

Decision support for alternative protein transitions by assessing cultured meat acceptance risk state under misinformation belief endorsement

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Abstract. Food system transitions involve contested claims, evolving governance, and uncertain public legitimacy. For pre-commercialised technologies such as cultured meat (CM), acceptance conditions can constrain transition progress before stable markets exist, especially when public evaluation is shaped through digital information environments. This paper develops an evidence-informed decision support framework to assess CM acceptance vulnerability under misinformation belief endorsement. The framework defines endorsement as misinformation-related claims being accepted and used as a basis for judgement, distinct from simple exposure. It situates endorsement within an information environment shaped by predispositions and credibility signals, and links endorsement patterns to an acceptance risk state that summarises whether acceptance conditions appear relatively stable or increasingly fragile. For decision use, endorsement is organised into three content domains, societal engineering, health and biotech conspiracies, and market and policy deception, and each domain is linked to acceptance risk cues and broad response classes. It can help firms, regulators, and transition stakeholders align engagement, governance signalling, and communication choices to the dominant acceptance vulnerabilities under contested information conditions.

Keywords: Alternative protein transitions, Decision support, Cultured Meat, Information environment

1 Introduction

Food system transitions are increasingly understood as complex and contested processes beyond linear technological substitutions. Decisions about which innovations to support, scale, or delay are often made under conditions of uncertainty, incomplete evidence, and competing social expectations [11, 25]. In this context, transition pathways are shaped not only by technical feasibility and economic viability, but also by public legitimacy, trust in institutions, and perceptions of fairness and control [5, 8].

Alternative proteins have been positioned as one potential component of future food system transitions, yet their role seems to be neither fixed nor uncontested. Cultured meat (CM), in particular, remains a pre-commercialised technology, with ongoing

uncertainty surrounding production scale, costs, regulatory trajectories, and sustainability outcomes [16, 23]. While it is often discussed in relation to environmental or ethical potential, existing evidence indicates that consumer acceptance represents a critical constraint, especially in early stages where direct experience is limited and public understanding is largely mediated through information environments [9, 28].

Research on CM acceptance has identified a wide range of influencing factors, including perceived naturalness, safety concerns, trust in producers and regulators, and affective responses such as disgust or unease [9, 18]. Comparative work across alternative protein categories further shows that acceptance drivers and barriers are not uniform, suggesting that transition decisions cannot rely on generic assumptions about “alternative protein consumers” [2, 14]. However, much of this literature has focused on explaining or predicting attitudes and intentions, with more limited attention to supporting decision-making under uncertainty.

At the same time, decision-makers in early transition contexts face an additional challenge where public perceptions are increasingly shaped within information environments characterised by misinformation, selective exposure, and distrust of institutions. Recent work has shown that misinformation effects are often overstated or poorly specified, and that simple notions of exposure obscure the importance of belief endorsement and meaning-making processes [1]. Nevertheless, evidence suggests that misinformation should not be ignored, particularly when it reinforces existing distrust or conspiracy-oriented worldviews that are resistant to factual correction [7, 26]. Reviews of audience resilience further indicate that susceptibility and resistance to misinformation are shaped by interacting individual, social, and contextual factors [13]. Information deficits alone offer an incomplete account. For pre-commercialised technologies such as CM, these dynamics can be especially consequential. When products are not yet widely available, public understanding can be largely constructed through narratives, claims, and counter-claims circulating in digital and media environments. As a result, endorsement of misinformation-related beliefs can translate into reputational risks, legitimacy challenges, and strategic uncertainty for firms and ecosystem actors long before market behaviour can be observed [11, 16]. From a transition perspective, acceptance therefore functions both as an outcome to be measured later, and as a decision-relevant risk that should be interpreted and managed in real time.

Despite this, a gap remains between consumer acceptance research and the needs of transition decision-makers. While existing studies document acceptance determinants, they rarely offer structured ways to interpret misinformation belief endorsement as a signal for decision-making, or to connect such signals to appropriate response options. This gap is particularly evident in contexts where acceptance concerns intersect with broader narratives of societal control, health risks, or institutional deception, which are difficult to address through conventional information provision alone [9, 26].

