Decision Control in Digital Ecosystems: Insights from Professional Football SMEs

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Article

Decision Control in Digital Ecosystems: Insights from Professional Football SMEs

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Abstract

Small and medium-sized enterprises (SMEs) increasingly operate within digital ecosystems where decision-making is mediated by external platforms, data infrastructures, and algorithmic tools. Under these conditions, managerial choice is shaped not only by internal capabilities, but also by ecosystem-level governance, information thresholds, and feedback mechanisms. This paper develops a theory-building analysis of decision-making under digital ecosystem conditions, using professional football clubs as a paradigmatic case of decision-intensive SMEs operating in data-rich, platform-mediated environments. Through a structured synthesis of the scientific literature, the study introduces the concept of Ecosystem-Mediated Decision Control (EMDC), which conceptualizes decision-making as a closed loop linking data inputs, algorithmic mediation, managerial judgment, and organizational feedback. The analysis demonstrates that artificial intelligence does not replace managerial agency, but restructures decision control by redistributing informational authority within the ecosystem. By articulating four decision dynamics—decision mode variability, information threshold effects, oscillatory human–algorithm control, and feedback-based decision stabilization—the paper offers a transferable explanatory framework for SMEs operating in digital ecosystems. The findings contribute to the literature on digital ecosystem economics by clarifying how decision authority, adaptability, and learning emerge under platform-mediated conditions.

Keywords: SMEs; digital ecosystems; platform governance; data analytics; artificial intelligence; decision-making; professional football clubs

Introduction

Small and medium-sized enterprises (SMEs) increasingly operate in economic environments characterized by digital ecosystems rather than isolated markets. In such contexts, decision-making unfolds under conditions of heightened uncertainty, asymmetric information, and strong dependence on external digital infrastructures. Platforms, data providers, analytics vendors, and regulatory actors collectively shape how information is generated, filtered, and transformed into actionable signals. As a result, managerial decision-making in SMEs is no longer confined to organizational boundaries, but becomes ecosystem-mediated (Jacobides et al., 2018; Adner, 2017; de Reuver et al., 2018; Cenamor et al., 2019; Snyder, 2019).

Under these conditions, marginal differences in decision quality may produce disproportionate economic outcomes. For SMEs, decisions regarding investment, resource allocation, hiring, and strategic positioning are often irreversible and subject to tight financial constraints. The growing integration of data analytics and artificial intelligence (AI) into these decisions promises improved rationality and efficiency, yet also introduces new forms of dependence, opacity, and control. Importantly, these analytical capabilities are rarely developed internally by SMEs; instead, they are embedded within digital ecosystems governed by external actors (Davenport and Harris, 2007; Jarrahi, 2018; Pasquale, 2015; Paré et al., 2015; Mănescu, 2025; Shrestha et al., 2019).

Professional football clubs represent a paradigmatic case of SMEs operating under such digital ecosystem conditions. Despite their visibility, most professional clubs face budgetary constraints,

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high sunk costs, and strong exposure to competitive and regulatory pressures. Their decision-making processes—ranging from recruitment and wage allocation to performance management and long-term investment—are increasingly mediated by data analytics platforms, algorithmic models, and ecosystem-level governance structures. As such, football clubs offer an analytically rich setting for examining how decision-making is reorganized in SMEs embedded in digital ecosystems (Dobson and Goddard, 2001; Storm and Nielsen, 2012; UEFA, 2022; Caglio et al., 2023; Torraco, 2005; Rein and Memmert, 2016).

While the literature on digital ecosystems and SMEs has expanded rapidly, existing research remains fragmented. Studies often focus either on technological adoption or on performance outcomes, implicitly assuming a linear relationship between data use and improved decision-making. Less attention has been paid to the decision-making process itself: how information becomes authoritative, how managerial judgment interacts with algorithmic mediation, and how feedback stabilizes or destabilizes decision routines over time (Vial, 2019; de Reuver et al., 2018; Cenamor et al., 2019; Wamba et al., 2017; Raisch and Krakowski, 2021).

This paper addresses this gap by developing a theory-building analysis of decision-making under digital ecosystem conditions. Drawing on a structured synthesis of the scientific literature, it introduces the concept of Ecosystem-Mediated Decision Control (EMDC) to explain how decision authority is structured, distributed, and recalibrated in SMEs operating within platform-mediated environments. Using professional football clubs as an illustrative case, the study articulates four decision dynamics that clarify how SMEs navigate uncertainty, maintain agency, and learn under conditions of digital ecosystem dependence.

The analysis is structured around four theory-driven decision dynamics. First, decision effectiveness depends on the organization's ability to alternate between intuition-based managerial reasoning and AI-supported analytical evaluation (D1: Decision Mode Variability). Second, the influence of analytics on organizational choice becomes consequential only once data relevance, quality, and contextual fit exceed ecosystem-specific thresholds (D2: Information Threshold Effects). Third, sustained decision quality emerges from a dynamic balance between algorithmic recommendation and human judgment, whereby decision authority oscillates to prevent cognitive rigidity and algorithmic overreach (D3: Oscillatory Human–Algorithm Control). Finally, decision processes stabilize over time through recursive feedback between organizational outcomes, analytical systems, and managerial trust, forming a closed-loop control structure (D4: Feedback-Based Decision Stabilization).

