



Navigating technology adoption: mapping beef producers' decision journeys

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Abstract

The adoption of agricultural technology (AgTech) and innovations by graziers is crucial for enhancing productivity and sustainability in the rangelands. However, the decision-making process is often complex and fraught with risk and uncertainty. This PhD project aims to support informed adoption decisions among beef producers in Queensland, Australia.

Participatory research interviews were conducted with a diverse range of industry stakeholders. Insights from these interviews were synthesized into a co-designed Customer Journey Map (CJM), which visually maps key decision points against the Diffusion of Innovations (DOI) stages—Knowledge, Persuasion, Decision, Implementation, and Confirmation. The CJM framework effectively guided the co-design process, enabling participants to contribute their unique perspectives.

The completed CJM provides a structured visual representation of the adoption process. It served as a pivotal tool in facilitating discussions during subsequent semi-structured interviews with beef producers and AgTech companies. By framing these interviews around the dynamic adoption process, the CJM aided in recalling crucial decision points and eliciting detailed insights into decision-making processes.

Beyond this project, the CJM serves as a versatile tool applicable to research focused on adoption decisions. Future phases will explore mapped decision points, focusing on identifying heuristics and biases that influence AgTech adoption. These insights will benefit stakeholders aiming to enhance extension and adoption programs. Additionally, findings from this study are positioned to align with current trends in artificial intelligence (AI). There is potential for personalized decision support tools to leverage this knowledge to offer tailored advice, supporting adoption and reducing decision fatigue.

Introduction

AgTech adoption is inherently complex, involving multiple stages and touchpoints, as conceptualised in Rogers' Diffusion of Innovations (DOI) (Rogers 1962). Adoption decisions are shaped by various personal, social, cultural, and economic factors, along with the specific attributes of the innovation itself (Pannell et al. 2006). Producers must weigh costs and benefits while navigating practical concerns such as compatibility with existing systems and limited technical support (Kuehne et al. 2017; Montes de Oca

Munguia et al. 2021). Additionally, the overwhelming array of available technologies contributes to choice overload, creating decision fatigue and uncertainty (Iyengar and Lepper 2000). These barriers are compounded by constrained time and expertise, which restrict producers' capacity to engage with complex technologies (Reichardt et al. 2009). Such challenges can prevent producers from effectively assessing whether a new technology offers a substantial 'relative advantage'—a key determinant of adoption, defined as a perceived improvement over current practice (Pannell et al. 2006).

Understanding decision-making within adoption pathways requires a dynamic approach that accounts for systemic and individual factors. While broader systemic barriers influence outcomes, the decision to adopt ultimately rests with producers, whose motivations and attitudes are shaped by their specific contexts (Nettle et al. 2022). Decision-making is iterative, with producers often reassessing their considerations as circumstances change and new information arises (Rogers 1962; Montes de Oca Munguia et al. 2021). Capturing these dynamics can be challenging, as participants may struggle to recall or articulate past decisions, potentially limiting insights into the complexities of the adoption process (Tversky and Kahneman 1974; Nisbett et al. 1977; Reisch and Zhao 2017; Streletskaya et al. 2020).

The 'probes approach' (Gaver et al. 1999) employs design-oriented tools for gathering data and co-exploring topics. Probes are designed to encourage participants to reflect on and share their experiences, enhance dialogue between researchers and participants, and stimulate meaningful discussion and reflection (Mattelmaki 2008). This study aims to investigate the utility of a co-designed Customer Journey Map (CJM), based on the DOI model (Rogers 1962), for exploring nuanced AgTech adoption experiences. By mapping the adoption process, the study seeks to explore how such tools might enhance our understanding of critical decision points, barriers and motivations in AgTech adoption.