The paper develops a decision-support framework for cultured meat transition decision-making by assessing acceptance vulnerability under misinformation belief endorsement. The framework draws on two prior research outputs including a conceptual synthesis and framework paper grounded in systematic literature review, and a Twitter/X discourse analysis used for qualitative, exploratory grounding [20, 21]. The proposed framework conceptualises acceptance risk as a decision-relevant state reflecting

the combined influence of knowledge, perceptions, and attitudes as they are shaped within the information environment. Rather than offering population-level behavioural prediction, the framework is presented as a risk-sensing and response-alignment heuristic for early transition decision moments. The aim is structured interpretation of belief endorsement patterns and their implications for acceptance vulnerability at early-stage transition decision points. It complements existing risk registers and stakeholder mapping tools by distinguishing between different endorsement logics (e.g., control, harm, deception) and linking them to distinct acceptance risk cues and response-option classes. The framework is not intended to delegitimise good-faith critique. It focuses on endorsement of demonstrably false or misleading claims and on how such endorsement dynamics reshape credibility constraints for decision-makers.

The paper makes three contributions. First, it reframes consumer acceptance as a decision-relevant risk in transition contexts, alongside its role as a downstream behavioural outcome. Second, it provides a structured way to connect misinformation belief endorsement to acceptance risk cues and corresponding response-option classes that can inform decision-making under uncertainty. Third, it offers a decision-support framework designed to be usable in multidisciplinary transition discussions where legitimacy, trust, and evidence uncertainty interact.

2 Literature review and conceptual foundations

Cultured meat has been positioned as one possible pathway within broader protein transitions, but the direction and pace of such transitions are shaped by more than technological readiness. Decisions are made under conditions of contested sustainability claims, evolving governance, and uncertain social legitimacy, where acceptance becomes a material source of transition risk going beyond a downstream “marketing” concern [11, 16, 23]. In this setting, consumer acceptance is best understood as dynamic and information-contingent, particularly because beliefs about cultured meat can be formed and reinforced in digital information environments where misleading claims, distrust cues, and conspiratorial narratives circulate and stabilise [1, 15, 19]. Importantly, contested transition debates may also include legitimate critique and unresolved evidence questions where the challenge for decision support is to distinguish these from endorsement of demonstrably false or misleading claims without treating all dissent as misinformation.

2.1 Protein transitions as multi-actor decisions under uncertainty

Protein transition decisions are typically framed as systemic changes involving multiple actors (industry, civil society, regulators, and consumers) and interacting policy and market dynamics [6, 8–11]. Within this framing, governance is often discussed through “policy mix” approaches that recognise that transitions involve interacting instruments and unintended repercussions, including distributional and legitimacy effects [11]. Questions of inclusion and legitimacy have been emphasised as particularly

salient in food-system change, because transitions can be contested not only on technical grounds but also in terms of procedural fairness and voice [8].

Across transition scholarship, decision-making is characterised by uncertainty (about outcomes and legitimacy), multiplicity (stakeholders and goals), and contestation (over what counts as sustainable and acceptable change). This matters for decision support because different framings of systemic change imply different expectations about speed, disruption, and institutional reconfiguration [5], while firm and sector-level change has also been described as constrained by structural lock-ins and conflicting pressures [25]. For CM specifically, “just transition” critiques highlight that alternative protein innovation can reproduce unsustainable political-economic dynamics if justice and power are not explicitly addressed, reinforcing that legitimacy conditions can become as consequential as technical feasibility [16].

Uncertainty is especially pronounced for CM because the technology remains pre-commercialised in most settings, and evidence on sustainability performance and scalability is still developing. Recent synthesis suggests that sustainability discussions remain fragmented across environmental assessment, social and health implications, and techno-economic feasibility, creating a knowledge context that can be interpreted selectively by different actors [23]. Under these conditions, decision-makers face a dual uncertainty including uncertainty about what the technology can deliver, and uncertainty about how it will be interpreted and accepted within the public sphere.

2.2 Acceptance of cultured meat and adjacent substitutes

A substantial body of consumer research has examined determinants of acceptance, often operationalised as attitudes, willingness to try, or purchase intentions. Recent reviews converge on a familiar set of drivers and barriers such as perceived naturalness/unnaturalness, perceived health and safety risk, disgust-related responses, trust in institutions and producers, perceived benefits (e.g., animal welfare), and cost/value perceptions [9, 18, 28]. The literature also indicates variability across contexts and populations, suggesting that acceptance is not a stable trait but a contingent judgement shaped by cultural and informational conditions [24, 28].

Comparative research across alternative protein categories is particularly relevant for transition decisions because choices are rarely binary (meat vs cultured meat); instead, portfolios are considered (plant-based, mycoprotein, insects, cultivated meat). Evidence from a nationally representative study in Singapore compared acceptance and drivers across several alternative proteins, reinforcing the point that “novel protein acceptance” is not a single phenomenon and that barriers differ by product type [14]. Preference structures also complicate adoption pathways, including how consumers categorise costs and benefits and respond to perceived externalities, implying that consumer response cannot be inferred from general pro-sustainability attitudes alone where product categories carry distinct symbolic meanings and perceived risks [2].