Together, these interrelated dynamics provide an explanatory lens for understanding how professional football clubs navigate uncertainty, distribute decision authority, and maintain decision performance in data-intensive, ecosystem-mediated environments.

1. Decision-Making under Digital Ecosystem Conditions: Reframing the Literature

1.1. SMEs as decision-intensive organizations in digital ecosystems

From an economic and organizational perspective, professional football clubs are best understood as decision-intensive entities operating under persistent uncertainty. Strategic and operational choices—ranging from player recruitment and contract negotiations to squad rotation and long-term investment—are characterized by high sunk costs, limited reversibility, and strong path dependence. Unlike many conventional firms, football clubs compete in environments where relative performance differences generate non-linear returns, amplifying the consequences of marginal decision errors (Hammerschmidt et al., 2021; Alabi and Urquhart, 2023; Evans, 2024; Garcia-del-Barrio and Reade, 2024).

The literature has long acknowledged these characteristics, emphasizing the centrality of managerial judgment in navigating competitive, institutional, and reputational constraints. However, decision-making in football clubs has traditionally been conceptualized as an internally

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bounded process, anchored in human expertise, experiential knowledge, and hierarchical authority. This view implicitly assumes that decision control resides primarily within the organization (Parnell et al., 2022; Bertheussen, 2023; Fan-Led Review of Football Governance, 2021; CIES Football Observatory, 2023).

Such an assumption becomes increasingly problematic under contemporary digital conditions. As clubs integrate external data sources, analytics platforms, and algorithmic tools into their routines, decision-making extends beyond organizational boundaries. Decision authority is no longer exercised solely through internal deliberation but is increasingly shaped by externally governed information infrastructures. This shift fundamentally alters the locus and structure of decision control, a transformation that existing economic models of the football club only partially capture (Gawer, 2021; Toma and Campobasso, 2023; Oxera, 2024; UEFA, 2023).

1.2. What the Literature Explains: Data, AI, and Performance Optimization

A rapidly expanding body of research examines the application of data analytics and artificial intelligence in professional football. This literature documents the use of advanced metrics in scouting and recruitment, performance monitoring, injury prevention, and tactical analysis. Empirical studies and applied contributions consistently report improvements in information availability, predictive accuracy, and operational efficiency (Lolli et al., 2024; Altmann et al., 2024; Tsilimigkras et al., 2024; Goes et al., 2021).

While these findings are valuable, they share two implicit assumptions. First, they tend to equate increased analytical sophistication with improved decision outcomes, suggesting a largely linear relationship between data use and performance enhancement. Second, they frequently treat AI as either a neutral decision-support tool or a functional substitute for human evaluation, without interrogating how analytical mediation reshapes decision processes (Raisch and Krakowski, 2021; Haesevoets et al., 2021; Marabelli et al., 2021; Krakowski et al., 2023).

As a result, the literature privileges **outputs**—such as performance indicators, efficiency gains, or injury reduction—over the **processes** through which analytical insights are interpreted, contested, and enacted. Decision-making itself remains a black box: analytics are shown to matter, but how they matter organizationally is rarely specified. This limitation becomes particularly evident when considering situations in which similar analytical tools produce divergent outcomes across clubs (Lebovitz et al., 2022; Ning et al., 2024; Karusala et al., 2024; Trautwein et al., 2025).

1.3. Unresolved Tensions: Decision Authority, Thresholds, and Human–Algorithm Interaction

Despite its breadth, existing research struggles to address several unresolved tensions that are central to decision-making under digital ecosystem conditions.

First, the literature provides limited insight into **decision mode variability (D1)**. While studies acknowledge the coexistence of human expertise and analytical tools, they rarely explain how organizations alternate between intuition-based reasoning and algorithmic evaluation over time, or how rigid dependence on either mode may undermine decision adaptability (Shepherd et al., 2024; Raisch and Krakowski, 2021; Sturm et al., 2023).

Second, the notion that analytics influence decisions only after certain **information thresholds (D2)** are met remains under-theorized. Data quality, relevance, and contextual fit are often assumed rather than problematized, obscuring why analytics sometimes fail to shape strategic choices despite technical availability (Hjelle et al., 2024; Gawer, 2022; Ofe and Sandberg, 2023; Ning et al., 2024).

Third, the interaction between human judgment and algorithmic recommendation is typically framed as either complementarity or substitution. This binary view overlooks the possibility of **oscillatory human–algorithm control (D3)**, whereby decision authority shifts dynamically to prevent cognitive lock-in or algorithmic overreach (Haesevoets et al., 2021; Donahue et al., 2022; Lehmann et al., 2022; Beverungen et al., 2022).

