

The Eighth Information Systems International Conference (ISICO 2025)

Mediating design tensions in AI-enhanced UX: A human-centered framework for enterprise information systems

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Abstract

Integrating artificial intelligence (AI) into enterprise information systems (EIS) transforms user experience (UX) collaboration but introduces complex design tensions. This study develops the HCAI-CUX framework to address tensions related to bias, transparency, stakeholder alignment, and automation. Drawing on a structured scoping review and thematic synthesis, six key tensions were identified and mapped to five Human-Centered AI (HCAI) principles. The resulting framework offers actionable guidance for aligning ethical values with AI-enhanced UX practices in enterprise settings, contributing to more inclusive, trustworthy, and scalable design outcomes.

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Peer-review under responsibility of the scientific committee of the Eighth Information Systems International Conference (ISICO 2025).

Keywords: Human-Centered AI; Enterprise Information Systems; Design Tension; UX Design.

1. Introduction

The rapid evolution of artificial intelligence (AI) and its growing integration into enterprise information systems (EIS) are reshaping how organizations approach user experience (UX) design[1]. AI technologies are increasingly deployed to enhance efficiency, support decision-making, and foster innovation in collaborative environments[2]. However, this transformation also introduces complex design challenges, referred to in this paper as design tensions, ranging from ethical concerns and technical constraints to competing stakeholder priorities. These challenges are

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especially salient in UX workflows, where the adoption of AI must be carefully aligned with human-centered design values[3].

EIS serve as critical infrastructure for organizational operations, enabling data management, task coordination, and cross-functional collaboration[4]. As AI becomes embedded in these systems, UX design pivotal in ensuring that interfaces remain transparent, inclusive, and aligned with user expectations. Yet, the integration of AI often results in design tensions that can undermine trust, usability, and ethical alignment if left unaddressed[5].

This paper addresses the following research question: How can organizations integrate AI into collaborative UX design processes within EIS while applying HCAI principles to mediate emerging design tensions? To explore this question, the study introduces the HCAI-CUX conceptual framework, which maps six recurring design tensions to five HCAI principles. The framework aims to support more ethical, scalable, and human-aligned AI integration in enterprise UX design. While prior studies have addressed aspects of AI usability, system governance, and ethical design, a lack of integrative frameworks remains, hindering the holistic understanding of the interplay between design tensions in collaborative UX workflows. This paper addresses that gap by synthesizing theoretical models, empirical insights, and practice-informed documentation to establish a conceptual foundation for HCAI-aligned UX innovation in EIS.

2. Background and Related Work

2.1. Human-Centered AI and UX Innovation

EIS serve as critical infrastructure for coordinating operations, managing workflows, and facilitating communication across departments[6]. Integrating AI in these systems often supports tasks like predictive analytics, workflow automation, and intelligent recommendations[7]. While these capabilities can improve speed and precision, they also introduce significant design tensions. For instance, AI-generated outputs may lack explainability, limiting users' ability to trust or challenge decisions. Similarly, overly automated workflows can erode user agency and reduce engagement, notably when users are excluded from the design and configuration stages.

HCAI offers a strategic approach to mitigating these tensions by framing AI design and deployment within human-centered principles[5, 8]. Transparency, for example, ensures that AI decisions are explainable and interpretable, particularly when integrated into decision support systems or AI-assisted dashboards. User empowerment focuses on preserving individual and team agency in AI-supported workflows by enabling users to customize automation levels, override AI-driven suggestions, or participate in system feedback loops. Equally important is fairness and inclusion, which addresses risks related to biased algorithms and non-representative data. Ensuring inclusivity involves fair model performance and inclusive UX design that accounts for the needs of diverse users with varying levels of digital literacy, cultural context, or accessibility requirements[9].

Another essential principle is iterative co-creation, which emphasizes the importance of ongoing collaboration among designers, developers, users, and other stakeholders throughout the AI system's lifecycle. Finally, accountability ensures that responsibility for AI-driven outcomes is clearly distributed and that mechanisms are in place for auditing system decisions. Without clear accountability, even ethically designed AI systems can pose organizational risks or lead to user frustration. Table 1 presents an overview of how HCAI principles intersect with typical enterprise system characteristics, highlighting common design challenges that have been documented in recent research.