Communication effects are also mixed and often smaller than implied in policy and advocacy debates. Experimental evidence in Australia showed that fact-based environmental messaging did not shift attitudes or intentions toward cultivated seafood, suggesting that “more information” or sustainability claims may be insufficient when

deeper concerns (trust, perceived unnaturalness, risk) dominate evaluation [3]. However, social cues and source dynamics can matter as influencer endorsements perceived as authentic and competent have been shown to affect willingness to buy cultured meat, indicating that informational social influence may shape attitude formation in high-uncertainty contexts [22]. Together, these findings point to a limitation in the acceptance literature for transition decision support: acceptance is frequently treated as an outcome of individual preferences, while information environments, trust cues, and belief formation processes are not consistently translated into decision-relevant signals [3, 18, 28].

Finally, several streams of research suggest that aversion can be partly driven by evolved threat-management responses, including disgust and contamination concerns, which may be difficult to shift through factual correction alone [10, 28]. This further supports the need to move beyond “information deficit” assumptions when considering decision support for acceptance risk.

2.3 Information environments, misinformation, and belief formation

Misinformation research provides conceptual and methodological cautions for integrating misinformation into acceptance assessment. Misinformation is not a singular, easily measured exposure as definitions vary and public concern can exceed what is empirically demonstrated in some contexts, creating risks of over-claiming effects or mis-specifying mechanisms [1]. At the same time, arguments that misinformation can be ignored have been challenged on conceptual and evidential grounds, including the claim that low prevalence in some measurements does not imply negligible harm, especially when effects are concentrated in high-stakes domains or among vulnerable groups [7]. For transition decision making, the implication is that neither alarmism nor dismissal is adequate. A mechanism-oriented approach is needed that clarifies how particular belief forms become credible and how they shape evaluations in specific contexts. This also implies that acceptance-related controversy should not be treated as “misinformation” by default as the decision-relevant question is when claims become endorsed as judgement anchors and thereby constrain credibility and legitimacy.

The concept of an information environment is increasingly used to capture the broader ecosystem shaping belief formation, including sources, signals, social networks, and institutional responses. In health policy literature, the information environment has been argued to function as an independent social determinant, influencing beliefs and behaviours in ways analogous to other structural determinants [19]. Empirical work in communication further shows that properties of digital information environments (including processing dynamics and presumed influence) can shape behavioural responses to misinformation, reinforcing the relevance of environment level conditions beyond individual traits [27]. A systematic synthesis also suggests that resilience or vulnerability to disinformation is multi-level, spanning individual dispositions, media use, trust, cultural context, and environmental factors, while noting that audience resilience is often invoked without consistent definitional clarity [13]. These points align with transition contexts where distrust in institutions and perceived manipulation can be central features of discourse around food technologies.

A further foundation concerns predispositions that shape whether misinformation is interpreted as plausible and worth endorsing [4, 26]. Technology-mediated processes can reinforce conspiracy mindsets, suggesting that belief systems can become self-stabilising and hard to correct [26]. For assessment purposes, this supports treating endorsement as the proximal mechanism of interest because exposure or knowledge alone may not explain acceptance outcomes. Food-specific scholarship similarly highlights that misleading information, established misconceptions, and “fake news” can shape perceived healthiness and acceptability, interacting with longstanding psychological and social drivers rather than operating as a simple additive effect [15].

2.4 Research gaps

Despite this evidence base, translation into decision-useful interpretation at concrete transition moments remains limited. Consumer acceptance research has generated substantial evidence on factors associated with attitudes, willingness, and intentions, yet it remains primarily organised around explanatory outcomes instead of structured guidance for decision teams [18, 28].

This means that where communication effects are examined, results can be mixed, indicating that acceptance risk cannot be assumed to shift reliably through generic information provision alone [3]. Second, because CM remains pre-commercialised, sustainability evidence is still developing across environmental, social, and techno-economic dimensions, creating uncertainty that can interact with trust and legitimacy concerns in public debate [16, 23]. Third, misinformation scholarship increasingly emphasises the need for conceptual clarity and mechanism specification, distinguishing endorsement processes from vague notions of exposure, yet these mechanisms do not seem to be consistently integrated into alternative protein acceptance discussions in ways that could be directly usable for transition decision support [1, 7]. Existing decision tools such as risk registers or stakeholder mapping may record “concern” but they typically do not distinguish endorsement logics that imply different acceptance vulnerabilities and require different credible response options. Finally, transition scholarship highlights legitimacy, inclusion, and systemic constraints, but consumer-facing information dynamics are not always incorporated into transition decision framings despite their potential to destabilise legitimacy and slow adoption pathways [8, 19, 25].

