

**Beyond the Attitude–Behaviour Gap: Systemic Alignment
and the Structural Reproduction of Bread Waste**

Abstract

Bread waste remains a persistent sustainability challenge in industrialised food systems despite increasing environmental awareness and technological optimisation. Existing research typically examines food waste from isolated behavioural, retail, or manufacturing perspectives, thereby overlooking the cross-level dynamics through which surplus is structurally reproduced. This paper reconceptualises bread waste as a systemic coordination problem emerging at the retail–consumer interface, shifting the analytical focus from actor-specific deficits to cross-level misalignment.

Building on the Theory of Planned Behaviour (Ajzen, 1991), Institutional Theory (DiMaggio and Powell, 1983; Scott, 1995), and Information Processing Theory (Galbraith, 1973), the study develops the Systemic Alignment Framework. The framework explains how retail promotional volatility generates demand fluctuations, how manufacturers respond through structural buffering and conservative forecasting, and how consumers make disposal decisions under bounded rationality within abundance-oriented choice architectures. The interaction of these internally coherent yet unsynchronised logics systematically reproduces surplus.

Methodologically, the study adopts an explanatory sequential mixed-methods design, combining a representative survey of German consumers with qualitative interviews across retail and manufacturing actors. By triangulating behavioural, institutional, and informational lenses, the study identifies key mechanisms of misalignment and outlines conditions under which alignment across actors becomes possible. The findings provide actionable insights for aligning demand generation, production planning, and consumer decision environments, thereby enabling more effective and systemically coordinated waste reduction strategies.

Keywords

Systemic alignment; food waste; bread supply chains; retail–consumer interface; supply chain coordination; institutional logics; sustainability

1. Introduction

This paper develops the Systemic Alignment Framework as a conceptual explanation of surplus reproduction in industrial food systems. While the framework is informed by ongoing empirical work in the German bread sector, the primary contribution of this paper lies in its theoretical integration and cross-level explanation of surplus reproduction. The empirical research design is outlined to indicate how the framework can be tested and operationalised in future research.

The sustainability challenge within global food systems has generated extensive research on food waste reduction and sustainable consumption (Poore and Nemecek, 2018; Springmann et al., 2018; Nyström et al., 2019). Despite technological innovation, transparency initiatives and rising environmental awareness, structural inefficiencies across supply chains continue to drive significant food loss and waste, particularly in highly perishable staple goods such as bread (Nyström et al., 2019; Rockström et al., 2020). Owing to its high production volume, short shelf life and cultural centrality, bread represents a critical yet comparatively underexamined obstacle to achieving a sustainable food economy (Kechagias et al., 2024).

In Germany, the industrialisation of bakery production reflects broader transformations in contemporary food systems. Large-scale manufacturing, national logistics networks and high service-level expectations have enhanced availability and efficiency, yet simultaneously institutionalised abundance-oriented consumption patterns that elevate surplus risk. Approximately 1.7 million tonnes of bread and bakery products are discarded annually in Germany (WWF Germany, 2022), with households accounting for 58 per cent of total food

waste and bread constituting 13 per cent of avoidable household waste (BMEL, 2020; Destatis, 2025). However, waste does not emerge solely at the consumer level. Forecasting mismatches, promotional volatility and production buffering contribute significantly upstream (Rohm et al., 2017; Jouzdani and Govindan, 2021; Lehtokunnas et al., 2022).

Existing research remains fragmented across disciplinary silos. Consumer studies emphasise psychological barriers and the attitude–behaviour gap (Han, 2020; White et al., 2019), retail research highlights pricing logics and competitive pressures (Bălan, 2021; Sheth and Parvatiyar, 2021), and manufacturing research focuses on forecasting constraints and operational efficiency (Glavič, 2021; Sadraei et al., 2023). While each stream provides valuable insights, their analytical separation obscures the cross-level dynamics through which surplus is structurally reproduced. However, this fragmentation obscures how interactions between these domains systematically reproduce surplus.

Recent behavioural and technological interventions demonstrate partial improvements. Capability-oriented interventions can reduce carbon-intensive consumption (Michie et al., 2011; Stancu et al., 2025), and circular economy strategies promise enhanced coordination (Borrello et al., 2020; Islam and Zheng, 2024). Yet governance research suggests that transparency and optimisation tools alone cannot resolve incentive asymmetries embedded within supply chain architectures (Bager, 2022). Responsibility for food waste is increasingly framed as shared across the retail–consumer interface (Aschemann-Witzel et al., 2023), but discursive expansion does not necessarily translate into structural coordination.

This paper argues that bread waste persists not primarily because of insufficient awareness or technological deficiency, but because behavioural activation, retail incentive systems and manufacturing information-processing structures remain misaligned. The core challenge is not the absence of initiatives, but the absence of cross-level alignment. Alignment refers to the

synchronisation of behavioural activation mechanisms, retail incentive structures and manufacturing information-processing architectures in ways that stabilise demand and minimise surplus formation. Conversely, misalignment refers to the structural non-synchronisation of these logics, where internally rational decision-making at one level generates volatility, uncertainty or inefficiency at another. Misalignment does not imply irrationality; rather, it denotes incentive incompatibility and temporal or informational decoupling across interdependent actors.

Building on the Theory of Planned Behaviour (Ajzen, 1991), Institutional Theory (DiMaggio and Powell, 1983; Scott, 1995) and Information Processing Theory (Galbraith, 1973), this study reconceptualises bread waste as a coordination problem crystallising at the retail–consumer interface. At this interface, consumers, retailers and manufacturers converge, each operating through internally rational yet differentiated logics: behavioural intention under bounded rationality, institutional market–legitimacy tensions, and uncertainty absorption through informational buffering.

Drawing on the notion of hybrid responsibility (Aschemann-Witzel et al., 2023), the paper argues that responsibility for food waste is negotiated across interdependent domains. However, while responsibility has become discursively hybridised, decision architectures remain structurally fragmented. The retail interface therefore emerges as the critical governance arena in which behavioural activation, commercial incentives and production planning intersect, yet remain insufficiently synchronised.

The proposed Systemic Alignment Framework advances circular economy debates (Boström, 2020; Islam and Zheng, 2024) by moving beyond actor-specific deficit explanations towards an analysis of cross-level misfit. Rather than asking which actor fails, the framework explains how rational yet unsynchronised system logics co-produce surplus. In doing so, it provides a

theoretically integrated foundation for coordinated sustainability transitions within industrialised food systems.

This study therefore addresses the following research question:
How can behavioural, strategic, and communicative alignment between consumers, retailers, and manufacturers reduce bread waste at the retail–consumer interface in Germany?

Its primary contribution lies in the theoretical integration of behavioural, institutional, and information-processing perspectives to explain the structural reproduction of bread surplus. While informed by an ongoing mixed-methods research design in the German bread sector, the central aim of this paper is conceptual development rather than empirical reporting. The outlined empirical strategy serves to demonstrate how the framework can be operationalised and tested in future research.

This paper makes three contributions to sustainability and supply chain research.

- First, it reconceptualises bread waste as a cross-level coordination problem rather than an actor-specific failure.
- Second, it extends the Theory of Planned Behaviour by embedding behavioural activation within system-conditioned choice architectures.
- Third, it introduces alignment as a governance construct for sustainable supply chain coordination.

