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Integrative Ethical Algorithmic Monitoring in Food Delivery: A Framework for Enhanced Managerial Decision-Making

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Abstract

The rapid expansion of food delivery platforms, governed by opaque algorithmic systems, presents a critical managerial challenge: balancing relentless operational efficiency with fundamental ethical imperatives like fairness, transparency, and accountability. To address this, this study designs and evaluates a novel Integrative Ethical Algorithmic Monitoring (IEAM) framework aimed at enhancing the quality of managerial decision-making. Employing a rigorous design science research approach, our methodology integrates conceptual synthesis from algorithmic management and ethical AI literatures with scenario-based simulations. These simulations utilize structured dummy data modeling a mid-sized platform's operations 50,000 orders and 500 drivers across diverse zones to test the framework's impact on key decision scenarios such as surge allocation and rating disputes. Key results demonstrate that the IEAM framework, which operationalizes ethics into dashboard metrics, significantly improves ethical outcomes. It reduced simulated order assignment disparity from 20% to 7% and increased the justified overturn rate for disputed algorithmic penalties by 40%. While marginal trade-offs in delivery time and processing costs were observed, the framework consistently shifted decisions toward greater equity. Its primary contribution is a validated, pragmatic tool that bridges abstract ethical AI principles with the daily realities of platform management. This enables more legitimate, sustainable, and data-driven governance, offering managers a proactive mechanism for responsible algorithmic oversight.

Keywords: *Algorithmic Management, Ethical AI, Food Delivery Platforms, Managerial Decision-Making, Simulation.*

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I. INTRODUCTION

The rapid expansion of digital platform-based food delivery services has fundamentally transformed operational coordination and managerial decision-making. Central to this transformation is the adoption of algorithmic management systems, which increasingly automate core managerial functions such as order allocation, performance evaluation, dynamic pricing, and workforce monitoring (Benlian et al., 2022; Jarrahi et al., 2021; Stark & Pais, 2020). By leveraging large-scale data and real-time optimization, these systems enable platforms to operate efficiently in high-volume, time-sensitive environments (Bates et al., 2023; Seghezzi & Mangiaracina, 2021). Importantly, the design and governance of such digital platforms are critical to ensure operational integrity, ethical oversight, and alignment with organizational objectives (Chen et al., 2022). The delegation of managerial authority to opaque algorithmic processes also introduces substantial ethical and governance challenges (Haggart & Keller, 2021; Weiskopf & Hansen, 2023). However, existing implementations largely prioritize efficiency optimization, often without embedding structured ethical oversight mechanisms directly into managerial workflows.

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A growing body of research highlights that algorithmic management, while operationally efficient, often embeds structural biases and obscures decision rationales from affected stakeholders, particularly gig workers (Bucher et al., 2021; Huang, 2023; Lu et al., 2024). In food delivery platforms, drivers are frequently subject to automated performance ratings, incentive adjustments, and penalties without meaningful transparency or opportunities for contestation (Milkman et al., 2021; Zhang et al., 2022). Such conditions contribute to perceived unfairness, diminished procedural justice, and heightened worker stress, which can ultimately undermine platform sustainability through increased turnover and reputational risk (Leicht-Deobald et al., 2022; Rezaei et al., 2024). For platform managers, these dynamics generate a persistent tension between achieving efficiency-driven performance targets and fulfilling ethical responsibilities related to fairness, transparency, and accountability. This tension highlights the need for decision-support mechanisms that can simultaneously account for operational performance and ethical implications in a measurable and actionable manner.

Despite the prominence of these concerns, existing academic literature reveals a significant gap at the intersection of algorithmic management and ethical AI governance. Prior studies have either focused on the technical optimization of algorithmic systems or examined ethical principles in largely abstract or normative terms (Tsamados et al., 2022; Weiskopf & Hansen, 2023). Relatively few studies provide concrete, operational approaches that enable managers to actively monitor and intervene in algorithmic decision-making using ethical criteria as part of routine managerial practice (Kadolkar et al., 2025; Rodgers et al., 2023). As a result, ethical oversight in platform organizations is often reactive, emerging only after conflicts escalate into public controversy or regulatory scrutiny, rather than being embedded within everyday decision-support systems (Koshiyama et al., 2024). This study addresses this gap by explicitly operationalizing ethical governance into quantifiable indicators that can be continuously monitored alongside traditional performance metrics. Unlike conventional audit-based or retrospective governance approaches, the proposed IEAM framework embeds ethics directly into the decision-making layer, enabling proactive and real-time ethical awareness rather than post hoc evaluation.

