EMBODIED FINANCE: A CONCEPTUAL FRAMEWORK FOR AGENCY, VALUE, AND TRUST

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The diffusion of artificial intelligence (AI) and platform architectures is transforming financial services beyond the mere technical integration of banking functionalities. While research on embedded finance emphasizes modularity, it offers limited insight into how systems evolve when AI-driven inference and platform environments jointly structure financial action. This paper introduces *embodied finance* as a relational–informational configuration in which services take form through interactions among humans, machines, and platforms. Drawing on information systems (IS), cognitive science, and platform economics, the proposed framework-the *machine-platform-crowd* triangle-reframes agency, trust, and value as emergent properties rather than institutional attributes. Agency is conceptualized as distributed enactment, value as identity-based informational persistence arising from uncertainty reduction, and trust as network-mediated expectation stabilization. The framework outlines illustrative proxies and a system-level observability lens, thereby enabling the distinction between embodied configurations and embedded integrations and supporting future empirical research on adaptive, AI-enabled financial systems.

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1 Introduction

The digital transformation of banking is reshaping not only financial services but also the organization of financial coordination itself (Lagarde, 2020). Financial capabilities increasingly operate beyond traditional institutional boundaries, becoming embedded within digital platforms, products, and everyday interactions (Zachariadis & Zachariadis, 2017; Sironi, 2022). This process of platformization has reorganized financial intermediation around platform-based ecosystems rather than discrete institutions (Srnicek, 2017; Casas-Cortés et al., 2023).

Within such environments, value creation extends beyond isolated transactions and is increasingly shaped by informational and behavioral dynamics, while trust emerges through repeated interaction, reputational signals, and collective participation rather than institutional guarantees alone (Benbasat et al., 2008; Zuboff, 2019). Recent advances in artificial intelligence (AI) and data-driven infrastructures further intensify this shift by enabling systems that infer context, anticipate behavior, and support financial decisions within digital platform settings (Liu, 2025; Ramadhan et al., 2025; European Banking Authority, 2024), thereby raising new governance and risk considerations (Paul, 2022).

In this scenario, financial interactions are no longer structured solely around human decision-making or institutional control. Instead, they are increasingly shaped by the interplay of human behavior, platform environments, and machine-based inference. This raises a fundamental question: *where do agency, value, and trust reside in contemporary digital financial services-within the human user, the machine, or the platform itself?*

2 Conceptual Claims

To address the research question, this paper adopts a conceptual theory-building approach to develop a grounded interpretative framework for emerging dynamics in digital finance. Given the still-nascent and unstable nature of AI-driven, platform-based finance, this method is required to clarify the underlying ontological properties prior to systematic empirical operationalization.

Specifically, the proposed framework-the **machine-platform-crowd** triangle-extends the machine-crowd perspective (McAfee & Brynjolfsson, 2017) by explicitly incorporating the platform as a structural environment. As illustrated in Figure 1, the framework conceptualizes the platform as the locus where interactions are orchestrated, feedback loops are stabilized, and human behavior and machine inference co-evolve. These dynamics define the conditions under which *agency*, *value*, and *trust* emerge as *interdependent properties* through sustained human–machine interaction. This relational-informational configuration is hereafter referred to as **embodied finance**-an emergent systemic condition in which financial services acquire form through interaction within platform environments.

– Prior research conceptualizes agency as situated and relational, emerging from human-environment interaction (Basso & Herrmann-Pillath, 2024). **Claim 1 (Agency).** In AI-mediated financial platforms, agency is a human-machine outcome shaped by inference-driven interaction (Aldasoro et al., 2025).

