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Behaviour & Information Technology

ISSN: 0144-929X (Print) 1362-3001 (Online) Journal homepage: www.tandfonline.com/journals/tbit20

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To cite this article: Luca Cacciolatti , Michael Christofi , Ioannis Christodoulou & Lê Hoàng Quỳnh (08 Jul 2026): Reframing ESG as an innovation logic: a theoretical model for human-centred AI-mechatronic integration in circular food economies, Behaviour & Information Technology, DOI: 10.1080/0144929X.2026.2699279

To link to this article: https://doi.org/10.1080/0144929X.2026.2699279

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BEHAVIOUR & INFORMATION TECHNOLOGY
https://doi.org/10.1080/0144929X.2026.2699279

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Reframing ESG as an innovation logic: a theoretical model for human-centred AI-mechatronic integration in circular food economies

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ABSTRACT
This conceptual paper explores Environmental, Social and Governance (ESG) principles as a transformative institutional logic capable of guiding AI and mechatronic innovation in circular food systems. Responding to calls for food systems transformation, we develop a theoretical framework that integrates institutional logics theory, human-centred design (HCD), and circular economy thinking. We conceptualise ESG as an emerging innovation logic that shapes how technologies are designed, legitimised and embedded within socio-technical systems. HCD is proposed as a mediating mechanism that translates ESG principles into socially legitimate and context-sensitive technological solutions. We further argue that the institutionalisation of ESG innovation logic is enabled through actor mobilisation, rhetorical framing, and governance infrastructures. The framework advances three propositions: first, that the centrality and compatibility of ESG logic within pluralistic innovation ecosystems promote sustainable and legitimate AI-mechatronic systems; second, that HCD translates ESG principles into ethically grounded design practices and third, that field-level governance mechanisms facilitate the institutionalisation of ESG-centred innovation in circular food systems. We discuss the theoretical implications for institutional logics research and offer practical insights for policymakers and designers seeking to align emerging technologies with circular economy objectives. Finally, we identify future research directions, including examining ESG logic evolution, HCD as an institutional logic and power asymmetries in logic translation.

ARTICLE HISTORY
Received 27 June 2025
Accepted 30 June 2026

KEYWORDS
Institutional logics; ESG; innovation; human-centred design; circular economy; food systems

1. Introduction

Innovation in agri-food systems is increasingly mediated by digital and automated technologies such as artificial intelligence (AI) and mechatronics. These technologies promise to enhance productivity, optimise resource use, and modernise agricultural value chains. However, they often reflect dominant innovation logics rooted in market efficiency and technocratic control, sidelining concerns of ethical governance, environmental sustainability, and user inclusivity. This tension has prompted growing academic and policy interest in aligning technological innovation with Environmental, Social, and Governance (ESG) principles (Galleli and Amaral 2025; Tashman 2020). ESG is no longer only a regulatory compliance tool; it is emerging as a strategic imperative for organisations and, as we contend in this paper, an institutional logic capable of reorienting design and innovation priorities across sectors, including food systems.

We focus on AI and mechatronic technologies because these systems offer dual capabilities to agri-food systems: they enhance precision and sustainability through data-driven control and enable decentralised, contextualised operations that align with circular economy objectives. The development of these technologies supports adaptive, locally grounded innovation capacities, allowing food systems to become more resilient, efficient, and equitable, provided ESG principles guide their development and deployment. Evidence from labour market analysis further indicates that technological transitions reshape skill demand and organisational expectations (Cacciolatti and Mar Molinero 2013), suggesting that AI-mechatronic innovation in food systems must be aligned with evolving human capabilities and governance structures rather than treated as purely technical substitutions.

AI enables real-time analytics, such as predictive crop modelling, resource optimisation, food demand

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predictions based on consumption patterns, and anomaly detection, while mechatronic systems integrate sensors, robotics, and actuators to physically enact interventions like targeted irrigation, autonomous harvesting, and AI-driven sorting (Turner and Small 2025; Zaman et al. 2025). The development of these technologies supports adaptive, locally grounded innovation capacities, allowing food systems to become more resilient, efficient, and equitable, provided ESG principles guide their development and deployment.

The integration of ESG as an innovation logic offers a powerful lens through which to rethink the development and deployment of AI-mechatronic systems in food systems, particularly in the context of the circular economy. Circular food economies aim to design out waste, regenerate natural systems, and localise production, i.e. goals that resonate strongly with ESG values (Trotter et al. 2023). Yet, without a shift in the underlying institutional logics that govern technological design, these aspirations risk remaining aspirational.

Building on Institutional Logics Theory (Thornton and Ocasio 2008), in this paper, we explore how ESG can be framed not as a constraint on innovation but as a guiding rationality that reshapes how technologies are imagined, built, and embedded in society. In this regard, the concept of human-centred design (HCD) is critical to operationalising this shift. HCD promotes participatory, ethical, and contextualised approaches to system design that foreground user needs and societal values (Norman 2005; Steen 2011). In the context of AI and mechatronics, HCD offers a counterbalance to automation-centric models, ensuring that systems enhance rather than replace human agency. When coupled with an ESG logic, HCD can anchor technological development within broader social goals such as justice, inclusivity, and wellbeing, essential elements in the transformation of food systems. Thus, in this paper, we address the following questions: What are the ESG implications of technological innovations in food systems? And how can ESG principles reshape AI-mechatronic design to support circular and human-centred innovation ecosystems?

To answer these important questions, we propose a theoretical model that conceptualises ESG as an institutional logic within innovation ecosystems. Drawing on insights from the institutional logics' literature (Besharov and Smith 2014; Reay and Jones 2015), human-centred design (Giacomin 2014; Steen 2011), and sustainability transitions (Michel 2019), we present propositions to guide future empirical investigations. Our theoretical model contributes to the literature on innovation and sustainability by showing how organisational and design-level dynamics intersect in shaping socially responsible, ethical, and inclusive technological futures.

Despite the growing integration of ESG within management and innovation research, existing work has largely treated ESG as either a compliance mechanism, a reporting framework, or a strategic orientation, rather than as a structuring logic that shapes how technologies are materially designed and legitimised. In parallel, institutional logics theory has provided robust explanations of organisational behaviour under pluralism, yet it has paid limited attention to how institutional values are translated into technological artefacts, interfaces, and design processes. This leaves an important theoretical gap at the intersection of institutional theory, innovation studies, and design research, which is, how normative logics such as ESG become embedded in the material and experiential dimensions of innovation systems. This paper addresses this gap by conceptualising ESG as an institutional logic that can anchor an innovation logic, thereby shaping AI and mechatronic development trajectories in circular food economies.

In doing so, our framework should be understood as a reconceptualisation and synthesis rather than as a simple extension of institutional logics theory. It reconceptualises ESG from a compliance-oriented construct into a generative institutional logic, while synthesising institutional logics theory with human-centred design and circular economy thinking to explain how values are operationalised within technological systems. This positioning allows us to move beyond organisation-centric explanations towards a design-embedded understanding of institutional influence.

The paper is structured in the following way: section two presents the theoretical foundations of this study, rooted in institutional logics theory, human-centred design, and circular economy thinking; section three presents the conceptual model on ESG as innovation logic for technological development, building some propositions; section four presents the discussion and implications, and section five concludes the paper.

2. Theoretical foundations

In complex food innovation ecosystems, achieving sustainable transformation requires more than technological advancement, but it necessitates a reconfiguration of the institutional and normative frameworks guiding innovation. This section draws on three interlinked conceptual domains to theorise this transformation: institutional logics, human-centred design (HCD), and circular economy thinking. Institutional logics theory explains how diverse and sometimes conflicting societal belief systems, e.g. market, scientific, and ESG logics, shape what is perceived as legitimate innovation and who holds authority within ecosystems. Building on the definition introduced earlier, we treat ESG logics as emergent normative orders that reorient AI and mechatronic innovations toward socio-ecological value. HCD complements this by offering a rigorous methodology for translating ESG principles into design practices, engaging users as co-creators in context-sensitive innovation processes, while circular economy thinking provides the systemic context, focusing on resource regeneration, closed-loop flows, and long-term resilience. We integrate these three perspectives to support the emergence of an innovation logic that embeds ethical, social, and environmental dimensions into technological design, enabling more legitimate, inclusive, and sustainable transformations of the agri-food sector.

2.1. Institutional logics theory

Institutional logics theory serves as a foundational framework for understanding how broader societal belief systems shape the behaviours, structures, and innovation strategies of organisations. First formalised by Thornton and Ocasio (2008), institutional logics are defined as 'socially constructed, historical patterns of material practices, assumptions, values, beliefs, and rules' that guide how individuals and organisations make sense of their actions and surroundings (101). These logics are embedded in institutional orders, such as the market, state, community, profession, religion, and family, and exert influence on actors by framing what constitutes legitimate goals, acceptable practices, and appropriate technologies.

