong intention to implement higher standard AW practices (see Figure 2), this does not necessarily lead to participation in formal AW programs. The distinction between participation in animal welfare programs and implementation of AW practices is crucial for policy and extension strategies. The analysis shows that many farmers are willing to improve animal welfare but reluctant to join formal programs, a nuance largely absent from Grotsch et al. (2025). In addition to the high bureaucratic burden often associated with program participation, as reported by pig farmers in a study by Schukat et al. (2020), audit processes themselves are frequently perceived as stressful and overly critical, leading to negative experiences among farmers (Lundmark Hedman et al., 2022). Another critical factor is the potential misalignment between farmers' own beliefs and values about good animal care and the specific criteria imposed by certification schemes, which may discourage participation (Lockard, 2024) despite farmers' intention to improve animal welfare. For instance, Lundmark Hedman et al. (2022) found in their study that most farmers questioned whether animal welfare audits genuinely lead to improvements in animal welfare. Differentiating from Grotsch et al. (2025) our analysis critically engages with farmers' perceptions of bureaucratic burden, trust in enforcement institutions, and potential crowding-out effects of extrinsic

incentives as well as the limitations of current animal welfare labeling systems and the divergence between farmers' own values and formal program criteria.

The proposed actions above hold the potential to convert farmers' intention into actual behavior. Given the strong role of HM, farmers may be more willing to invest in animal welfare improvements than in purely profit-driven business optimizations. Benefits and efforts for livestock keepers and animal caretakers on farms also go beyond monetary cost-benefit analyses in other studies (Wildraut and Mergenthaler, 2020). For farmers, non-use values of animal husbandry may be relevant (Lagerkvist et al., 2011; Hansson and Lagerkvist, 2015, 2016; Hansson et al., 2018). These types of values explain why people in the livestock sector take action to provide animal welfare beyond the requirements of legislation, productivity, and profitability considerations (Schreiner, 2016). Still, the operational costs arising from the implementation of AW practices are assessed by the respondents as too high in relation to the benefits. At the same time, results show that a higher expected economic benefit (PE; B = 0.074) has a slightly positive influence on the intention to implement AW practices. This suggests that while many farmers recognize potential financial returns, these may not be sufficient to outweigh perceived cost barriers for the majority, as also highlighted in the study by Schukat et al. (2019).

Contrary to our expectations, the factors EE, SI, FC, TR and OH have no influence on the dairy farmers' intention to implement AW practices. This implies that farmers appear willing to endure a certain level of efforts (EE) for the implementation of enhanced animal welfare, which may partly arise due to the current absence of necessary conditions (FC) on the farm. This is supported by the fact that the individual statement (S1) 'To meet animal welfare requirements, I have high investment costs', also has no influence on farmers' intention. If these conditions are perceived as given and not subject to short-term change, they might be seen as background conditions rather than active enablers of behavior, thus reducing their relevance for intention. Given that the sample largely consists of larger, future-oriented farms—nearly half of which plan to expand—the lack of influence of S1 may suggest that these farmers are already accustomed to making investments and therefore do not perceive investment costs as a barrier to improving animal welfare. Yet particularly documentation-related efforts are perceived as excessively high. Farmers may view such efforts as inevitable parts of routine farming, and thus not decisive for their behavioral intention. Moreover, strong intrinsic motivation might offset the negative effect of perceived effort. Nonetheless, relying solely on farmers neglects the industry's role in creating enabling conditions for effective animal welfare implementation (Mergenthaler et al., 2025). Excessive bureaucracy and compliance demands may ultimately undermine farmers' intrinsic motivation. Milk processors, policymakers, label owners, and retailers must collaborate to reduce administrative burdens and support farmers in acting on their intrinsic motivation —without placing excessive focus on economic incentives. At the same time, ensuring financial feasibility is critical. The significant influence of the factor PV on intention underscores the importance for farmers that the costs incurred through the implementation of AW practices can at least be offset (cf. Schukat et al., 2019), for example by increased sales revenue. Farmers are likely to carefully weigh farm-specific cost-benefit considerations when deciding whether to implement AW practices in reality. However, precise economic evaluations in this context are inherently difficult, as many of the necessary farm-specific indicators are not easily measurable or available. This uncertainty may contribute to the well-known intention–behavior gap.