Table 1. Overview of HCAI Principles and Associated UX Challenges in EIS Contexts

HCAI Principle	EIS Context	Common Design Challenges
Transparency	AI-generated analytics and reports	Lack of explainability; opaque model behavior
User empowerment	Workflow automation and assistants	Over-reliance on AI, limited override mechanisms
Fairness & inclusion	User roles in HR/finance/healthcare	Bias in decision outcomes; non-representative training data
Iterative co-creation	Agile or cross-functional teams	Fragmented feedback loops, inconsistent user engagement
Accountability	Compliance-heavy domains	Ambiguous roles in AI failures, lack of traceability

2.2. Collaborative UX in Enterprise Information Systems

In the context of EIS development, collaborative UX design refers to integrating of cross-functional stakeholders throughout the system's design and development lifecycle[10]. Unlike consumer-facing applications, EIS are complex, large-scale platforms that support critical organizational operations, often across departments, regions, and user roles. Traditional UX approaches, which focused on isolated usability testing or post-development feedback, have proven insufficient in EIS environments. Instead, collaborative UX has emerged as a strategic response to ensure that systems align with user needs and business workflows, operational constraints, and compliance requirements[11].

The development of EIS requires early and ongoing collaboration, mainly because these systems must accommodate diverse personas, task hierarchies, and process flows. In such environments, buyers (e.g., executives or procurement teams) often differ from end-users (e.g., customer service agents, data entry clerks), creating a critical gap in design alignment. Collaborative UX practices, such as stakeholder workshops, co-design sessions, and journey mapping, help bridge this gap by involving users throughout the development process[12]. Modern collaborative platforms and toolchains (e.g., Figma, InVision, Miro, Jira, Confluence) now facilitate seamless UX integration within Agile and DevOps-driven EIS development environments. These tools enable real-time feedback, version control, and stakeholder engagement, which are crucial for managing the scale and complexity of enterprise projects. Collaborative UX methods support modular development, enabling rapid prototyping and iterative testing within sprint cycles[13].

Despite its advantages, implementing collaborative UX in EIS development presents notable challenges. Organizational silos, limited UX maturity, or perceptions of UX as secondary to core functionality can restrict meaningful collaboration. Furthermore, EIS projects often face rigid deadlines, compliance constraints, and dependencies on legacy systems that make UX iteration difficult[14]. Setting clear, measurable goals across teams, fostering a shared understanding of UX value, and embedding UX roles early in project planning are critical success factors. As enterprise systems become increasingly AI-augmented and user expectations evolve, the role of collaborative UX in EIS development will be even more critical. The integration of HCAI into enterprise UX design introduces new tensions (e.g., automation vs human agency or accuracy vs contextual usability) that require co-creative, interdisciplinary solutions[15]. Future-ready EIS must support not just functional efficiency but also adaptability, explainability, and inclusivity. Collaborative UX offers a pathway to embed these values into complex systems from the ground up, aligning user experience with enterprise-wide transformation goals[16].

3. Methodological Approach

This study employs a conceptual methodology to investigate how HCAI principles can mitigate design tensions in AI-supported collaborative UX practices within EIS. The methodological approach is structured into three integrated stages: (1) a structured scoping review, (2) a thematic synthesis of design tensions, and (3) the construction of the HCAI-CUX conceptual framework.

The investigation began with a structured scoping review to examine the current state of research at the intersection of AI-enhanced UX design, HCAI theory, and EIS development. The review followed the PRISMA 2020 guidelines emphasizing clarity, replicability, and methodological rigor. Searches were conducted across four major academic databases: Scopus, IEEE Xplore, ACM Digital Library, and SpringerLink. Boolean queries were used to retrieve publications that addressed at least two of the following core domains: AI, UX or software design, and enterprise information systems. The queries included combinations of keywords such as “AI,” “*Artificial Intelligence*,” “UX,” “*User Experience*,” “*Software Design*,” and “*Enterprise*,” filtered by title, abstract, and keywords, and limited to peer-reviewed journal and conference publications from 2017 to 2025.