3 Evidence base and framework development approach

3.1 Evidence base

The framework was developed using two main evidence sources, supplemented by targeted literature aligned with the conference focus. First, it draws on prior conceptual work that synthesised the CM acceptance literature and organised it into a decision-relevant framework intended for early-stage commercialisation and transition contexts [20]. That work established acceptance as multi-dimensional, extending beyond product attributes to include affective and contextual influences that shape evaluation when

direct experience is limited [20]. In the present paper, this conceptual foundation is carried forward, with greater emphasis placed on the role of information conditions and belief formation in high-uncertainty settings, reflecting recent scholarship in misinformation and information-environment research [1, 19].

Second, the framework is informed by a Twitter/X discourse analysis undertaken as part of the wider research project [21]. Twitter/X was treated as a naturally occurring space in which claims, doubts, and legitimacy challenges around cultured meat are articulated and contested in real time. Topic modelling was used to structure a large volume of posts, followed by qualitative interpretation to examine recurring claim types and justificatory patterns in everyday language [21]. Topic clusters were then grouped into higher-order topic families and interpreted iteratively to derive the three endorsement domains used in this paper. This evidence was not treated as representative of public prevalence and it was used to identify salient belief patterns that plausibly shape how CM is evaluated under contested information conditions. To support transparency without reproducing raw posts, Table 1 in Chapter 5 provides paraphrased endorsement markers that illustrate the domain logic.

In addition, the framework was refined through targeted engagement with recent literature emphasising transitions as contested, multi-actor processes where legitimacy and trust shape feasible pathways, and where decision-making often proceeds under uncertainty [8, 11, 25]. Together, these inputs supported an evidence-informed approach in which well-established acceptance determinants were retained, while discourse-grounded belief patterns were used to foreground information-environment dynamics that can destabilise acceptance conditions.

3.2 Development process

Framework development followed an iterative conceptual development approach rather than empirical model testing. It was designed for early transition decisions around CM, where decision teams may often interpret evolving public narratives and legitimacy pressures without relying on mature market indicators. For that reason, the framework is oriented toward interpreting acceptance vulnerability as a decision-relevant risk state, with explanatory and predictive modelling reserved for subsequent work. The framework retains a simple structure to support practical use. It treats the information environment as the context shaping what is regarded as credible and actionable, and it focuses on misinformation belief endorsement as the pathway through which that context can translate into acceptance vulnerability [1, 19]. Endorsement is organised into three content domains including societal engineering beliefs, health and biotech conspiracy beliefs, and market and policy deception beliefs, based on recurring discourse patterns and supported by literature emphasising that vulnerability and resistance to misleading information reflect interacting individual, social, and contextual factors [13]. The domains are treated as analytically distinct because they differ in their dominant evaluative logic (autonomy/control, harm/contamination, and governance illegitimacy/capture), even where specific topics may overlap. To ensure that the framework is decision-relevant, these endorsement patterns are linked to acceptance risk cues and broad

response directions, consistent with work treating misinformation as a practical organisational risk issue [17].

3.3 Scope and analytical limits

The framework is presented as a conceptual decision-support structure. Illustrative claim types are paraphrased and used to clarify the logic without reporting prevalence estimates or reproducing raw posts. The intention is to provide minimal but decision-relevant transparency on how endorsement logics were structured, while avoiding claims about population prevalence or effect size. Detailed discourse reporting, measurement development, and empirical testing are reserved for subsequent outputs.

4 The decision-support framework

4.1 Framework overview

The proposed framework is intended for early transition contexts where public evaluation is shaped through information environments and where decision teams must interpret emerging signals without relying on mature market indicators or behavioural data [11, 19, 25]. Figure 1 summarises the framework logic. The framework treats misinformation belief endorsement as the key mechanism linking the information environment to acceptance vulnerability. Endorsement is defined as misinformation-related claims being accepted and used as a basis for judgement (e.g., repeated, defended, or treated as credible), distinct from simple exposure to misleading content [1, 7]. Misinformation research has shown that exposure cannot be treated as equivalent to belief or downstream impact without clarifying what is accepted and how it anchors evaluation [1].