The relevance of institutional logics for understanding technological innovation lies in their explanatory power for pluralism and conflict. In innovation ecosystems, particularly those tackling grand challenges such as climate change or food system sustainability, organisations frequently operate in a regime of logic multiplicity, where competing institutional prescriptions must be reconciled (Besharov and Smith 2014). For instance, in agri-food contexts, entrepreneurs may face tensions between the market logic (focused on profit maximisation and scalability), the scientific logic (emphasising technical rigour and innovation), and emerging ESG logics, which prioritise ethical, social, and environmental performance (Galleli and Amaral 2025; Michel 2019).

Studies on logic compatibility and centrality provide additional insight into how organisations engage with multiple logics. Besharov and Smith (2014) propose that organisations differ in the degree to which these logics are central to core activities and whether they are compatible with one another. Where ESG is treated as peripheral and incompatible with dominant logics, it may result in symbolic or decoupled practices. On the contrary, when ESG logic is central and compatible, it can enable genuine institutional hybridity, fostering inclusive innovation strategies and systems change. An empirical example comes from Cerbone and Maroun (2020), who used institutional logics theory to study how firms listed on the Johannesburg Stock Exchange integrated ESG into their reporting practices. They found that where ESG-related logics were peripheral and incompatible with dominant financial logics, ESG initiatives often resulted in symbolic adoption or decoupling, aligning with Besharov and Smith's (2014) typology. However, in firms where ESG was treated as central and compatible, it became embedded in materiality assessments and strategic decision-making, facilitating more authentic and transformative ESG integration.

The potential for logic transformation found in the literature is central to our paper's theorisation. Thornton, Ocasio, and Lounsbury (2012) identify three interrelated mechanisms, i.e. actor mobilisation, rhetorical framing, and field-level governance. These are critical to the evolution and institutionalisation of new logics.

Actor mobilisation refers to the capacity of individuals and organisations to coordinate collective action and mobilise resources, influence, and legitimacy in support of emerging logics. These actors, ranging from activists and policymakers to firms and community leaders, play a pivotal role in destabilising dominant logics and advancing alternative ones through coalitions and advocacy networks.

Rhetorical framing involves the strategic use of language, narratives, and symbols to shape how logics are perceived and understood. When linking new logics to widely accepted societal values, such as justice, sustainability, or innovation, actors can enhance their resonance and acceptance across diverse audiences (Suddaby and Greenwood 2005). Framing is especially important in contested fields where multiple logics coexist, as it can bridge cultural gaps and align heterogeneous interests, making innovation ecosystems more equitable, diverse, and inclusive.

An institutional field refers to a community of organisations that, in aggregate, constitute a recognised area of institutional life. In a food systems context, this could include key suppliers, resource and product consumers, regulatory agencies, and other organisations that produce similar services or products (DiMaggio and Powell 1983). Institutional fields are shaped by shared norms, beliefs, practices, and cognitive frameworks that influence organisational behaviour and legitimacy within a given domain.

Field-level governance pertains to the institutional infrastructure, such as standards bodies, policy frameworks, and inter-organisational networks, that facilitates the coordination, diffusion, and reinforcement of institutional logics. It provides the formal and informal rules through which new logics gain legitimacy, structure organisational behaviour, and ultimately reshape field-level norms.

These mechanisms underpinning institutional logics are particularly salient in food innovation ecosystems, where actors must respond to institutional complexity while building legitimacy for alternative models, such as circular economies or regenerative agriculture. In these contexts, the interplay of mobilisation, framing, and governance enables new ESG-aligned logics to take root and shapes how technologies like AI and mechatronics are designed and justified (Michel 2019; Siefkes, Peters, and Weidinger 2024).

In this theoretical context, we propose ESG as an institutional logic capable of reconfiguring how AI and mechatronic technologies are designed and deployed in food systems. Its normative content, which includes the concern for intergenerational equity, participatory governance, and socio-ecological resilience, positions it as a counter-logic to technocratic paradigms that often prioritise efficiency over inclusion. Furthermore, the ESG logic aligns closely with human-centred design principles, offering a composite frame through which designers, engineers, and stakeholders can co-create and co-construct ethically and culturally-tuned innovations.

2.2. Human-centred design

Human-centred design (HCD) can play a key role in an ESG approach, providing legitimacy for technological development with a social focus at heart. HCD is a design philosophy and methodology aimed at developing systems that prioritise the perspectives, capabilities, and contexts of the people they are intended to serve. According to the Organisation for Standardisation 9241-210 (2010, 2), HCD is 'an approach to systems design and development that aims to make interactive systems more usable by focusing on the use of the system and applying human factors/ergonomics and usability knowledge and techniques'. HCD is increasingly recognised as a design methodology that integrates the experiential, cognitive, and contextual needs of users throughout the design lifecycle. Its foundational principles include a deep understanding of users' needs, active user involvement throughout design, iterative development, and responsiveness to social and environmental context (Giacomin 2014). It has been defined as 'a multi-stage problem-solving process that not only requires designers to analyse and foresee how users are likely to use a product, but also to test the validity of their assumptions in real-world tests involving actual users' (Giacomin 2014, 610). In that sense, HCD is closely related to, but distinct from, design thinking. While both approaches emphasise creativity, iteration, and empathy, HCD has its roots in ergonomics, usability engineering, and human–computer interaction, placing rigorous emphasis on usability, performance, and user-system fit (Norman 2005). Design thinking, in contrast, emerged from the product design and business innovation realms, where the focus lies in problem framing, ideation, and broader innovation processes (Baker and Moukhliss 2019). Design thinking is more expansive in application, often used to catalyse organisational change and strategic innovation, whereas HCD is typically narrower, targeting user-centred functionality and technical usability in specific artefacts or systems. In practice, HCD and design thinking overlap in the use of their tools and mindsets even if they differ in their disciplinary heritage, scope, and evaluative criteria.

Conceptually, HCD is bounded by its focus on usability, user empowerment, and iterative co-design. Unlike design thinking, which emphasises ideation and systemic innovation, HCD maintains a grounded approach focused on enhancing user experience and system functionality within specific use contexts (Nguyen Ngoc, Lasa, and Iriarte 2022). Norman, Stappers, and Sluis-Thiescheffer (2021) highlight HCD's operational boundaries by contrasting it with more speculative, forward-facing design methodologies, emphasising its utility in translational settings that demand reproducibility and user validation. It is important to consider that the HCD approach is increasingly applied to domains such as health systems (Norman, Stappers, and Sluis-Thiescheffer 2021), industrial automation (Nguyen Ngoc, Lasa, and Iriarte 2022), and socio-technical innovation, highlighting its versatility but also its need for rigorous boundary definition to preserve design integrity. When applied to ESG-guided innovation in circular food systems, HCD ensures that technological interventions, e.g. particularly AI and mechatronics, are refined to local knowledge systems, ethical concerns, and broader societal wellbeing.

It is important to note that the interface between human-centred design and mechatronics is not only technical. It has epistemological and ethical dimensions. While mechatronics traditionally prioritises system automation and performance, its integration with HCD introduces a sensitivity to user experience driven by the socio-cultural context, and which capitalises on adaptive feedback. As Johnson, Gross, and

Hennessy (2022) demonstrate, embedding user co-creation principles into the development of precision robotics enhances both user trust and system usability, especially in complex agricultural environments. This design approach ensures that mechatronic systems are technologically advanced as well as accessible, contextually embedded and responsive to community needs. For this reason, the relevance of HCD lies in its role as the operational mechanism through which ESG logic is embedded into technological innovation.

In the domain of AI and mechatronic systems for food systems transformation, HCD offers a practical methodology to align design practices with values of inclusivity, equity, and sustainability. The involvement of users, farmers, cooperatives, and community organisations in participatory design, coupled with the contextualisation of systems within local social and environmental realities allows HCD to mitigate risks of technological imposition and ensures ethical integration. This is particularly important in circular food economies, where value regeneration and socio-ecological justice are central objectives. In the context of AI and mechatronic systems for food innovation, embedding ESG-aligned human-centred design enhances UX and system design by ensuring that algorithmic interfaces and robotic functionalities are co-developed with users and responsive to social and environmental concerns, thereby increasing adoption, trust, and long-term system viability. So, combining ESG logic with HCD can address the challenge of technology legitimacy in complex innovation ecosystems. Rather than viewing end-users as passive adopters, HCD reframes them as co-creators and knowledge holders, thereby supporting the ESG emphasis on stakeholder governance and social wellbeing. Community-based design projects demonstrate how local engagement fosters technological legitimacy and deepens contextual responsiveness (Farooq et al. 2007). Such synergies can foster inclusive, legitimate, and resilient AI-driven innovations in food systems. However, user trust in AI systems also depends on the perceived epistemic value and ethical transparency of digital tools, as demonstrated in the case of food recommendation apps (de Kervenoael et al. 2024).