To address this gap, this study examines an Integrative Ethical Algorithmic Monitoring (IEAM) framework designed for algorithmically managed food delivery platforms. The framework translates core ethical principles fairness, transparency, and accountability into quantifiable monitoring indicators that can be integrated directly into managerial dashboards (Hao & Demir, 2024; Uslu et al., 2024). By embedding ethical metrics alongside conventional operational key performance indicators, the framework seeks to make ethical considerations visible at the point of managerial decision-making rather than relying on ad hoc ethical judgment. The central research objective is to assess whether the availability of real-time ethical indicators influences

managerial decision outcomes in ways that improve equity while maintaining operational viability. The novelty of the IEAM framework lies in its integrative design, which bridges the gap between normative ethical principles and operational decision systems by transforming abstract values into actionable, continuously measurable indicators. In contrast to traditional ethical audits or compliance checks, IEAM functions as an embedded monitoring mechanism that supports ongoing ethical calibration within managerial processes rather than external evaluation after decisions are made. Accordingly, this study contributes theoretically by extending the literature on ethical AI governance into applied, decision-centric frameworks, methodologically by operationalizing ethics into measurable constructs within a simulation environment, and practically by providing a deployable approach for managers to incorporate ethical considerations into everyday platform operations.

Methodologically, this study adopts a Design Science Research (DSR) approach and evaluates the IEAM framework through a controlled simulation environment (Benlian et al., 2022). Using structured dummy data representing 50,000 orders and 500 drivers across multiple geographic zones, the simulation compares managerial decisions generated under a conventional efficiency-oriented model with those informed by IEAM-integrated ethical monitoring (Acciarini et al., 2020; Gudigantala et al., 2023). The paper is structured as follows. First, it synthesizes relevant literature on algorithmic management, ethical AI governance, and managerial decision-making. It then presents the research methodology and simulation design, reports the comparative results, discusses their theoretical and practical implications, and concludes by outlining limitations and directions for future research in responsible algorithmic governance.

II. LITERATURE REVIEW

This study draws upon three complementary streams of scholarly literature that function as analytical lenses rather than as formal grand theories: algorithmic management in platform-based work, ethical artificial intelligence (AI) and algorithmic governance, and managerial decision-making in data-driven environments. Together, these lenses explain how algorithmic systems redistribute managerial authority, generate ethical risks, and shape decision-making processes within digital platform organizations. Prior studies indicate that ethical challenges in food delivery platforms emerge precisely at the intersection of these domains, where algorithmic optimization, governance mechanisms, and managerial judgment converge. Accordingly, this literature review synthesizes these analytical lenses to establish a coherent conceptual foundation for the development of the Integrative Ethical Algorithmic Monitoring (IEAM) framework.

A. Algorithmic Management in Platform-Based Work

The concept of algorithmic management has been widely examined in the literature on digital labor and platform organizations. It refers to the delegation of core managerial functions such as task allocation, performance monitoring, evaluation, and incentive distribution to algorithmic systems driven by large-scale data and automated optimization rules (Benlian et al., 2022; Jarrahi et al., 2021; Stark & Pais, 2020). In the context of food delivery platforms, algorithmic management structures operational processes including order assignment, route optimization, dynamic pricing, and worker rating mechanisms, thereby enabling real-time coordination of large and geographically dispersed workforces (Huang, 2023; Seghezzi & Mangiaracina, 2021). This mode of management reduces reliance on direct human supervision while enhancing scalability and operational efficiency.

Despite these advantages, empirical research consistently highlights ethical and organizational tensions associated with algorithmic management. One central concern is algorithmic opacity, which limits workers' ability to understand, anticipate, or contest decisions that directly affect their income and performance evaluations (Bucher et al., 2021). Furthermore, standardized performance metrics often fail to account for contextual variability such as weather conditions, traffic congestion, or restaurant-related delays resulting in systematically biased evaluations that disproportionately disadvantage certain workers (Huang, 2023). These findings suggest that algorithmic management not only transforms managerial control but also introduces ethical risks that cannot be adequately addressed through efficiency-oriented optimization alone.