2. Fragmented Sustainability Perspectives and Systemic Misalignment

2.1 Bread Waste as a System-Level Sustainability Failure

Bread waste constitutes a significant sustainability challenge due to its contribution to greenhouse gas emissions, inefficient resource use, and systemic inefficiencies across the supply chain (Glavič, 2021; Poore and Nemecek, 2018). Unlike many other food categories, bread is highly perishable and produced at scale, making overproduction and mismatches between supply and demand particularly waste-intensive (Funk et al., 2021).

Although research on reducing food waste is expanding (Rockström et al., 2020; Springmann et al., 2018), the specific structural characteristics of bread production and distribution remain underexplored. As a result, bread waste is often analysed in isolation rather than as a systemic coordination problem. Glavič (2021, p. 16) emphasises that “reducing food waste through improved supply chain coordination is crucial for mitigating environmental impacts, particularly in the bread industry”. However, most interventions remain actor-specific rather than system-oriented.

Retail discounting strategies, for example, can reduce consumer-level waste (Schulze et al., 2024), yet they do not address upstream inefficiencies such as inaccurate demand forecasting, rigid production cycles and shelf-life constraints (Liu and Jiang, 2024). Lehtokunnas et al. (2022) identify poor coordination, demand mismatches and inadequate storage conditions as central drivers of waste, while Jouzdani and Govindan (2021) emphasise the absence of synchronised data-sharing mechanisms between retailers and manufacturers.

At the same time, the environmental footprint of bread remains significant due to agricultural inputs, transportation and energy-intensive baking processes (Desiderio et al., 2022; Sadraei et al., 2023). Circular economy solutions, such as repurposing surplus bread for animal feed or bioenergy, provide partial mitigation (Borrello et al., 2020; Islam and Zheng, 2024).

However, their scalability is constrained by economic and logistical barriers (Borrello et al., 2020), and joint manufacturer–retailer strategies for reducing CO₂ emissions remain underdeveloped (Sadraei et al., 2023; Sovacool et al., 2021).

Taken together, these findings indicate that bread waste is not merely the result of isolated operational inefficiencies, but an emergent property of fragmented system structures and misaligned incentives across the supply chain. This structural ambiguity reflects what Aschemann-Witzel, Randers and Pedersen (2022, p. 1514) describe as a contested “retail–consumer interface”, where responsibility for food waste is negotiated rather than clearly allocated to a single actor.

2.2 Consumer Behaviour and the Attitude–Behaviour Gap

Research on sustainable consumption consistently documents a persistent gap between pro-environmental intentions and actual purchasing behaviour (Al-Obadi et al., 2022; Rausch and Kopplin, 2021; Schäufele and Janssen, 2021; Vermeir et al., 2020; Zhuo et al., 2022). While consumers frequently express strong environmental values, decisions are often guided by price sensitivity, habitual routines and convenience (Bollani et al., 2019; Steg, 2022; Thøgersen, 2021). Interpreting this discrepancy as moral inconsistency risks overstating individual agency while obscuring the structural and system-level conditions under which behaviour occurs. This suggests that the attitude–behaviour gap cannot be fully understood without considering the broader system in which consumer decisions are embedded.

Behavioural intervention research provides a more differentiated perspective. Nudging has been promoted as a low-cost mechanism for shaping choice architectures (Reisch and Sunstein, 2021). Yet Stancu et al. (2025) demonstrate that nudges remain limited when capability and opportunity constraints persist. Drawing on the COM-B framework (Michie et al., 2011), they show that strengthening perceived capability produces more sustained

behavioural change than informational cues alone. Behavioural change is therefore more robust when system conditions enable, rather than merely prompt, alternative action.

Economic research further situates consumer behaviour within market structures. Willingness-to-pay studies confirm the centrality of price sensitivity (Casalegno et al., 2022; Gomes et al., 2023), yet often treat price as exogenous rather than shaped by upstream retail and manufacturing strategies (Sheoran and Kumar, 2021). Shelf positioning research similarly illustrates how visibility and margin logics privilege high-profit products (Cisternas et al., 2020). Consumer “choice” thus unfolds within commercially structured environments that systematically preconfigure available options and purchasing outcomes.

The responsibility debate reinforces this structural perspective. Aschemann-Witzel, Randers and Pedersen (2023) distinguish between a consumer-governed narrative and a shared contribution narrative, describing an ongoing expansion of hybrid responsibility. While normatively significant, such expansion does not resolve underlying incentive misalignments within the system. Responsibility diffusion without coordinated decision architectures risks weakening accountability.

Qualitative studies of food handling practices further demonstrate that disposal decisions rely heavily on expiration dates and precautionary heuristics (Barone and Aschemann-Witzel, 2022). Waste emerges from routinised purchasing, storage and discarding practices rather than solely from attitudinal deficits. Trust in technological innovations develops gradually within these routines, indicating that behavioural change requires structural reinforcement within the system rather than information provision alone.

Taken together, the persistence of the attitude–behaviour gap reflects not individual inconsistency, but structurally embedded choice architectures. Bread waste cannot be

explained solely at the level of intention; it must be understood as the interaction between bounded rationality and system-configured market environments.

2.3 Retail Strategy and Incentive Structures

Retailers occupy a structurally dominant position within contemporary food systems, shaping pricing architectures, shelf visibility, promotional intensity, private-label development and manufacturers' market access (Herzberg et al., 2022; Sheth and Parvatiyar, 2021). This gatekeeping role enables retailers to influence not only purchasing decisions, but also the framing of sustainability within consumption environments. As a result, retail strategy plays a central role in shaping system-level alignment or misalignment across the supply chain.

In response to rising environmental and ethical concerns, retailers have introduced eco-labelling schemes, dynamic pricing for near-expiry products and sustainability-oriented communication strategies (Arnoldussen et al., 2022; Bălan, 2021). Carbon footprint labelling has gained prominence amid regulatory pressure and decarbonisation agendas. However, implementation remains uneven and constrained by data fragmentation, limiting the translation of transparency into system-level alignment.

A structural tension emerges between sustainability commitments and competitive imperatives. Retail markets remain characterised by intense price competition, margin optimisation and turnover maximisation (Janssens et al., 2019). Promotional strategies such as multi-buy offers may increase short-term sales while simultaneously stimulating over-purchasing and waste (Aschemann-Witzel et al., 2023; Kotler and Keller, 2016). Thus, commercial logics actively reproduce the inefficiencies that sustainability initiatives seek to mitigate.

Consumer preference research further complicates this tension. Evidence shows that freshness, taste and animal welfare frequently outweigh environmental attributes in

purchasing decisions (Ammann et al., 2024; Amato et al., 2023). Sustainability communication centred exclusively on carbon metrics may therefore misalign with dominant consumer heuristics. Retailers therefore face a strategic dilemma between promoting environmental transparency and aligning sustainability narratives with dominant consumer preferences.

Behavioural intervention research suggests that purchasing environments can reduce emissions when reflective engagement complements structural defaults (Banerjee et al., 2023). Yet such hybrid interventions require coordination and may conflict with short-term sales optimisation. Moreover, executional greenwashing—such as green-coloured packaging absent substantive improvements—can generate competitive advantages without corresponding environmental improvements (Boncinelli et al., 2023), thereby distorting competitive incentives within the system.