2.3. Circular economy thinking

In the context of complex innovation ecosystems, circular economy thinking offers a transformative alternative to linear modes of production and consumption, particularly pertinent to the food sector. It promotes regenerative practices, closed-loop resource flows, and systemic resilience, which are values that align closely with sustainability imperatives and growing ESG expectations (Geissdoerfer et al. 2017). In food systems, circular economy thinking encourages innovations that enhance nutrient cycling, reduce waste, preserve biodiversity, and decarbonise supply chains. Technologies underpinning such innovations range from AI-enabled waste analytics to mechatronic systems for precision agriculture and processing (Trotter et al. 2023). Yet, technological solutions alone are not sufficient to drive sustainable food system transformation. Innovation ecosystems must also contend with diverse and sometimes conflicting institutional prescriptions, embodied by institutional logics (Thornton, Ocasio, and Lounsbury 2012). These logics constitute the cultural and normative rules of the game, shaping what is valued, who holds authority, and which technologies are seen as legitimate.

Innovation logic refers to a field-level coordination principle that structures how technological innovation is designed, evaluated, and legitimised across multiple institutional logics (Greenwood et al. 2011; Thornton, Ocasio, and Lounsbury 2012). Unlike institutional logics, which are rooted in societal orders such as the market, profession, or state and prescribe normative orientations, innovation logic does not introduce new values per se. Rather, it operates as a second-order, meta-structural principle that governs how diverse logics are selectively combined, prioritised, and translated into concrete innovation practices, design choices, and evaluation criteria (Smets and Jarzabkowski 2013). In our study, ESG is not conceptualised as an innovation logic itself, but as an institutional logic whose normative content can anchor an innovation logic when it becomes central and compatible with other dominant logics, thereby shaping AI and mechatronic development trajectories (Thornton, Ocasio, and Lounsbury 2012).

Such institutional frameworks represent knowledge architectures that fundamentally guide innovation through shared mental models and cultural cognition (Kaipa 2000).

In food system contexts, this often means balancing market logics focused on efficiency and scalability with community, environmental, and ESG logics that prioritise equity, resilience, and long-term sustainability (Michel 2019; Siefkes, Peters, and Weidinger 2024). We argue that the interaction of these logics can combine into an innovation logic, which is a meta-logic that orients technological design, resource allocation, and collaboration norms within the ecosystem. When ESG logic is central and compatible with other prevailing logics, it can structure the ecosystem around inclusive, ethically sound innovation. Likewise, when ESG remains peripheral or incompatible, innovation may remain extractive, technocratic, and disconnected from users' realities (Cerbone and Maroun 2020).

What are the risks? When the dominant logic in food systems is framed by market and technocratic imperatives, e.g. prioritising efficiency, scale, and productivity, there are considerable risks for ecological and social sustainability. These logics tend to promote linear models that externalise environmental costs, intensify monoculture practices, and marginalise smallholders and traditional food actors. Garnett (2014) critiques this orientation, illustrating how industrial livestock systems, underpinned by market rationales, exacerbate biodiversity loss, climate change, and public health crises through unsustainable feed and waste practices. Similarly, genetically modified crop promotion in sub-Saharan Africa, often driven by international agribusinesses under technocratic logic, has encountered resistance due to limited community engagement and legitimacy, reinforcing social exclusion (Stone 2011). In contrast, ESG-aligned or sustainability-centred logics offer a regenerative alternative, orienting innovation ecosystems towards circularity, equity, and resilience. El Bilali, Allahyari, and Damalas (2019) argue that transitions in food systems require inclusive governance and multi-actor innovation models, where technologies such as AI and mechatronics are co-designed with stakeholders to ensure cultural alignment and environmental responsibility. These innovation logics not only enhance system legitimacy but also promote long-term value creation consistent with circular economy and human-centred design principles.

This is where HCD becomes critical, as it offers a practical methodology for embedding the normative dimensions of ESG into the technical workflows of innovation. It reframes users not as passive recipients but as co-creators of technological artefacts and processes. For instance, visual artefacts that represent sustainability behaviours can empower users by enhancing behavioural awareness and engagement (Perera et al. 2024). Such logic positions AI and mechatronic technology implementation in food systems not solely as efficiency tools, but as vehicles for achieving socially equitable and environmentally regenerative systems.

While institutional logics theory has been highly effective in explaining organisational responses to institutional complexity, it has been less effective in accounting for how normative logics shape the material configuration of technologies and their human-technology interfaces (Greenwood et al. 2011; Orlikowski and Scott 2008). Extant work has predominantly focused on organisational practices, identities, and structures, rather than on technological artefacts and design processes themselves. Our paper advances institutional theory by extending it into the domain of technological innovation, conceptualising innovation logic as the mechanism through which institutional values are translated into system architectures, interfaces, and user experiences. In doing so, the framework bridges institutional theory with human–computer interaction and design research, offering an analytically grounded explanation of how ESG values become embedded, or at times excluded, within AI and mechatronic systems in food innovation ecosystems.

3. ESG as innovation logic for technological development: conceptual model and propositions

In this section, we develop a conceptual model of how an ESG logic can evolve into a central innovation logic within food system transformation. Drawing on institutional logics theory, we argue that the integration of ESG principles into innovation ecosystems is shaped by their compatibility with other dominant logics, such as market or technocratic rationalities.

In our framework, ESG does not function as a composite or standalone meta-logic. Instead, it operates as an institutional logic whose normative content, centred on sustainability, social responsibility, and governance accountability, can anchor an innovation logic when it becomes central and compatible with other dominant logics. This anchoring role is operationalised through its influence on design priorities, evaluation criteria, and legitimacy judgments within innovation ecosystems, as synthesised in Figure 1.

We build on the concept of institutional logic explained in section 2.1, and innovation logic refers to the meta-structural principles that coordinate and legitimise technological development across institutional contexts. These meta-structures are the overarching organising frameworks that guide how actors align norms, resources, and practices across heterogeneous institutional environments. Unlike traditional logics that prescribe specific norms or goals, innovation logic operates as a mediating framework that integrates diverse logics, such as market, ESG, and scientific, into a cohesive orientation guiding collaborative practices, resource allocation, and design goals within innovation ecosystems. As Spohrer, Maglio, and Vargo (2022) argue, innovation logic in complex service systems aligns stakeholder interests by providing a shared logic of value co-creation and system adaptability. This framing enables institutional actors to reconfigure their relationships and evaluation criteria towards inclusivity and sustainability.

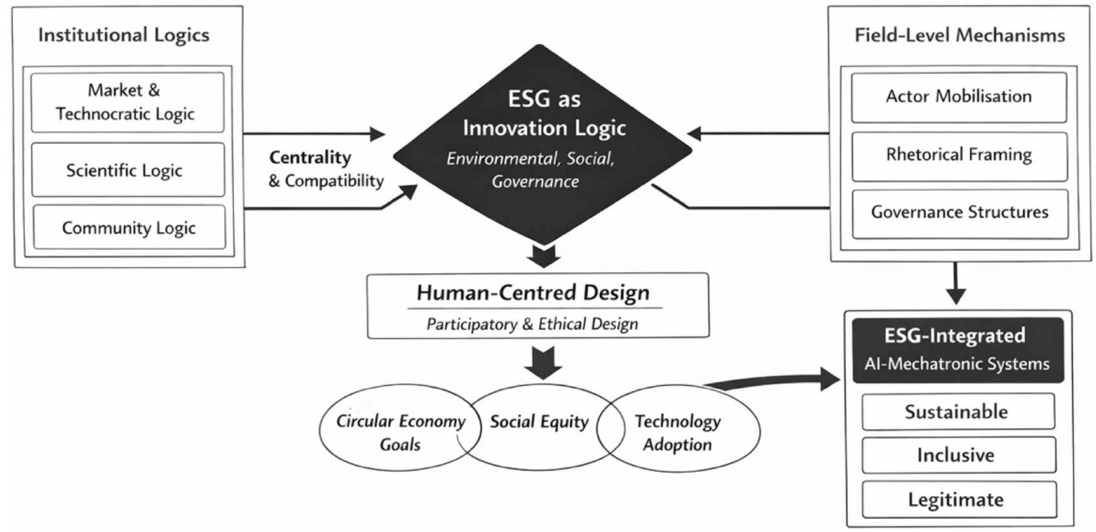

Figure 1. ESG as an innovation logic for AI-mechatronic integration in circular food economies.

When the ESG logic becomes central and compatible, it contributes to the emergence of a composite innovation logic that reorients technological development towards inclusive, sustainable, and legitimate outcomes, facilitating its spread and adoption. HCD acts as the mediating mechanism that translates ESG values into situated and participatory technological solutions. This operationalisation ensures the usability of AI and mechatronic systems while also embedding ethical and contextual relevance.

