Usability Benefits: An Update for the AI Age

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Abstract

Usability benefits have since 90s been analyzed through cost-benefit analysis, cost-justifying usability, or strategic usability that justify user-centered design by contrasting the estimated expenses of usability activities with projected gains in productivity, reduced errors, and improved user satisfaction. Three decades later, the socio-technical landscape has fundamentally shifted. In our present socio-technical systems, usability is no longer an optional investment requiring justification. Usability is a prerequisite for safe, trustworthy, and effective human-technology interaction and human-AI collaboration. This article revisits and updates the classic "usability cost-benefit" and "cost-justifying usability" frameworks for the AI age, arguing that the historical focus on usability costs is not useful anymore. Modern design and development workflows already incur these costs through iterative prototyping, data collection, model evaluation, and regulatory accessibility compliance. A successful human-AI interaction requires usability work and depends on how deeply human-centered principles are embedded into the design to ensure that AI-augmented tasks remain controllable and comprehensible, keeping the human in the loop.

Keywords

Human-computer interaction, Usability benefits, Human-AI interaction, AI interaction design

1. Introduction

Usability is defined as one of the main software product, system, and service quality attributes in the international standard. Usability refers to the capability of the product to be understood by, learned, used by and attractive to the user, when used under specified conditions [27, 29]. However, usability has often been treated in ICT industry as a negotiable investment which has inherent value but often needing justification in competition with other design and development priorities. The classical cost-justifying usability work emerged in the late 90s and early 2000s as a response to the needs of the usability and user-centered design (UCD) practitioners, who had to persuade organizational management that usability activities (e.g., prototyping, usability testing, expert review) were worth doing because their benefits would outweigh their costs [7, 11, 17, 41, 59].

In this approach, usability benefits were typically articulated through cost-benefit analysis, where improved usability was expected to generate measurable returns such as higher productivity, fewer errors, reduced support and training needs, and improved customer satisfaction and sales [7, 17, 51, 59]. There were some benefits in this approach. First, it offered structured categories for identifying benefits. A lifecycle approach by Bevan [7] framed benefits

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across development, sales, use, and support, thereby providing an organizational map of where the value of better usability shows up. Second, this approach offered methods, tools, and arguments for persuading management. Donahue [17], for example, presents a cost-benefit method and illustrates how an interaction change can be translated into time savings and then into monetary savings over a system's lifespan. Bias and Mayhew's book [11] similarly emphasizes practical techniques and cases designed to help usability professionals justify an appropriate usability investment, explicitly targeting organizations operating under then new web/intranet development contexts.

However, the assumptions behind cost-justification were historically conditional and products of their time. They reflected a period of ICT history when it was still plausible and possible for development organizations to design and ship systems, software, and services with minimal structured attention to usability and then address problems reactively, if at all [7, 17, 55]. This assumption that usability could be an optional investment has been questioned from within the cost-justification literature itself. There have been studies arguing that it is incorrect to treat usability costs as purely additive, because every software system has a user interface, and building that interface consumes time and money regardless of whether it is designed intentionally for better usability or not [14, 17, 55, 60]. Therefore, the relevant comparison is rarely between "paying for usability" and "paying nothing," but rather between paying deliberately (early, systematically) and paying implicitly (late, repeatedly, and most likely more expensively) [7, 17, 51, 53, 60].

Three decades later, the development landscape has shifted further. Many contemporary development environments already rely on iterative cycles of prototyping, refinement, release, feedback, and redesign, meaning that organizations inevitably incur interface and human-computer interaction design and development costs regardless of whether they label them "usability work" or not [17, 45, 50, 51, 60,]. This shift matters because it changes the question to be asked. Rather than asking whether usability work should be done at all, the more important question becomes how human-centered principles are embedded within everyday workflows and whether interaction decisions are driven by robust understanding of users and contexts, and whether evaluation is treated as a one-off event or as an ongoing assurance [17, 37, 60].

At the same time, a second shift reshapes the design of socio-technical systems. The emergence of AI-enabled design and design of AI-enabled socio-technical systems changes the character of human-technology interaction. In AI-augmented work, users must interpret system outputs, decide when to rely on them, and recover when they are wrong, which raises the importance of controllability, comprehensibility, and failure recovery as interaction properties [18, 35, 58, 62, 80]. Importantly, this argument does not depend on specialized or controversial claims about AI, because it follows from general HCI concerns with visibility, error prevention, and recovery, now amplified by AI-mediated decision and action loops [52, 55, 76].