Belief endorsement is shaped within an information environment that includes individual and social predispositions affecting credibility judgements in uncertain contexts, and sources and signals that shape perceived plausibility and legitimacy [13, 19, 27]. The framework's decision-relevant outcome is an acceptance risk state, used here as a structured summary of whether acceptance conditions appear relatively stable or increasingly fragile. In this paper, "risk state" refers to vulnerability in acceptance conditions that can affect legitimacy, stakeholder relationships, and feasibility of transition progress even before widespread product access exists [16, 23]. The construct is interpretive, and is intended to support structured judgement under uncertainty, without estimating behavioural probabilities.

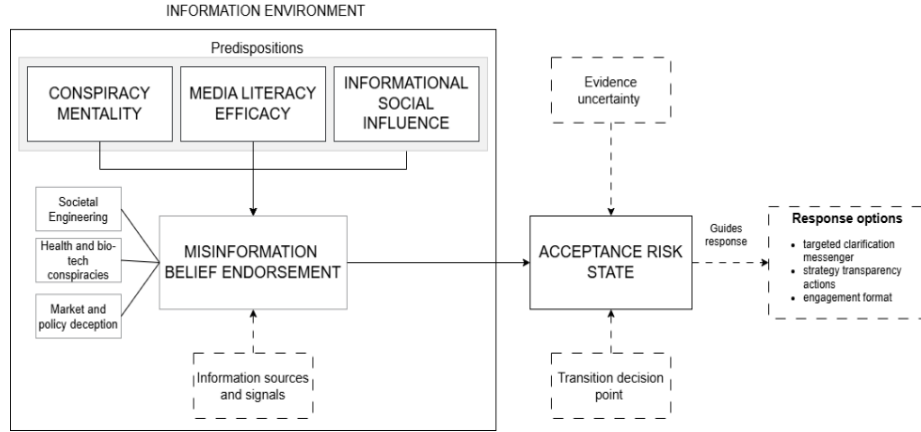


Fig. 1. Conceptual framework

The framework is intended to support structured interpretation of endorsement patterns as signals of emerging acceptance vulnerability under contested information conditions.

4.2 Core components and definitions

Information environment (predispositions). Predispositions are treated as influences that shape how information is interpreted and whether certain claims feel plausible or worth repeating in high-uncertainty contexts. In technology related domains, conspiracy-linked belief dynamics can become self-reinforcing through social and informational mechanisms, which can shift evaluation away from evidence appraisal and toward distrust based interpretations [26]. Wider synthesis also indicates that vulnerability or resistance to misleading information reflects interacting individual, social, and contextual influences, with influences extending beyond information deficits alone [13]. For this paper, three predisposition types are retained as conceptually relevant which include conspiracy-oriented interpretations, confidence in evaluating online information quality, and reliance on social proof under uncertainty [12, 13, 27].

Information environment (sources and signals). In this framework it refers to the channels and credibility cues through which claims circulate (e.g., perceived source credibility, social proof signals, and the wider platform context). Research on digital information environments indicates that behavioural and evaluative responses to misinformation are shaped by processing dynamics and environmental properties, as well as by message content [27]. Related arguments also frame the information environment as a structuring condition shaping what is regarded as credible and actionable [19].

Misinformation belief endorsement. It is organised into three domains used in this paper as a practical structure for interpreting claim logics observed in CM discourse and aligning response thinking. These elements are not treated as exhaustive of scepticism, nor are they intended to classify all criticism as misinformation, but as distinct endorsement patterns with different implications for acceptance vulnerability:

- Societal engineering beliefs- CM framed as coercive societal control or imposed change, aligning with broader technology conspiracy dynamics and legitimacy concerns [16, 26].
- Health and biotech conspiracy beliefs- CM framed as inherently unsafe, contaminating, or deliberately harmful. Food related misleading information has been discussed as shaping perceived healthiness and acceptability, particularly where scientific uncertainty exists and narratives simplify complexity [15, 23]. Disgust and contamination intuitions are also highlighted as barriers that may be difficult to shift through factual correction alone [10].
- Market and policy deception beliefs- CM approvals, subsidies, and labelling framed as corrupt, captured, or designed to mislead. This connects directly to institutional trust and legitimacy conditions that are salient in transition governance contexts [11, 19].