Technological solutions, including AI-driven inventory systems and blockchain traceability, are frequently proposed to enhance efficiency (Islam and Zheng, 2024; Lehtokunnas et al., 2022). However, without inter-organisational data integration and incentive alignment, technological optimisation risks remaining siloed (Pullman et al., 2018).

Taken together, the literature reveals a structural paradox. Retailers are uniquely positioned to shape sustainability transitions within the food system, yet competitive pressures incentivise promotional volatility, margin-driven assortment strategies and symbolic signalling. Retail sustainability initiatives therefore often remain compartmentalised rather than embedded in integrated supply chain systems.

From a system perspective, retail strategy functions not merely as an intermediary layer, but as a central alignment mechanism—or a powerful amplifier of misalignment—within the bread supply chain. Bread waste persistence therefore requires analysing retail incentive

structures as system logics that shape both upstream production decisions and downstream consumption routines.

2.4 Manufacturing Constraints and Production Logics

Bread manufacturing operates at the intersection of environmental urgency and commercial constraint, and plays a central role in shaping system-level surplus dynamics. Agri-food systems contribute substantially to greenhouse gas emissions, biodiversity loss and resource depletion (Poore and Nemecek, 2018; Rockström et al., 2020; Springmann et al., 2018), accounting for roughly one-third of anthropogenic emissions (Čapla et al., 2025). Although bread is less emission-intensive than livestock products, its cumulative footprint across cultivation, milling, baking, packaging and distribution remains significant (Rafiee et al., 2024; Sadraei et al., 2023).

Life cycle assessment models advocate systemic redesign and efficiency optimisation (Jouzdani and Govindan, 2020; Nosratabadi et al., 2020), yet often assume aligned incentives across supply chain actors, an assumption that is rarely met in practice. Empirical evidence challenges this premise. Forecasting misalignment, fragmented data-sharing and retailer-driven replenishment logics systematically generate surplus production (Jouzdani and Govindan, 2021; Lehtokunnas et al., 2022). Technological optimisation potential therefore exists, but structural coordination failures constrain its realisation.

Circular economy frameworks promote waste valorisation and closed-loop systems (Borrello et al., 2020; Marín-García et al., 2023), including recovery pathways such as animal feed or biogas conversion (Brancoli et al., 2020; Islam and Zheng, 2024). However, scalability remains limited by logistical complexity and uncertain economic viability (Glavič, 2021). While consumers may express willingness to engage in circular provisioning, producers

remain hesitant due to financial risk exposure and unclear returns (Borrello et al., 2020). Circular economy initiatives thus often remain aspirational rather than structurally embedded.

Digital technologies, including AI-driven forecasting and blockchain-based traceability, promise enhanced coordination (Islam and Zheng, 2024; Jouzdani and Govindan, 2020; Lehtokunnas et al., 2022). Yet technological infrastructure cannot compensate for misaligned system structures or strategic opportunism (Bager, 2022). Implementation costs, interoperability barriers and power asymmetries limit practical impact. Digitalisation enhances visibility, but does not ensure incentive compatibility.

Economic pressures further constrain sustainability adaptation. Bread production operates under narrow margins and intense retailer price competition (Desiderio et al., 2021; Panzone et al., 2021). Retail dominance restricts manufacturers' capacity to internalise sustainability investments within pricing structures (Glavič, 2021; Poore and Nemecek, 2018). Conservative forecasting and overproduction therefore function as rational risk-avoidance strategies under conditions of demand uncertainty. Existing market structures reward availability and volume stability over resource optimisation.

Consumer demand signals introduce additional tension. Although willingness-to-pay studies indicate increasing openness to sustainable products (Casalegno et al., 2022; Gomes et al., 2023), purchasing behaviour in staple categories remains primarily price- and freshness-driven (Ammann et al., 2024; Panzone et al., 2021). Environmental attributes frequently rank below taste, health and convenience (Ammann et al., 2024), and sustainable production innovations may encounter resistance when perceived as unfamiliar (Amato et al., 2023). Manufacturing innovation therefore does not automatically translate into market acceptance.

Behavioural interventions at the consumer level further illustrate structural asymmetry. Reflective nudging can reduce carbon-intensive choices (Banerjee et al., 2023), yet broader

market dynamics remain shaped by pricing and promotional mechanisms within the system (Antošová et al., 2023). Behavioural change alone cannot offset upstream incentives prioritising scale and turnover.

Certification and labelling mechanisms attempt to bridge production and consumption (Bravo et al., 2024; Čapla et al., 2025), but effectiveness depends on trust and perceived transparency (Aminravan et al., 2025). Executional greenwashing can distort competitive incentives, enabling symbolic cues to generate market gains without substantive environmental improvement (Boncinelli et al., 2023). Sustainability signalling may therefore decouple from environmental substance within the broader system.

Manufacturers thus navigate regulatory pressures, retailer bargaining power and volatile input costs while attempting environmental adaptation (Desiderio et al., 2021; Sadraei et al., 2023). Without supportive policy instruments or cross-sectoral coordination mechanisms (Boström, 2020; Kotler, 2011; Yamoah and Acquaye, 2019), sustainability investments remain strategically fragile.

Much of the literature isolates production efficiency from retail strategy and consumer behaviour (Panzone et al., 2021; Sadraei et al., 2023), thereby obscuring system interdependencies. Large-scale industrial production increases efficiency yet amplifies surplus risk under demand volatility (Poore and Nemecek, 2018; Searchinger et al., 2018), while standardisation reduces adaptability and resilience (Nyström et al., 2019).

These dynamics indicate that manufacturing decisions are not isolated operational choices, but system-conditioned responses to downstream volatility.

Manufacturing constraints in the bread sector are therefore not merely technological limitations, but structurally embedded outcomes of market architecture. Aligning bread

production with planetary boundaries (Rockström et al., 2020) requires cross-level incentive realignment rather than isolated process optimisation. Sustainability challenges in bread manufacturing thus reflect a systemic coordination failure rather than a deficit of environmental knowledge.

3. Theoretical Integration: Bread Waste as Cross-Level Misalignment

3.1 Consumer Level: Extending the Theory of Planned Behaviour in Habitual and Institutionally Embedded Contexts

At the consumer level, bread waste is predominantly interpreted through the intention–behaviour gap in sustainable consumption (Vermeir et al., 2020; White et al., 2019). Within this tradition, the Theory of Planned Behaviour (TPB) (Ajzen, 1991) has become the dominant analytical framework, modelling behaviour as a function of attitudes, subjective norms and perceived behavioural control. Numerous food-related studies apply TPB to explain why positive sustainability attitudes fail to translate into consistent purchasing and disposal behaviour (Cao et al., 2024; O’Neill et al., 2023; Rausch and Kopplin, 2021; Verma and Kapoor, 2025). However, this perspective remains insufficient for explaining behaviour in system-conditioned consumption environments.

However, transferring TPB to routinised, low-involvement product categories such as bread risks theoretical reductionism by neglecting the structural and institutional conditions under which behaviour occurs. In the German bakery context, consumption is shaped by embedded traditions, convenience expectations, price competition and habitual purchasing patterns. Eraslan and Kahrens (2025) show that transparency, trust and perceived quality influence responsible bread consumption, yet habitual behaviour and convenience frequently override sustainability intentions. Similar findings indicate that perceived risks, price sensitivity and

trust structures moderate TPB relationships in sustainable food contexts (Cao et al., 2024; Verma and Kapoor, 2025).