When the usability work fails in new HCI settings and contexts, such as in human-AI interaction, the result is not merely slower task completion. It can also result in a loss of control, misplaced reliance, and failure cascades that damage trust and stall adoption [3, 47, 56, 62, 87].

These shifts in socio-technical landscape and ICT field render the historical focus on "usability costs" not as useful anymore as the primary framing. The classical models were designed to persuade organizations that had not institutionalized usability to begin with, using ROI as a language for resource allocation [11, 17, 70].

Meanwhile, the most important usability "benefits" are no longer limited to productivity metrics. They increasingly include prerequisites for safe and trustworthy collaboration: legibility (interaction makes system behavior understandable) [6, 52, 74], controllability (users can steer, override, and correct) [21, 52, 58], recoverability (the system supports detection and repair of failure) [55, 80, 81], and accountability (actions and outcomes leave usable traces that support responsibility and improvement) [16, 17, 26, 62, 82].

A third motivation for this update is that cost-justification has known limitations, which are linked to the evidence (and lack thereof) provided in the literature. Usability cost-benefit analysis research and cost-justification research contains a large share of opinion-based and case-based work and relatively little theoretical or empirical research with substantiated cost and benefit data, weakening confidence in generic formulas and generalizability claims [5, 60 65]. Furthermore, these usability cost-benefit models do not fully cover the whole spectrum of cost-benefit analysis as a well-known research method, because vital information is often missing or is speculative [59]. These limitations have persisted partly because usability was not universally accepted or integrated into development practice, so justification work often functioned as internal persuasion relevant to a specific organizational context rather than cumulative scientific measurement [10, 65].

In addition, empirical accounts demonstrate that usability cost-benefit talk can backfire. An interpretive case study showed how usability cost-benefit considerations contributed to divergent meanings and motives within an organization and to a dynamic where usability became associated with rising development costs and schedule risks, turning usability into a "curse word" and undermining the usability work within the case organization [66].

Some more recent work on usability as a strategic resource also points to shifts in persuasion strategy that resonate with this paper's argument. Aly and Sturm contrast "goal-setting" (usability benefits/profits framing) with "fear-setting" (losses/cost-of-inaction framing when the level of usability is too bad), suggesting that decision-makers may sometimes be more influenced by what might be lost if usability is ignored than by what might be gained if usability is explicitly addressed [3].

This paper is theoretical and conceptual, and it revisits and updates the classic usability benefit and cost-justification frameworks for the AI age. It has three contributions. First, it synthesizes classic frameworks and assumptions, including lifecycle-based benefit categorization (development, sales, use, support) and stepwise cost-benefit methods [7, 11, 17]. Second, it consolidates evidence that cost-justification research often lacks robust, transferable empirical grounding and that cost-benefit framing may produce unintended organizational consequences [5, 66]. Third, it proposes an updated framework for usability benefits in AI-augmented socio-technical systems that reframes benefits around prerequisites for safe and trustworthy human-AI interaction and collaboration, providing actionable design principles and evaluation implications. The update follows an established pattern of adapting usability benefit models to new domains, such as gamification, open-source software development, and automated driving [62, 67, 68]. This paper focuses specifically on usability, because it is the cornerstone of human-technology interaction, and the interaction design and the service design build on it [63, 69].

2. Background

This section reviews the historical foundations of usability benefit discourse and cost-justifying usability, clarifies how prominent models structure costs and benefits, and summarizes the documented limitations and risks of cost-justification as a persuasion strategy.

The research tradition on usability benefits and usability cost-benefit analysis emerged from a practical concern. Many organizations recognized usability as desirable but struggled to allocate resources to usability activities because benefits were hard to identify, quantify, and to defend in management terms [7, 10, 11, 17, 32, 46, 65]. Furthermore, this perceived challenge of identifying usability benefits was further reinforced by broader evidence that IT investments in general often failed to translate into productivity gains without disciplined user centered development practices [34]. This highlights the broader managerial challenge as the value of usability was not straightforwardly realized or attributed without disciplined practices and systematic processes [10, 11, 52, 61, 72].

A key historical change was to align usability work with the general logic of cost-benefit analysis. This meant identifying costs (resources invested in user-centered activities) and comparing them with benefits (savings or added value realized across a system's lifecycle). Donahue's account exemplifies this move by presenting cost-benefit analysis as a practical first step for introducing usability and describing how to translate interaction improvements into monetary value [17].

A central reference point for cost-justifying usability is the edited book Cost-Justifying Usability: An Update for the Internet Age [11], which positions itself as a practitioner-oriented resource for justifying usability investment in modern web/intranet and complex application contexts, building on the earlier edition of the same book. The addition of the web/intranet usability benefits showed that usability cost-benefit models could be and should be updated to fit in with the advancements of technology and ICT field in general.