Finally, existing research pays insufficient attention to **feedback-based decision stabilization (D4)**. While performance feedback is widely studied, its recursive effects on both analytical systems

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and managerial trust are seldom integrated into a coherent explanation of how decision processes evolve and stabilize over time (Afroogh et al., 2024; Ning et al., 2024; Thomas et al., 2022; Hu et al., 2024; Tomprou and Lee, 2022).

Taken together, these gaps suggest that current literature lacks an explanatory framework capable of accounting for decision-making when analytical capabilities are externalized, algorithmically mediated, and embedded in ecosystem-level governance structures

1.4. Toward an Ecosystem-Mediated Perspective on Decision Control

The limitations identified above point to a fundamental conceptual shortcoming. Much of the existing literature treats data analytics and AI as attributes of the organization, overlooking the fact that these capabilities are increasingly **ecosystem-mediated** (Gawer, 2022; Chen et al., 2022; Hanisch et al., 2023). In professional football, access to data, analytical models, and benchmarking standards is often governed by leagues, federations, and platform providers, reshaping both informational asymmetries and decision authority (Lolli et al., 2024; FIFPRO, 2022; UEFA, 2022).

Under such conditions, decision-making cannot be adequately explained as either human-driven or algorithm-driven (Hanisch et al., 2023; Costabile, 2024). Instead, it must be understood as a **control process** emerging from the interaction between organizational actors, algorithmic mediation, and feedback embedded in digital ecosystems (Volz et al., 2025; Thomas et al., 2022). This realization motivates the need for a conceptual framework that explicitly captures how decision control is structured, distributed, and stabilized under ecosystem-mediated digital conditions.

.2. Methodological Approach

.2.1. Research Design and Epistemological Positioning

This study adopts a **theory-building research design** grounded in structured conceptual synthesis of the scientific literature. The objective is not empirical testing or statistical generalization, but the development of an explanatory framework capable of clarifying how decision-making is reorganized in professional football clubs operating under digital ecosystem conditions.

Epistemologically, the paper is positioned within **interpretive organizational research**, drawing on economic and management theory to explain processes rather than outcomes. Decision-making is treated as a dynamic organizational phenomenon shaped by information structures, governance arrangements, and feedback mechanisms. This positioning is particularly suitable for emerging contexts—such as AI-mediated decision environments—where empirical evidence is fragmented and existing theories provide only partial explanations.

2.2. Literature Identification Strategy

A structured literature identification process was conducted using **Web of Science** and **Scopus**, selected for their comprehensive coverage of peer-reviewed research in economics, management, and sport-related organizational studies. The search focused on publications released between **2010 and 2025**, a period corresponding to the rapid diffusion of data analytics, artificial intelligence, and platform-based infrastructures in professional football.

Search strings combined keywords related to professional football and organizational decision-making (e.g., *professional football clubs*, *sport organizations*, *decision-making*, *governance*) with terms associated with digital technologies and ecosystems (e.g., *data analytics*, *artificial intelligence*, *algorithms*, *platforms*, *digital ecosystems*). To ensure conceptual completeness, backward and forward citation tracking was applied to influential articles identified during the initial search.

2.3. Inclusion and Exclusion Logic

The selection of literature followed explicit inclusion and exclusion criteria designed to preserve analytical relevance and conceptual coherence.

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Studies were **included** if they:

- examined professional football clubs or comparable professional sport organizations as **economic or managerial entities**;
- addressed decision-making, organizational governance, or strategic control;
- analyzed the role of data analytics, artificial intelligence, or digital platforms with implications for organizational choice.

Studies were **excluded** if they:

- focused exclusively on physiological, biomechanical, or tactical performance without organizational relevance;
- addressed amateur or recreational sport contexts;
- presented purely technical algorithmic developments without connection to decision-making processes.

This logic ensured that the reviewed literature contributed directly to understanding how decisions are shaped, mediated, and stabilized within professional football organizations.

2.4. Conceptual Synthesis Procedure

Rather than summarizing studies descriptively, the analysis employed a **conceptual synthesis procedure** aimed at identifying recurring decision-related mechanisms across heterogeneous research streams. Selected studies were examined for how they conceptualized information flows, analytical mediation, managerial agency, and performance feedback.

The synthesis progressed through three analytical stages. First, decision-relevant elements were extracted from the literature and grouped into preliminary conceptual categories. Second, relationships among these categories were examined to identify patterns of mediation, dependence, and feedback. Third, these relationships were integrated into a coherent explanatory structure, resulting in the Ecosystem-Mediated Decision Control (EMDC) framework.

This procedure allowed the literature to be reorganized around the decision-making process itself, rather than around technologies or performance outcomes.

2.5. Analytical Deduction and Alignment with Theory-Driven Dynamics

The EMDC framework was developed through **analytical deduction**, guided by the four theory-driven decision dynamics introduced in the Introduction (D1–D4). Each dynamic served as a deductive lens through which the synthesized literature was interpreted.

- **Decision Mode Variability (D1)** informed the identification of alternating patterns between intuition-based and algorithm-supported decision routines.
- **Information Threshold Effects (D2)** guided the examination of conditions under which analytical outputs gain decision authority.
- **Oscillatory Human–Algorithm Control (D3)** structured the interpretation of shifting decision dominance between human judgment and algorithmic recommendation.
- **Feedback-Based Decision Stabilization (D4)** oriented the analysis toward recursive learning and trust recalibration processes.