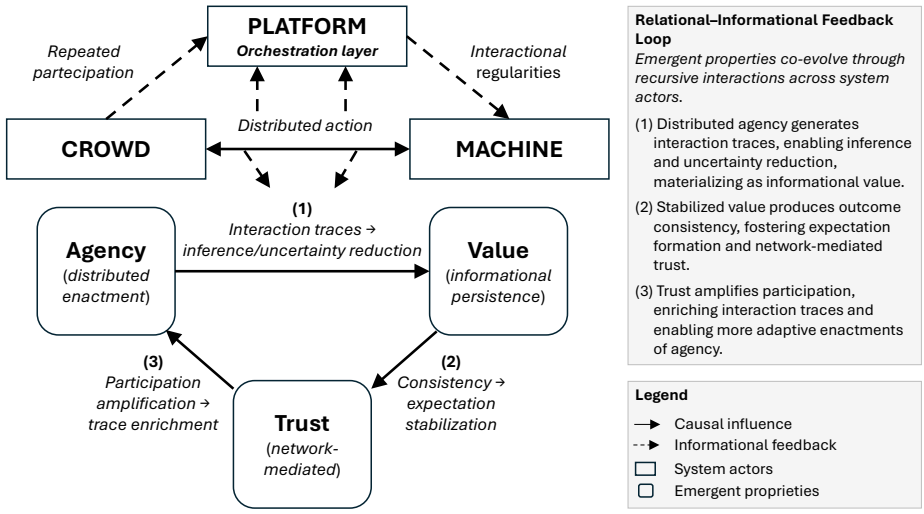

Figure 1: Machine–Platform–Crowd relational–informational framework
Source: Own

- In platform economies, economic value has been interpreted either as behavioral surplus extraction or as coordination enabled by platform infrastructures (Zuboff, 2019; Srnicek, 2017).
  Claim 2 (Value). In platform environments, value reflects the system's capacity to preserve and propagate informational regularities over time, thereby reducing uncertainty and amplifying economic significance through collective participation (Krakauer et al., 2020).
- Trust in digital environments has traditionally been grounded in institutional safeguards and service-level guarantees (Benamati & Serva, 2007).
  Claim 3 (Trust). In platform-mediated financial services, repeated interaction and peer participation progressively reinforce perceived reliability and legitimacy, generating self-reinforcing dynamics consistent with network externalities (Katz & Shapiro, 1985).

2.1 Positioning and Related Work

The proposed framework builds on three complementary streams of information systems (IS) and platform research, while addressing their limitations in explaining AI-mediated financial environments.

First, *fintech and digital banking* studies document technology-driven transformation (Murinde et al., 2022; Sironi, 2022) but often treat platforms as intermediation channels rather than as constitutive environments shaping interaction and behavior.

Second, *platform governance* research examines coordination, control, and boundary resources (Tiwana, 2014; Dinçkol et al., 2023), yet typically analyzes agency, value, and trust as separate concerns.

Third, *algorithmic and AI agency* studies investigate human–machine interaction (Krakowski, 2025; Aldasoro et al., 2025) but primarily focus on discrete tasks rather than on system-level dynamics that emerge from sustained interactions.

This paper integrates these streams through an information-theoretic lens, shifting the analytical focus from isolated constructs to evolving relationships through which agency, value, and trust jointly shape platform-based financial systems. This perspective clarifies how financial services acquire form through ongoing human–

machine interaction. It also extends IS and platform research beyond functional decomposition toward a systemic understanding of embodied finance.

3 Conceptual Foundations of Embodied Finance

This section develops the conceptual foundations of embodied finance by examining the systemic conditions through which agency, trust, and value are reconfigured.

3.1 Agency in Digital and Platform-Based Financial Services

In traditional financial systems, agency is framed as deliberate human choice within stable institutional constraints (Basso & Herrmann-Pillath, 2024). In platform-based financial services, this view becomes insufficient as agency increasingly emerges from situated interactions between human action and the environment.

From an enactive perspective, agents continuously perceive, interpret, and act in response to contextual signals, with agency inferred from behavioral regularities rather than from declared intentions (Varela et al., 1991). This view aligns with distributed cognition in IS (Hutchins, 1995), in which cognition is shared across actors, artifacts, and environments through interactions. It resonates with socio-technical accounts in which agency is enacted through networks of human and non-human elements (Latour, 2005).

At a system level, these dynamics can be abstracted as adaptive inference–action cycles, capturing recurrent feedback between perception, interpretation, and action under uncertainty. In the cognitive sciences, such feedback loops are often described as perception–action cycles (Fuster, 2003, 2017). In this paper, the term is used descriptively to denote feedback-driven interaction in socio-technical systems, without invoking specific neurobiological assumptions. As financial services become embedded within digital ecosystems, payments, credit, and identity verification are increasingly activated contextually within interaction flows rather than through direct user–institution engagement (Murinde et al., 2022; Ferrari, 2022).

When AI-augmented infrastructures operate in these environments, systems increasingly infer and anticipate behavioral patterns, thereby orienting financial action through adaptive regulation rather than explicit choice (Tian et al., 2026;

Aldasoro et al., 2025). Agent-based payment systems exemplify this shift, as financial actions are increasingly mediated by software agents operating within user-defined constraints (Birch & Rutter, 2025). These mechanisms are reflected in recent applications to cognitive credit risk detection (Chiappino, 2026).