B. Ethical AI and Algorithmic Governance

The ethical AI and algorithmic governance literature provides normative principles and organizational mechanisms for evaluating the societal and organizational consequences of automated decision-making systems. Central ethical principles articulated within this stream include fairness, transparency, explainability, and accountability, particularly in systems that mediate access to economic opportunities and working conditions (Tsamados et al., 2022). Scholars emphasize that, in the absence of explicit governance arrangements, algorithmic systems tend to reproduce historical inequalities while diffusing responsibility for adverse outcomes across technical and organizational layers.

In response to these challenges, recent research advocates proactive governance mechanisms such as algorithmic auditing, impact assessments, and continuous monitoring practices (Koshiyama et al., 2024; Rodgers et al., 2023). Algorithmic audits are increasingly conceptualized not merely as one-off technical inspections, but as ongoing organizational practices aimed at detecting bias, assessing fairness, and scrutinizing decision rationales over time. However, much of this literature remains either technically oriented focusing on model-level diagnostics or normatively abstract,

offering limited guidance on how ethical principles can be operationalized within everyday managerial decision-support routines. As a result, ethical AI governance is frequently institutionally decoupled from operational management practices in platform-based organizations.

C. Managerial Decision-Making in Algorithmically Mediated Contexts

The literature on managerial decision-making examines how managers interpret information, evaluate alternatives, and exercise judgment under conditions of uncertainty and complexity. In algorithmically mediated environments, decision-making increasingly relies on analytics dashboards, predictive models, and automated recommendations that promise objectivity, consistency, and efficiency (Acciarini et al., 2020). While such systems can enhance decision speed and standardization, they also introduce the risk of automation bias, whereby managers over-rely on algorithmic outputs and reduce critical scrutiny, particularly when decision processes are opaque or poorly understood (Eberhard, 2023).

Within platform-based organizations, decision-support systems typically prioritize efficiency-oriented key performance indicators, such as delivery speed, cost minimization, and resource utilization. Ethical dimensions including fairness in workload distribution or accountability in performance evaluation are rarely made explicit within these systems. Consequently, managers often lack the informational basis necessary to recognize ethical trade-offs or to intervene in biased algorithmic outcomes (Gudigantala et al., 2023). Research on human–AI complementarity argues that decision-support tools should augment managerial judgment by making ethical considerations visible and actionable, rather than replacing human discretion with automated optimization (Cui et al., 2024; Zhang et al., 2022).

D. Synthesis of Analytical Lenses and Identification of the Research Gap

Synthesizing these three analytical lenses reveals a persistent structural gap in the governance of algorithmically managed food delivery platforms. The algorithmic management literature offers detailed accounts of efficiency gains and transformations in managerial control but provides limited prescriptive insight into how managers may ethically intervene in algorithmic decision processes. The ethical AI and algorithmic governance literature articulates robust normative principles and advocates mechanisms such as auditing and monitoring, yet these contributions often remain abstract or technically focused, with limited integration into routine managerial decision-making practices. Meanwhile, research on managerial decision-making highlights cognitive risks and information asymmetries in data-driven environments but rarely engages with the ethical challenges specific to platform-based algorithmic management. Taken together, these

three streams remain conceptually fragmented, with no unified mechanism that translates ethical principles into actionable inputs within managerial decision-support systems.

Table 1 synthesizes the three analytical lenses used in this study and highlights their respective contributions and limitations in explaining ethical challenges in algorithmically managed food delivery platforms. As shown in the table, existing studies tend to address efficiency, ethics, and managerial cognition in relative isolation, resulting in fragmented guidance for practitioners operating in real-time platform contexts. No single analytical lens currently offers an integrated, sector-specific approach that connects ethical AI principles with the informational needs of managerial decision-support systems in food delivery platforms. In response to this identified gap, this study introduces the Integrative Ethical Algorithmic Monitoring (IEAM) framework as a design-oriented analytical tool intended to support managerial reflection and oversight in algorithmically mediated environments.

Rather than presenting a comprehensive solution, the framework operationalizes selected ethical principles fairness, transparency, and accountability into measurable monitoring dimensions that can be incorporated into managerial dashboards and examined through simulation-based analysis. In doing so, the IEAM framework offers a contextualized and exploratory approach to integrating ethical considerations into managerial decision-support processes within food delivery platforms. This fragmentation creates a critical design-level gap: while ethical principles are well-established conceptually, they are not operationalized in a way that can be embedded into the informational architecture of managerial dashboards and decision workflows. Consequently, managers lack a structured interface through which ethical considerations can be continuously observed, evaluated, and incorporated into algorithmically mediated decisions, which limits the practical applicability of existing governance and auditing approaches.