The alignment between EMDC and these dynamics ensures internal coherence between the conceptual framework and the analytical orientation of the study.

2.6. Methodological Boundaries and Limitations

As a theory-building study, this paper does not provide empirical validation of the proposed framework. Instead, its contribution lies in **explanatory integration**, offering a structured lens through which future empirical research can be designed.

The reliance on secondary sources introduces an inherent limitation related to selection and interpretation. This limitation is mitigated through transparent selection criteria, explicit analytical

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logic, and consistent grounding in peer-reviewed research. Moreover, by focusing on professional football clubs, the framework prioritizes analytical depth over immediate generalizability.

Nevertheless, the EMDC framework is intended to be transferable to other decision-intensive organizations operating within digital ecosystems, subject to contextual adaptation and empirical testing.

3. Results of Conceptual Synthesis: Ecosystem-Mediated Decision Control (EMDC)

The conceptual synthesis of the literature reveals that decision-making in professional football clubs operating in digital ecosystems cannot be adequately explained by existing models that assume either human-centered judgment or data-driven rationality. Instead, decision-making emerges as a **control process** shaped by ecosystem-mediated information flows, algorithmic filtering, managerial interpretation, and recursive feedback. This section presents the **Ecosystem-Mediated Decision Control (EMDC)** framework as the central result of the study.

3.1. Core Assumption of EMDC

The EMDC framework is grounded in a single core assumption: **decision control in professional football clubs is mediated by digital ecosystems rather than exercised exclusively within organizational boundaries**. Clubs do not simply "use data" or "apply AI"; they operate within externally governed infrastructures that define what data is accessible, how it is processed, and which analytical logics are privileged.

Under these conditions, decision-making authority is distributed across organizational actors, algorithmic systems, and ecosystem-level governance arrangements. AI does not eliminate uncertainty or replace managerial agency; instead, it restructures the decision environment by shaping information visibility, salience, and timing. Decision outcomes thus reflect not only internal preferences or competencies, but also the club's position within the broader digital ecosystem.

Figure 1 visualizes the ecosystem mediation layer and the main external actors shaping decision control in football clubs.

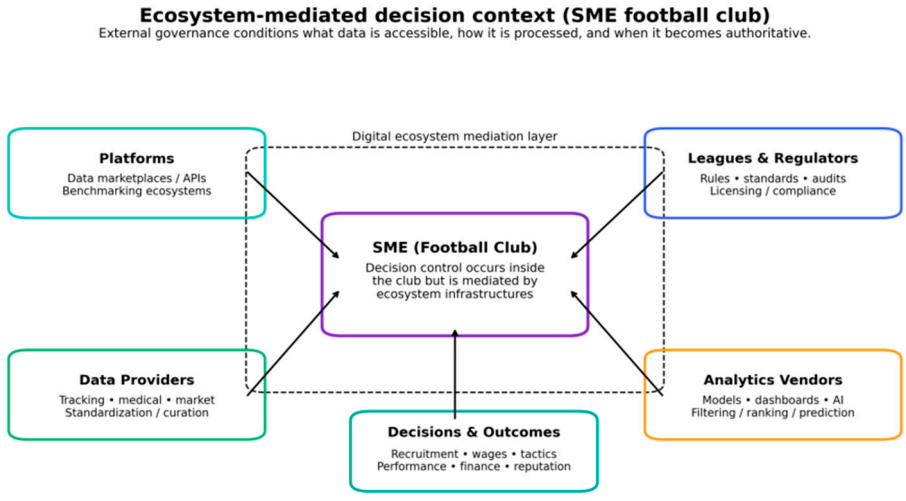

Figure 1. Ecosystem-mediated decision context.

3.2. Structural Components of EMDC

The EMDC framework conceptualizes decision-making as a closed loop composed of four interdependent components.

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Decision Inputs represent the heterogeneous data streams that inform organizational choice. These include performance metrics, medical and workload indicators, financial data, market valuations, and contextual information such as scheduling density or regulatory constraints. Importantly, a substantial share of these inputs is generated, standardized, or curated by ecosystem-level actors rather than by the club itself.

Algorithmic Mediation refers to the analytical and AI-based systems that transform raw data into decision-relevant signals. Through processes of filtering, ranking, prediction, and recommendation, algorithms structure the decision space by determining which information is emphasized, which patterns are deemed salient, and which options appear viable. Algorithmic mediation thus performs a gatekeeping function, reducing informational complexity while simultaneously introducing new forms of dependence and opacity.

Managerial Judgment encompasses the interpretive and evaluative activities through which decision-makers assess algorithmic outputs in light of strategic objectives, contextual knowledge, and risk considerations. Rather than disappearing under AI-supported decision-making, managerial agency is reconfigured: judgment shifts from direct evaluation of raw information to critical interpretation of algorithmically mediated signals.