One potential explanation for the non-significance of the TR construct may lie in how farmers perceive their role in the agricultural sector (cf. Mergenthaler et al., 2025). The item wording implies a shared responsibility for the sector's reputation, yet it remains unclear whether farmers identify themselves as part of a broader "sector" and whether they consider compliance with animal welfare guidelines as a contribution to a shared image. Our study did not explicitly assess farmers' self-perception in this regard. Furthermore, assuming that all farmers benefit equally from robust control systems may ignore existing power imbalances within the sector. These systems are usually implemented by external institutions or market actors such as dairy companies or certifiers, while farmers often carry the burden of compliance without having any say in their design or flexibility. This structural imbalance may affect how farmers perceive trust in enforcement and whether they view it as supportive or as an expression of top-down pressure. The non-significant effect of OH may be explained by social desirability bias, as nearly all dairy farmers strongly agreed with the statements within this construct. To counteract this, it is recommended that future studies measure actual animal welfare using indicators and replace OH with such data. The high level of agreement with OH may also be due to distorted perceptions. Operational blindness among dairy farmers may lead to problems in their own animal husbandry being overlooked or downplayed. Additionally, self-selection bias may have led farmers with more critical views of their own husbandry practices to avoid participating in the survey.

While the factor SI does not have a significant influence on intention, the individual statement (S2) 'I only implement new animal welfare practices under pressure from my dairy' shows a negative effect (B = -0.101). These dairy requirements are largely driven by political regulations and are aligned with public expectations regarding animal welfare. Therefore, SI likely does have an existing negative impact, but farmers primarily experience this pressure through the dairies (S1). This result underscores the importance of involving and motivating farmers from the outset to proactively engage in improving animal welfare. Rising mandatory requirements may discourage motivated farmers and hinder further progress. This may result in farmers implementing only verifiable requirements, without going beyond them.

The control variable Farm vision (D1), indicating whether a farm plans to expand production, shows a significant positive effect on the intention to implement AW practices. This supports the assumption that growth-oriented farms are more likely to view AW practices as a strategic response to increasing expectations from consumers and the food retail sector. This is especially relevant as structural change in the dairy sector leads to fewer, but larger and

more professional farms. It seems plausible that expanding farms are more likely to remain in the market. Beyond market requirements, it is conceivable that farmers with a growth-oriented vision also increasingly recognize that sustainable farm development is inseparably linked to continuous improvements in animal welfare—not just driven by regulations, but also by their own intrinsic conviction to enhance animal well-being. If growth-oriented farms are especially open to AW practices, this could support long-term structural improvements in animal welfare across the sector. However, the current level of animal welfare on farms of different sizes should also be considered. Yet, some studies suggest that animal welfare outcomes are comparable across farm types or may even be slightly better on larger farms (e.g., Robbins et al., 2016; Gieseke et al., 2018; Lindena and Hess, 2022). This is also reflected in our model, which shows that herd size has no significant effect on farmers' intention to implement AW practices. Interestingly, one German animal welfare certification scheme restricts participation for farms above a certain herd size. This example illustrates that certain requirements in AW certification schemes may not directly relate to animal welfare and should therefore be critically examined and evidence-based, ideally in close collaboration with farmers, as also proposed by Schukat et al. (2019), and other relevant stakeholders.

5 Conclusion

The German dairy sector is in transition in the realm of animal welfare. The inherent potential for enhancing animal welfare and implementing higher standard AW practices is notably high. The linchpin in this transition lies in farmers' commitment to continuously improving animal welfare, alongside their intrinsic motivation, which should be fostered through supportive framework conditions. By offering accessible and tailored training, mentoring or coaching programs, supported either freely or economically, dairy farmers can be empowered, fostering a profound understanding and commitment to animal welfare. Even more important is the role of the broader dairy sector—including milk processors, policymakers, label owners, and retailers—in shaping the framework conditions for effective animal welfare implementation. As farmers' intrinsic motivation is crucial, industry stakeholders should facilitate this transition by reducing regulatory burdens. A collective, sector-wide effort is essential to ensure that farmers have the necessary freedom to navigate these changes, supported by the structural conditions needed to achieve lasting improvements in animal welfare. Further research in this area is essential to identify ways to further enhance intrinsic motivation effectively, ensuring sustainable and lasting improvements in AW practices. Despite the unexpected finding that economic aspects have minimal influence, it remains essential to ensure that farmers do not incur losses in profit when enhancing animal welfare on their farms, particularly since farm-specific cost-benefit considerations may become more relevant at the point of actual implementation. Addressing the practical challenges, such as reducing additional efforts, requires a multifaceted approach. Farm-specific advice and automated technical solutions designed to simplify animal welfare documentation can potentially ease the implementation process, ensuring a smoother transition for farmers.

Data availability statement

The datasets presented in this study can be found in online repositories. The names of the repository/repositories and accession number(s) can be found below: https://doi.org/10.7910/DVN/SQSDCJ, Harvard Dataverse, V1.

Ethics statement

The studies involving humans were approved by Ethikkommission der Georg-August-Universität Göttingen. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

Author contributions

HG: Conceptualization, Data curation, Formal Analysis, Investigation, Methodology, Project administration, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing. MM: Writing – review & editing. HS: Conceptualization, Formal Analysis, Methodology, Supervision, Writing – review & editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Supplementary material

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fanim.2025.1461282/full#supplementary-material

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