In response to this identified gap, this study introduces the Integrative Ethical Algorithmic Monitoring (IEAM) framework as a design-oriented analytical tool intended to support managerial reflection and oversight in algorithmically mediated environments. The conceptual rationale for IEAM emerges directly from the intersection of the three analytical lenses: it addresses the opacity and control limitations identified in algorithmic management, the operationalization challenges highlighted in ethical AI governance, and the information-processing constraints emphasized in managerial decision-making literature. Rather than presenting a comprehensive solution, the framework operationalizes selected ethical principles fairness, transparency, and accountability into measurable monitoring dimensions that can be incorporated into managerial dashboards and examined through simulation-based analysis. By embedding these ethical indicators alongside conventional performance metrics, IEAM effectively reconfigures the informational basis of managerial decision-making, enabling ethics

to function as a parallel evaluative dimension rather than an external audit layer. In doing so, the IEAM framework offers a contextualized and exploratory approach to integrating ethical considerations into managerial decision-support processes within food delivery platforms. This positioning advances algorithmic governance by moving beyond post hoc evaluation mechanisms toward an embedded, real-time monitoring paradigm that aligns ethical oversight with operational decision processes.

Table 1. Synthesis of Analytical Lenses and Identification of the Research Gap

Analytical Lens	Key Researchers	Core Focus	Key Insights	Identified Limitations
Algorithmic Management	(Benlian et al., 2022; Bucher et al., 2021; Huang, 2023; Jarrahi et al., 2021; Stark & Pais, 2020)	Delegation of managerial functions to algorithmic systems in platform-based work	Enhances operational efficiency, scalability, and real-time coordination; reshapes managerial control through data-driven automation	Limited guidance on ethical managerial intervention; high opacity and potential bias in performance evaluation and task allocation
Ethical AI and Algorithmic Governance	(Chen et al., 2022; Koshiyama et al., 2024; Rodgers et al., 2023; Tsamados et al., 2022; Weiskopf & Hansen, 2023)	Normative principles and governance mechanisms for responsible algorithmic decision-making	Emphasizes fairness, transparency, accountability, and explainability; promotes practices such as algorithmic auditing, monitoring, and platform governance design	Often abstract or technically oriented; weak integration into daily managerial decision-support routines
Managerial Decision-Making in Data-Driven Contexts	(Acciarini et al., 2020; Cui et al., 2024; Eberhard, 2023; Gudigantala et al., 2023)	Cognitive and behavioral aspects of managerial judgment supported by analytics and algorithms	Highlights benefits of decision-support systems alongside risks of automation bias and over-reliance on algorithmic outputs	Rarely addresses ethical risks specific to algorithmically managed platform work
Integrated Research Gap	—	—	—	Absence of a sector-specific framework that operationalizes ethical AI principles into measurable indicators embedded within managerial decision-support systems

III. RESEARCH METHOD

This study adopts a Design Science Research (DSR) methodology to develop and evaluate a design-oriented decision-support artifact for algorithmically managed food delivery platforms. DSR is an established methodological approach in information systems research that emphasizes

the systematic design, development, and evaluation of artifacts intended to address identified organizational problems (Benlian et al., 2022). The methodological choice is appropriate given the study's focus on bridging conceptual ethical principles with practical managerial decision-support mechanisms. Specifically, the study addresses the lack of structured tools that enable managers to incorporate ethical considerations into algorithmically mediated decision-making processes systematically and operationally. Accordingly, the DSR approach is complemented with a simulation-based evaluation design to enable controlled, reproducible experimentation of the proposed IEAM framework under standardized conditions.

The research process follows the core stages of the DSR paradigm, including problem identification, definition of design objectives, artifact development, demonstration, and evaluation. As illustrated in Figure 1, the process begins with a structured synthesis of the literature on algorithmic management, ethical AI governance, and managerial decision-making to establish the conceptual requirements of the artifact. These insights inform the design objectives of the Integrative Ethical Algorithmic Monitoring (IEAM) framework, which seeks to translate selected ethical principles, namely fairness, transparency, and accountability, into decision-relevant monitoring indicators. The framework is deliberately conceptualized as an integrative monitoring layer embedded within managerial dashboards rather than as an external compliance or auditing mechanism. The evaluation stage is operationalized through simulation scenarios that replicate typical decision-making conditions in food delivery platforms, enabling consistent comparison between baseline and IEAM-supported decision logic.