Organizational Feedback captures the outcomes of decisions in both sporting and economic terms. Match results, player performance, injury incidence, financial performance, and reputational effects feed back into the decision system. This feedback recalibrates analytical models, reshapes managerial trust in algorithmic tools, and influences future decision routines.

To clarify the managerial logic of EMDC, Table 1 summarizes the four structural components of the decision control loop and their roles in ecosystem-mediated decision-making.

Table 1. Managerial structure of the EMDC decision control loop.

EMDC Component	Managerial Function	How the Ecosystem Mediates Control	Operational Indicators (Club Level)	Key Managerial Decisions
Decision Inputs	Define the information base on which decisions are possible	Data availability, format, and comparability are shaped by leagues, platforms, and data providers	Performance KPIs; medical/workload reports; financial constraints; market benchmarks; regulatory limits	Recruitment scope; wage ceilings; tactical options; risk exposure
Algorithmic Mediation	Prioritizes options and structures managerial attention	Algorithms filter, rank, and recommend options, acting as decision gatekeepers	Rankings, scores, predictions, shortlists, scenario simulations	Shortlisting players; contract valuation; tactical scenarios; load optimization
Managerial Judgment	Exercises strategic discretion over algorithmic signals	Judgment shifts from raw evaluation to interpretation and selective override	Override frequency; contextual exceptions; risk adjustments; justification narratives	Final approval; strategic trade-offs; negotiation timing
Organizational Feedback	Stabilizes or revises future decision routines	Outcomes recalibrate model trust and managerial reliance on analytics	Performance outcomes; injury rates; financial results; reputational effects	Model recalibration; trust thresholds; routinization of decision processes

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3.3. The Decision Control Loop

Taken together, these components form a **closed decision control loop**. Figure 2 visualizes this closed-loop structure and the sequential transformation of inputs into actionable decisions and feedback.

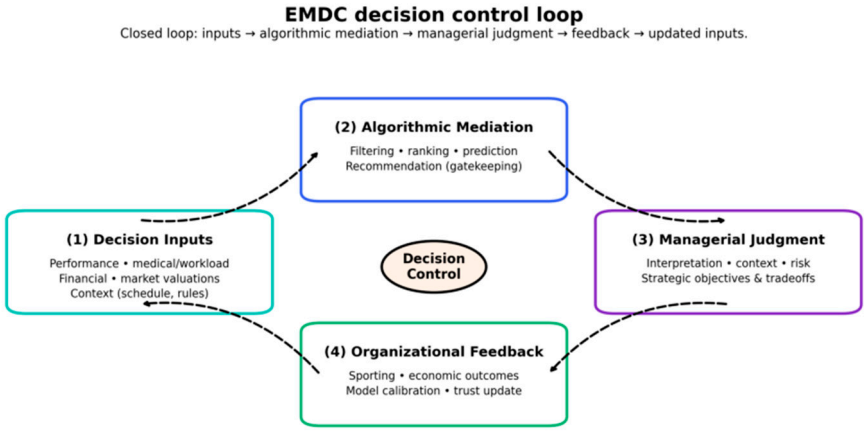

Figure 2. Ecosystem-mediated decision context.

Decision inputs are transformed through algorithmic mediation, interpreted through managerial judgment, enacted through organizational choice, and evaluated through feedback from outcomes. Crucially, this loop is not static. Each iteration modifies both the analytical systems and the cognitive orientation of decision-makers.

This dynamic explains why decision-making effectiveness depends on **decision mode variability (D1)**. Clubs that rely rigidly on either intuition or algorithms risk decision stagnation. EMDC predicts that decision quality improves when organizations alternate between analytical and experiential modes, using each to compensate for the limitations of the other.

The framework also clarifies **information threshold effects (D2)**. Algorithmic mediation influences decisions only when data quality, relevance, and contextual alignment exceed ecosystem-specific thresholds. Below these thresholds, managerial judgment dominates; above them, analytical signals gain decision authority.

Furthermore, EMDC captures **oscillatory human–algorithm control (D3)**. Decision authority shifts dynamically between human judgment and algorithmic recommendation, preventing cognitive lock-in and algorithmic overreach. This oscillation sustains adaptability in volatile competitive environments.

Finally, the recursive nature of the decision loop underpins **feedback-based decision stabilization (D4)**. Over time, repeated feedback calibrates both analytical models and managerial trust, stabilizing decision performance without eliminating uncertainty. Decision systems learn not by converging toward optimality, but by refining the balance between control and flexibility.

3.4. Implications of EMDC as a Conceptual Result

As a conceptual result, EMDC reframes decision-making in professional football clubs as an emergent property of ecosystem-mediated control rather than a function of individual rationality or technological sophistication. The framework explains why similar analytical tools may produce divergent outcomes across clubs and why data abundance alone does not guarantee superior decisions.

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Figure 3 summarizes EMDC by mapping the four decision dynamics (D1–D4) onto the closed decision control loop.