The initial search yielded 326 articles. After screening titles and abstracts, 52 papers were selected for full-text review. A second-level screening based on relevance to the study's objectives narrowed this number to 31. An additional six articles were added via backward snowballing, resulting in a final corpus of 37 studies. The inclusion criteria required that studies address AI-enhanced design workflows, UX collaboration, or HCAI integration in enterprise settings. Studies focused solely on algorithmic optimization, hardware implementation, or consumer-facing UX without enterprise application were excluded. Quality screening considered peer-review status, citation relevance, and publication venue.

To analyze this corpus, a thematic synthesis methodology was employed. This approach was chosen for its ability to integrate insights from diverse qualitative sources and derive mid-level theoretical constructs[17, 18]. Open coding was used to extract recurring patterns, concerns, and contradictions related to AI-UX integration. Codes were then grouped into higher-order categories through axial coding to generate key themes. This iterative process led to the identification of six recurring design tensions, each representing a point of friction between human-centered values and AI-driven operational objectives in enterprise environments.

The next stage of the methodology involved developing the HCAI-CUX framework, which maps the six identified tensions to five foundational HCAI principles. The construction of the framework was informed by key conceptual perspectives from prior human-centered AI literature. Shneiderman's framework for trustworthy AI[19], Yang et al.'s co-adaptive interaction model[20], and Amershi et al.'s design guidelines for human-AI interaction[21] helped shape our thinking on how to structure the relationship between users, AI functionalities, and collaborative workflows. Xu and Zhao's synthesis of global design standards[22] offered practical orientation for embedding principles such as accountability, inclusivity, and transparency into system design. Furthermore, Abedin et al.'s analysis of hybrid intelligence and design tensions[23] directly influenced our approach to identifying and organizing the tensions addressed in the framework. These works provided the theoretical scaffolding that guided how tensions, HCAI principles, and design strategies are interconnected in a way that is both ethically grounded and operationally applicable in the enterprise UX domain. Tools and methods were selected based on two criteria: (1) their frequent citation in the reviewed literature and design research communities and (2) their documented application in enterprise-level UX workflows. While the framework does not endorse specific tools, examples such as SHAP and LIME illustrate how contemporary technical practices can help operationalize HCAI principles in addressing real-world design tensions.

4. Identifying Design Tensions in AI-Enhanced UX: Findings from Thematic Synthesis

Based on a thematic synthesis of academic literature and AI-supported design tool documentation[24–26], this study identifies six core design tensions that complicate the integration of AI into collaborative UX workflows within enterprise information systems. To contextualize the emergence and complexity of these tensions, we introduce a UX Maturity Model (Figure 1), informed by prior research on the evolution of UX practice in enterprise environments[13, 16], which illustrates how the sophistication of AI-UX integration evolves across various enterprise settings. As organizations transition from low to high maturity, the nature and intensity of design tensions also shift, underscoring the need for adaptive frameworks that balance human agency, explainability, and ethical considerations across various development stages.

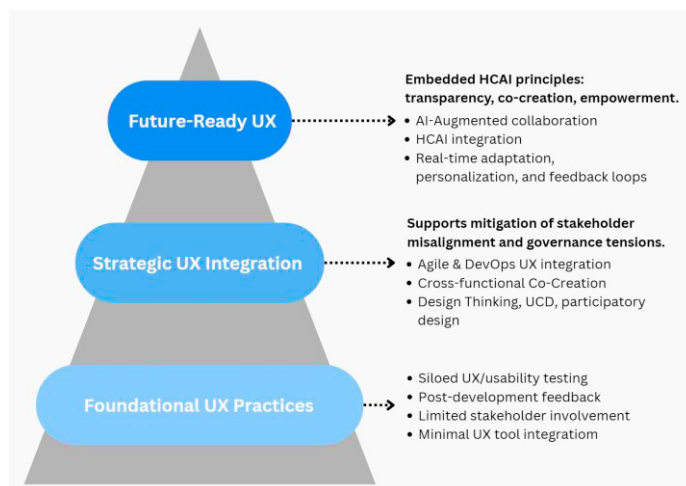


Fig. 1. UX Maturity Model in EIS.