The artifact development stage involves operationalizing the identified ethical principles into monitoring dimensions suitable for routine managerial use. As shown in Figure 1, this stage focuses on embedding ethical indicators alongside conventional operational metrics to ensure that ethical considerations are visible at the point of decision-making. This design choice is informed by prior research on algorithmic management and decision-support systems, which highlights the risks of opacity and automation bias when ethical information is excluded from managerial interfaces (Acciarini et al., 2020; Bucher et al., 2021). By integrating ethical metrics into existing dashboards, the IEAM framework is intended to support reflective managerial judgment rather than to replace human discretion with automated decision rules. The operationalization of ethical constructs into measurable indicators is based on a combination of literature-informed constructs and structured synthetic assumptions, ensuring conceptual validity while maintaining simulation feasibility.

A. Simulation Design Assumptions

The simulation is constructed using structured synthetic data representing a stylized food delivery platform environment. The dataset includes 50,000 delivery orders and 500 drivers distributed across multiple geographic zones, reflecting a medium-to-large scale operational setting consistent with platform-based logistics systems. Orders are assumed to follow a semi-random distribution with temporal clustering to simulate peak and off-peak demand patterns, while driver availability is modeled as a dynamic pool with stochastic presence across zones. Zone segmentation is predefined to represent spatial heterogeneity in demand density and service coverage.

Key assumptions underpinning the simulation include: (i) demand arrives in time-discrete intervals with probabilistic variation, (ii) drivers are assigned based on proximity and availability heuristics, (iii) baseline managerial decisions prioritize efficiency (e.g., minimizing delivery time and maximizing assignment throughput), and (iv) ethical considerations are initially absent in the baseline model. In contrast, the IEAM-enhanced model incorporates fairness-aware adjustments in assignment logic, such as balancing workload distribution and flagging potential inequities. These assumptions are grounded in prior literature on algorithmic management and platform operations, combined with controlled synthetic modeling to ensure consistency and reproducibility of experimental conditions (Huang, 2023; Seghezzi & Mangiaracina, 2021).

B. Scenario Generation

The simulation evaluates three primary operational scenarios that reflect common managerial decision contexts in food delivery platforms: surge demand allocation, disputed performance evaluation, and routing adjustments. Each scenario is generated using rule-based logic combined with probabilistic variation to emulate real-world uncertainty. For example, surge scenarios are triggered when simulated order volume exceeds predefined thresholds within a zone, requiring dynamic redistribution of drivers. Dispute scenarios are introduced by injecting conflicting signals into performance metrics (e.g., delays caused by external factors), while routing scenarios involve variations in traffic conditions and distance optimization constraints.

Scenario generation follows a controlled randomization process where input parameters such as demand intensity, driver availability, and contextual disruptions are sampled from predefined distributions. This ensures variability across simulation runs while maintaining comparability between baseline and IEAM-enabled decision models. The use

of probabilistic scenario generation allows the simulation to capture a range of operational conditions without relying on real-world proprietary datasets. Each scenario is executed multiple times to reduce stochastic variance and improve robustness of observed outcomes.

C. Simulation Parameters and Configuration

The simulation is configured with fixed baseline parameters, including 50,000 orders, 500 drivers, and multiple geographic zones representing spatial operational units. Additional parameters include average order density per zone, driver-to-order ratio, assignment thresholds, and response time constraints. These parameters are selected based on a combination of literature-informed heuristics and synthetic modeling assumptions consistent with prior studies on platform logistics systems (Gudigantala et al., 2023; Leicht-Deobald et al., 2022). All parameters are initially held constant to ensure controlled comparison between the baseline and IEAM conditions. However, the simulation design allows for extensibility through sensitivity analysis, where selected parameters (e.g., demand intensity or driver availability) can be varied to observe their impact on decision outcomes. This configuration supports both internal validity (through controlled conditions) and external interpretability (through scalable parameter settings). The parameterization is fully documented to ensure reproducibility of the simulation environment and results.