Acceptance risk state. The acceptance risk state summarises whether acceptance conditions appear increasingly fragile under prevailing endorsement patterns. It consolidates acceptance concerns repeatedly identified in the CM and alternative protein literature (e.g., perceived risk, trust, disgust-related responses, legitimacy concerns) into a decision-oriented construct suitable for early stage contexts where market behaviour cannot yet be observed [9, 18, 28]. The purpose of the construct is interpretive, supporting decision teams in recognising when evaluation appears to be shifting toward entrenched distrust, categorical rejection, or intensified legitimacy contestation in ways that may constrain transition feasibility. For practical interpretation, acceptance conditions can be observed along a spectrum. They may appear:

- relatively stable, where concerns remain responsive to discussion and evidence;
- increasingly sensitive, where endorsement patterns consolidate and trust signals weaken;
- fragile, where distrust becomes entrenched and rejection is framed in categorical or identity-linked terms.

The distinctions are qualitative and intended to inform judgement about when closer monitoring or strategic recalibration may be necessary.

4.3 Contextual elements supporting transition decision use

To reflect how transition decisions are made under uncertainty and legitimacy pressure, the framework includes contextual elements that shape how endorsement signals can be interpreted and acted upon. Evidence uncertainty is treated as a background condition because sustainability and feasibility assessments remain contested and developing for cultured meat, which creates space for selective interpretation in public debate [23]. The framework also recognises that credibility is channel-contingent including sources, platform cues, and social signals influence both how claims travel and how responses are received [19, 27]. In addition, acceptance vulnerability can intensify at specific decision moments, such as controversies, regulatory milestones, or market entry debates, when legitimacy judgements become especially salient for governance and strategy [11, 25]. Finally, endorsement patterns are linked to response classes as decision-support

prompts. The response classes are not presented as tested interventions, consistent with risk-management perspectives that treat misinformation as an organisational risk to be managed under uncertainty [7, 17].

5 Applying the framework at decision moments

CM transition decisions are often taken at moments when public evaluation is being shaped by contested claims, uneven trust, and fast-moving online narratives. In these situations, decision teams need a structured way to interpret which misinformation related claims are being treated as credible (i.e. endorsed) and what that implies for acceptance vulnerability and response choices. The framework can be used to support structured interpretation since it focuses on endorsement and links dominant endorsement logics to acceptance risk cues and response directions that remain feasible under prevailing credibility constraints [1,7, 13, 19].

5.1 Practical steps for decision use

In practice, the framework can be applied through a short workflow as follows:

- Monitor and capture recurring claims from relevant areas (mainstream coverage, stakeholder conversations, regulator-facing debate, and major social platforms), focusing on claims that are repeated, defended, or treated as credible [1, 7]. In resource-constrained settings, this can be done through periodic scans around key events (e.g., consultation windows, announcements) instead of continuous monitoring.
- Classify endorsement logic using the three belief domains (societal engineering, health/biotech conspiracies, market/policy deception). Multi-classification can be expected when claims blend logics [13].
- Assess acceptance vulnerability by identifying what the dominant logic implies considering autonomy threat and resistance, harm certainty and contamination intuitions, or governance illegitimacy and capture assumptions [7, 19].
- Select response direction as a class of action aligned to the credibility constraints of the moment (e.g. messenger choice, governance signals, oversight transparency), avoiding default reliance on generic fact correction when the dominant logic is not evidence-responsive [1, 7].
- Record and review whether endorsement patterns shift over time to support disciplined interpretation and response alignment under uncertainty [1, 13].

5.2 Linking belief endorsement domains to acceptance risk cues and response directions

Table 1 translates the three belief domains into decision-relevant cues and response directions.

Table 1. Endorsement-to-response mapping

Endorsement domain	Illustrative endorsement markers from Twitter/X	Acceptance risk cues for decision teams	Response emphasis (classes, not evaluated interventions)
Societal engineering	CM framed as an “elite/globalist” project linked to WEF, “Great Reset”, Agenda 2030, coercion/mandates, “control”, “depopulation”, and paired with “eat bugs” narratives; personified blame toward powerful actors (e.g. tech figures)	High reactance and identity-based refusal. Evaluation shifts from product evidence to autonomy threat and symbolic resistance. Distrust becomes self-protective, not just informational	Autonomy-respecting engagement (choice-preserving framing, avoid coercive tone. E.g., emphasising voluntariness, opt-in pilots). Procedural fairness and voice signals (credible participation formats, stakeholder inclusion. E.g., open consultation formats chaired by trusted intermediaries). Messenger strategy that reduces “elite” cueing and emphasises locally trusted intermediaries (e.g., local public health figures, community-based organisations).
Health and biotech conspiracies	Claims that the product is grown from “cancer cells”, causes cancer, contains mRNA, is GMO/engineered, is “toxic/chemical”, “Frankenfood”, “contaminating”, “untested”, “lab rat” framing	Harm certainty and contamination intuitions Disgust and perceived unnaturalness intensify. Precautionary demands (ban/stop) replace conditional openness. Correction attempts may be read as minimization.	Oversight visibility and process transparency (what testing/monitoring exists and how decisions are made. E.g. publishing clear testing pathways and decision criteria). Uncertainty-competent safety communication (clear boundaries of what is known/unknown. E.g. explicitly stating where evidence is still developing). Credible third-party scrutiny rather than brand-led reassurance (e.g. independent scientific review, regulator-facing summaries).
Market and policy deception	Claims that FDA/USDA approvals are corrupt/captured, “bought”, bribed; “follow the money” frames (subsidies/taxpayer funding); “labelling to dupe consumers”; bans/procurement restrictions framed as political collusion	Governance legitimacy breakdown. Suspicion toward regulators, standards, and firms. Reputational fragility and partnership hesitation. Even accurate information can be discounted as captured.	Governance credibility actions (traceable compliance processes, clarity on standards, conflicts, funding, and decision pathways. E.g. transparent conflict of interest disclosures, audit-ready documentation). Transparent regulatory engagement posture (e.g. open publication of consultation responses and rationale). Accountability signaling that reduces capture interpretations (e.g. clear delineation of roles between firms, regulators, and assessors).

