

Consumers' awareness of animal welfare issue and livestock innovations: a PLS-SEM approach

The increasing consumer interest in Farm Animal Welfare (FAW) is prompting more and more individuals to opt for products that emphasize ethical farming practices and brands that associate themselves with respect for FAW. This extends not only to food products like eggs and meat but also to non-food items such as cosmetics.

In the case of agricultural products, information regarding FAW is typically conveyed to consumers via specific labels or brands, serving to fill the informational gap about the production processes of certain goods in the food market. However, when consumers buy products tagged with animal welfare labels, their understanding of the sustainability practices associated with them may not always be accurate. Moreover, consumer knowledge about farming practices involving animals may be substantially limited in terms of both fundamental and more complex aspects. In cattle farming, for example, certain practices such as animal grazing are well known and considered highly important by consumers: the existence of a premium price associated with these practices is widely confirmed in literature (Mazzocchi and Sali, 2022). The same applies in the choice of poultry products, with consumers showing a marked preference for options such as free-range eggs, pasture-raised animals, or antibiotic-free products (Slack and Sharma, 2022).

However, it is crucial to note that a substantial portion of consumers does not fully understand a significant number of farming practices. Aspects such as the lifespan of a dairy cow under intensive farming, the use of artificial insemination, or even the life cycle of a productive cow are areas where consumer knowledge often falls short. Studies show that although dairy cows can live up to 20 years, their lifespan is considerably shortened under modern farming conditions (Dallago et al., 2021), resulting in a decrease in the longevity of dairy cows in most countries characterized by high individual milk production (Dallago et al., 2021). Several aspects of animal farming are not widely communicated or understood, leading to a lack of awareness among consumers about the specific details and processes involved in the production of animal-derived products.

In traditional intensive farming, the practice of separating the calf from its mother immediately after birth is common. This is justified on several grounds, including increased profits, better control over the calf's milk intake, enhanced calf health monitoring, and reduced stress for both the cow and the calf (Meagher et al., 2019). Additionally, the immediate separation of the calf from its mother aims to prevent direct colostrum intake and potential contact with infected faeces from the adult cow. It is also necessary to eradicate certain diseases, such as paratuberculosis. However, the impact of this practice on both the calf and the cow's health is still a matter of debate. Direct suckling of colostrum and milk by the calf has been shown to be protective against mastitis, and prolonged cow-calf contact promotes the development of normal social behaviour in the calf and higher weight gains (Meagher et al., 2019). From an environmental sustainability perspective, the management of cow-calf separation requires further investigation, as there are multiple aspects to consider. With prolonged cow-calf contact, the quantity of milk sold is lower, which inevitably leads to increased emissions and waste per unit of product. Furthermore, prolonged cow-calf contact has been associated with faster growth in animals, which can lead to reduced health issues, a lower age at first calving, and increased milk production (Mogensen et al., 2022). Management practices that involve increased cow-calf contact are indeed well-received by consumers, as reported in a recent study (Sirovica et al., 2022). Among the available strategies to address management issues and milk losses associated with cow-calf separation in intensive farming, one approach could be using nurse cows. Nurse cows are healthy cows that are not milked and are solely dedicated to nursing a group of calves (Broucek et al., 2020). This practice allows for continued calf-mother interaction while minimizing the potential negative impacts on milk production and management challenges in intensive farming systems.

An examination of intensive farming systems in Italy reveals a noteworthy evolution in the sector: over the past 50 years, individual milk production has more than doubled, but this growth has been coupled with a reduction in lactation length — falling from 334 days in 2010 to 324 days by 2020 (AIA, 2022). A trend towards maximizing animal productivity has emerged, favouring the presence of primarily first-lactation cows within farming operations. While slightly less productive than multiparous cows, these animals present fewer health complications. However, this strategy necessitates a higher turnover of young livestock, such as heifers and young cows, to replace culled adult cows. The implications of this approach extend beyond increased production costs associated with the upkeep of a larger cohort of non-productive animals, as it also exacerbates the environmental footprint of milk production within these facilities (De Vries, 2020).

In light of these observations, the present study seeks to elucidate the effects of consumer understanding and perceptions of FAW on WTP for innovative practices within cattle farming. The investigation will explore the correlation between consumers' comprehension and perceptions of FAW and their readiness to endorse novel livestock farming techniques financially. Specifically, this research aims to shed light on the influence of consumers' environmental and ethical attitudes, their perceptions of animal welfare, and their knowledge concerning FAW on their WTP for animal products sourced from cattle farming.

Methodology

Partial Least Squares Structural Equation Modeling (PLS-SEM) is a technique that enjoys widespread utilization in many published works, particularly within the spheres of management and marketing. One of the primary merits of PLS-SEM lies in its capacity to estimate complex models involving multiple constructs, variables, and paths, circumventing the need for rigid data distribution assumptions. This aspect of flexibility proves instrumental when handling non-experimental data, which often exhibits divergence from ideal distribution assumptions inherent in real-world scenarios. In this study, we employ the Partial Least Squares (PLS) methodology due to the relatively small sample size constraints and the indeterminate nature of data distribution arising from survey-based data collection.