D. Evaluation Metrics

The evaluation framework employs a dual set of metrics encompassing operational and ethical dimensions. Operational metrics include delivery time, order fulfillment rate, and resource utilization efficiency, which reflect traditional performance indicators in platform management systems. Ethical metrics include workload fairness, transparency of decision rationales, and accountability indicators reflecting the degree to which decisions can be explained or traced. These ethical dimensions are operationalized into measurable proxies derived from literature on ethical AI governance and platform labor conditions (Gudigantala et al., 2023; Leicht-Deobald et al., 2022). Fairness is assessed through workload distribution variance across drivers, transparency is approximated by the availability and clarity of decision explanations in the simulation logs, and accountability is evaluated based on the traceability of decision paths within the system

logic. In some cases, ethical indicators are normalized into comparable scales to facilitate aggregation and comparison. This dual-metric approach enables a comprehensive evaluation of how the IEAM framework influences both efficiency and ethical outcomes simultaneously, rather than treating them as mutually exclusive objectives.

E. Reproducibility and Decision Logic

To ensure reproducibility, the simulation follows a structured decision logic pipeline. First, incoming orders are processed and matched with available drivers using a baseline heuristic prioritizing proximity and availability. Second, the IEAM-enabled model introduces an additional evaluation layer where ethical indicators are computed alongside operational metrics. Third, final assignment decisions are adjusted based on a weighted consideration of both operational efficiency and ethical thresholds. Although the exact algorithmic implementation is abstracted at a high level, the decision flow is consistent across all simulation runs, ensuring comparability of outcomes. This structured workflow allows the simulation to be replicated by maintaining consistent input parameters, decision rules, and scenario generation processes. The combination of rule-based assignment logic and controlled stochastic inputs ensures that the evaluation remains both systematic and adaptable for future extensions or alternative parameter settings.

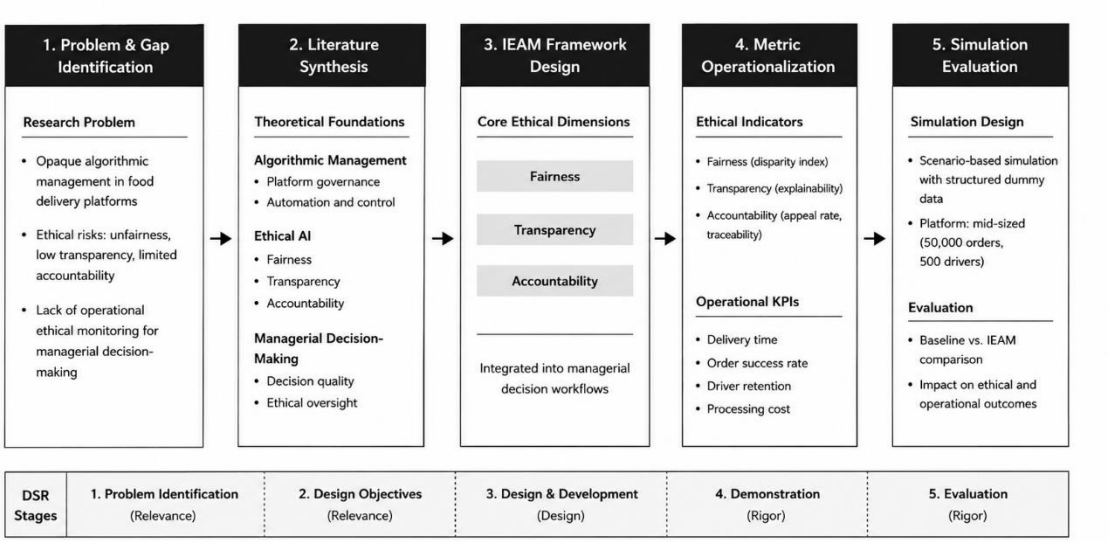

Figure 1. Research Methodology and IEAM Framework Development Workflow

IV. RESULT AND DISCUSSION

A. Result

This study evaluates Integrative Ethical Algorithmic Monitoring (IEAM) through simulation, comparing managerial performance between a conventional efficiency-based model and a model integrating IEAM. Both models were tested under identical operational parameters, allowing performance differences to be directly attributed to ethical indicators within the simulation environment and based on modeled assumptions. The analysis focuses on two dimensions: operational efficiency and ethical decision quality. Findings demonstrate measurable changes in both dimensions, highlighting the practical relevance of ethical indicators in managerial decision-making under the defined simulation conditions rather than in live operational deployment.

a) Operational Performance

IEAM integration produces measurable operational changes. As shown in Table 2, the IEAM model increased average delivery time from 32.5 ± 2.1 min to 33.1 ± 2.0 min, a marginal increase of 1.8%. Task distribution is more balanced, reducing workload concentration and enhancing overall operational fairness. System responsiveness remains high, maintaining operational flexibility during demand surges. These results indicate that, within the simulation environment, incorporating ethical indicators introduces a modest efficiency adjustment while improving distributional balance across drivers. These results mirror prior empirical findings, showing that additional operational data improves allocation fairness without significant efficiency loss (Huang, 2023; Jarrahi et al., 2021).