Bread is a high-frequency, low-deliberation product purchased under time pressure and price salience (Bollani et al., 2019; Steg, 2023). Decision-making is shaped less by reflective environmental reasoning than by bounded rationality and heuristic processing (Thøgersen, 2021). Expiration dates function as cognitive anchors that transform uncertainty into rule-based disposal behaviour (Barone and Aschemann-Witzel, 2022). Waste thus becomes embedded in stabilised routines rather than emerging solely from attitudinal inconsistency. As a result, behaviour is less intention-driven than context-conditioned.

Empirical evidence further challenges purely attitudinal explanations. Retail price promotions, often criticised as drivers of over-purchasing, demonstrate heterogeneous effects depending on consumer characteristics and behavioural capabilities. Discount-oriented households do not necessarily waste more food; food waste is moderated by environmental consciousness, household size and food management skills. Structural retail mechanisms therefore interact with individual dispositions rather than deterministically producing waste outcomes.

Research on sustainable food choices also shows that knowledge and pro-environmental awareness alone rarely produce behavioural change. Even sustainability-aware consumers face barriers such as high prices, unclear labelling and structural constraints. Intervention research grounded in the COM-B framework (Michie et al., 2011) emphasises that behavioural change requires capability and opportunity conditions in addition to motivation. Strengthening perceived capability extends the logic of perceived behavioural control within TPB, highlighting the importance of system-enabled action.

Compared with conventional TPB applications that treat behaviour as primarily intention-driven, this study argues that bread waste persistence reflects cross-level misalignment

between individual cognition and system-structured market environments. Retail pricing architectures, portion formats, assortment design and promotional cues systematically shape purchasing volumes and stockpiling behaviour. These system mechanisms condition the activation of TPB components. To capture this complexity, this study extends TPB by integrating three contextualised constructs: trust, perceived responsibility and perceived effectiveness.

Trust is conceptualised as a relational system mechanism linking consumers to retailer and manufacturer initiatives. Evidence from sustainability labelling research indicates that combined eco- and social labels do not automatically generate additive value effects; outcomes depend on perceived credibility. In bread markets characterised by industrialisation and transparency concerns, trust becomes a precondition for activating sustainability-oriented intentions.

Perceived responsibility captures attributional framing and extends norm activation logic (Han, 2020; Schwartz, 1977). Awareness of environmental consequences does not automatically translate into personal obligation. Responsibility may be externalised to retailers, manufacturers or broader system actors, moderating intention formation.

Perceived effectiveness functions as a motivational filter. If consumers doubt that individual action meaningfully reduces food waste, positive attitudes remain behaviourally inert. Sustainability awareness may therefore coexist with behavioural inertia due to structural and perceptual barriers. Drawing on Social Cognitive Theory (Bandura, 1977), self-efficacy is embedded within perceived behavioural control. Capability to plan purchases, manage storage and reuse surplus bread strengthens enactment.

However, such capability must be interpreted as system-conditioned rather than purely individual. The resulting conceptual architecture (Figure 1) proposes a hierarchical structure:

1. **Baseline dispositions** (general trust, environmental concern, food waste awareness)
2. **Shape context-specific perceptions** (trust in retailer initiatives; perceived responsibility; perceived effectiveness)
3. **Influence core TPB constructs** (attitude, subjective norms, perceived behavioural control/self-efficacy)
4. **Lead to behavioural intention and bread waste behaviour**

Extended TPB Model: A Conceptual Framework for Bread Waste Behaviour

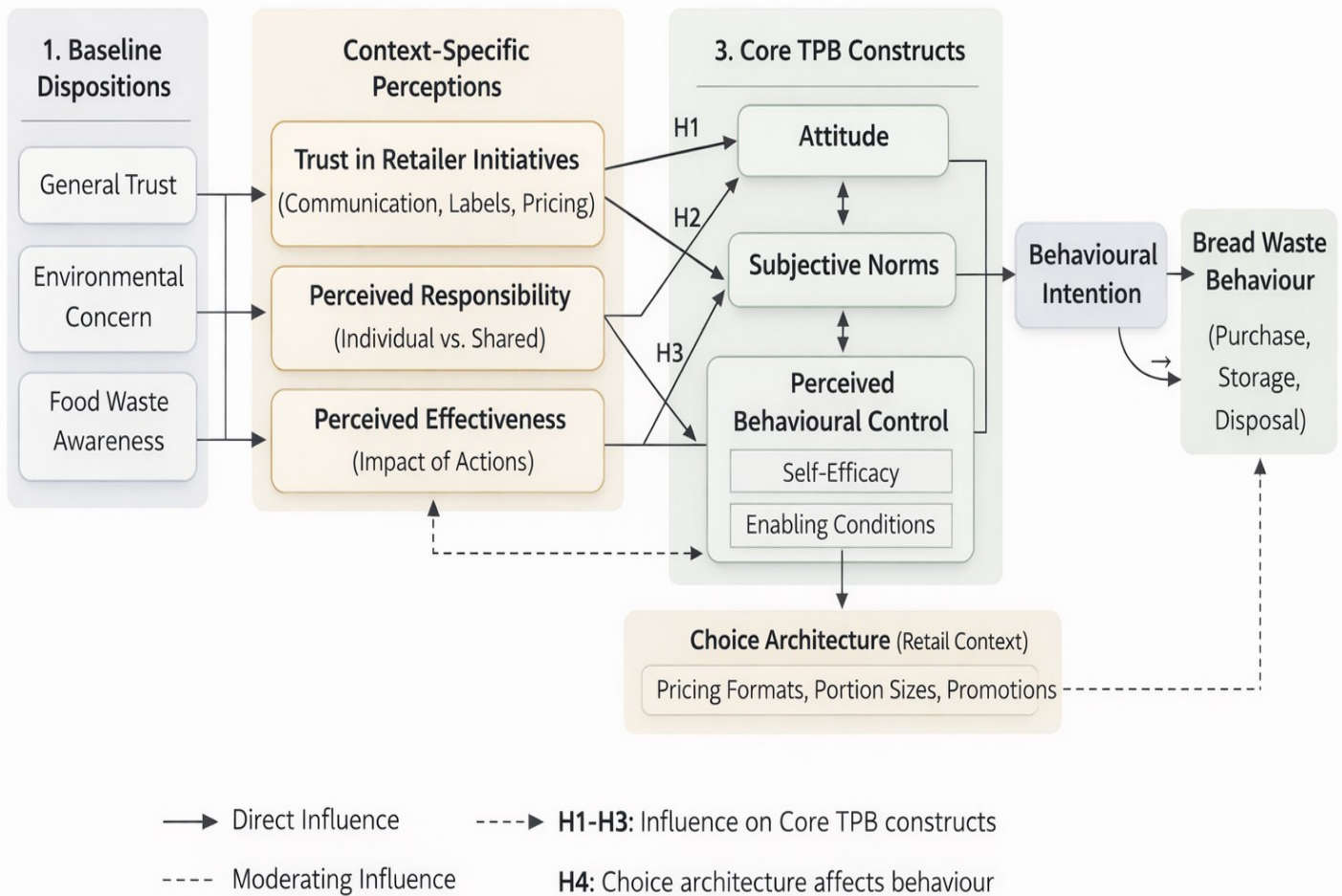


Figure 1: Conceptual TPB Model, (author's own work)

Choice architecture operates as a system-conditioning layer shaping behavioural enactment. In contrast to traditional TPB applications that emphasise internal attitudinal deficits, this extended framework conceptualises bread waste as a structurally embedded behavioural outcome. Waste emerges not merely from weak intentions but from the interaction of bounded rational cognition, habitual consumption practices and system-designed market environments. By integrating trust, attributional responsibility and perceived effectiveness into TPB, the model provides a system-sensitive behavioural explanation that links individual cognition to system-level incentive structures.

