Barriers to Strategic Analysis and Smart Technology Adoption in Developed Dairy Farms: A Qualitative Pilot Study

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Abstract: Developed dairy farms face increasing turbulence from climate change, market volatility and rapid digitalization. While strategic analysis is widely promoted, its systematic use, and the strategic integration of smart technologies, remains limited. This qualitative pilot study, grounded in strategic management and innovation literature, explores these challenges by combining a targeted review with ten semi-structured interviews involving farmers (3), consultants (4), a veterinarian specialized in data-driven farming, a policymaker, and a professor of strategic analysis. Across this diverse group, seven interrelated barriers emerged: constrained information use, low digital readiness, behavioural resistance, weak entrepreneurial orientation, institutional uncertainty, underused advisory support and fragmented decision routines. The findings highlight a persistent gap between established strategic tools (SWOT, PESTEL, scenario planning) and their practical application: digital investments are often reactive rather than strategically embedded. The contribution lies in framing digital transformation as a strategic capability challenge, not only a technological one, and translating the barrier set into actionable levers for managers, advisors and policymakers. As a pilot, the study also sets out a research agenda for broader comparative analysis of strategy and digital adoption in agriculture, providing both immediate insights and directions for future work.

Keywords: strategic analysis, dairy farming, smart technologies, barriers, digital readiness
JEL Classification : Q10, Q16, O33

1 Introduction

Developed dairy farms are increasingly exposed to turbulence arising from climate change, market volatility, and rapid digitalisation (Graddy-Lovelace, 2021; EU, 2023). Strategic analysis is often recommended as a tool to strengthen resilience and guide long-term decision-making (Chaleb, 2024), yet its systematic application among dairy farmers remains limited. Meanwhile, smart technologies associated with Industry 4.0 and Agriculture 5.0 are increasingly available (Klingenberg, Valle Antunes Junior & Müller-Seitz, 2022; Jerhamre, Carlberg & Zoest, 2022) but adoption in practice is frequently reactive and operational rather than strategically integrated. This raises important questions about how farmers approach strategic planning in a rapidly changing environment.

The research gap lies in understanding why strategic analysis is underutilised, what prevents its broader adoption, and how overcoming these barriers, particularly by treating digitalisation as a strategic capability rather than a purely technical add-on, can improve long-term performance and resilience in dairy farming. Addressing this gap requires examining both systemic constraints and stakeholder perspectives to explain why strategic analysis remains underused in developed farms. This study addresses the question: *What are the main barriers experienced by managers of developed dairy farms in applying strategic analysis, particularly when adopting smart technologies, to respond effectively to a turbulently changing agricultural environment?*

Herewith, it contributes by triangulating literature, field evidence, and multiple stakeholder perspectives, and by highlighting divergences in how these actors perceive barriers, an angle that extends beyond prior studies which mainly confirm existing findings. The paper first reviews relevant literature on strategic analysis and barriers to technology adoption. It then outlines the qualitative research design, which combines a targeted literature review with ten semi-structured interviews. The results present seven interrelated barriers, which are positioned within established typologies and triangulated with field evidence. The discussion interprets these findings considering strategic management theory and digital transformation, and the paper ends with a conclusion.

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2 Methods

A narrative literature review (Scopus, Web of Science, Google Scholar) synthesized work on strategy in agriculture and digital adoption. Inclusion required relevance to strategic management/decision routines or digital transformation in agri-food and peer-reviewed status or recognized policy reports. Articles were included if they focused on strategic management, innovation, or digital adoption in agriculture; non-relevant or smallholder-only studies were excluded. The review yielded seven consolidated categories, financial, institutional, informational, behavioural, organizational, market, technological, consistent with recent syntheses (Flemming et al., 2019; Hayden, Mattimoe & Jack, 2021, Zhao et al., 2024; Nicolas-Davies et al, 2021).

Ten semi-structured interviews (June–September 2025) involved farmers (3), consultants (4), a data-driven veterinarian, a policymaker, and a professor in strategic analysis. Participants were purposefully selected to capture complementary perspectives on strategic behaviour, digital readiness, and innovation. The diversity was intentional for this pilot, aiming to explore a broad range of views rather than achieve representativeness. Interviews (45–75 min) followed a flexible guide, were held via MS Teams, transcribed verbatim, anonymised, and stored.