As illustrated in Figure 1, organizations at higher stages of UX maturity tend to adopt more integrated and intelligent design practices, which in turn intensify the socio-technical frictions between automation and human-centered values. These frictions often manifest as recurring design tensions that emerge when integrating AI into collaborative UX workflows within enterprise environments. The six tensions identified are summarized below:

- T1: *Fairness vs. Bias* [9, 25]
- T2: *Automation vs. Human Agency* [3, 14]
- T3: *Explainability vs. Usability* [15]
- T4: *Stakeholder Alignment vs. Fragmentation* [12, 27]
- T5: *Inclusivity vs. Standardization* [5, 9]
- T6: *Scalability vs. Accountability* [26, 28]

These six tensions are not isolated challenges, and they often overlap and interact in the complex realities of enterprise software environments. Figure 2 visualizes how specific characteristics of EIS relate to each of these design tensions.

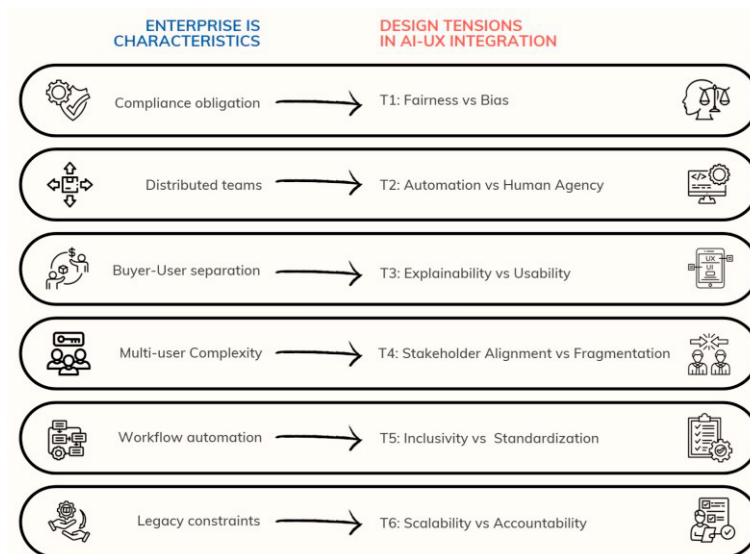


Fig. 2. Mapping of enterprise information system characteristics to AI-UX design tensions.

One of the most foundational tensions arises from persistent algorithmic bias, often driven by non-representative training data or implicit assumptions embedded in model design. In EIS, where AI-driven decisions influence hiring, customer scoring, or resource allocation, biased outputs can lead to discriminatory outcomes and erode equity. The lack of diversity in training data and insufficient testing across user demographics may cause AI systems to favor dominant patterns, marginalizing outlier behaviors and voices. AI tools in EIS are increasingly supporting the automation of routine or decision-intensive tasks, from predictive analytics to UI generation. While automation offers significant efficiency gains, it can compromise user agency when overly rigid, opaque, or irreversible. In enterprise UX, this tension manifests when employees are required to accept AI recommendations without sufficient control or override options, leading to a loss of ownership over workflows.

Enterprise AI systems often operate in high-stakes, time-sensitive environments where transparency is vital to decision-making. However, explainability features are frequently sacrificed to preserve usability or speed. Users interacting with smart assistants, automated dashboards, or adaptive interfaces may be presented with results or suggestions that lack clear justification. EIS development typically involves multiple stakeholders who bring divergent goals and mental models. Developers may prioritize system performance and data integrity, while designers

emphasize usability and accessibility. Business leads, meanwhile, focus on ROI and time-to-market. These misalignments can lead to siloed decision-making, where AI-enhanced features are developed without sufficient input from cross-functional teams.