Bevan's TRUMP report and Donahue's "Usability and the Bottom Line" share a pragmatic aim. Both aim at making usability benefits legible to managerial decision-making, but they do so through different analytical approaches. Bevan [7] offers a particularly clear lifecycle framework for benefits and costs, organizing value across development, sales, use, and support/maintenance and then encouraging a comparison against the costs of user-centered activities. The appeal of this approach is that it aligns usability with organizational functions and budget lines where savings or revenue effects may appear over time.

Donahue [17], by contrast, introduces a stepwise method for translating usability improvements into monetary terms, but his most important contribution is conceptual rather than procedural. He challenges the common framing of usability as an "add-on cost" by arguing that user-interface costs are inevitable and intrinsic, because every system with human-computer interaction has an interface for the users to interact with. Therefore, every design incurs interaction design and development costs whether usability is engineered intentionally or paid for later through rework, training, and support. This implies that the real managerial choice is not whether to pay for usability or not, but whether to pay for usability early and deliberately or to pay more later and reactively.

Whereas Bevan and Donahue provide models and methods for arguing the value of usability work, Aydin et al. [5] and Rajanen and Iivari [66]expose why cost-justification can be fragile in practice. Aydin et al. [5] focused on evidence quality, while Rajanen and Iivari [66] focused on the organizational consequences of usability cost-benefit analysis. Aydin et al. [5] characterized the usability cost-benefit analysis and usability cost-justification literature as dominated by opinion-based and case-based contributions with comparatively little empirically substantiated cost-benefit data, which weakens confidence in universal formulas and makes transferability across organizations precarious. In other words, even when cost-justification is rhetorically compelling, its quantitative credibility can be undermined by the scarcity of robust comparative evidence and the assumption-heavy nature of many estimates. Furthermore, the usability cost-benefit analysis models do not take into account the evolution of ICT field, practices and technologies. Rajanen and Iivari's interpretive case study [66] complements this critique by showing how cost-benefit discourse can backfire politically. In the case company the usability cost-benefit considerations contributed to divergent interpretations and motives and to usability becoming a "curse word" inside an organization, illustrating that highlighting usability costs without timely, credible, and shared benefit narratives can shift attention toward cost control and schedule anxiety, ultimately undermining usability work. Both of these critiques suggest that the limitations of usability cost-justification are not only methodological (weak or nonexistent evidence) but also socio-organizational (how cost talk reshapes meanings and power relations), strengthening the argument that AI-age "benefits" should be framed less as ROI cost-benefit calculations and more as prerequisites for trustworthy, controllable human-AI interaction.

Aly and Sturm propose "fear-setting" as an alternative persuasion strategy for cost-justifying usability, shifting attention from promised gains (e.g., increased productivity or sales) toward avoided losses and the cost of inaction, such as preventable rework, escalation of support burden, adoption failure, or reputational harm when usability problems are discovered late and at scale [3]. This framing is noteworthy in the context of usability benefits because it explicitly acknowledges an asymmetry that cost-justification debates often struggle with. Namely, that the costs of usability work are frequently visible and immediate, while benefits may be delayed, distributed across stakeholders, and difficult to quantify with confidence [5, 60]. By emphasizing the risks of "not doing usability," fear-setting resonates with long-standing HCI observations that systems will be "tested" in the field if usability evaluation is deferred, meaning real users unwittingly become de facto usability testers and organizations may pay later through expensive fixes, user dissatisfaction, lost sales, and operational disruption [17, 51, 60, 70]. At the same time, this fear-setting approach can be interpreted as a response to documented organizational dynamics in which cost-benefit discourse backfires. When usability is framed primarily as an additional expense, it may become politically vulnerable and recast as a cost center, only to be cut under deadline pressure, even though UI, usability, and interaction work and redesign costs are incurred no matter what [17, 60, 66]. However, fear-setting does not replace usability benefit approach but rebalances it by making visible that the most compelling "benefit" of usability work may be preventing predictable and unpredictable high-cost consequences later on in the design and development process, rather than promising incremental improvements and benefits that are difficult to substantiate in advance or that are inconsequential [3, 5, 66].