Endorsement cues are paraphrased from the Twitter/X corpus and reflect recurring narrative markers [21]. The response directions are framed as credibility oriented classes of action presented without intervention evaluation evidence, consistent with the need to avoid over specifying effects in a pre-commercialised context [1, 7, 15]. Examples are included to clarify practical meaning.

The logic outlined in Table 1 can be observed in high-salience regulatory or consultation periods. For instance, when recurring and defended claims frame cultured meat

as part of an “elite” or externally imposed project linked to loss of autonomy, such endorsements fall within the societal engineering domain. In this configuration, acceptance vulnerability is indicated less by product-specific safety concerns and more by heightened autonomy reactance and symbolic resistance. Under these conditions, responses centred on detailed technical reassurance are unlikely to address the dominant evaluative logic. Greater emphasis is instead placed on autonomy-respecting engagement, visible procedural fairness, and the use of locally trusted intermediaries, consistent with the response classes summarised in Table 1. Ongoing review of endorsement patterns would then indicate whether evaluation shifts toward conditional concerns or remains anchored in control-based distrust. The table is intended to support structured judgement in contexts where fixed intervention rules are not available. Its value lies in differentiating endorsement logics so that response alignment reflects prevailing credibility conditions.

5.3 Using the framework in common decision moments

Before applying the framework, mixed endorsement patterns should be expected, particularly when controversies blend health risk claims with broader distrust of governance. In such cases, classification should prioritise the dominant evaluative logic shaping acceptance vulnerability, while noting secondary logics that may require parallel response emphases. Use may also differ by actor type. For example, startups may have limited legitimacy capital and therefore rely more heavily on third-party scrutiny and credible intermediaries, incumbents may face stronger expectations of transparency and accountability, while regulators may prioritise procedural fairness, clear rationale, and visible independence to prevent capture interpretations

The framework has a potential to be most useful when endorsement patterns increase around high salience decision contexts. During fast-moving controversies, efficient classification may help teams avoid mismatched responses (e.g. detailed safety rebuttals when the dominant logic is perceived as an autonomy threat, or branding reassurance when the dominant logic is capture and deception) [7, 27]. Around regulatory milestones and consultation periods, market/policy deception narratives tend to become more consequential because they target approval legitimacy including governance and process credibility therefore become central [11, 19]. During market-entry and naming/labelling debates, contamination and perceived consumer deception frames can escalate acceptance vulnerability even when the underlying technical evidence has not changed. More credible responses combine uncertainty-competent explanation with clear oversight signals, and not treating naming as a purely commercial branding choice [10, 15].

6 Contribution to knowledge and decision support for sustainable and resilient transitions

The framework contributes to decision support for early stage CM transitions by positioning acceptance vulnerability as an interpretive condition shaping commitments

under uncertainty. In contested transition contexts, firms and governance actors often need to make commitments (e.g. investment, engagement, regulatory positioning, partnership-building) under uncertainty and legitimacy pressure, while public meaning-making can shift faster than the underlying technical evidence. A resilience oriented approach to decision support therefore benefits from structured interpretation of emerging vulnerabilities, consistent with transition literature emphasising contestation, legitimacy, and governance conditions as determinants of whether pathways accelerate or stall [11, 16, 25]. Continued uncertainty in sustainability and feasibility assessments further intensifies these interpretive pressures in public debate [23].