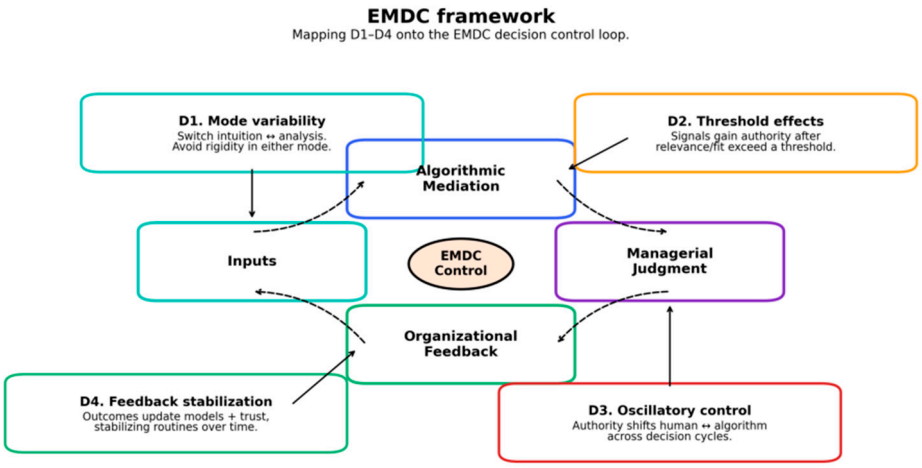

Figure 3. EMDC framework.

By positioning AI as a mediating rather than determining force, EMDC provides a coherent explanation for the persistence of managerial agency under digital conditions and for the structural dependencies introduced by platform-based ecosystems. These insights form the basis for the interpretive analysis developed in the Discussion section.

4. Discussion

This study set out to explain how decision-making in professional football clubs is reshaped when data analytics and artificial intelligence are embedded within digital sport ecosystems. The **Ecosystem-Mediated Decision Control (EMDC)** framework provides an integrative explanation by shifting the analytical focus from technologies or performance outputs to the **structure and dynamics of decision control** (Raisch and Krakowski, 2021; Gawer, 2022; Chen et al., 2022; Costabile, 2024). In this section, the discussion is explicitly organized around the four theory-driven decision dynamics (D1–D4), demonstrating how EMDC clarifies unresolved issues in the literature and generates economically meaningful implications.

4.1. Decision Mode Variability and the Limits of Data-Driven Rationality (D1)

The first contribution of EMDC lies in its clarification of **decision mode variability**. Existing literature often assumes that decision-making quality improves monotonically with increased analytical sophistication (Sturm et al., 2023; Raisch and Krakowski, 2021). EMDC challenges this assumption by showing that decision effectiveness depends on the organization's capacity to **alternate** between intuition-based managerial reasoning and AI-supported analytical evaluation (Haesevoets et al., 2021).

In professional football clubs, intuition and experience remain indispensable due to contextual complexity, time pressure, and incomplete information (Shepherd et al., 2024). At the same time, exclusive reliance on intuition exposes organizations to cognitive bias and path dependence. EMDC explains how oscillation between decision modes preserves adaptability by allowing each mode to compensate for the limitations of the other. From an economic perspective, this finding reframes rationality not as optimization through data accumulation, but as **dynamic calibration of decision modes** under uncertainty.

4.2. Information Threshold Effects and Ecosystem-Dependent Decision Authority (D2)

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The second dynamic addressed by EMDC concerns **information threshold effects**. While the availability of data and analytics is often treated as a binary condition—present or absent—EMDC highlights that analytical influence on decisions emerges only once data relevance, quality, and contextual fit exceed **ecosystem-specific thresholds**.

Figure 4 illustrates how analytical influence remains limited below an ecosystem-specific threshold and increases once relevance/quality and contextual fit make analytics actionable.

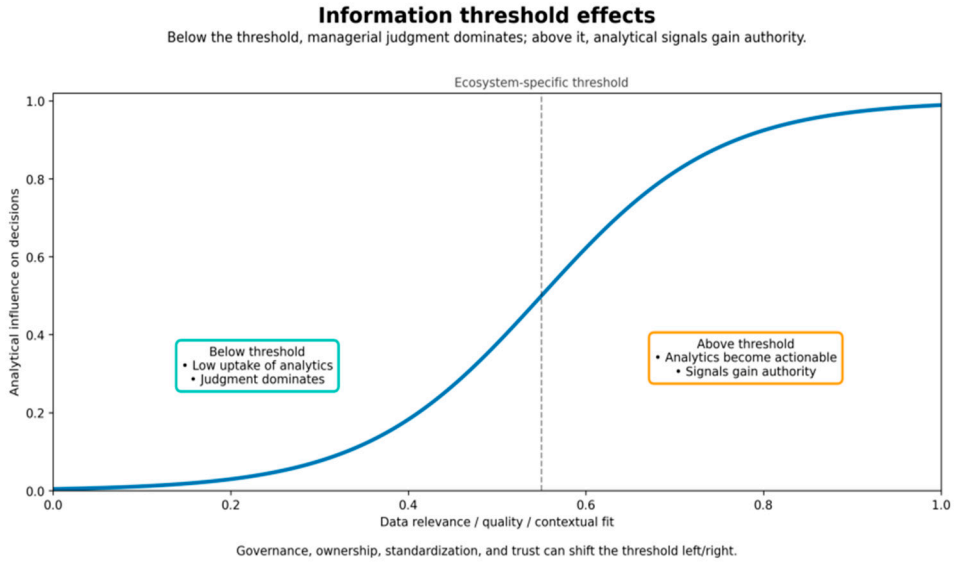

Figure 4. Information threshold effects.