We also identify actor mobilisation, rhetorical framing, and field-level governance as critical mechanisms for institutionalising ESG logic at the ecosystem level. These mechanisms reinforce legitimacy, build coalitions of support, and shape governance norms, enabling the systemic embedding of ESG-centred innovation logics. Each of the following subsections elaborates further on these concepts and generates propositions that articulate a key causal mechanism in the formation and institutionalisation of ESG-aligned innovation trajectories.

3.1. ESG logic for innovation ecosystems and the innovation trajectories

In pluralistic innovation ecosystems such as food systems, the centrality and compatibility of ESG logic with other dominant logics critically shape innovation outcomes. When ESG logic is peripheral or deemed incompatible with prevailing market or technocratic logics, innovation tends to reflect symbolic compliance or greenwashing, rather than substantive system change (Cerbone and Maroun 2020). This is consistent with Besharov and Smith's (2014) typology, which highlights the risk of decoupling and legitimacy gaps when institutional logics are misaligned. Similarly, when ESG logic is positioned as both central and compatible, it can combine with scientific and market logics into a cohesive innovation logic, offering a normative framework that not only legitimises technology adoption but also redefines the criteria of technological success in terms of equity, inclusion, and sustainability (Galleli and Amaral 2025).

Given the importance of centrality and compatibility as elements supporting innovation logics, their dynamic nature should also be considered. Logics evolve through negotiation and consensus, and organisations may actively reframe ESG principles to increase their compatibility with prevailing frames such as efficiency or innovation. As Smets and Jarzabkowski (2013) argue, such recombination processes are often enacted through practice, whereby logics are not only passively received but reinterpreted and blended at the micro-level. As Cacciolatti and Lee (2022) posited, communities of practice can make use of intelligence as a social resource to gather local (often tacit) knowledge embedded in the local culture. This adaptive capability enables ESG logics to gradually gain ground in fields initially dominated by market rationalities. This mechanism is similar to the one fostering alternative food networks (Cacciolatti et al. 2024), as they embrace (i.e. centralise and make compatible) the ESG logic. In food innovation ecosystems, this can be seen in the rise of sustainable business models where profitability is pursued in tandem with ecological regeneration and community empowerment. Recent research shows that embedding sustainability principles into the early stages of AI system design supports inclusive and context-sensitive innovation outcomes, particularly when co-designed with local actors (Pansera and Owen 2018).

Beyond its explanatory value, the framework also offers diagnostic leverage. Specifically, the model enables researchers and practitioners to assess the degree to which ESG logic is central and compatible within a given innovation ecosystem, and to identify where misalignments occur across design practices, governance structures, and actor configurations. Such diagnostic application allows for the identification of whether innovation trajectories are likely to produce symbolic compliance, partial alignment, or systemic transformation.

If we want to strengthen our understanding of the interplay of institutional logics, HCD, and ESG in determining innovation trajectories, it is important that we delineate the underpinning mechanisms and separate them from the outcomes. For instance, the centrality and compatibility of ESG logic act as mechanisms that mediate how actors align innovation practices. In the meantime, their outcome lies in the extent to which technologies contribute to inclusive and sustainable transformation. This causal structure clarifies the theorised relationship and has the potential to facilitate empirical testing.

Furthermore, a point we consider important is that the centrality and compatibility of ESG logic should be understood as dynamic rather than static conditions. Institutional logics evolve through negotiation, contestation, and recombination, and their influence on innovation trajectories may strengthen or weaken over time (Reay and Hinings 2009; Smets and Jarzabkowski 2013). ESG integration may initially remain symbolic or peripheral, but sustained alignment, supported by governance mechanisms and design practices, can progressively embed ESG values into technological systems. This temporal perspective enhances the diagnostic and empirical applicability of our framework, particularly for longitudinal studies of AI and mechatronic innovation. Thus, our first proposition is

> **Proposition 1**: When ESG logic is central and compatible with dominant logics in an innovation ecosystem, the resulting innovation logic fosters system-wide transformation towards sustainable, inclusive, and legitimate outcomes in AI and mechatronic deployment. Therefore, an ESG logic fosters the design of AI-mechatronic systems that are participatory and culturally adaptable, enhancing user engagement and system relevance.

3.2. Human-centred design as an interface for innovation logic legitimation

Human-centred design is theoretically distinctive because it operates at the interface between institutional values and technological materiality. Rather than prescribing ethical outcomes ex ante, HCD embeds normative commitments through iterative engagement with users, translating abstract ESG principles, such as inclusion, transparency, and accountability, into concrete interface features, system functionalities, and interaction flows (Giacomin 2014; ISO 9241-210, 2010). In this sense, HCD functions as a mediating mechanism that enables ESG logic to shape innovation outcomes by influencing how AI and mechatronic systems are designed, experienced, and legitimised (Norman, Stappers, and Sluis-Thiescheffer 2021). Prior research on digital knowledge exchange further shows that when users perceive systems as misaligned with their values or governance expectations, they strategically withhold knowledge, undermining trust and system effectiveness, highlighting the importance of value-aligned, participatory design in socio-technical systems (Zhai et al. 2023).

HCD plays a vital intermediary role in translating ESG logic into technological artefacts and practices that are socially legitimate and culturally contextualised. Unlike technocratic design approaches that prioritise efficiency, HCD is grounded in iterative co-creation with end-users, allowing for the surfacing of the ethical, cultural, and experiential dimensions of innovation. This participatory orientation ensures that design outcomes are not only usable but meaningful within the socio-institutional context they inhabit (Giacomin 2014; ISO 9241-210, 2010). HCD's commitment to iterative prototyping and reflexive feedback loops aligns strongly with the continuous adaptation demands of circular food economies. Gamification and co-creation dynamics have also been shown to reinforce emotional and cognitive engagement in design processes, enhancing overall user experience and value creation (Martín-Peña, García-Magro, and Sánchez-López 2024). Also, HCD's epistemological foundation in constructivism means that knowledge is co-produced rather than extracted from users (Sanders and Stappers 2008). This orientation is especially critical in food systems, where cultural appropriateness, environmental stewardship, and stakeholder inclusion intersect, enhancing the potential for sustainability in the system. Thus, HCD operationalises the ethical and procedural dimensions of ESG logic. It does so by grounding technological design in lived experiences while ensuring that innovations are effective, equitable, resilient, and democratically anchored. This is echoed in service domains, where studies show that acceptance of service robots depends not only on functionality but also on emotional trust and sociocultural alignment (Pande and Gupta 2023). In further support, Ananny and Crawford (2018) argue that trust in AI systems increases when design processes are transparent, participatory, and grounded in broader societal values, as these are principles inherently promoted by ESG-centred approaches. Thus, HCD operates as the mediating mechanism that links the ESG logic to the quality and legitimacy of the innovation outcomes. This helps to specify the generative mechanisms and intervening structures that influence organisational outcomes in institutional contexts (Shepherd and Suddaby 2017). Therefore, our second proposition is

> **Proposition 2**: Human-centred design mediates the relationship between ESG logic and innovation outcomes by enabling participatory, context-sensitive, and legitimacy-enhancing innovation processes that reduce the risk of technological imposition and exclusion. Thus, where ESG logic is embedded, AI-mechatronic systems are perceived as being more ethical, explainable, and trustworthy by diverse stakeholders.

3.3. The logic evolution through mobilisation, framing, and governance

The institutionalisation of ESG-centred innovation logic depends on more than internal alignment. In fact, it requires field-level mechanisms that reinforce its legitimacy and scalability. According to Thornton, Ocasio, and Lounsbury (2012), these include actor mobilisation, rhetorical framing, and field-level governance. Actor mobilisation involves building coalitions of support across stakeholders, such as government bodies, civil society organisations, private firms and citizens, who can collectively reconfigure institutional priorities (Nordling 2024). Emerging tools such as serious games offer novel approaches for simulating governance scenarios, thereby facilitating participatory foresight in innovation ecosystems (Cavada and Rogers 2020).

Rhetorical framing, in turn, allows ESG logic to be aligned with culturally resonant narratives, such as justice, regeneration, or intergenerational equity, enhancing its appeal and legitimacy (Suddaby and Greenwood 2005).

Critically, these mechanisms do not operate in isolation. They are synergistic and recursive at the same time: successful rhetorical framing can facilitate actor mobilisation, which in turn may pressure institutional actors to revise governance structures. As Zietsma et al. (2017) demonstrate, institutional change often requires a dialectical process of contestation and reinforcement, where new logics are simultaneously disruptive and consolidative in their own right. In food systems, this interplay is crucial for embedding ESG-centred innovation logics into technological agendas, enabling legitimacy to be scaffolded across multiple institutional levels, from design practices to policy frameworks. Incidentally, Köhler et al. (2019) demonstrate that sustainability-oriented governance structures provide fertile ground for the emergence of adaptive, ESG-guided innovation ecosystems, particularly in contexts such as food systems transitioning to circular models. Thus, our third proposition is

> **Proposition 3**: The evolution and institutionalisation of an ESG-centred innovation logic is contingent upon the interplay of actor mobilisation, rhetorical framing, and field-level governance that reinforce the legitimacy and systemic embeddedness of ESG-aligned innovations in food systems. Thus, ESG-guided innovation ecosystems better support circular food economies, enabling regenerative practices through ethically aligned technology.