Under these conditions, both human actors and artificial systems engage in feedback-driven interaction within shared environments. Agency can therefore no longer be attributed exclusively to either humans or machines. Within embodied finance, agency emerges as a *distributed and enacted property* of human–machine interaction, sustained through jointly evolving dynamics of perception, inference, and action.

3.2 Value as Informational and Identity-based

Platform environments can be understood as structured aggregates of interacting individuals (crowds) operating within rule-based and automated systems (machines) orchestrated by platform architectures. In such settings, value does not arise solely from exchange but from the stabilization of information generated through repeated human–machine–environment interactions.

From an information-theoretic perspective, this dynamic can be formalized by the principle of informational individuality introduced by Krakauer et al. (2020). In this framework, individuality is not a static attribute but the capacity of a system to preserve and propagate information about itself over time. Identity, in this sense, emerges from the persistence of interactional regularities that link past interactions to future system behavior. Although originally developed for biological systems, this perspective builds on more general principles of information and uncertainty reduction (Shannon, 1948) and can be extended to non-biological informational architectures. In such systems, persistence is characterized by regularities in interaction patterns that systematically reduce uncertainty across contexts and over time. In platform-based financial services, user identities function as linked informational records that constrain future system responses through algorithmic inference; with repeated interactions, such inference progressively reduces uncertainty (Kalman, 1960; Floridi, 2011).

Throughout this section, persistence refers to a single underlying phenomenon: the stabilization of identity-linked informational regularities that reduce uncertainty across repeated interactions.

This view complements established perspectives in platform economics. While Parker et al. (2016) emphasize interaction density and network effects, and Zuboff (2019) critiques behavioral data extraction, informational persistence provides a formal account of how platforms generate value through the accumulation and reuse of identity-linked regularities. Value is not merely extracted from data but emerges from the system's capacity to preserve, infer, and propagate structured information across interactions.

In digital financial services, identity therefore becomes a dynamic configuration rather than a static attribute (Birch, 2016). It is actively co-produced through repeated, traceable contextual activities in which human behavior and environmental signals-including machine-mediated inference and automated responses—jointly shape future coupled human–environment states.

Accordingly, value in embodied finance reflects a platform system's capacity to sustain *identity-based informational persistence*: a cumulative and relational property emerging from ongoing human–machine interaction within platform environments. Value follows the logic of informational persistence—it is path-dependent, relationally constituted, and amplified through collective participation rather than predefined economic inputs.

3.3 Trust Beyond Institutions

Trust became salient with the shift of banking services to digital channels, as technology increased interpersonal distance and reduced traditional cues of reassurance (Benamati & Serva, 2007). It consequently shifted from institutional safeguards toward service-level determinants such as perceived security, data protection, and technological robustness (Broekhoff et al., 2024; Jafri et al., 2024).

Platform-based financial environments extend these accounts by introducing interaction-driven trust dynamics. Digital banking increasingly relies on applications in which social influence and user participation are central to trust formation (Barroso & Laborda, 2022; Swartz, 2020; Zeng & Hu, 2025).

Despite concerns about distrust, the convergence of digital platforms and embedded finance sustains growth in remote banking, shifting trust from institutions toward user experience (Murati et al., 2024; Zhang & Kim, 2025).

As financial services migrate toward open ecosystems, trust emerges through engagement and feedback rather than as an ex ante institutional condition. These dynamics align with evidence from online markets and network externalities, in which participation reinforces adoption (Benbasat et al., 2008; März, 2025).

Similar dynamics can be observed in mobile-first banks operating as platform-like financial ecosystems. Rapid user growth, followed by continued large-scale adoption-as observed, for instance, in Revolut[1]-reflects the orchestration of expanding service portfolios and user interactions within unified digital environments. While such expansion results from multiple factors, including product innovation and marketing strategies, the platform literature frequently associates comparable adoption patterns with network effect dynamics (Katz & Shapiro, 1985; Bartels & Schmitt, 2022). As participation increases, perceived reliability and legitimacy are reinforced through social proof and ecosystem effects, progressively reducing collective uncertainty (Pavlou & Gefen, 2004). Trust and network expansion thus co-evolve within these environments. From the network society perspective, legitimacy shifts from centralized institutions to relational–informational structures (Castells, 1996). In embodied finance, this reorientation places participation at the center of trust formation, situating trust within patterns of repeated *network-mediated* interaction across the ecosystem.