Table 2. Operational Performance Comparison

Indicator	Efficiency Model	IEAM Model
Average Delivery Time	32.5 ± 2.1 min	33.1 ± 2.0 min (↑1.8%)
Resource Utilization Balance	Uneven	More Balanced
Responsiveness to Demand Surges	High	High

Interpretation: The efficiency model accelerates delivery with high tolerance for workload imbalance, consistent with Algorithmic Management Theory (Bucher et al., 2021; Huang, 2023). IEAM's balanced workload confirms that reported asymmetries are not algorithm-inherent but depend on managerial access to indicators, consistent with Hybrid Control Theory (Jarrahi et al., 2021). Ethical indicators provide additional information on workload and contextual bias, enabling managers to balance efficiency and fairness and operationalize ethical principles proactively within the constraints of the simulated decision logic.

b) Ethical Performance

Differences are more pronounced in ethical performance (Table 3). The IEAM model demonstrates measurable improvements in workload balance, decision transparency, and responsiveness to contextual bias, quantified on a 5-point Likert scale. Compared to the efficiency

model, ethical performance increases from 2–4 for workload balance and decision transparency, and from 1–3.5 for responsiveness to contextual bias. These improvements reflect the effect of embedding ethical monitoring indicators into the decision-support layer, rather than relying solely on implicit managerial judgment or post-hoc evaluation. These quantified improvements support the notion that operationalizing ethical indicators enhances managerial oversight and mitigates automation bias (Cui et al., 2024; Eberhard, 2023; Tsamados et al., 2022).

Table 3. Ethical Performance Results (Likert Scale 1–5)

Ethical Indicator	Efficiency Model	IEAM Model
Workload Balance	2	4
Decision Transparency	2	4
Responsiveness to Contextual Bias	1	3.5

B. Discussion

a) Implications for Algorithmic Management

IEAM's balanced workload confirms that reported asymmetries are not algorithm-inherent but depend on managerial access to indicators (Bucher et al., 2021; Huang, 2023). Ethical indicators mediate algorithmic outcomes, allowing managerial discretion to be applied effectively, consistent with Hybrid Control Theory (Jarrahi et al., 2021). The 1.8% increase in delivery time mirrors (Huang, 2023), confirming that additional operational data improves workload balance without substantial efficiency loss. Compared to traditional dashboard-based or performance monitoring systems that primarily emphasize efficiency metrics, IEAM differs by explicitly incorporating fairness and contextual bias indicators into the same decision interface, thereby expanding the informational basis available to managers. Compared to earlier studies, IEAM operationalizes ethical indicators proactively, rather than relying solely on post-hoc data reporting, positioning it as a decision-support enhancement rather than a passive monitoring tool.

b) Ethical AI Governance and Managerial Decision-Making

These findings suggest that ethical governance does not need to be solely retrospective or regulatory (Rodgers et al., 2023; Tsamados et al., 2022). By integrating ethical indicators into daily decision-making, managers can enhance transparency and actively address algorithmic biases. Unlike prior literature emphasizing automation bias risks (Cui et al., 2024; Eberhard, 2023), IEAM supports proactive managerial intervention while maintaining operational efficiency. In this sense, IEAM operationalizes ethical AI governance principles such as fairness, accountability, and transparency by embedding them directly into the managerial decision layer rather than treating them as external audit or compliance mechanisms. This approach aligns with broader algorithmic governance frameworks that advocate continuous monitoring and

accountability, but extends them by providing a concrete, system-level implementation within operational dashboards. This demonstrates the practical potential of ethical indicators in real-time managerial oversight and contributes to ongoing debates on responsible AI deployment in platform-based environments.