The three propositions should be read as sequential and interdependent elements of a single theoretical model. Proposition 1 specifies the structural conditions under which ESG logic can anchor an innovation logic within pluralistic ecosystems. Proposition 2 identifies human-centred design as the mediating mechanism through which ESG values are translated into technological artefacts and user experiences. Proposition 3 explains how field-level mechanisms enable this innovation logic to stabilise and scale across the ecosystem. When taken altogether, these propositions articulate a causal pathway from institutional values to design practices and system-level outcomes (Thornton, Ocasio, and Lounsbury 2012; Greenwood et al. 2011).

Altogether, the propositions also generate predictive expectations. Where ESG logic remains peripheral or incompatible, innovation outcomes are likely to reflect technocratic optimisation and limited social legitimacy. Where ESG logic becomes central but lacks effective mediation through human-centred design, outcomes may exhibit normative intent without practical usability or stakeholder adoption. Only when centrality, mediation, and institutionalisation mechanisms align can innovation ecosystems produce durable, scalable, and inclusive technological transformation

4. Discussion and implications

We have conceptualised how an ESG logic, when central and compatible with dominant institutional logics, supports an innovation logic that shapes AI and mechatronic development in food systems via HCD and circular economy principles. Our three propositions were designed to capture this process, yet each contains inherent tensions and practical limitations that merit critical reflection. First, when looking at ESG compatibility and innovation system transformation, while evidence suggests that ESG compatibility can act as a catalyst to inclusive innovation, e.g. Danone's regenerative agriculture strategies, which show how the centrality and compatibility of ESG logic with scientific and community logics can give rise to an innovation logic that aligns technological development with regenerative practices. This hampers long-term resilience and shared value creation in food systems (Dentoni, Bitzer, and Pascucci 2021), and significant power imbalances remain a persistent challenge. This example shows how the centrality and compatibility of ESG logic with scientific and community logics can give rise to, or hamper, an innovation logic that aligns technological development with regenerative practices, long-term resilience, and shared value creation in food systems.

Large agribusinesses, often commercialised through market logic, may absorb an ESG rhetoric into corporate social responsibility without relinquishing profit-first orientations. A study by Scholtens (2022) indicates that such ESG washing may curtail any systemic transformation, relegating sustainable practices to the margins. Thus, while compatibility is necessary, it may be insufficient unless accompanied by mechanisms that shift control over resources, knowledge, and governance toward underrepresented actors (e.g. smallholders, cooperatives).

In that sense, the distribution of power within the organisation plays a critical role. Centrality does not necessarily guarantee longevity. ESG logic may gain initial institutional foothold through external pressure (e.g. consumer advocacy), but without a robust internalisation, which requires reconfiguring incentive structures and measuring non-financial, long-term outcomes, such innovation logic may remain superficial (Eccles and Klimenko 2019). Therefore, future empirical research should interrogate how ESG logic is embedded in revenue models, performance metrics, and executive compensation, beyond mere symbolic alignment.

Second, when looking at HCD as a tool to foster the legitimacy of an innovation logic, we notice that this design approach undoubtedly enhances the social legitimacy of AI-mechatronic systems (Norman, Stappers, and Sluis-Thiescheffer 2021) due to its focus on human needs as a precursor to the design of technical solutions. However, the quality and depth of participatory processes vary significantly. Instances of tokenistic participation, where local input is solicited only to legitimise pre-set designs, may reproduce inequities rather than dismantle them. This illustrates that human-centred design only functions as an effective mediating mechanism when participation is substantive and iterative, as tokenistic engagement undermines the translation of ESG values into technological artefacts and weakens system legitimacy.

As an example, AI-driven precision agriculture platforms in sub-Saharan Africa included local farmers in consultations but ignored their concerns in final designs, reinforcing digital inequities under the guise of community engagement (Blair and Madill 2019).

This example demonstrates that when ESG logic remains peripheral to dominant market and technocratic logics, AI-based agricultural innovations tend to prioritise efficiency and scalability at the expense of contextual relevance and social inclusion, thereby reproducing existing inequalities rather than supporting sustainable food system transformation. Also, this emphasises the importance of reflexive practices: designers must critically examine who is included, who speaks for whom, and which knowledge sources are elevated. Furthermore, the scalability of HCD approaches in complex innovation ecosystems poses challenges. While HCD excels in small-scale pilot contexts, transitioning to full deployment can dilute its participatory essence as standardisation demands override contextual sensitivity. For example, large-scale smart-waste systems, despite initial community co-design, have often regressed to technocratic implementation when rolled out nationally (Middlemiss and Parrish 2021). Therefore, HCD processes must be institutionalised through organisational policies and governance standards, rather than remaining episodic events.

Third, what has been said so far goes in tandem with the process of institutional change that takes place through mobilisation, framing, and governance, thus leading to a shift from the dominant market and technocratic logics to an alternative ESG-led innovation logic (REF). These institutional mechanisms critically important, yet the challenge lies in sustaining multi-level alignment over time. Although actor mobilisation can generate momentum, coalitions often fracture around conflicting interests once regulatory or market leverage wanes (Geels et al. 2019). Similarly, rhetorical framings, while potent instruments, may lose legitimacy when narratives diverge from lived experiences, as seen in the case of the ‘green innovation’ promises made, which failed to deliver visible benefits (Voß and Kemp 2006).

A further illustrative example can be found in AI-enabled food transparency and recommendation applications, where algorithmic assessments of nutritional or environmental impact shape consumer decision-making. When such systems are developed under ESG-aligned innovation logics and informed by human-centred design, they can enhance user trust and perceived legitimacy by making evaluation criteria transparent and contextually meaningful. Conversely, when driven primarily by market optimisation, these systems risk reinforcing information asymmetries and normative bias, limiting their contribution to socially inclusive food systems. This illustrates how ESG-aligned innovation logics, when operationalised through human-centred design, can enhance the perceived legitimacy and epistemic value of algorithmic food information systems, whereas market-driven optimisation risks reinforcing opacity and normative bias.

Last but not least, governance frameworks remain predominantly structured around efficiency and productivity metrics, with limited avenues to enforce ESG-centred standards in food systems. Even when policies encourage regenerative practices, subsidy systems often favour high-output producers, perpetuating existing inequalities (Pe'er et al. 2020). These tensions highlight the fragility of institutionalising the ESG logic, suggesting a greater role for multi-level meta-governance approaches that align local, national, and supranational structures to sustain transformation while adopting a multi-actor, multi-stakeholder systems approach to food systems transformation.

For instance, mechatronic innovations in circular food processing provide an additional illustrative context. Automated sorting, waste recovery, and resource optimisation systems can either reinforce efficiency-driven logics or support regenerative outcomes depending on how ESG values are embedded through governance and design. Where actor coalitions and regulatory frameworks prioritise circularity and social responsibility, mechatronic systems are more likely to be designed for adaptability, transparency, and local integration, reinforcing the institutionalisation of ESG-centred innovation logic. This example demonstrates that mechatronic technologies support circular food economies most effectively when ESG-centred innovation logics are reinforced through coordinated governance and actor mobilisation, shaping design priorities towards adaptability, transparency, and resource regeneration.

Our model for human-centred AI-mechatronic integration for circular food economies based on an ESG innovation logic bears several implications. For theory development, the conceptualisation of ESG as an emergent institutional logic that does not operate at the field or organisational level, but as a meta-logic shaping technological trajectories, challenges prevailing assumptions in institutional theory. Traditional institutional models often treat logics as stable and domain-specific. Yet, our study highlights their dynamic, relational, and co-evolutionary nature, especially under conditions of pluralism, such as in food innovation ecosystems. This calls for theory refinement that better accounts for the temporal sequencing of logic centrality, the role of peripheral actors in logic mobilisation, and the material anchoring of logics within technological artefacts. Also, the interplay between institutional logics and HCD design offers a novel empirical space where normativity, materiality, and agency intersect, urging scholars to integrate insights from design theory and science and technology studies into institutional logics research to enrich institutional theory with a more nuanced understanding of the mechanisms underpinning the transition from dominant to alternative logic. From an empirical standpoint, the framework can be operationalised through multi-level measurement strategies. ESG logic centrality may be assessed through content analysis of organisational priorities and investment patterns, compatibility through the alignment between ESG objectives and dominant performance metrics, and human-centred design through observable participatory practices, iterative design cycles, and user integration mechanisms. Field-level mechanisms such as mobilisation, framing, and governance can be captured through network analysis, discourse analysis, and policy instrumentation. This opens a clear pathway for future empirical testing across longitudinal and comparative research designs.