[1] Revolut expanded from roughly 150,000 users in 2016 to more than 52 million by 2024 (Revolut, 2016–2024), illustrating large-scale participation dynamics. Available at: https://www.revolut.com/en-US/reports-and-results/

4 Embodied Finance as a Relational–Informational Feedback System

The diffusion of embedded finance paradigms has progressively reduced the visibility of the financial institution as a bounded entity through the standardization of financial capabilities (Mula, 2025), which are exposed as programmable components via APIs (Kopperapu, 2025). As a result, financial services have become increasingly integrated as native elements within heterogeneous digital ecosystems (Lin et al., 2025; Finken & Hensen, 2025).

Following Aoki's reconceptualization of institutions, as extended by Basso and Herrmann-Pillath (2024), institutional order is no longer understood as a set of static rules or firm-based constraints but as residing in stable conditions of relations (Aoki, 2011) rather than in bounded digital artifacts (Hui, 2014).

Building on this perspective, embodied finance can be understood as an ontological shift in which financial services take the form of a relational–informational (i.e., interaction- and information-driven) configuration, while their functional capabilities remain embedded within platform environments. Within such environments, agency, value, and trust emerge as systemically interdependent properties through coupled crowd–machine dynamics.

4.1 Feedback Dynamics across Emergent Properties

This section presents embodied finance as a systemic configuration rather than a property of individual technologies or services. Through an illustrative scenario, it shows how agency, value, and trust co-emerge within a relational–informational feedback dynamic (Figure 1). Consider a mobile-first financial platform such as Revolut, where payments, savings, and investment-related services are progressively integrated into a unified digital environment. Here, repeated interactions generate informational traces that support service expansion and, once stabilized across contexts, enable adaptive or AI-mediated functionalities. From a system perspective, at a given decision point, each possible future user action or preference pattern (e.g., payment, saving allocation, travel-related spending, investment choice) is associated with broad, highly uncertain expectations (i.e., near-uniform probability distributions), reflecting the absence of stabilized interactional regularities.

As interactions recur, completed actions progressively validate specific trajectories over others. Each realized outcome leaves informational traces that persist across sessions and contexts. These traces do not define static user preferences but dynamically reshape the system's inferential expectations. As a result, the platform becomes capable of differentiating responses across similar situations based on accumulated regularities.

This transition becomes observable when the system increasingly proposes context-consistent payment options in familiar situations, thereby reducing interactional friction. Agency, in this configuration, does not reside exclusively in either the user or the system but emerges as distributed enactment within adaptive interaction loops. Adaptive response latency and action-path diversity thus become visible markers of this process, indicating that financial actions are no longer purely rule-driven but contextually enacted.

As informational traces accumulate, inferential uncertainty progressively narrows, making future user action trajectories increasingly predictable. System outcomes become more consistent across comparable situations, and explanations of decisions-implicit or explicit-grow more coherent over time. This stabilization reflects the emergence of value as identity-based informational persistence: the system's capacity to preserve and reuse structured regularities linking past interactions to future responses. Explanation consistency and confidence-interval contraction, therefore, are observable manifestations of this informational consolidation.

Trust does not precede this process; rather, it stabilizes through repeated and verifiable interaction (Borgogno & Colangelo, 2020; Casolaro et al., 2025). As outcomes become predictable in familiar contexts and deviations trigger exception-based responses rather than blanket procedural enforcement, expectations consolidate. Participation becomes self-reinforcing, extending beyond individual users to the network level, where collective interaction patterns further enrich the informational environment. Verification stability and cross-platform coherence thus render trust observable as a network-mediated property grounded in interactional reliability rather than institutional assertion.

4.2 System Observability and Implications

The proxies summarized in Table 1 are designed to capture system-level dynamics through their joint variation over time, making changes in the underlying relational–informational configuration observable.

Table 1: Embedded finance capabilities and embodied relational–informational functions

Embedded Capability	Relational Function	Emergent Property (Embodied)	Informational Systemic Function	Indicative proxy (interpretive role)
Programmability Standardized financial capabilities (e.g., risk, KYC, compliance)	**Distributed action**	**Agency** (distributed enactment)	**Variation generation** (introduction of action diversity)	**Adaptive latency & action-path diversity** Deviation from predefined scripts under contextual signals, rendering agency observable as situated enactment.
Interoperability Cross-actor technical integration via APIs	**Repeated participation**	**Trust** (network-mediated)	**Expectation stabilization** (coordination and reliability)	**Verification stability & cross-platform coherence** Consistency of outcomes across services over time, expressing trust as stabilized expectation rather than institutional assumption.
Integrability Native embedding within platform journeys	**Interactional regularities**	**Value** (identity-based informational persistence)	**Uncertainty reduction** (informative inference)	**Explanation consistency & confidence-interval contraction** Persistence of identity-linked regularities enabling sustained uncertainty reduction under explanatory constraints.