3.2 Retail Level: Institutional Logics, Market Efficiency and the Amplification of Volatility

Retailers occupy a structurally central position within contemporary food systems. Positioned between manufacturers and consumers, they mediate demand signals, allocate shelf space, design pricing architectures and shape promotional intensity (Herzberg et al., 2022; Sheth and Parvatiyar, 2021). Their strategic decisions therefore influence both downstream consumption behaviour and upstream production planning. As a result, retail strategy plays a central role in shaping system-level alignment or misalignment across the supply chain.

From an Institutional Theory perspective (DiMaggio and Powell, 1983; Scott, 1995), retail organisations operate under multiple, and often competing, institutional logics. On the one hand, a dominant market-efficiency logic prioritises turnover maximisation, margin protection and competitive price positioning. Retail markets are characterised by intense availability competition and performance-driven KPIs that reward short-term sales growth (Janssens et al., 2019). Promotional cycles and volume-based incentives, embedded in this commercial logic, stimulate temporary purchasing peaks and basket expansion. Although such

mechanisms are economically rational within competitive markets, they systematically generate volatile demand signals that propagate upstream across the system.

On the other hand, retailers are increasingly subject to legitimacy pressures linked to sustainability, transparency and corporate responsibility (Bălan, 2021; Čapla et al., 2025). Regulatory expectations, media scrutiny and stakeholder activism create normative and coercive pressures to demonstrate environmental responsibility. As a result, retailers adopt eco-labelling schemes, sustainability reporting practices and food waste reduction initiatives as mechanisms of legitimacy alignment.

Institutional Theory predicts that organisations respond to such pressures through symbolic and substantive conformity (Meyer and Rowan, 1977). However, symbolic adoption—often labelled executional greenwashing when environmental claims lack structural backing—may reinforce rather than resolve system inefficiencies (Boncinelli et al., 2023). Sustainability communication may expand the discursive allocation of responsibility across the retail–consumer interface (Aschemann-Witzel et al., 2023), yet discursive expansion does not automatically translate into operational realignment of core incentive structures within the system.

This tension between commercial optimisation and legitimacy signalling produces a structural contradiction within the system. While market logics incentivise assortment breadth, promotional intensity and high service levels, sustainability logics require waste reduction, demand stabilisation and resource efficiency. Reactive discounting of near-expiry products may reduce visible in-store waste (Glavič, 2021), but such end-of-pipe strategies do not address structural forecasting asymmetries or volatility induced by promotional design.

In contrast to interpretations that attribute retail-driven waste primarily to managerial inefficiency, the institutional lens suggests that retailers act rationally within plural and

sometimes conflicting system environments. Competitive market expectations reward abundance and constant availability, while sustainability norms demand restraint and resource optimisation. The coexistence of these logics institutionalises ambivalence rather than coherence within the system.

Retail thus functions not merely as an operational intermediary, but as a system-level amplifier of demand volatility. Pricing architectures, shelf allocation and promotional cycles convert competitive market pressures into fluctuating demand signals that simultaneously influence consumer purchasing patterns and manufacturer production buffers (Herzberg et al., 2022; Janssens et al., 2019). Misalignment at the retail level arises when sustainability commitments remain decoupled from core commercial incentive systems.

Within the Systemic Alignment Framework, retail occupies the pivotal coordination node that translates institutional expectations into market-facing practices. It directly conditions the activation of consumer behavioural mechanisms (Theory of Planned Behaviour; Ajzen, 1991) and indirectly shapes manufacturer responses under uncertainty (Information Processing Theory; Galbraith, 1973). Volatility amplification is therefore not an aberration, but an emergent outcome of unresolved tensions between market-efficiency and legitimacy pressures within the broader system (DiMaggio and Powell, 1983; Scott, 1995).

3.3 Manufacturer Level: Information Processing, Structural Buffering and Rational Surplus Formation

Manufacturers within perishable food systems operate under narrow margins, short product life cycles and high service-level expectations. Production planning and forecasting systems are primarily designed to minimise stock-outs and ensure consistent availability (Jouzdani and Govindan, 2021). In highly competitive retail environments, service-level reliability is not merely an operational objective but a prerequisite for maintaining commercial relationships.

As a result, manufacturing systems play a critical role in stabilising—or reproducing—system-level imbalances within the supply chain.

From the perspective of Information Processing Theory (Galbraith, 1973), organisations must design structures capable of absorbing environmental uncertainty. When task uncertainty increases, organisations either expand information-processing capacity or introduce buffers to stabilise operations. In the context of bread production, volatile retail demand signals, promotional fluctuations and limited real-time data integration increase environmental uncertainty within the system. Under such conditions, conservative forecasting and buffer production represent rational structural responses to uncertainty rather than managerial inefficiencies.

Empirical research confirms that fragmented data-sharing and information asymmetries between retailers and manufacturers exacerbate demand mismatches (Lehtokunnas et al., 2022). When downstream sales volatility is only partially transparent, manufacturers compensate through safety stocks, overproduction and standardised batch models. These buffering mechanisms reduce the probability of costly stock-outs but simultaneously institutionalise surplus formation. Overproduction therefore emerges not as inefficiency, but as a structurally embedded risk-management strategy within the system.

In contrast to behavioural interpretations that attribute waste to operational miscalculation, the information-processing lens suggests that surplus production is a predictable outcome of constrained coordination architectures. The problem lies not in irrational production decisions, but in constrained information integration across organisational boundaries. Manufacturers optimise within the informational structures available to them.

Technological innovations, such as digital traceability systems and circular economy initiatives, are frequently presented as corrective mechanisms capable of improving

coordination (Borrello et al., 2020; Islam and Zheng, 2024). These instruments enhance transparency and reduce information latency, but do not resolve underlying coordination failures. When incentive systems remain fragmented, improved data visibility does not necessarily translate into aligned decision-making within the broader system (Bager, 2022).

Furthermore, sustainability-oriented production adjustments are constrained by economic viability. Investments in waste reduction, product redesign or shelf-life extension remain financially fragile when retailer bargaining power limits price renegotiation and consumer demand remains price-sensitive (Ammann et al., 2024; Panzone et al., 2021). Under such conditions, manufacturers face a structural dilemma: sustainability adaptation increases short-term cost exposure, while competitive contracts reward cost efficiency and availability reliability.

Compared with the retail level, where tension arises between market-efficiency and legitimacy logics (DiMaggio and Powell, 1983; Scott, 1995), manufacturer-level tension is primarily informational and structural. Retailers amplify demand volatility through promotional architectures; manufacturers respond by stabilising production through buffering and conservative forecasting. These responses are internally coherent, yet externally misaligned across the system. Within the Systemic Alignment Framework, manufacturers function as structural stabilisers that inadvertently reproduce surplus at the system level. Production systems respond predictably to volatility generated downstream, embedding precautionary buffers into organisational routines. Misalignment at this level reflects rational optimisation within a fragmented system architecture, where information flows, contractual incentives and sustainability expectations remain insufficiently integrated.