For policy makers, while ESG adoption is growing in food policy discourse, our findings suggest that integration remains fragile without structural realignment. From a governance perspective, the framework provides a decision-making tool rather than a normative aspiration. ESG-centred innovation cannot flourish in policy environments dominated by yield-oriented incentives or fragmented regulatory oversight. Policymakers must address these systemic incongruities by embedding ESG criteria into public procurement, technology grants, and agricultural subsidies, linking resource access to demonstrable social and environmental co-benefits. For instance, policy makers could (i) create ESG-linked technology funding streams that require co-design with affected stakeholders, particularly marginalised food system actors; (ii) mandate participatory innovation assessments as a condition for regulatory approval of new AI/mechatronic tools in agri-food sectors, and (iii) support multi-actor innovation platforms where government, researchers, farmers, and civil society collaboratively define success metrics and ethical standards.

Finally, there are some implications for AI and mechatronic designers and innovators. Our model reframes ESG as a design logic with epistemic and operational significance rather than treating it as an external compliance burden. HCD offers a pathway to internalise ESG by integrating user knowledge, values, and concerns into system requirements. However, design teams often lack institutional mandates, technical tools, or cultural capacity to enact such transformation. Practitioners could embed ethics and inclusion checklists at each design milestone to assess stakeholder representation, explainability, and environmental impacts. Also, they could institutionalise user feedback loops beyond prototyping, through adaptive governance of the deployed systems (e.g. ongoing field-level audits). The framework also allows practitioners to anticipate failure modes in innovation design. For instance, systems developed without meaningful user integration are likely to face adoption resistance, while those lacking ESG alignment may generate short-term efficiency gains but long-term legitimacy deficits. Finally, they could use participatory foresight methods to anticipate the long-term implications of deployed technologies on food sovereignty, equity, and resilience.

Although rhetorical framing plays a critical role in fostering innovation logics, system-wide ESG-centred innovation is not simply a matter of will or rhetoric; it requires the systemic redesign of institutional architectures, design protocols, and evaluative frameworks, and our propositions offer a foundation for this reconfiguration. Our work lays the basis for scholars and practitioners alike to test, refine, and extend our propositions. Appendix 1 summarises the propositions and their contribution to ESG as an innovation logic.

5. Conclusions

In this paper, we propose a theoretical framework that conceptualises ESG as an institutional logic capable of shaping inclusive, sustainable innovation in AI and mechatronic systems within transforming food systems. We developed three key propositions: first, that when ESG logic is central and compatible with prevailing market and scientific logics, it can generate a cohesive innovation logic that supports system-wide transformation, supporting circular economy thinking; second, that HCD acts as a crucial interface, operationalising ESG principles through participatory, context-sensitive design practices; and third, that the institutionalisation of an ESG-centred innovation logic depends on the interplay of actor mobilisation, rhetorical framing, and field-level governance mechanisms. In doing so, we advance institutional logics theory by demonstrating how normative logics become materially embedded within technological systems, offering a design-oriented perspective that connects institutional theory with innovation studies and human–computer interaction.

Our theoretical contribution lies in the integration of institutional logics theory with HCD and circular economy thinking to explain how an ESG logic can orient and legitimise technological development in complex innovation ecosystems. This theorisation bridges fragmented discourses in innovation and sustainability by shifting the role played by ESG from an external standard to a structuring force within institutional fields. Thus, if we reconceptualise ESG as an innovation logic, we show how normative commitments can be embedded in the design and adoption of emerging technologies, supporting a sustainability effort that we contextualise in the contexts of specific technologies (i.e. AI and mechatronics) for a specific domain (i.e. food systems). More specifically, our primary theoretical contribution lies in distinguishing innovation logic as a second-order, field-level coordination mechanism that governs how multiple institutional logics are translated into technological artefacts, interfaces, and user experiences. By extending institutional logics theory into the domain of human-centred technological design, our framework bridges institutional theory with human–computer interaction and innovation studies. Our framework explains not only whether ESG values are adopted, but how they become materially embedded in AI and mechatronic systems through design practices and field-level coordination.

Our framework is subject to important boundary conditions. It is most applicable to innovation ecosystems characterised by institutional pluralism and contested technological futures, such as food systems undergoing sustainability transitions. Moreover, while human-centred design provides a powerful mediating mechanism, its effectiveness depends on the depth and authenticity of participation. Tokenistic or extractive design practices may reproduce rather than resolve existing power asymmetries. Thus, if we look at its limitations, in primis, it remains largely conceptual, requiring empirical validation through comparative case studies across regions and food system contexts. Also, the interaction of logics may vary significantly depending on institutional maturity, actor configurations, and local sociopolitical histories, which are dimensions that we could not fully account for in a theoretical paper. Lastly, while we address HCD as a mediating interface, further work is needed to operationalise how HCD processes can structurally embed ESG concerns in technological pipelines beyond pilot interventions.

Our paper lays the groundwork for a critical reimagining of how ESG can function as a transformative institutional logic, guiding both the ethics and the efficacy of innovation for sustainable food futures. Building on this foundation, future research could pursue several complementary avenues. First, scholars could empirically trace the trajectories of logic centrality and compatibility over time through longitudinal, multi-level case studies of ESG-integrated AI and mechatronic innovations in food systems, combining archival analysis, elite interviews, and design documentation to capture how alignment or conflict between logics evolves across development, deployment, and scaling phases. Second, there is a need to develop practice-sensitive analytical tools, such as design ethnographies, UX audits, or comparative analysis of design artefacts, to examine how human-centred design practices both reflect and actively shape institutional logics, revealing the recursive interplay between everyday design decisions and broader institutional structures. Finally, future studies should adopt critical and comparative research designs, including cross-regional case comparisons or participatory action research with marginalised food system actors, to interrogate power asymmetries and unintended consequences arising from the translation of ESG, market, and technological logics across diverse socio-institutional contexts, particularly in global food systems characterised by deep-seated inequalities.

Author contributions

CRediT: **Luca Cacciolatti:** Conceptualization, Supervision, Writing – original draft, Writing – review & editing; **Michael Christofi:** Conceptualization, Writing – review & editing; **Ioannis Christodoulou:** Conceptualization, Writing – review & editing; .

Disclosure statement

No potential conflict of interest was reported by the author(s).

References

Ananny, M., and K. Crawford. 2018. “Seeing without Knowing: Limitations of the Transparency Ideal and its Application to Algorithmic Accountability.” *New Media & Society* 20 (3): 973–989. https://doi.org/10.1177/1461444816676645.

Baker, D., and S. Moukhliss. 2019. “Concretising Design Thinking: A Content Analysis of Systematic and Extended Literature Reviews.” *Review of Education* 7 (3): 607–641. https://doi.org/10.1002/rev3.3186.

Besharov, M. L., and W. K. Smith. 2014. “Multiple Institutional Logics in Organizations: Explaining their Varied Nature and Implications.” *Academy of Management Review* 39 (3): 364–381. https://doi.org/10.5465/amr.2011.0431.

Blair, E. H., and A. Madill. 2019. “Ethical Design and Co-Creation in Digital Services.” *Journal of the Association for Information Science and Technology* 70 (7): 695–708. https://doi.org/10.1002/asi.24105.

Cacciolatti, L., J. Lee, G. Sacchi, and S. H. Lee. 2024. “Guest Editorial. Revisiting the Slow Food Movement: Three Cases of Heritage, Innovation, and Sustainability in Alternative Food Networks.” *Economia agro-alimentare/Food Economy: XXVI* 2:83. https://doi.org/10.3280/ecag2024oa18190.

Cacciolatti, L., and S. H. Lee. 2022. “Collective Knowledge and Social Innovation in Communities of Practice: The Case of the Slow Food Movement in Italy.” In *The Routledge Companion to Knowledge Management*, edited by I. Nonaka and J. Chen, 271–288. London: Routledge.

Cacciolatti, L., and C. Mar Molinero. 2013. “Analysing the Demand for Supply Chain Jobs through Job Advertisements.” *Departmental Working Paper Series.* kar.kent.ac.uk.

Cavada, M., and C. D. F. Rogers. 2020. “Serious Gaming as a Means of Facilitating Truly Smart Cities: A Narrative Review.” *Behaviour & Information Technology* 39 (6): 695–710. https://doi.org/10.1080/0144929X.2019.1677775.

Cerbone, D., and W. Maroun. 2020. “Materiality in an Integrated Reporting Setting: Insights Using an Institutional Logics Framework.” *Journal of Accounting and Public Policy* 39 (1): 106735. https://doi.org/10.1016/j.jaccpubpol.2019.106735.

de Kervenoael, R., A. Schwob, R. Hasan, and S. Kemari. 2024. “Food Choice and the Epistemic Value of the Consumption of Recommender Systems: The Case of Yuka’s Perceived Value in France.” *Behaviour & Information Technology* 43 (7): 1381–1400. https://doi.org/10.1080/0144929X.2023.2212088.