EIS often seek to standardize experiences across geographies and departments. However, this drive toward consistency can marginalize users who speak different languages, rely on assistive technologies, or come from underrepresented cultural backgrounds. Inclusivity requires that UX systems support diverse cognitive models and interaction patterns. However, enterprise scalability constraints often limit personalization and accessibility enhancements.

As AI functionalities are scaled across large enterprise systems, governance becomes increasingly complex. In distributed teams working across time zones or departments, assigning responsibility for AI outcomes can be ambiguous. Features like AI-based decision support or workflow automation often operate across layers of infrastructure, involving multiple toolchains and contributors. This distributed responsibility leads to “responsibility dilution,” where no individual or team feels empowered to question or revise problematic system behavior. Without mechanisms for traceability and feedback incorporation, organizations risk deploying systems that lack accountability and long-term adaptability[4, 29–31].

5. Conceptual Framework: HCAI-CUX

The HCAI-CUX conceptual framework provides a structured and actionable model for addressing critical design tensions that emerge when integrating AI into collaborative UX design within enterprise information systems (EIS). These tensions, ranging from algorithmic bias to unclear governance, represent the complex socio-technical trade-offs that design and development teams encounter when working in agile, cross-functional environments. Left unaddressed, such tensions can compromise user agency, inclusivity, transparency, or system adaptability, thereby undermining the very goals of ethical AI integration in enterprise systems.

To mitigate these challenges, the framework operationalizes five core HCAI principles: Transparency (P1), User Empowerment (P2), Fairness & Inclusion (P3), Iterative Co-Creation (P4), and Accountability (P5). Each principle serves as a design lens for interpreting and responding to specific tensions. These are not merely ethical ideals, but they are increasingly influencing the structure of modern AI-UX tools. Figure 3 presents the HCAI-CUX conceptual

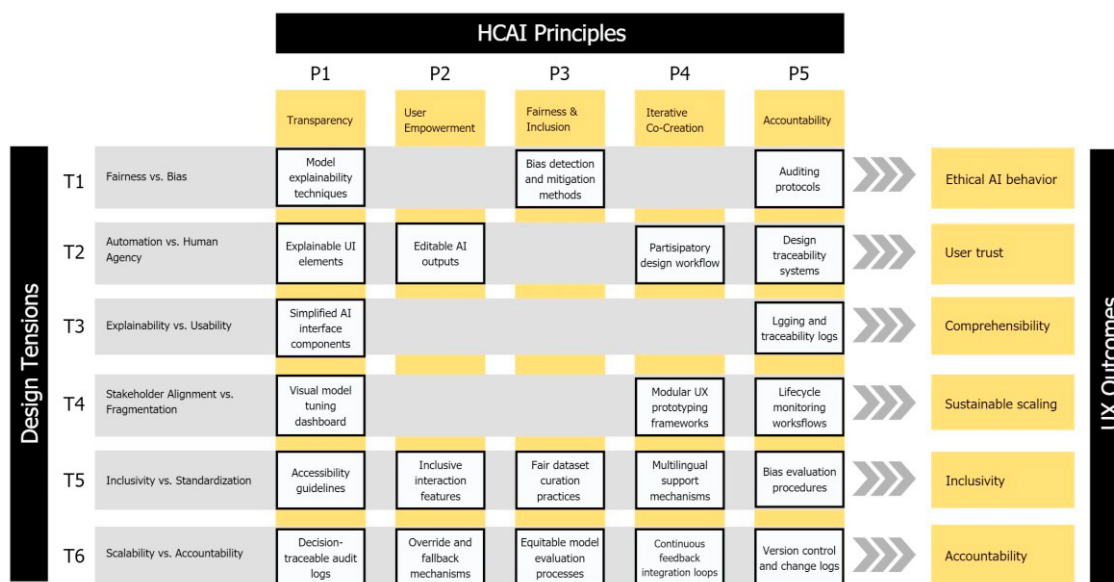


Fig. 3. The HCAI-CUX conceptual framework.

framework, which visually maps six key design tensions (T1–T6) to five HCAI principles (P1–P5), along with the corresponding design interventions and their intended UX outcomes.