3.4 The Systemic Alignment Framework: Triangulating Behavioural, Institutional and Informational Logics

Individually, the consumer, retail and manufacturer perspectives provide internally coherent yet incomplete explanations for the persistence of bread waste. The Extended Theory of Planned Behaviour (Ajzen, 1991; Vermeir et al., 2020; White et al., 2019) explains how attitudes, subjective norms and perceived behavioural control interact with bounded rationality, trust structures and perceived effectiveness to shape disposal decisions. Institutional Theory (DiMaggio and Powell, 1983; Scott, 1995) clarifies how retail organisations operate under competing market-efficiency and legitimacy logics (Janssens et al., 2019; Bălan, 2021; Čapla et al., 2025). Information Processing Theory (Galbraith, 1973) demonstrates why manufacturers structurally buffer environmental uncertainty through conservative forecasting, batch optimisation and surplus production (Jouzdani and Govindan, 2021; Lehtokunnas et al., 2022).

Taken in isolation, each perspective appears rational within its own analytical boundary. Consumers act prudently under perceived freshness uncertainty and food safety risk (Barone and Aschemann-Witzel, 2022). Retailers optimise competitively under margin pressures and performance-driven KPIs (Janssens et al., 2019; Sheth and Parvatiyar, 2021). Manufacturers stabilise production systems in response to volatile demand signals and incomplete information (Jouzdani and Govindan, 2021). None of these actors behaves irrationally. Yet inefficiencies emerge not from behavioural failure, but from cross-level misalignment between differentiated decision logics (Glavič, 2021; Lehtokunnas et al., 2022).

At the consumer level, heuristic reliance on expiration dates and precautionary disposal reflects bounded decision-making under uncertainty (Barone and Aschemann-Witzel, 2022; Thøgersen, 2021). At the retail level, promotional cycles, assortment breadth and high service-level commitments amplify demand variability (Aschemann-Witzel et al., 2023; Kotler and Keller, 2016). At the manufacturer level, uncertainty is absorbed through structural buffering, safety stocks and overproduction (Jouzdani and Govindan, 2021). Each actor

responds rationally to its immediate incentive environment; collectively, however, these responses generate reinforcing surplus dynamics.

This interaction forms a self-reinforcing coordination loop. Retail-driven demand peaks increase forecast volatility upstream. Manufacturers respond by embedding precautionary buffers into production routines. Increased shelf availability normalises abundance, reinforcing consumer expectations of freshness and constant completeness. Expiration cues subsequently trigger precautionary disposal, thereby stabilising predictable waste patterns. The cycle becomes self-reinforcing through repeated institutionalisation of these behaviours (Nyström et al., 2019; Rockström et al., 2020). Bread waste therefore emerges not as a behavioural deficit, nor solely as a system failure, but as an emergent property of structurally differentiated yet interdependent decision systems. The misfit lies in the non-synchronisation of three logics:

- **Behavioural logic:** intention activation under bounded rationality, moderated by trust, perceived responsibility and perceived effectiveness (Ajzen, 1991; Han, 2020; Vermeir et al., 2020).
- **Institutional logic:** market-efficiency, competitive positioning and legitimacy pressures within retail environments (Bălan, 2021; DiMaggio and Powell, 1983; Scott, 1995).
- **Informational logic:** uncertainty absorption through buffering structures and conservative forecasting within manufacturing systems (Galbraith, 1973; Jouzdani and Govindan, 2021).

These logics intersect most visibly at the retail–consumer interface. Pricing architectures, promotional mechanisms, shelf visibility and sustainability communication coalesce at this junction (Herzberg et al., 2022). Responsibility is discursively hybridised (Aschemann-Witzel

et al., 2023), yet discursive expansion does not equate to structural coordination. Hybrid responsibility without incentive synchronisation diffuses accountability while leaving surplus-generating mechanisms intact. This triangulated perspective advances prior research in two critical respects.

First, it shifts intention–behaviour scholarship beyond individual-level inconsistency by embedding behavioural activation within organisational incentive systems and information-processing architectures. Consumer choice is system-conditioned by retail pricing logics (Gomes et al., 2023; Sheoran and Kumar, 2021), shelf design (Cisternas et al., 2020) and sustainability signalling structures (Aminravan et al., 2025; Boncinelli et al., 2023). Behavioural capability is therefore structurally mediated.

Second, it reframes food waste reduction from isolated intervention design to systemic coordination. Behavioural nudges (Banerjee et al., 2023; Reisch and Sunstein, 2021), reactive discounting (Glavič, 2021) or technological forecasting tools (Islam and Zheng, 2024) may generate local efficiency gains. However, without cross-level alignment across behavioural capability, retail incentive systems and manufacturing information-processing structures, reinforcing surplus loops persist. The contribution of the Systemic Alignment Framework lies not merely in conceptual integration, but in reframing surplus as a structurally reproduced outcome of rational yet unsynchronised system logics. Bread waste is reproduced where system logics collide; it can only be reduced where these logics converge. As illustrated in Figure 2, surplus reproduction arises when behavioural activation mechanisms, retail incentive systems and manufacturing information-processing architectures remain unsynchronised. The retail–consumer interface functions as the critical coordination arena in which alignment must be achieved for durable waste reduction.