Methods

This study employed qualitative methods, grounded in participatory action research principles, to explore the decision-making processes of AgTech adoption among beef producers in Queensland, Australia. The study adopted a co-design approach to ensure that outcomes were directly relevant and beneficial to the target community (Trischler et al. 2019; Rundle-Thiele et al. 2021; Moretti et al. 2022). The Customer Journey Map (CJM) framework was structured with the horizontal axis representing the stages of the DOI model (Knowledge, Persuasion, Decision, Implementation, and Confirmation) (Rogers 1962), as proposed by Ong et al. (2022). The vertical axis consists of three overarching themes (Activities, Motivations, and Barriers) to provide a comprehensive lens to capture the dynamics of the adoption journey, in a similar approach to Moretti et al. (2022). Six participants, comprising a producer, consultant, economist, station manager, social scientist, and extension officer, were purposefully selected for their extensive experience with AgTech adoption decisions, to capture a broad spectrum of perspectives and enable a deeper understanding of the adoption process and its contextual factors.

Data was collected through semi-structured interviews conducted online via Microsoft Teams. Each interview lasted approximately 60 minutes and included an introduction to the study followed by an adoption journey mapping activity. A blank CJM framework was shared on-screen, and participants' insights were recorded in real time as the interviewer guided them through each segment. Opportunities were offered for refinement. The analysis synthesized interview insights into a single map. Initially compiled as a comprehensive document, themes and connections were distilled through an iterative process. The final map was refined into a concise, single-page format designed for clarity and practicality, ensuring its effectiveness as a probe for engaging beef producers in interviews. Reflexivity was incorporated to

evaluate the utility of the CJM as a facilitation tool for eliciting nuanced responses, while acknowledging the researcher’s influence on the process (Finlay 2002).

Results

The co-design process proved to be a highly effective approach for developing the CJM. Conducting individual online interviews facilitated a deep and nuanced exploration of the adoption process from various stakeholder perspectives, while overcoming logistical challenges posed by a workshop format such as scheduling conflicts and geographic dispersion. This approach ensured that each participant could dedicate focused time to the mapping activity, yielding rich and varied insights critical for capturing the complexities of AgTech adoption. This co-design approach laid the foundation for a robust and adaptable CJM (Fig. 1), designed as a probe for exploring the AgTech adoption process. The CJM was piloted in a follow-up study to assess its practical application and effectiveness. Semi-structured interviews were conducted with 22 producers and AgTech stakeholders in-person, during which both participants and the researcher used the printed CJM to guide discussion.

Participants actively engaged with the CJM, which facilitated rich conversations and uncovered nuanced insights into the decision-making process that might otherwise have been overlooked. Producers frequently used the map to articulate their decision pathways and reflect on their experiences. The CJM proved effective in keeping discussions focused and re-engaging participants when thought processes stalled, ensuring interviews made the best use of limited time. In the pilot interviews, AgTech providers highlighted the CJM’s value in capturing the dynamic nature of adoption, reflecting their observations of how customers often move between stages and how motivations and barriers shift in response to changing circumstances and priorities. One provider noted its utility in making the adoption process more tangible, stating, “I would like a copy of this ... it would help explain things to people [in the AgTech industry] so quickly and easily.