Transcripts were coded in NVivo (Lumivero, 2025) using two stages: descriptive codes for concrete frictions (e.g., capital constraints, data overload, advisory use), followed by theoretical coding linking segments to broader innovation, behavioural, and capability concepts (Vennix, 2019). Coding was done by the researcher, iteratively compared with literature categories. As a pilot, the goal was not saturation but to identify recurring themes and map them onto established typologies for future studies. The participant diversity was intentional, allowing for variation across farmers, advisors, policymakers, and experts, thereby ensuring that the exploratory coding captured a wide spectrum of perspectives within the limits of a pilot design.

3 Research results

The analysis identified seven interrelated barriers, summarised in Table 1, and mapped to established categories with supporting evidence from literature, field observations, and interviews. This crosswalk situates the findings within existing typologies while reflecting stakeholder perspectives. While most barriers reflect findings from prior studies, their interpretation diverged across stakeholders.

Constrained information use: Farmers and consultants both noted difficulties turning data into actionable insights. Multiple digital systems were used, but rarely integrated across platforms or with advisory input, creating silos between technologies and between farmers and advisors. Consultants emphasised underuse of advisory channels, while farmers framed the issue more as technical incompatibility. This finding aligns with earlier work on information bottlenecks (Flemming et al., 2019; Sutherland et al., 2023) but diverges in showing that farmers perceive the issue less as a knowledge-flow problem and more as a technical one, revealing a gap in how barriers are interpreted.

Low digital readiness: Strongly emphasised by both farmers and advisors, with adoption of IoT sensors and monitoring systems remaining uneven and largely reactive. Investments were often made only when problems arose rather than strategically. Farmers highlighted interoperability and lack of training, while consultants stressed reluctance to embed tools into decision-making. Previous studies underline infrastructural and interoperability challenges (Klerkx & Rose, 2020; Zhao et al., 2024), but the findings add nuance: even farms with relatively advanced infrastructure struggled, suggesting that readiness is as much about strategic embedding as technological capacity.

Behavioural resistance: Farmers described reliance on routines and "gut feeling" as pragmatic risk management, whereas consultants interpreted this as inertia. Generational contrasts appeared, with younger successors more open to structured analysis and older managers defending established approaches. While literature often treats behavioural inertia as a major barrier (Hayden et al., 2021; Dawkins, 2021), the findings diverge in showing that farmers themselves downplay this, reframing it as adaptation rather than resistance.

Weak entrepreneurial orientation: Advisors and policymakers pointed to limited diversification and cautious investment strategies. Farmers often adopted a financially conservative attitude, shaped by the capital intensity and risk of dairy farming. Consultants observed that investments were reactive rather than proactive, suggesting entrepreneurial drive was constrained by risk aversion, high fixed costs, and narrow market orientation. This finding supports prior research on strategic inertia (George et al., 2019; Kuipers et al., 2021) but adds that financial conservatism can be both protective and limiting, offering stability in the short term while hindering innovation over time.

Institutional uncertainty: Policy volatility and subsidy reforms discouraged long-term planning. Farmers and consultants agreed that shifting regulations undermined investment horizons, while policymakers admitted frequent reforms

contributed to this uncertainty. This aligns with prior evidence on destabilising policy environments (EU, 2023; Gonzales-Martinez et al., 2021), but our data highlight that consultants viewed uncertainty as manageable with scenario planning, but farmers rarely applied such tools. The finding diverges from literature that often assumes institutional barriers are external and unavoidable, showing that managerial routines also shape their effect.

Underused advisory support: Farmers often saw consultants as crisis problem-solvers rather than strategic partners, while advisors expressed frustration at being involved too late. This limited knowledge transfer and slowed adoption of innovations. The barrier also reinforced constrained information use, as advisory input could help translate data into strategy. Earlier work highlights underuse of extension services (Ingram et al., 2022; Helfenstein et al., 2020), but our findings diverge in showing that farmers were less aware of this gap, suggesting an unrecognised barrier that advisors identified more strongly than farm managers.