Dentoni, D., V. Bitzer, and S. Pascucci. 2021. “Cross-Sector Partnerships and the Co-Creation of Dynamic Capabilities for Stakeholder Orientation.” *Journal of Business Ethics* 169 (2): 397–415. https://doi.org/10.1007/s10551-020-04548-2.

DiMaggio, P. J., and W. W. Powell. 1983. “The Iron Cage Revisited: Institutional Isomorphism and Collective Rationality in Organizational Fields.” *American Sociological Review* 48 (2): 147–160. https://doi.org/10.2307/2095101.

Eccles, R. G., and S. Klimenko. 2019. “The Investor Revolution.” *Harvard Business Review* 97 (3): 106–116.

El Bilali, H., M. S. Allahyari, and C. A. Damalas. 2019. “A Conceptual Framework for Understanding the Transition towards Sustainable Food Systems.” *Sustainability* 11 (19): 4941. https://doi.org/10.3390/su11194941.

Farooq, U., C. H. Ganoe, L. Xiao, C. B. Merkel, M. B. Rosson, and J. M. Carroll. 2007. “Supporting Community-Based Learning: Case Study of a Geographical Community Organization Designing Its Website.” *Behaviour & Information Technology* 26 (1): 5–21. https://doi.org/10.1080/01449290600811503.

Galleli, B., and H. F. Amaral. 2025. “Bridging Institutional Theory and Social and Environmental Efforts in Management: A Review and Research Agenda.” *Journal of Cleaner Production*, in press.

Garnett, T. 2014. “What is a Sustainable Healthy Diet? A Discussion Paper.” Food Climate Research Network, University of Oxford. https://foodsource.org.uk/sites/default/files/building-block-pdfs/FCRN-sustainable-healthy-diets.pdf.

Geels, F. W., B. K. Sovacool, T. Schwanen, and S. Sorrell. 2019. “Sociotechnical Transitions for Sustainable Development: Where Next?” *Environmental Innovation and Societal Transitions* 31:1–4. https://doi.org/10.1016/j.eist.2018.09.003.

Geissdoerfer, M., P. Savaget, N. M. P. Bocken, and E. J. Hultink. 2017. "The Circular Economy - A New Sustainability Paradigm?" *Journal of Cleaner Production* 143:757–768. https://doi.org/10.1016/j.jclepro.2016.12.048.

Giacomin, J. 2014. "What is Human Centred Design?" *The Design Journal* 17 (4): 606–623. https://doi.org/10.2752/175630614X14056185480186.

Giua, C., V. C. Materia, and L. Camanzi. 2022. "Smart Farming Technologies Adoption: Which Factors Play a Role in the Digital Transition?" *Technology in Society* 68:101869. https://doi.org/10.1016/j.techsoc.2022.101869.

Greenwood, R., M. Raynard, F. Kodeih, E. R. Micelotta, and M. Lounsbury. 2011. "Institutional Complexity and Organizational Responses." *Academy of Management Annals* 5 (1): 317–371.

International Organization for Standardization. 2010. "ISO 9241-210:2010 - Ergonomics of Human-System Interaction - Part 210: Human-Centred Design for Interactive Systems." ISO. https://www.iso.org/standard/52075.html.

Johnson, M. D., A. M. Gross, and D. A. Hennessy. 2022. "Human Factors in Agricultural Robotics: Incorporating Participatory Design in the Development of Autonomous Systems." *Journal of Field Robotics* 39 (2): 345–365. https://doi.org/10.1002/rob.22039.

Kaipa, P. 2000. "Knowledge Architecture for the Twenty-First Century." *Behaviour & Information Technology* 19 (3): 153–161. https://doi.org/10.1080/014492900406146.

Köhler, J., F. W. Geels, F. Kern, J. Markard, E. Onsongo, A. Wieczorek, F. Alkemade, et al. 2019. "An Agenda for Sustainability Transitions Research: State of the Art and Future Directions." *Environmental Innovation and Societal Transitions* 31:1–32. https://doi.org/10.1016/j.eist.2019.01.004.

Martín-Peña, M. L., C. García-Magro, and J. M. Sánchez-López. 2024. "Service Design through the Emotional Mechanics of Gamification and Value Co-Creation: A User Experience Analysis." *Behaviour & Information Technology* 43 (3): 486–506. https://doi.org/10.1080/0144929X.2023.2177823.

Michel, B. 2019. "Collaborative Institutional Work to Generate Alternative Food Systems." *Academy of Management Journal* 62 (1): 60–85. https://doi.org/10.5465/amj.2016.0892.

Middlemiss, L., and B. D. Parrish. 2021. "Building Critical Action and Implementation Research for Sustainable Consumption Transitions: Sustainability Labs, Policy Incubation, and co-creation of Alternative Food Networks." *Sociology Compass* 15 (9): e12910. https://doi.org/10.1111/soc4.12910.

Nguyen Ngoc, H., G. Lasa, and I. Iriarte. 2022. "Human-Centred Design in Industry 4.0: Case Study Review and Opportunities for Future Research." *Journal of Intelligent Manufacturing* 33 (1): 35–76. https://doi.org/10.1007/s10845-021-01796-x.

Nordling, N. 2024. *Transformative Innovation Ecosystems*. Tampere University. https://trepo.tuni.fi/bitstream/handle/10024/160291/978-952-03-3588-5.pdf.

Norman, D., P. J. Stappers, and W. Sluis-Thiescheffer. 2021. "Human-Centered Design: Understanding its History, Meaning, and Position in Design Research." *Design Issues* 37 (3): 1–18. https://doi.org/10.1162/desi_a_00632.

Norman, D. A. 2005. "Human-Centered Design Considered Harmful." *Interactions* 12 (4): 14–19. https://doi.org/10.1145/1070960.1070976.

Orlikowski, W. J., and S. V. Scott. 2008. "*10* Sociomateriality: Challenging the Separation of Technology, Work and Organization". *Academy of Management Annals* 2 (1): 433–474.

Pande, S., and K. P. Gupta. 2023. "Indian Customers' Acceptance of Service Robots in Restaurant Services." *Behaviour & Information Technology* 42 (12): 1946–1967. https://doi.org/10.1080/0144929X.2022.2103734.

Pansera, M., and R. Owen. 2018. "Framing Inclusive Innovation within the Discourse of Development: Insights from Case Studies in India." *Research Policy* 47 (1): 23–34. https://doi.org/10.1016/j.respol.2017.09.007.

Pe'er, G., Y. Zinngrebe, F. Moreira, C. Sirami, S. Schindler, R. Müller, V. Bontzorlos, et al. 2020. "A Greener Path for the EU Common Agricultural Policy." *Science* 367 (6470): 449–451. https://doi.org/10.1126/science.aaz8874.

Perera, D., N. Verdezoto Dias, S. Lannon, J. Gwilliam, and P. Eslambolchilar. 2024. "Exploring the Design of Physical Artefacts to Visualise Household Consumption for Encouraging Sustainable Practices." *Behaviour & Information Technology* 43 (14): 3356–3370. https://doi.org/10.1080/0144929X.2024.2398673.

Reay, T., and C. R. Hinings. 2009. "Managing the Rivalry of Competing Institutional Logics." *Organization Studies* 30 (6): 629–652.

Reay, T., and C. Jones. 2015. "Qualitatively Capturing Institutional Logics." *Strategic Organization* 14 (4): 441–454. https://doi.org/10.1177/1476127015589981.

Sanders, E. B.-N., and P. J. Stappers. 2008. "Co-Creation and the New Landscapes of Design." *CoDesign* 4 (1): 5–18. https://doi.org/10.1080/15710880701875068.

Scholtens, B. 2022. "Blending Corporate Social Responsibility and Financial Performance through ESG." *Journal of Sustainable Finance & Investment* 12 (1): 1–13. https://doi.org/10.1080/20430795.2021.1983913.

Shepherd, D. A., and R. Suddaby. 2017. "Theory Building: A Review and Integration." *Journal of Management* 43 (1): 59–86. https://doi.org/10.1177/0149206316647102.

Siefkes, M. J., A. L. Hamer, L. Haarland, and B. Øyvind. 2024. "Profit First, Environmental Impact Second? Investigating Hybrid Institutional Logics in Cleantech Venture Capital." *Business Strategy and the Environment* 33 (8): 7922–7941. https://doi.org/10.1002/bse.3902.

Smets, M., and P. Jarzabkowski. 2013. "Reconstructing Institutional Complexity in Practice: A Relational Model of Institutional Work and Complexity." *Human Relations* 66 (10): 1279–1309. https://doi.org/10.1177/0018726712471407.

Spohrer, J. C., P. P. Maglio, and S. L. Vargo. 2022. "Scaling Service Systems through Innovation Logics." *MIS Quarterly Executive* 21 (3): 221–239. https://doi.org/10.25300/MISQ/2022/14569.

Steen, M. 2011. "Tensions in Human-Centred Design." *CoDesign* 7 (1): 45–60. https://doi.org/10.1080/15710882.2011.563314.