The Systemic Alignment Framework

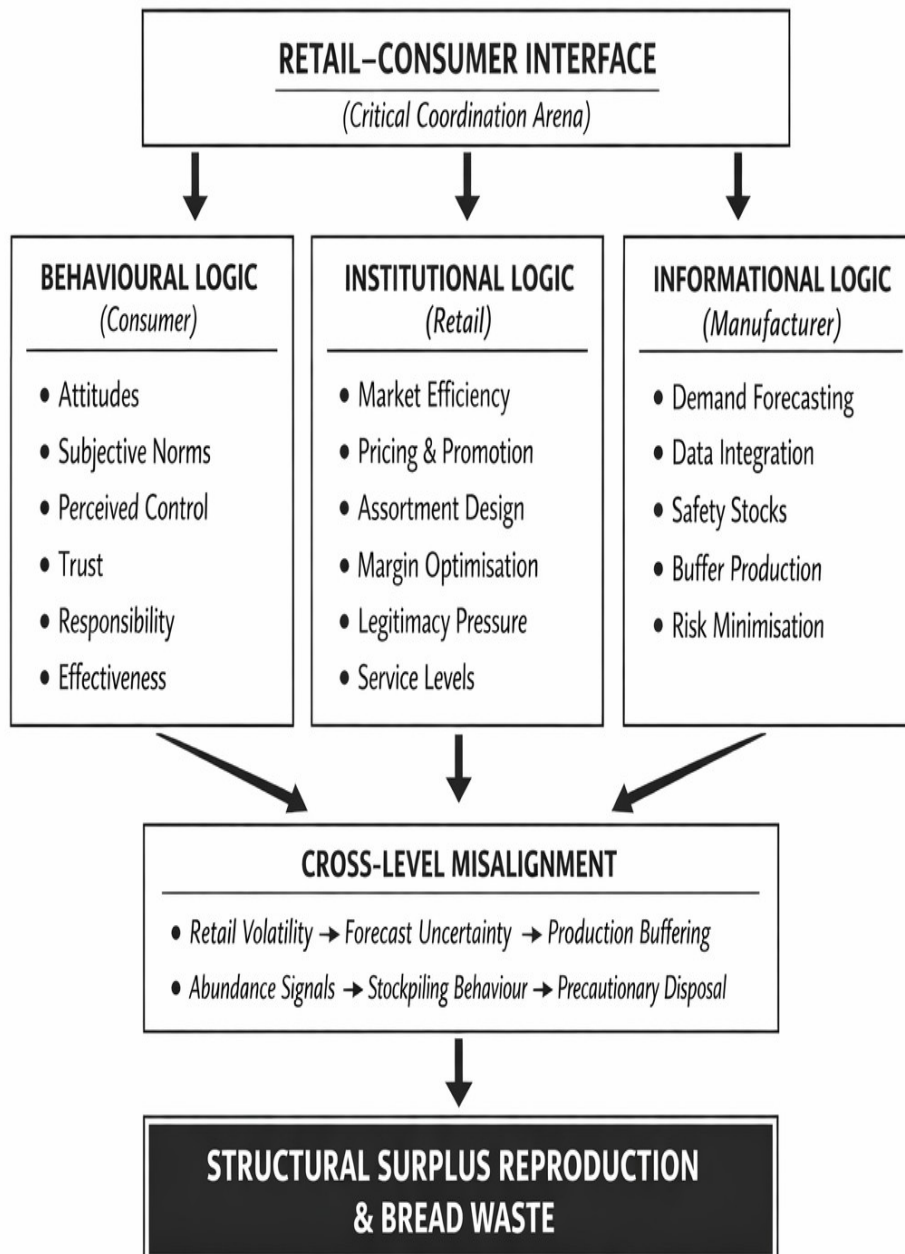


Figure 2: The Systemic Alignment Framework, (author's own work)

4. Emerging Analytical Directions: Examining Cross-Level Misalignment at the Retail–Consumer Interface

The preceding analysis conceptualised bread waste as an emergent outcome of cross-level misalignment between behavioural, institutional and informational logics. While each logic is internally coherent, their interaction at the retail–consumer interface generates systemic inefficiencies. Rather than advancing prescriptive solutions, this section identifies key analytical tensions that structure the empirical agenda of this study.

4.1 Behavioural Rationality and Institutional Conditioning

Behavioural research commonly interprets food waste through intention–behaviour inconsistencies (Vermeir et al., 2020; White et al., 2019), whereas retail studies emphasise pricing architectures, promotional intensity and margin optimisation as primary drivers of purchasing patterns (Janssens et al., 2019; Sheth and Parvatiyar, 2021). These strands are rarely analysed jointly.

Consumer decision-making unfolds within retail environments structured by assortment breadth, visibility hierarchies and promotional cues (Aschemann-Witzel et al., 2023; Cisternas et al., 2020). Heuristic reliance on expiration dates and precautionary disposal (Barone and Aschemann-Witzel, 2022) therefore reflects not isolated behavioural deficits but bounded rationality enacted within institutionally configured choice architectures.

The analytical question is not whether consumers or retailers are primarily responsible, but how behavioural capability is conditioned by institutional design. Intention-based explanations risk overstating individual agency; retail-centric accounts risk neglecting risk aversion and cognitive simplification. The challenge lies in systematically examining their interaction within the broader system.

4.2 Institutional Volatility and Informational Buffering

Retail competition is marked by high service-level expectations and frequent promotional cycles (Kotler and Keller, 2016). While institutionally rational under performance pressures, such volatility increases environmental uncertainty for upstream actors (Galbraith, 1973).

Fragmented data-sharing and forecast asymmetries contribute to surplus production (Jouzdani and Govindan, 2021; Lehtokunnas et al., 2022). Manufacturers respond through buffering strategies that prioritise availability over resource optimisation. Retail efficiency thus contrasts with manufacturing stabilisation.

The tension is structural: retail optimisation amplifies variability; manufacturing optimisation absorbs it. Neither actor is individually inefficient, yet their interaction institutionalises surplus within the system. Empirical investigation must therefore trace how demand signalling mechanisms translate into production buffers and where coordination failures become embedded.

4.3 Hybrid Responsibility and Structural Ambiguity

Responsibility for food waste is increasingly framed as hybrid across retailers and consumers (Aschemann-Witzel et al., 2023). While normatively progressive, the operational translation of hybrid responsibility remains ambiguous.

Sustainability communication and labelling (Bălan, 2021; Čapla et al., 2025) may enhance legitimacy without altering core incentive systems. Behavioural interventions (Banerjee et al., 2023; Reisch and Sunstein, 2021) may shift micro-decisions without addressing upstream volatility. The coexistence of symbolic responsibility and structural inertia raises questions regarding the depth of current sustainability transitions.

At the retail–consumer interface, responsibility is discursively negotiated, yet promotional logics and production buffers remain largely intact. Clarifying how discursive alignment relates to structural coordination constitutes a central empirical task.

Taken together, these tensions define the empirical focus of the present study. The central question is not whether individual actors can improve performance in isolation, but whether cross-level alignment across behavioural activation, institutional incentives and informational structures is structurally feasible within prevailing market systems.

5. Methodological Design and Triangulation

5.1 Literature Triangulation

The systematic review is derived directly from the research question concerning behavioural, strategic and communicative alignment at the retail–consumer interface in Germany. The search process follows a single research-question-driven search string. For analytical clarity, the identified literature is first examined in isolation across three perspective-based clusters before being comparatively synthesised. This staged procedure ensures conceptual differentiation prior to integration, rather than conducting three independent reviews.

The search strategy is structured along three strands:

- Consumer-level research (Vermeir et al., 2020; White et al., 2019; Thøgersen, 2021; Eraslan and Kahrens, 2025)
- Retail-level research (Bălan, 2021; Sheth and Parvatiyar, 2021; Janssens et al., 2019; Aschemann-Witzel et al., 2023)
- Manufacturer-level research (Jouzdani and Govindan, 2021; Lehtokunnas et al., 2022; Borrello et al., 2020; Glavič, 2021)

Each strand is analysed independently before comparative clustering to identify overlaps, contradictions and explanatory blind spots (Tranfield et al., 2003; Page et al., 2021). Literature triangulation thus reconstructs how behavioural, institutional and informational explanations coexist in the literature without systematic integration.

5.2 Data Triangulation

The empirical design follows an explanatory sequential mixed-methods structure (Creswell and Plano Clark, 2018).

Phase I: Quantitative Consumer Survey (Norstat)

Operationalising the Extended TPB (Ajzen, 1991), the survey measures behavioural determinants, perceived responsibility, trust in retailer and manufacturer initiatives, and perceived effectiveness. Quantitative analysis identifies behavioural alignment gaps (Vermeir et al., 2020; White et al., 2019; Panzone et al., 2021).

Phase II: Qualitative Interviews

Semi-structured interviews with retailers and manufacturers explore pricing architectures, promotional cycles, sustainability communication, forecasting routines and institutional constraints (Bryman, 2016; Denzin and Lincoln, 2018). This phase explains organisational drivers of misalignment.

Phase III: System-Level Extension

Where appropriate, interviews with associations or NGOs extend the cross-level synthesis without introducing an additional analytical level. Sequential integration ensures interpretive coherence across phases.