Fragmented decision routines: Decision-making was frequently ad hoc and short-term, shaped by financial pressures and operational demands. Farmers admitted choices were often made "day by day" without structured meetings or tools, with little use of frameworks such as SWOT, while consultants noted this weakened the use of strategic analysis. Literature links ad hoc planning to financial stress (Dong et al., 2019; George et al., 2019), but the findings add that fragmented routines interact with other barriers, limiting entrepreneurial orientation and advisory integration, thus increasing their impact.

Table 1 Mapping empirical barriers to barrier categories.

Empirical barriers	Barrier categories	Connection/Interpretation	Evidence Literature/field	Emphasis in interviews
Constrained information use	Informational	Farmers struggle to turn available data into actionable insights.	Lit: Bottlenecks in knowledge flows Field: advisory channels underutilized.	Moderate: consultants stress, famers less explicit.
Low digital readiness	Technological	Lack of digital infrastructure and skills slows technological adoption	Lit: Smart-tech adoption challenges. Field: Reluctance to alter routines	Strong: repeatedly raised by farmers and advisors.
Behavioural resistance	Behavioural	Risk aversion and attachment to routines reduce willingness to adopt strategic tools	Lt: resistance widely noted. Field: Reluctance to alter routines.	Weak/moderate: Mainly highlighted by consultants.
Weak entrepreneurial orientation	Market/organizational	Limited strategic drive and financial conservatism reduce competitiveness	Lit: Strategic inertia constrains Innovation. Field: Slow diversification	Moderate: Advisors and policymaker emphasized.
Institutional uncertainty	Institutional	Policy volatility creates hesitation in long-term planning	Lit: CAP/policy unpredictability. Field: reluctance to invest.	Strong: consensus among all groups.
Underused advisory support	Informational/organizational	Weak uptake of extension services reducing learning and slow adoptions	Lit: Underused extension services. Field: Services not systematically embedded.	Moderate: Advisors confirmed, farmers less so.
Fragmented decision routines	Financial/organizational	Ad hoc decision making undermines long-term strategy	Lit: Linked to financial stress. Field: short-term focus common.	Strong: Mentioned both by farmers and consultants.

Source: own processing

4 Discussion

The novelty of this pilot study lies not in identifying new barriers but in triangulating literature, field evidence, and stakeholder perspectives to show how barriers are differently perceived. These divergences themselves emerge as barriers to strategic alignment. While the seven barriers align with prior typologies, their importance varied: institutional uncertainty

(Barrier 5) and low digital readiness (Barrier 2) were strongly emphasised, while behavioural resistance (Barrier 3) was downplayed by farmers but stressed by consultants.

The results confirm that barriers are interconnected across institutional, informational, technological, behavioural, market, financial, and organisational domains. This supports earlier findings that strategic inertia and fragmented routines (Barriers 4 and 7) are systemic rather than individual-level issues (George et al., 2019; Flemming et al., 2019; Roux et al., 2022). Framing these barriers as constraints on dynamic capabilities adds nuance to agricultural strategic management, which often treats technology adoption and strategic analysis separately (Klerkx & Rose, 2020; Fuertes et al., 2020; Sutherland et al., 2023).

Low digital readiness and constrained information use (Barriers 1–2) highlight that digitalisation is not only about tools but about capabilities. Investments in IoT, data platforms, and automation often remained reactive, repeating warnings that adoption without strategy brings limited gains (Zhao et al., 2024; Ingram et al., 2022; Klingenberg et al., 2022). Interoperability issues and data overload reinforced this pattern, suggesting that smart farming must be embedded in broader planning frameworks rather than treated as a technical add-on. This is consistent with recent studies stressing that digitalisation is a socio-technical transition requiring managerial as well as technical adaptation (Klerkx & Rose, 2020; Jakku et al., 2023).

A key divergence lies in perceptions of behavioural resistance (Barrier 3). Consultants emphasised inertia and reluctance to change, while farmers described pragmatism and reliance on routines as risk management in uncertain contexts. This suggests behavioural barriers may be under-recognised by farmers themselves, a finding that extends prior studies which present resistance as a dominant constraint (Hayden et al., 2021; Nicolas-Davis et al., 2021). Generational contrasts observed in our interviews further complicate this picture, with younger successors showing greater openness to structured analysis, a nuance less prominent in the literature.