Our hypothesis posits a positive correlation between three latent factors: ethical-environmental consumer attitudes, perception of animal welfare, and knowledge of animal welfare, each having an impact on the WTP for animal products derived from sustainable cattle farming. These latent factors have been identified based on the results gleaned from the Ethically Minded Consumer Behavior (EMCB) scale (Sudbury-Riley and Kohlbacher, 2016), Animal Welfare scale (Kendall et al., 2006) and AW knowledge scale, respectively. We also examine the influence of certain socio-economic variables, specifically respondents' age, level of education, and gender, on WTP.

The initial segment of our survey solicited information regarding the respondents' personal demographics and food consumption habits; the subsequent section was designed to evaluate the respondents' WTP choices. The concluding portion comprised attitudinal scales that investigated respondents' ethical and environmental beliefs, attitudes towards animal welfare, and knowledge of animal welfare. **The data collection was carried out by direct interviews with students at the University of Milan in Italy from March to May 2023; 133 complete questionnaires were collected, thus representing preliminary results.**

Values, beliefs, and moral norms play a significant role in shaping individuals' behavior towards environmental issues. Attitudinal scales have commonly been used to measure individuals' attitudes towards the environment. These scales typically consist of a series of statements or questions that individuals respond to, indicating their level of agreement or disagreement with each item. The responses are then used to determine the individual's overall attitude towards the environment,

capturing their beliefs, feelings, and evaluations regarding environmental issues. Environmental attitudes, in particular, have been extensively studied in the literature. They involve individuals' perceptions and beliefs about the natural environment, including factors that may compromise its quality. We decided to employ the ethically minded consumer behaviour (EMCB) scale, created and validated by Sudbury-Riley and Kohlbacher (2017), to investigate the influence of various consumption motivations concerning environmental matters and corporate social responsibility.

The concept of animal welfare encompasses societal values, personal beliefs, and ethical considerations, which can influence consumer purchasing decisions. Additionally, intensive livestock systems have had an impact on consumer awareness, leading to changes in consumption patterns. In accordance with the study conducted by Marescotti et al. (2019), the third scale utilized in our research is the "Animal Welfare" scale. This scale, consisting of eight items, was originally developed by Kendall et al. in 2006. It specifically addresses ethical concerns related to animal production.

Results and conclusions

Our preliminary data collection yielded insightful results concerning consumers' awareness of animal welfare issues and their WTP for animal products stemming from innovative livestock practices. Using PLS-SEM, we found a significant positive relationship between our three latent factors and WTP, with each factor contributing to the overall model. Furthermore, our results substantiated the influence of socio-economic variables, such as the level of education and gender, on consumers' WTP.

Firstly, consumers' environmental and ethical attitudes, as measured by the Ethically Minded Consumer Behavior (EMCB) scale, had a significant positive effect on their WTP for animal products from sustainable cattle farming. This finding suggests that individuals who are more conscientious about the environment and uphold stronger ethical principles are more likely to pay a premium for products that promote animal welfare as they may perceive their purchase decisions as a form of support for ethical farming practices and a means of combating issues related to intensive farming systems. Similarly, perceptions of animal welfare significantly affected consumers' WTP, reaffirming the importance of consumer awareness and sensitivity about livestock farming conditions. Consumers with higher scores on the Animal Welfare scale, indicative of more favourable attitudes towards animal welfare, demonstrated a stronger WTP for products derived from ethical farming practices.

Furthermore, consumers' knowledge of FAW, as measured by the AW knowledge scale, positively influenced their WTP. This suggests that an informed consumer base is crucial for the acceptance and adoption of livestock innovations, and more knowledge about the realities of animal farming, such as the common practice of separating the calf from its mother immediately after birth or the lifespan of a dairy cow under intensive farming, encourages consumers to pay more for products that are derived from sustainable cattle farming practices.

Among the socio-economic variables, the level of education was positively correlated with WTP, indicating that more educated consumers were willing to pay more for animal products associated with improved welfare standards.

Our study also revealed a significant knowledge gap among consumers regarding specific livestock practices, particularly within cattle farming. We found that while consumers were generally aware of and appreciated practices like animal grazing, their understanding of the complexities and intricacies of livestock farming was limited. This lack of knowledge extended to practices like the immediate separation of calves from their mothers, artificial insemination, and the shortened lifespan of dairy cows under intensive farming conditions. We found that the perception of innovative practices such as prolonged cow-calf contact and the use of nurse cows was generally positive among consumers, but this perception was not necessarily backed by a deeper understanding of these practices. Despite

this, these innovative practices were perceived as more aligned with consumers' ethical and animal welfare considerations, thereby encouraging a higher WTP.

These findings have significant implications for brands' communication and marketing strategies associating themselves with animal welfare and sustainable practices. Providing accurate and accessible information about livestock farming practices, both traditional and innovative, can boost consumers' knowledge, positively impact their perception, and enhance their WTP for products linked with ethical and sustainable practices.

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