5.3 Theoretical Triangulation

Three theoretical lenses correspond to stakeholder levels:

- Extended Theory of Planned Behaviour as the consumer-level lens (Ajzen, 1991; plus the study's extensions)
- Institutional Theory as the retail-level lens (DiMaggio and Powell, 1983; Scott, 1995)
- Information Processing Theory as the manufacturer-level lens (Galbraith, 1973; Jouzdani and Govindan, 2021; Lehtokunnas et al., 2022)

Each explains rational behaviour under bounded conditions; inefficiencies emerge at their intersection. Theoretical triangulation enables structured comparison and prevents single-theory dominance.

5.4 From Triangulation to Systemic Synthesis

Synthesis is organised around three alignment dimensions:

- behavioural alignment
- strategic alignment
- communicative alignment

By integrating literature clusters, quantitative findings and qualitative narratives, the study identifies where trust mechanisms, incentive structures and information-processing routines fail to synchronise. Triangulation thus functions as the analytical mechanism through which systemic alignment is empirically grounded rather than merely methodologically validated (Denzin, 1978).

6. Research agenda and empirical validation strategy

6.1 Anticipated Empirical Patterns of Misalignment

The proposed explanatory sequential mixed-methods design is expected to reveal not isolated inefficiencies, but patterned and reproducible misalignment across behavioural, institutional and informational dimensions at the retail–consumer interface.

At the consumer level, the representative survey is likely to confirm persistent intention–behaviour discrepancies (Vermeir et al., 2020; White et al., 2019). However, rather than interpreting these discrepancies as individual inconsistency, the study anticipates that perceived effectiveness and trust in retailer and manufacturer initiatives will significantly moderate behavioural intention. High responsibility attribution may coexist with low perceived systemic impact, thereby weakening behavioural enactment. In other words, awareness without perceived systemic leverage remains inert. Such findings would substantiate the extended TPB logic developed in Section 3.1 and reinforce the relevance of capability and opportunity structures highlighted in COM-B research (Michie et al., 2011; Stancu et al., 2025).

At the retail level, qualitative interviews are expected to reveal a structural duality. Retail actors may articulate sustainability commitments while simultaneously prioritising margin protection, promotional competitiveness and service-level reliability. This would reflect the coexistence of market-efficiency and legitimacy logics (DiMaggio and Powell, 1983; Scott, 1995). Sustainability initiatives may therefore appear strategically peripheral rather than structurally embedded in pricing and assortment systems.

At the manufacturer level, interviews are expected to confirm that conservative forecasting, safety stocks and batch optimisation are framed as rational risk-management responses to volatile demand signals (Jouzdani and Govindan, 2021; Lehtokunnas et al., 2022). Surplus

production may not be interpreted internally as inefficiency, but as necessary uncertainty absorption consistent with Information Processing Theory (Galbraith, 1973).

If these patterns emerge, they would empirically substantiate the Systemic Alignment Framework: bread waste would appear not as behavioural failure, nor as managerial negligence, but as a structurally reproduced outcome of rational yet unsynchronised system logics.

6.2 Theoretical Contribution

This study advances sustainability research in three interrelated ways.

First, it reframes the intention–behaviour gap in bread consumption by embedding behavioural activation within organisational incentive systems and cross-actor information structures. Rather than treating consumer inconsistency as the primary explanatory variable, the study conceptualises behavioural outcomes as structurally conditioned by retail choice architectures and upstream decision environments (Ajzen, 1991; Cisternas et al., 2020; Gomes et al., 2023). The gap is not merely psychological; it is systemically produced.

Second, it extends Institutional Theory in retail sustainability research by linking legitimacy work not only to symbolic conformity (Meyer and Rowan, 1977), but to volatility amplification across the supply chain. Retail practices are theorised as transmission mechanisms through which competitive market pressures translate into upstream instability and surplus reproduction (DiMaggio and Powell, 1983; Scott, 1995).

Third, by integrating Information Processing Theory into food waste debates, the study explains overproduction as a structurally rational response to uncertainty and fragmented information integration (Galbraith, 1973; Jouzdani and Govindan, 2021). This shifts the

analytical focus from actor-centric blame attribution towards system-level misalignment in decision architectures.

Collectively, the contribution lies not simply in integration, but in theoretical repositioning. The Systemic Alignment Framework reconceptualises bread waste as a structurally reproduced coordination outcome within modern food systems.

6.3 Managerial and System Implications

The framework suggests that the persistence of bread waste despite extensive research, technological innovation and behavioural campaigns is not paradoxical. It is structurally predictable.

Behavioural nudges alone (Reisch and Sunstein, 2021) may influence micro-decisions but cannot counteract volatility embedded in promotional architectures. Technological forecasting tools (Islam and Zheng, 2024) may enhance transparency but cannot compensate for incentive incompatibility. Sustainability communication (Bălan, 2021; Čapla et al., 2025) may enhance legitimacy without altering buffering structures.

The central implication is therefore systemic: durable waste reduction requires synchronisation across behavioural capability, retail incentive systems and manufacturing information-processing structures. Without cross-level alignment, interventions remain compensatory rather than transformative.

The retail–consumer interface emerges as the critical coordination arena where hybrid responsibility (Aschemann-Witzel, Randers and Pedersen, 2022) must transition from discursive attribution to structural integration.

7. Limitations and Boundary Conditions

This study is deliberately system-focused. Its analytical strength is also its boundary.

First, the framework is developed within the German bread sector. Bread is culturally central, high-frequency and symbolically embedded in everyday consumption. Yet even within this context, large volumes of wheat-intensive products such as toast are produced and discarded at scale. Transferability to other food categories or national systems requires empirical validation.

Second, the theoretical triangulation privileges Extended TPB, Institutional Theory and Information Processing Theory. Alternative lenses, such as Practice Theory or Resource Dependence Theory, may yield additional explanatory depth.

Third, cross-sectional survey data cannot fully capture dynamic adaptation processes, and interviews may reflect strategic narratives rather than operational routines.

Finally, system alignment at the retail–consumer interface may be constrained by macro-level structures including global commodity markets, climate volatility and agricultural policy regimes. Rising wheat demand, climate pressure and a growing global population intensify the urgency of alignment. Yet these structural forces remain partially exogenous to the present design.

These limitations do not weaken the framework; they delineate its scope.

8. Conclusion

Bread waste in industrialised food systems persists despite decades of research, behavioural campaigns and technological optimisation. This persistence is not evidence of ignorance. It is evidence of structural inertia.

Consumers act under bounded rationality. Retailers optimise under competitive and legitimacy pressures. Manufacturers stabilise production under uncertainty. Each actor behaves rationally within its structural constraints.

The persistence of bread waste therefore reflects not irrationality, but misalignment.

In a context of climate instability, resource pressure and a growing global population, the continued large-scale production and disposal of wheat-intensive staple goods reveals a deeper systemic contradiction. The issue is not the absence of knowledge. It is the absence of synchronised decision architectures.

By triangulating behavioural, institutional and informational logics, this study reconceptualises bread waste as a structurally reproduced coordination outcome within modern food systems. The retail–consumer interface is not merely a transactional space. It is the critical alignment node of the system. Bread waste is reproduced where system logics collide; it can only be reduced where these logics converge.

Sustainable bread consumption is therefore not primarily a matter of awareness, pricing or technology. It is a matter of structural alignment.

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