A second contribution concerns how misinformation is incorporated into acceptance assessment. The framework centres belief endorsement as the mechanism linking contested information conditions to acceptance vulnerability. This responds to conceptual critiques that misinformation research becomes weak when it blurs exposure, belief, and downstream effects without specifying what is accepted and how it is used in evaluation [1]. By focusing on claims that are accepted, repeated, defended, or used as judgement anchors, the framework links misinformation dynamics to acceptance vulnerability without making prevalence claims. Such an approach is consistent with the argument that misinformation should not be dismissed simply because measured exposure or average effects may be uneven, especially when it reinforces distrust or entrenched interpretive frames that resist conventional correction [7]. It also aligns with evidence that conspiracy-linked belief systems can become self-reinforcing and identity-protective, shaping evaluation of emerging technologies [26]. The framework does not treat all scepticism or normative disagreement as misinformation. It focuses on recurring endorsement patterns that attribute intentional harm, coercive control, or institutional corruption in ways that alter credibility conditions.

The decision support contribution lies in translating these points into a problem-structuring framework that can be used at decision moments. The framework supports early warning and sensemaking by helping teams identify which endorsement logics are salient, what kind of acceptance vulnerability they imply, and which broad response directions are more credible under prevailing trust conditions. This draws on an information environment perspective in which belief formation is shaped by interacting individual, social, and contextual factors, rather than information deficits alone [13]. It also reflects evidence that digital information environments influence behavioural responses through processing dynamics and social signals, making environment-level conditions part of the decision context [27]. Related literature further argues that information environments can operate as structural determinants that shape what is regarded as credible and actionable, reinforcing the need for decision support that is calibrated to credibility constraints [19].

Finally, the framework's differentiation of endorsement logics supports adaptive decision-making in line with sustainable and resilient transitions which require responses to heterogeneous legitimacy challenges, not a single communication solution. By organising endorsement into distinct belief domains and linking them to acceptance risk cues and response-option classes, the paper provides a structured basis for judgement under uncertainty while remaining consistent with the evidential limits of a pre-commercialised context. Figure 1 summarises the conceptual logic and Table 1

operationalises this differentiation into domain-specific risk cues and response classes. In doing so, it offers a contribution as a decision support framework intended to strengthen interpretation and response alignment in the information conditions that increasingly shape transition feasibility.

7 Conclusion

This paper developed an evidence informed decision support framework for assessing Cultured Meat acceptance vulnerability under misinformation belief endorsement. In pre-commercialised transition contexts, decision teams often need structured interpretation of emerging acceptance vulnerability before population-level behavioural prediction is feasible. Therefore, the framework uses an acceptance risk state as a decision-oriented summary of whether acceptance conditions appear relatively stable or increasingly fragile. It positions the information environment as the context shaping whether misinformation related claims are endorsed and treats endorsement as the mechanism through which contested information conditions can translate into heightened acceptance vulnerability. To support use at transition decision points, the paper also provided illustrative mapping from endorsement domains to acceptance risk cues and broad response classes, intended to support judgement and guide response alignment, without prescribing tested interventions. Figure 1 presents the conceptual structure of this logic, and Table 1 translates it into a domain-specific endorsement-to-response mapping tool.

Several limitations follow from the scope and evidence base. The framework is conceptual and designed for decision support under uncertainty, so it does not provide prevalence estimates, validated effect sizes, or behavioural prediction claims. The empirical grounding is qualitative and exploratory, drawing on Twitter/X discourse to identify recurring endorsement logics. This offers insight into how claims are framed and defended in naturally occurring debate, but it is not representative of the wider public and cannot be used to infer population-level attitudes. Also, the mapping between endorsement patterns, acceptance risk cues, and response classes remains provisional as well, reflecting structured synthesis and discourse-informed plausibility rather than evaluation evidence on what responses are effective across audiences or settings. In addition, the acceptance risk state compresses diverse acceptance processes into a single decision-oriented construct and does not capture the full variation likely to exist across consumer segments and cultural contexts. Although operational clarification has been provided in terms of indicative stability and fragility conditions, further empirical refinement would be required for systematic monitoring or comparative application.

Next steps focus on strengthening empirical foundations and decision relevance. Further work could look at refining the endorsement domains through discourse analysis across additional platforms, including how narratives cluster, co-occur, and intensify around key decision points. In addition, measurement development and primary data collection can be used to test the proposed pathway from information-environment predispositions to endorsement and to acceptance vulnerability. Such work would allow future research to examine whether the framework functions primarily as an

interpretive heuristic, a risk-sensing device, or a precursor to more formalised modelling approaches within transition decision support.

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