Communicating Data Transparency in Dairy: Understanding Producers' Perceptions of Privacy, Security, and Ownership in Precision Technology Adoption

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Introduction / Need for Research

Precision dairy technologies (PDTs) have become increasingly common as producers adopt tools that automate data collection to improve herd management, efficiency, animal health, and economic outcomes (Abeni et al., 2019; Monteiro et al., 2021; Trapanese et al., 2025). However, PDTs rely on data extraction, storage, and transfer, raising growing concerns about privacy, security, and ownership among producers (Wiseman et al., 2019; Kaur et al., 2022; Barton et al., 2025). Producers have reported uncertainty about who owns farm-generated data, the degree of control they retain, and how third parties may access or use their information (Fadul-Pacheco et al., 2022; Barton et al., 2025). These concerns are intensified by rising cyber threats in food and agriculture and by a lack of clear, transparent communication from agricultural technology providers (ATPs) regarding data handling practices. Because producers rely on trusted information networks when forming adoption decisions, communication plays a central role in shaping perception, risk evaluation, and willingness to share data. Agricultural communicators must therefore understand producer concerns to design transparent, trust-centered messages that support informed decision-making (Keller et al., 2020).

Theoretical Framework

The Privacy Calculus theory suggests individuals make data disclosure decisions by weighing perceived benefits against perceived risks (Meier & Krämer, 2022). When applied to digital technologies, the framework is expanded to include issues such as procedural fairness, transparency, and trust in those who manage, share, or secure data (Sah & Jun, 2024). This study used an amended Privacy Calculus model to analyze producers' perceptions of PDT data practices, focusing on perceived benefits, risks, trust, and procedural fairness. Procedural fairness is defined as the perceived fairness or transparency of technology provider data-handling practices.

Methodology

Eight dairy producers participated in one-hour, semi-structured interviews designed to explore perceptions of data privacy, security, ownership, and control in relation to precision dairy technologies (Lewis-Beck et al., 2004). Participants were recruited through a regional dairy listserv using convenience, opt-in sampling, allowing producers with firsthand experience using PDTs to self-select into the study (Golzar et al., 2022). Deductive thematic coding was applied using an a priori codebook to identify themes related to perceived risks, benefits, trust, and procedural fairness (Fife & Gossner, 2024). To enhance trustworthiness, two researchers independently coded the transcripts and engaged in consensus checking to ensure shared interpretation of the data. The analysis identified recurring patterns and points of convergence or contradiction in participant experiences. To support triangulation, descriptive findings from a concurrent producer survey were used to contextualize attitudes toward data transparency, risk awareness, and trust in technology providers. The survey served as a secondary data source to compare perceptual trends, strengthen validity of the interpretations, and highlight the broader relevance of the themes that emerged from the qualitative interviews.

Findings

Producers consistently described PDTs as valuable tools that improve efficiency, reduce labor strain, and provide actionable insights that support herd health and day-to-day management. Participants valued having "another set of eyes on the farm" for peace of mind and quicker action on health issues. Others noted that technology allowed them to "do more with fewer people" and make decisions based on real-time data rather than guesswork or intuition. Despite perceived benefits, participants were unsure how their farm data would be handled after leaving their operations. Many were unsure "who all sees the information" or what happens to it "after it goes into the cloud." Concerns focused primarily on control and consent, with multiple producers questioning whether they truly retained ownership of the data generated on their farms. Some worried that third parties could use their information in ways that might disadvantage them. Others feared over-reliance on digital systems, noting that a system failure or breach could "shut everything down" or result in data loss. Trust emerged as a factor influencing how producers evaluated these risks. Participants expressed trust in peers, local advisors, and individuals with whom they had established relationships. Across interviews, producers indicated a desire for clearer explanations written in plain language, more transparency about where data goes, and more control over decisions about sharing. Several stated they would be more willing to share data if they felt confident in how it would be used and who was benefiting. Survey results from 10 producers reflect qualitative themes around concerns and confusion about data ownership, with 70% of farmers agreeing ownership terms are confusing and 50% reporting they did not understand the arrangement they have with their provider. Farmers' trust in service providers varied across the survey data, with some trusting providers overall and others indicating distrust about specific occurrences, such as providers sharing or accessing data without authorization.

Conclusions

Findings from this study show how dairy producers evaluate the perceived benefits of PDTs against the perceived risks, considering trust and feelings of control. When communication about data practices is vague, incomplete, or overly technical, producers interpret the process as procedurally unfair, which elevates perceived risk and weakens trust. Conversely, when producers feel informed, they are more open to recognizing the potential benefits of PDTs. By applying the Privacy Calculus framework, this study adds insight into how communication shapes producer reasoning around adoption and data sharing.

Recommendations

Agricultural communicators can play a role in reducing uncertainty by developing messaging that clearly explains data handling and improves transparency. For Extension, this includes developing neutral, research-based communication resources and incorporating data literacy into programming. For industry communicators, improving consent language, clarifying data processes, and adopting transparent communication strategies may strengthen producer trust. Addressing producer concerns through clearer, more credible communication has the potential to increase understanding, reduce perceived risk, and support adoption of dairy technologies.

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