Stone, G. D. 2011. "Field versus Farm in Warangal: Bt Cotton, Higher Yields, and Larger Questions." *World Development* 39 (3): 387–398. https://doi.org/10.1016/j.worlddev.2010.09.008.

Suddaby, R., and R. Greenwood. 2005. "Rhetorical Strategies of Legitimacy." *Administrative Science Quarterly* 50 (1): 35–67. https://doi.org/10.2189/asqu.2005.50.1.35.

Tashman, P. 2020. "A Natural-Resource Dependence Perspective of the Firm: How and Why Firms Manage Natural Resource Scarcity." *Business & Society* 59 (6): 1071–1112. https://doi.org/10.1177/0007650317720603.

Thornton, P. H., and W. Ocasio. 2008. "Institutional Logics." In *The SAGE Handbook of Organizational Institutionalism*, edited by R. Greenwood, C. Oliver, R. Suddaby, and K. Sahlin, 99–129. London: SAGE.

Thornton, P. H., W. Ocasio, and M. Lounsbury. 2012. *The Institutional Logics Perspective: A New Approach to Culture, Structure and Process*. Oxford: Oxford University Press.

Trotter, P. A., I. Papoutsis, P. Nussbaumer, and H. Friedl. 2023. "The Role of Supply Chains for the Sustainability Transformation of Global Food Systems." *Journal of Industrial Ecology* 27 (6): 1585–1602. https://doi.org/10.1111/jiec.13445.

Tukker, A. 2015. "Product Services for a Resource-Efficient and Circular Economy - a Review." *Journal of Cleaner Production* 97:76–91. https://doi.org/10.1016/j.jclepro.2013.11.049.

Turner, J. A., and B. Small. 2025. "Enhancing Precision Agriculture through Cloud-Based Transparent AI Tools for Sustainable Farming." *Nature Scientific Reports* 15 (1): 93417. https://doi.org/10.1038/s41598-025-93417-3.

Van der Burg, S., M. J. Bogaardt, and S. Wolfert. 2019. "Ethics of Smart Farming: Current Questions and Directions for Responsible Innovation towards the Future." *NJAS - Wageningen Journal of Life Sciences* 90-91:100289. https://doi.org/10.1016/j.njas.2019.01.001.

Voß, J.-P., and R. Kemp. 2006. "Sustainability and Reflexive Governance: Introduction." In *Reflexive Governance for Sustainable Development*, edited by J. P. Voss, D. Bauknecht, and R. Kemp, 1–28. Cheltenham: Edward Elgar.

Wolfert, S., L. Ge, C. Verdouw, and M. J. Bogaardt. 2017. "Big Data in Smart Farming - A Review." *Agricultural Systems* 153:69–80. https://doi.org/10.1016/j.agsy.2017.01.023.

Zaman, M. H. M., N. A. M. Pauzi, N. Zainal, and M. H. Zaman. 2025. "Artificial Intelligence in Precision Agriculture: A Systematic Review (2000-2023)." *Journal of Agricultural Engineering* 37 (2): 1025–1047. https://doi.org/10.17576/jkukm-2025-37(2)-38.

Zhai, X., M. Wang, N. S. Chen, U. Ghani, and L. Cacciolatti. 2023. "The Secret Thoughts of Social Network Sites Users: A Scale for the Measurement of Online Knowledge-Hiding in a Knowledge Exchange Context." *Interactive Learning Environments* 31 (5): 2899–2913.

Zietsma, C., P. Groenewegen, D. Logue, and C. R. Hinings. 2017. "Field or Fields? Building the Scaffolding for Cumulation of Research on Institutional Fields." *Academy of Management Annals* 11 (1): 391–450. https://doi.org/10.5465/annals.2014.0052.

Appendix 1. Synthesis of the three propositions, illustrating their causal interdependencies and clarifying how, together, they support the reframing of ESG as an innovation logic guiding human-centred AI-mechatronic integration in circular food economies.

Proposition	Core Focus	Key Mechanism	Outcome	Inter-propositions Link	ESG as an Innovation Logic
Proposition 1: *When ESG logic is central and compatible with dominant logics in an innovation ecosystem, the resulting innovation logic fosters system-wide transformation towards sustainable, inclusive, and legitimate outcomes in AI and mechatronic deployment. Therefore, an ESG logic fosters the design of AI-mechatronic systems that are participatory and culturally adaptable, enhancing user engagement and system relevance.*	ESG logic within pluralistic innovation ecosystems	Centrality and compatibility of ESG logic with market and scientific logics	Sustainable, inclusive, and legitimate AI-mechatronic innovation trajectories	Establishes the structural precondition for Propositions 2 and 3 by anchoring an innovation logic	Positions ESG as an institutional logic capable of anchoring an *innovation logic* that reorients technological design and evaluation criteria beyond efficiency and scale
Proposition 2: *Human-centred design mediates the relationship between ESG logic and innovation outcomes by enabling participatory, context-sensitive, and*	Human-centred design as a mediating interface	Participatory design, iteration, usability, contextualisation	Trust, legitimacy, user engagement, and ethical system adoption	Operationalises Proposition 1 by translating ESG values into concrete technological artefacts and experiences	Demonstrates how ESG becomes *materially embedded* in AI-mechatronic systems through design practices, rather than

(*Continued*)

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Proposition	Core Focus	Key Mechanism	Outcome	Inter-propositions Link	ESG as an Innovation Logic
legitimacy-enhancing innovation processes that reduce the risk of technological imposition and exclusion. Thus, where ESG logic is embedded, AI-mechatronic systems are perceived as being more ethical, explainable, and trustworthy by diverse stakeholders.					remaining symbolic or rhetorical
Proposition 3: *The evolution and institutionalisation of an ESG-centred innovation logic is contingent upon the interplay of actor mobilisation, rhetorical framing, and field-level governance that reinforce the legitimacy and systemic embeddedness of ESG-aligned innovations in food systems. Thus, ESG-guided innovation ecosystems better support circular food economies, enabling regenerative practices through ethically aligned technology.*	Institutionalisation and scaling of ESG-centred innovation logic	Actor mobilisation, rhetorical framing, field-level governance	Diffusion, stabilisation, and reinforcement of circular food economy practices	Reinforces and sustains the outcomes of Propositions 1 and 2 at the ecosystem level	Explains how ESG-centred innovation logic becomes durable and scalable across food systems, enabling systemic transformation rather than isolated innovation

Appendix 2. Illustrative examples of how the three propositions support the development and adoption of ESG-based AI and mechatronic applications in agrifood systems, contrasted with alternative non-ESG innovation trajectories.

Proposition Tenets	ESG-based AI & Mechatronic Trajectory	Mechanism	Illustrative Agrifood Applications	Non-ESG (Market or Technocratic) Trajectory	Risks of Non-ESG Trajectory
Proposition 1: ESG logic centrality and compatibility	ESG logic becomes central and compatible with market and scientific logics, anchoring an innovation logic oriented towards sustainability, equity, and legitimacy	Reorientation of design priorities, evaluation criteria, and success metrics beyond efficiency and scale	AI-enabled precision agriculture platforms integrating environmental indicators (e.g. soil health, water use) alongside yield optimisation, such as digital decision-support systems used in agroecological farming initiatives in Europe (Wolfert et al. 2017)	ESG logic remains peripheral; innovation driven primarily by cost reduction, yield maximisation, and scalability	○ Marginalisation of smallholders ○ Ecological degradation ○ Over-reliance on data-intensive systems unsuited to local contexts
Proposition 2: HCD as mediating mechanism	Human-centred design translates ESG values into system interfaces, workflows, and interaction logics	Participatory design, iterative prototyping, contextual usability testing	Co-designed robotic and sensor-based systems in smallholder farming, where farmers participate in interface design and system calibration, improving usability and adoption (Giua, Materia, and Camanzi 2022; Van der Burg, Bogaardt, and Wolfert 2019)	Design driven by engineering optimisation with limited user engagement	○ Low adoption ○ Mistrust of AI systems ○ Tokenistic participation ○ Deskilling of agricultural labour

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Proposition Tenets	ESG-based AI & Mechatronic Trajectory	Mechanism	Illustrative Agrifood Applications	Non-ESG (Market or Technocratic) Trajectory	Risks of Non-ESG Trajectory
Proposition 3: Mobilisation, framing, and governance	ESG-centred innovation logic is institutionalised and scaled through coordinated governance and actor coalitions	Policy incentives, standards, narratives of circularity and justice	AI-supported food waste reduction and circular supply-chain initiatives, enabled through public-private partnerships and regulatory frameworks in EU food systems (Trotter et al. 2023; Tukker 2015)	Fragmented deployment driven by firm-level interests without ecosystem coordination	○ ESG washing ○ Fragmented adoption ○ Lack of interoperability ○ Failure to achieve system-wide circularity