c) *Efficiency–Ethics Trade-Offs*

The marginal increase in average delivery time (1.8%) represents a limited and manageable trade-off between efficiency and ethics. System responsiveness to demand surges remains high, showing that ethical indicators recalibrate optimization priorities without reducing system capacity. From a conceptual perspective, this trade-off reflects a re-weighting of optimization objectives rather than a conflict between mutually exclusive goals, suggesting that efficiency and ethics can be jointly optimized within certain operational thresholds. These results align with prior findings indicating that ethical interventions can enhance worker trust and perceptions of fairness, critical factors in platform workforce management. Within the broader literature, such trade-offs are often framed as tensions between short-term efficiency maximization and long-term sustainability, where ethical considerations may introduce slight performance adjustments but contribute to more stable and equitable system outcomes. Overall, IEAM achieves a practical balance between operational performance and ethical considerations.

d) *Research Contributions and Scope*

This study clarifies how ethical indicators integrate into managerial decision-making in food delivery platforms. IEAM acts as a mediator between algorithmic data and managerial intervention, making ethical principles active decision inputs. The contribution is methodological and sector-specific, highlighting internalization of ethics through platform system design rather than external controls. From a theoretical perspective, the study extends algorithmic governance literature by demonstrating how ethical principles can be embedded into operational decision-support systems rather than treated as abstract governance ideals. From a methodological perspective, it contributes a simulation-based Design Science Research approach for operationalizing ethical constructs into measurable indicators within controlled environments. From a practical perspective, it offers a structured framework that platform managers can potentially adapt to incorporate ethical monitoring into everyday decision-making processes. These findings specifically inform managerial decisions in algorithmic food delivery platforms;

caution is required when generalizing to other algorithmic contexts due to differences in domain-specific constraints, data structures, and governance requirements.

V. CONCLUSION AND RECOMMENDATION

This study demonstrates that ethical considerations can be systematically integrated into managerial decision-making within algorithmically managed food delivery platforms through the use of a design-oriented decision-support framework. By adopting a Design Science Research approach, the study develops and evaluates the Integrative Ethical Algorithmic Monitoring (IEAM) framework, which embeds ethical principles fairness, transparency, and accountability directly into managerial dashboards. The simulation-based results indicate that the inclusion of ethical monitoring produces more balanced workload distribution, enhanced transparency of decision rationales, and increased managerial responsiveness to contextual bias. Importantly, these improvements are achieved without substantially undermining operational efficiency, suggesting that ethical oversight can function as an enabling rather than constraining mechanism in platform management. However, these findings are derived from a controlled simulation environment based on predefined assumptions and synthetic data, which may not fully capture the complexity, unpredictability, and behavioral dynamics of real-world platform operations.

From a theoretical perspective, this research contributes to the literature on algorithmic management and ethical AI governance by operationalizing normative ethical principles into measurable, decision-relevant indicators. The findings extend research on human–algorithm complementarity by illustrating how ethical information reshapes managerial judgment in algorithmically mediated environments. From a practical standpoint, the IEAM framework provides actionable guidance for platform managers seeking to balance efficiency with ethical legitimacy in high-volume, time-sensitive operations. The study also highlights the importance of embedding ethical considerations directly into decision-support systems rather than treating them as external governance mechanisms or post hoc evaluation tools. Although the evaluation is conducted in a controlled simulation setting, the framework offers a scalable foundation for future empirical validation using real-world platform data and longitudinal research designs. Future research should therefore focus on validating the IEAM framework in live operational environments, incorporating real transaction data, and examining how managerial behavior evolves over time when ethical indicators are continuously available. In addition, longitudinal studies are recommended to assess the sustained impact of IEAM on organizational outcomes, worker welfare, and platform governance effectiveness, as well as to evaluate how the framework adapts to changing market conditions and evolving algorithmic systems.

AI Usage Statement

This study utilized generative artificial intelligence tools as a supporting instrument during the research process. AI assistance was employed to support language refinement, structural clarity, and academic tone in the drafting and revision of the manuscript. The use of AI was limited to editorial and linguistic support and did not involve the generation of empirical data, simulation results, analytical interpretations, or substantive theoretical arguments. All conceptual development, research design, methodological decisions, data simulation, result interpretation, and conclusions were conceived, validated, and finalized by the author. The author retains full responsibility for the originality, accuracy, and integrity of the content presented in this article. The use of AI complies with ethical academic standards and does not replace human scholarly judgment or authorship.

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