By linking design tensions to HCAI principles, practical interventions, and enterprise UX outcomes, the HCAI-CUX framework bridges the gap between theoretical concepts and real-world applications. As EIS continue to embed AI across workflows, this framework offers a roadmap for designing AI-driven UX processes that are not only intelligent but also transparent, inclusive, and accountable. Many of the strategies outlined in Figure 3 are supported by current-generation AI-enhanced design and collaboration platforms. For instance, Figma AI supports editable AI-generated layouts and collaborative prototyping, aligning with strategies under *user empowerment* and *co-creation*. Notion AI offers multilingual support, summarization, and flexible override features, thereby enhancing *inclusivity* and *user agency*. Miro enhances participatory UX workflows through AI-powered clustering and collaborative whiteboarding, supporting *co-creation* and *accessibility*. On the enterprise workflow side, Jira and Confluence provide structured traceability, version control, and decision-logging capabilities, directly supporting *the principles of accountability and transparency*. These tools exemplify how HCAI principles can be embedded into AI-enhanced UX collaboration within EIS.

6. Implications for Research and Practices

The HCAI-CUX framework offers both a theoretical foundation and a practical roadmap for aligning ethical principles with technical strategies in AI-enhanced collaborative UX design within EIS. For UX practitioners, the framework underscores the role of AI not as a substitute for human creativity but as an augmentative force that supports ideation, iteration, and inclusive design. Emphasis is placed on preserving user agency, promoting transparency through explainable interfaces, and embedding participatory co-creation methods to address tensions such as stakeholder misalignment or system opacity. For software developers and EIS architects, the framework advocates for explainable, adaptable, and ethically resilient systems. Strategies include the integration of interpretable models, fairness-aware toolkits, and user override capabilities, which are particularly critical in highly regulated domains. A modular architecture, such as microservices, enables the scalable incorporation of UX feedback, bias mitigation, and lifecycle monitoring into development pipelines.

At the organizational level, successful AI-UX integration requires more than technical readiness. It requires cultural alignment, ethical governance, and policies that support data stewardship and cross-functional collaboration. Governance structures grounded in value-sensitive design help ensure that AI systems uphold accountability, fairness, and transparency. For researchers, the HCAI-CUX framework provides a basis for empirical validation and cross-domain application. Future work may explore how design tensions and HCAI principles manifest across sectors or geographies and assess the framework's impact on trust, usability, and long-term organizational outcomes.

7. Conclusion and Future Work

This paper examined how HCAI principles can help mediate complex design tensions that arise when integrating AI into collaborative UX workflows within EIS. Through a structured scoping review and thematic synthesis, we identified six recurring tensions that reflect fundamental frictions between AI capabilities and human-centered design values. To address these, we proposed the HCAI-CUX framework, which systematically maps each tension to five core HCAI principles and associated design strategies.

The framework offers both theoretical and practical contributions by linking abstract ethical principles—such as transparency, user empowerment, fairness, inclusion, iterative co-creation, and accountability—to actionable methods within enterprise UX contexts. Our analysis underscores the importance of participatory practices, explainability features, and fairness-aware tooling to ensure AI systems support collaboration, inclusivity, and adaptability. The framework also highlights the importance of mid-level automation, hybrid human-AI decision-making, and adaptive feedback loops in aligning technical performance with user expectations.

This conceptual research provides a strong foundation, but its limitations include a lack of empirical validation. Future work should focus on field studies and real-world prototyping to test and refine the framework. Further research

is also needed to explore how HCAI principles can be operationalized across diverse enterprise contexts, enhance cross-functional collaboration, and align agile UX practices with long-term usability, inclusivity, and fairness goals.

Acknowledgements

This research is supported by the Indonesia Endowment Fund for Education (Lembaga Pengelola Dana Pendidikan – LPDP), Ministry of Finance, Republic of Indonesia. The authors gratefully acknowledge the funding provided through the LPDP doctoral scholarship program, which made this work possible. The author also wishes to thank Dr. Tony Clear of Auckland University of Technology, whose guidance and insightful discussions contributed meaningfully to shaping several ideas presented in this paper.

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