These thresholds are not purely technical; they are shaped by governance arrangements, data ownership, standardization practices, and trust in platform providers (Costabile, 2024; Ofe and Sandberg, 2023). As a result, similar analytical tools may exert different levels of decision authority across clubs, depending on their position within the digital ecosystem (Ning et al., 2024; Lehmann et al., 2022). This insight helps explain why data-driven initiatives frequently underperform expectations and why decision-making outcomes diverge despite apparent technological parity.

Economically, D2 underscores the role of ecosystems in structuring informational asymmetries and redistributing decision power. Decision authority shifts not simply toward those who adopt AI, but toward those who control or effectively navigate the ecosystem conditions under which analytics become actionable (Chen et al., 2022).

4.3. Oscillatory Human–Algorithm Control as a Source of Decision Resilience (D3)

The third contribution of EMDC lies in conceptualizing **oscillatory human–algorithm control**. Prior research often frames human–AI interaction as either complementarity or substitution (Raisch and Krakowski, 2021; Donahue et al., 2022). EMDC moves beyond this binary by demonstrating that sustained decision quality arises from **dynamic oscillation** between algorithmic recommendation and human judgment (Haesevoets et al., 2021; Lehmann et al., 2022).

Figure 5 visualizes this oscillatory pattern of decision authority, highlighting why dynamic switching prevents both cognitive lock-in and algorithmic overreach.

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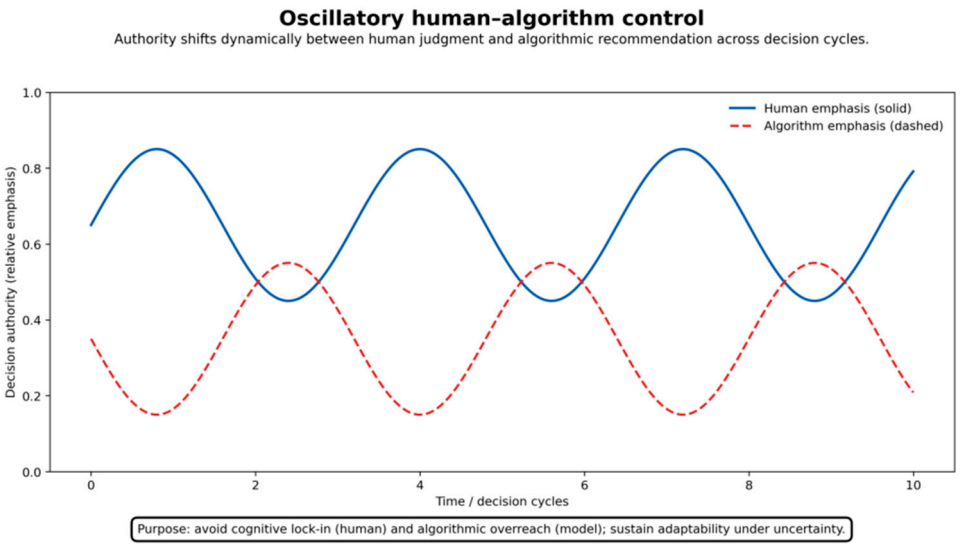

Figure 5. Oscillatory human–algorithm control.

In volatile competitive environments such as professional football, static reliance on algorithms risks overfitting, rigidity, and loss of contextual sensitivity. Conversely, persistent human dominance limits scalability and learning. EMDC explains how oscillation between control modes enhances decision resilience by preventing cognitive lock-in and algorithmic overreach (Donahue et al., 2022; Raisch and Krakowski, 2021). Over time, this oscillatory balance allows clubs to maintain responsiveness to changing conditions while benefiting from analytical consistency (Sturm et al., 2023; Ning et al., 2024).

This dynamic has broader implications for organizational theory, suggesting that effective human–AI integration is less about optimal task allocation and more about **temporal structuring of decision authority**.

4.4. Feedback-Based Decision Stabilization and Organizational Learning (D4)

The fourth dynamic addressed by EMDC concerns **feedback-based decision stabilization**. Unlike static models of decision-making, EMDC emphasizes the recursive effects of outcomes on both analytical systems and managerial trust. Sporting results, financial performance, and reputational consequences feed back into the decision loop, reshaping model calibration, risk tolerance, and interpretive routines (Daschner and Obermaier, 2024; Afroogh et al., 2024; Ning et al., 2024).

This recursive feedback explains how decision systems evolve toward relative stability without converging to fixed optimal solutions. Instead, stabilization emerges through iterative recalibration of both human and algorithmic components. From an economic standpoint, D4 highlights decision-making as a learning process embedded in organizational routines rather than as isolated choice events.