STAGE	Knowledge/ Awareness <i>When you first find out about a new AgTech</i>	Persuasion <i>When you gather more info & form an opinion</i>	Decision <i>When you make your choice to accept/reject</i>	Implementation <i>When you acquire and start using it</i>	Continuation (or Discontinuation) <i>When you decide to keep using it, or not</i>
ACTIVITIES/ INTERACTIONS	Word of mouth Industry events Online Media Internal conversations	What do other producers think? Get more detailed info Figure out how it could work with my system/business Narrow down the choices Internal conversations Trusted advisors	Evaluation - is this right for our business? Chat with suppliers Internal conversations Broader industry support Decision (proceed or not)	Set up and installation Testing Technical help and more info Putting into practice Internal conversations Discuss with trusted advisors/producer groups	Internal conversations Did it meet expectations? Seek reassurance from others Ongoing support Sharing experience with other producers Feedback to suppliers
MOTIVATIONS	Curiosity Problem-solving Positive observations Business objectives Clear benefits	Seeing it in action Clear value proposition Willingness to give it a go Access to help or trial Feelings about the tech Producer group support	Convinced of cost benefit (price, quality, features) Internal consensus Good communication & support from supplier Successful trial Social influence	Success - achieving goals, solving problems Value & benefits (expected and unanticipated) Easy to setup, easy to use Problem solving attitude Ongoing support	Working well Clear value & benefits Savings (time, costs, labour) Fits with enterprise Positive reinforcement of the decision
BARRIERS	Uncertainty, unclear benefits Constraints (time, money, compatibility, complexity) No one else using it yet Lack of support or clear information Unexpected circumstances Traditional values and skepticism about the technology’s necessity	Lack of value Lack of support Doesn't fit my system/process It's too hard Skeptical about suppliers Skeptical about hype Risks of being early adopter (time to work through) Subscription costs	Unclear benefits, poor return on investment Support and trust concerns Time and effort Product concerns - compatibility/complexity Risky Unexpected circumstances Connectivity	Resource & time constraints (skills/labour challenges) Not seeing benefits, not living up to hype Product issues - cost, quality, complexity, subscription fees Readiness to adapt/change, overcome problems Not fit for our system/business Unexpected circumstances	Not working well Not seeing enough benefits Product changes: outdated, superseded, decreased ease of use, cost increases Shift in direction/goals Social pressure Got enough from the trial

Fig. 1: Customer Journey Map (CJM) for AgTech Adoption by Beef Producers.

Discussion

Findings demonstrate the CJM as an effective probe for exploring AgTech adoption decision-making. Like other design-oriented tools described by Gaver et al. (1999) and Mattelmaki (2008), the CJM fostered participant reflection, facilitated meaningful discussions, and encouraged engagement by making abstract adoption concepts more tangible. By structuring insights across the DOI stages (Rogers 1962) and categorizing them into Activities, Motivations, and Barriers, the map aids in the examination of adoption dynamics, making it a practical tool for understanding the multifaceted challenges of adoption. Its visual and accessible format fosters participant engagement and reflection, aligning with Santos and Gonçalves (2021), who emphasize journey mapping as a method for simplifying complex processes.

Notably, the CJM serves as a valuable tool for enhancing qualitative research by structuring discussions and uncovering nuanced experiences which can be used to identify strategic leverage points for intervention. Exploring adoption pathways using the CJM aids in revealing the cascading effects of early-stage challenges. For instance, an unclear understanding of benefits during early stages often translated into a perceived lack of value and return on investment (ROI) in later stages, ultimately diminishing the perceived relative advantage.

Its adaptable design positions the CJM as a potential tool for studies across agricultural sectors and innovations (Moretti et al. 2022), holding value for stakeholders beyond academia. Developers of extension and adoption programs can harness insights to develop strategies that align with producer motivations and address barriers, enabling more targeted and effective engagement (Murray-Prior and Wright 2001; Santos and Gonçalves 2021; Nettle et al. 2022). Additionally, AgTech providers can use the CJM to better understand customer pathways and barriers and refine communication and support strategies.

The framework design and limited number of co-design contributors may have left certain aspects of adoption underexplored, such as the role of relationships and trust. However, the CJM effectively fulfilled its purpose as a facilitation tool, enabling participants in the pilot study to quickly grasp and expand upon the map, adding nuance and filling in gaps based on their own experiences. Future studies could broaden the co-design participant base, adjust the vertical axis to capture relevant factors, and experiment with more interactive probe designs to further enhance engagement and insight generation.

As a probe, the CJM provides a structured process to bridge theoretical understanding and practical application. This aligns with emerging trends in artificial intelligence, particularly the development of personalized decision-support tools. These tools could deliver tailored advice, identify leverage points, and mitigate decision fatigue to support adoption. Beyond enhancing the understanding of AgTech adoption processes, the CJM advances research methodologies and practical applications, serving as a versatile framework that can be adapted to various agricultural contexts and stakeholder needs.

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