In empirical settings, the proxies in Table 1 can be observed in platform data.

Agency proxies describe how distributed enactment becomes observable within interaction flows, including user actions and response times. *Action-path diversity* and *adaptive latency* capture the range of potential user interactions (e.g., pay now or later, allocate savings, or select an investment option) and the relative reaction time to a system trigger (e.g., from a suggested option to the user's action). Value proxies track the persistence and predictive relevance of identity-linked information over time. *Explanation consistency* tracks the repeated reuse of stable behavioral features across similar cases, while *confidence-interval contraction* indicates the increasing predictive relevance of such information as uncertainty decreases. Trust emerges when the platform generates predictable and coherent expectations under similar conditions. *Verification stability* reflects the consistency of outcomes across repeated interactions, while *cross-platform coherence* indicates whether similar users or situations produce consistent outcomes across integrated services over time. Together, these indicators signal reliable and sustainable platform behavior.

When adaptive latency decreases while action-path diversity increases, agency is not simply accelerating—it is reconfiguring. When explanation consistency and confidence intervals stabilize, value is not merely accumulating—it is persisting as structured informational identity. When verification outcomes become coherent across services and exceptions replace procedural enforcement, trust is not assumed—it is enacted and stabilized.

Observing any single proxy in isolation is insufficient. Changes acquire meaning only when interpreted relationally within the feedback system described in Section 4.1. For example, increased participation without corresponding reductions in uncertainty may signal marketing-driven adoption rather than embodied stabilization, while uncertainty reduction without sustained participation may indicate brittle inference rather than trust formation. Embodied configurations are therefore identifiable through coordinated shifts across agency-, value-, and trust-related manifestations rather than through absolute levels.

From an IS perspective, this joint observability provides a diagnostic lens rather than a predictive model, aligning with platform governance approaches that emphasize adaptive monitoring metrics (Dinçkol et al., 2023) and systemic alignment with

human intent[2]. It enables researchers and practitioners to distinguish between embedded integrations—where financial functions remain modular and procedural—and embodied configurations—where interaction, inference, and participation become structurally coupled.

At the governance level, this distinction shifts attention from static rule compliance toward traceability, contestability, and transparency of adaptive responses in such systems. The framework thus does not prescribe optimization targets but offers a means to observe whether a system is transitioning toward embodied dynamics, and where breakdowns in the feedback loop may undermine sustainability, legitimacy, or user alignment.

5 Conclusions and Future Directions

This paper has shown that the digital transformation of financial services extends beyond the functional integration of banking capabilities into non-financial platforms. Moving past embedded finance as a primarily technological paradigm, it introduces embodied finance as a relational–informational configuration in which financial services acquire form through ongoing interaction among humans, machines, and platforms. Building on the machine–platform–crowd framework, the analysis clarified how agency, trust, and value are reconfigured in digital environments not as static institutional attributes but as *distributed and enacted system-level properties*, stabilized through interaction, inference, and informational continuity. From a governance perspective, this view highlights how such relational–informational configurations introduce boundary conditions centered on traceability, explainability, oversight, and the protection of identity-based informational persistence rather than on static compliance alone.

At the same time, the framework is conceptual and entails important limitations. Future research is needed to (i) formalize embodied finance within a coherent theoretical and information-theoretic architecture, (ii) empirically validate the proposed emergent properties through system-level and longitudinal analyses based on the joint temporal co-variation of the proxies outlined in Table 1, and (iii) examine structural risks and limits of embodied financial systems, including

[2] These implications resonate with European regulatory frameworks such as the AI Act, PSD2, and eIDAS, which emphasize traceability, contextual oversight, and accountability in socio-technical financial systems.

scalability, loss of user control, opacity of inference, and concentration of informational power. Addressing these directions is essential to assess whether embodied financial configurations can remain sustainable, governable, and aligned with human intent as platform-based finance evolves.

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Summary

This paper introduces embodied finance as a novel conceptual framework for understanding how financial services evolve in AI-enabled, platform-based environments. Moving beyond embedded finance as a model of technical integration, it argues that financial services increasingly take form through interactions among humans, machines, and platforms. The proposed machine–platform–crowd framework reconceptualizes agency, value, and trust as emergent system-level properties: agency as distributed enactment, value as identity-based informational persistence, and trust as network-mediated expectation stabilization. The paper also develops an observability perspective through illustrative proxies, showing how embodied configurations can be distinguished from modular embedded integrations. This conceptualization provides a basis for future empirical research on how agency, value, and trust evolve in AI-enabled financial ecosystems.