Importantly, EMDC clarifies that feedback does not merely validate or invalidate past decisions; it actively restructures future decision authority. Trust in analytics, thresholds of acceptance, and reliance on intuition are all endogenous to prior outcomes (Ning et al., 2024; Lebovitz et al., 2022).

4.5. Managerial, Economic, and Governance Implications

Taken together, the four dynamics articulated by EMDC have significant implications beyond professional football. Managerially, the framework cautions against rigid adoption of data-driven paradigms and emphasizes the importance of designing decision routines that preserve variability, oscillation, and feedback sensitivity (Raisch and Krakowski, 2021; Haesevoets et al., 2021).

Economically, EMDC reveals how digital ecosystems reshape competitive balance by redistributing decision control through data governance, platform dependence, and threshold effects

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(Gawer, 2022; Chen et al., 2022). Clubs embedded in favorable ecosystem positions may achieve disproportionate advantages, not through superior performance alone, but through enhanced decision authority (Toma and Campobasso, 2023; Costabile, 2024).

From a governance perspective, the framework raises critical questions regarding accountability, transparency, and strategic autonomy (Ofe and Sandberg, 2023; Hu et al., 2024). When decision control is ecosystem-mediated, responsibility becomes distributed across organizational actors and external platforms, complicating traditional notions of managerial accountability.

To translate the EMDC framework into actionable insights, Table 2 summarizes its managerial, economic, and governance implications for professional football clubs operating within digital ecosystems.

Table 2. Managerial, economic, and governance implications of EMDC.

Domain	Core Implication	What Changes Under EMDC	Design or Policy Focus	Primary Actors
Managerial	Decision quality depends on dynamic control, not on maximizing data use	Managers shift from evaluating raw information to governing when and how analytics are used	Decision routines with explicit switching rules; override governance; feedback review cycles	Sporting directors; executives; analytics leads
Economic	Digital ecosystems redistribute decision control and value capture	Competitive advantage depends on ecosystem position rather than standalone analytical capability	Data access rights; standardization strategies; reduction of informational asymmetries	Clubs; platform providers; league organizers
Governance	Accountability becomes distributed across organizations and platforms	Responsibility for decisions is shared between clubs, vendors, and regulatory bodies	Transparency thresholds; audit trails; compliance protocols; model accountability	Leagues; regulators; analytics vendors; club governance bodies

.4.6. Contribution to Theory and Future Research Directions

As a theory-building contribution, EMDC advances the literature by offering a coherent explanation of decision-making under digital ecosystem conditions. Rather than adding another application-focused study, the framework integrates dispersed insights into a structured model that can guide empirical investigation.

Future research may empirically test the dynamics proposed here by examining how different governance arrangements, ecosystem positions, and feedback mechanisms affect decision outcomes over time. Comparative studies across leagues or organizational contexts could further refine the generalizability of EMDC beyond professional football.

Conclusions

This paper developed a theory-building explanation of how decision-making in professional football clubs is reshaped under conditions of digital ecosystem integration. By shifting the analytical focus from technological adoption and performance outputs to the **structure of decision control**, the study addressed a critical gap in the literature on data analytics and artificial intelligence in professional sport.

The central contribution of the paper is the **Ecosystem-Mediated Decision Control (EMDC)** framework, which conceptualizes decision-making as a closed loop linking data inputs, algorithmic

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mediation, managerial judgment, and organizational feedback. EMDC demonstrates that artificial intelligence does not replace managerial agency, nor does data availability automatically improve decision quality. Instead, decision control emerges from the interaction between human and algorithmic elements embedded within ecosystem-level governance structures.

By articulating four theory-driven decision dynamics—decision mode variability (D1), information threshold effects (D2), oscillatory human–algorithm control (D3), and feedback-based decision stabilization (D4)—the framework explains why decision outcomes differ across clubs with similar technological resources. These dynamics highlight that effective decision-making depends not on the volume of data or the sophistication of algorithms alone, but on how decision authority is distributed, alternated, and stabilized over time.

From a managerial perspective, the findings caution against rigid data-driven paradigms and emphasize the need for decision routines that preserve interpretive flexibility, threshold awareness, and feedback sensitivity. Economically, the analysis shows that digital sport ecosystems can amplify competitive asymmetries by reallocating decision control through platform governance and data access. From a governance standpoint, EMDC raises important questions regarding accountability, transparency, and strategic autonomy in data-intensive organizational environments.

Beyond professional football, the framework offers a transferable lens for understanding decision-making in other decision-intensive organizations embedded in digital ecosystems. As artificial intelligence continues to mediate organizational choice across sectors, the need for explanatory models that account for control, feedback, and governance becomes increasingly urgent.

Future research should empirically examine the dynamics proposed by EMDC across different institutional contexts, ecosystem configurations, and time horizons. Such work would not only test the framework's propositions, but also contribute to a more nuanced understanding of how organizations learn, adapt, and retain agency in algorithmically mediated environments.

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