Weak entrepreneurial orientation (Barrier 4) further constrained strategic capacity. Advisors and policymakers highlighted limited diversification and reactive investments, while farmers described financial conservatism as a necessary safeguard against market volatility and high capital intensity. This finding confirms earlier work on strategic inertia (George et al., 2019; Kuipers et al., 2021), but adds nuance: entrepreneurial drive is not absent, but channelled into risk avoidance, which may provide stability in turbulent markets yet restrict long-term competitiveness. By showing how entrepreneurial caution is perceived as both rational and limiting, the data extend the literature that often frames it as purely a weakness.

Institutional uncertainty (Barrier 5) was consistently stressed across stakeholder groups, with subsidy reforms and regulatory volatility discouraging long-term planning. This is in line with studies on the destabilising effects of policy environments (EU, 2023; Gonzales-Martinez et al., 2021; De Schutter et al., 2020). Yet our data also suggest that such uncertainty is not purely external: consultants saw tools such as scenario planning as a way to mitigate volatility, but farmers rarely adopted them. This diverges from the literature, which often frames institutional barriers as structural and unavoidable, by showing how managerial routines also shape their impact.

Underused advisory support (Barrier 6) and fragmented decision routines (Barrier 7) point to dual weaknesses: advisory services were seldom integrated into farm routines, and decision-making was reactive and short-term. This reinforces claims that advisory systems must move beyond technical fixes to foster strategic thinking (Ingram et al., 2022; Helfenstein et al., 2020; Borman et al., 2022). Advisors therefore play a pivotal role in bridging operational problem-solving with long-term capability-building, but their contributions remain underutilised.

As a pilot, participant diversity was intentional to capture varied perspectives. Future research should test this framework with larger and more homogeneous farmer samples. The added value of this study lies in showing that farmers frame day-to-day pragmatism as adaptation, consultants see resistance, policymakers stress institutional uncertainty, and there is a link between digital readiness to advisory use. These divergences are not minor details but practical frictions that hinder collective action. Viewed through a strategic management lens, this reframes digitalisation not as a technological upgrade but as a strategic capability challenge. Thus, the findings contribute to strategic management theory by demonstrating how systemic barriers constrain dynamic capabilities, and to digital transformation debates by reframing digitalisation as a capability rather than a purely technological issue. The contribution lies less in naming barriers and more in showing how misaligned perspectives hinder their resolution. Addressing these misalignments is crucial to building the shared strategic capacity needed for developed dairy farms to systematically engage in strategic analysis and smart technology adoption. These findings extend beyond dairy farming, as the misalignment of stakeholder perceptions can be understood as a coordination failure within dynamic capabilities, reflecting broader debates in strategic management about how organizations integrate, build, and reconfigure resources under uncertainty (Teece et al., 1997; George et al., 2019).

By situating agricultural digitalisation within this theoretical lens, the study links sector-specific barriers to more general challenges of strategic alignment in turbulent environments.

5. Conclusion

This pilot study examined barriers to the use of strategic analysis and the integration of smart technologies in developed dairy farms, identifying seven interrelated barriers mapped onto established typologies that confirm the importance of financial, institutional, informational, behavioural, organisational, market, and technological factors. Its contribution lies in two ways: first, by triangulating literature, field observations, and stakeholder perspectives to connect conceptual models with practice; and second, by showing that divergences in stakeholder perceptions, rather than any single barrier, can themselves hinder the uptake of strategic analysis and smart technologies. By surfacing these misalignments and reframing digitalisation as a strategic capability challenge rather than a purely technological issue, the study offers a relational explanation for why strategic analysis remains underused in developed dairy farms. While not claiming representativeness or saturation, it provides a grounded framework and entry points for larger comparative research, demonstrating that misaligned perceptions themselves form a barrier to collective strategic action and that overcoming them is essential to build the shared capacity required for systematic strategic analysis and smart-technology adoption. The study shows that divergent perceptions are as constraining as institutional or technological barriers, underscoring the need for shared strategic capacity in digitalising dairy farming. Therefore, although rooted in dairy farming, the study speaks to strategic management more broadly: it shows that overcoming misaligned perceptions is not only a sectoral challenge but a fundamental condition for building dynamic capabilities in organizations facing technological and institutional turbulence.

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