Finally, domain adaptation work (e.g., gamification) demonstrates a pragmatic method for updating usability benefit the models without reinventing them from scratch. The usability benefit model should preserve the core benefit categories (such as development-time savings, reduced errors, reduced training/support, and improved acceptance) while reinterpreting what those categories mean in a new context where the dominant value mechanisms, risks, and adoption drivers differ from conventional productivity-centric settings [61, 62, 66, 68]. For example, in the gamification context, usability benefits cannot be observed solely through traditional lenses like "time saved" or "throughput increased", but for example through how the usability of gamification design affects engagement, motivation, sustained participation, and acceptance [68]. This approach illustrates a broader methodological approach. Usability benefit model is best understood as a transferable scaffold, a stable structure for thinking and communicating, while the content of categories and their relative importance must be adjusted to the domain's socio-technical realities (e.g., what counts as "error," what counts as "success," and what kind of interaction issues are most costly) [7, 60, 69]. Importantly, domain adaptation also provides a way to avoid the weaknesses of universal usability ROI claims. Rather than asserting that a single usability benefit formula could be generalized across different contexts, adaptation treats usability benefit reasoning as contextual and comparative, emphasizing credible pathways (mechanisms) from usability work to outcomes in that domain and making assumptions explicit [5, 65]. In this paper, this logic forms the foundation for the AI-age update for usability benefits by keeping the clarity of classic lifecycle and usability benefit categories, but shifts emphasis toward prerequisites (legibility, controllability, recoverability, accountability) that are especially important for adoption and safe operation in AI-augmented work, which is analogous to how gamification required re-centering usability benefits on engagement and sustained use [68].

3. Usability as a prerequisite for Human-AI interaction and collaboration

Next, this paper proposes an updated framework for understanding usability benefits in the AI age. Rather than treating usability as an optional investment that must be justified primarily through return-on-investment calculations, the framework reframes usability benefits as prerequisites for safe, trustworthy, and effective human-AI collaboration [4, 62, 77, 78]. The motivation is pragmatic. When AI capabilities are embedded into everyday workflows, interaction quality between user and AI becomes a condition for the viable AI use, not a discretionary enhancement [29, 74]. In other words, the central question must now be shifted from "Is usability worth paying for?" to "Is the human-AI interaction designed so that ordinary users can understand what the system is doing, maintain meaningful control, and recover when things go wrong?" [4, 11, 17, 21, 52, 62, 77].

This updated framework follows a methodological pattern used in earlier works. Adapting general usability benefit frameworks to new domains by preserving the conceptual skeleton while changing how benefits are interpreted and prioritized to match domain-specific dynamics [19, 23, 68]. The logic of adaptation is to retain what remains analytically useful, such as broad lifecycle phases and the overall benefit categories, while revising the interpretation of "benefit" to reflect what also covers the changes in the ICT business and emergence of human-AI-interaction. This approach is particularly relevant because cost-benefit models in the usability

literature have historically offered broad categories and persuasive templates rather than transferable measurement formulas. Therefore, domain adaptation provides a disciplined way to modernize the model without claiming that one generic ROI formula applies across contexts [7, 9, 42, 65, 83].

Classical cost-justifying usability frameworks assume usability work must "earn its place" through demonstrable financial return, typically framed in terms of reduced development rework, reduced training and support costs, improved productivity, or increased sales and customer satisfaction [7, 11, 17, 31, 34, 51]. In the AI age, this persuasion logic becomes less useful because the user expectations have changed. Human-AI interaction is inevitable, and the risks of poor interaction are high when users now expect better level of interaction than before [4, 27, 34, 54, 79, 88]. Donahue's "inevitable interface cost" argument remains pivotal here, as every system has an interface and consumes resources to design, build, and revise it whether or not usability is part of the design process intentionally. Furthermore, AI intensifies what is at stake because users must be able to interpret outputs, decide when to rely on them, and intervene when the system is wrong [17, 21, 35, 57, 74]. Consequently, usability is treated in this framework as interaction infrastructure. Users must be able to understand (legibility), steer and override (controllability), recover from breakdowns (recoverability), and establish responsibility through usable traces (accountability) [6, 16, 52]. These are not some exotic "AI-only" usability prerequisites. They are part of a logical continuum of general HCI concerns about feedback, error prevention, and recovery, made more consequential when system outputs are probabilistic, mediated, operationally consequential, and meaningful to the user [4, 6, 7, 17, 52, 54].

Bevan's lifecycle structuring remains valuable as a scaffold because it clarifies where benefits actually happen (development, sales, use, support) and to whom, but the meaning of "benefit" within each phase must be updated for AI-augmented interaction [7, 24, 27, 29]. In development, classic benefit claims emphasize earlier problem discovery and reduced late-stage redesign; in the AI age the corresponding benefit becomes preventing interaction patterns that are uncontrollable or incomprehensible, because such patterns can trigger expensive post-deployment remediation and stalled adoption [12, 13, 74]. In use, classic benefit claims emphasize productivity and reduced errors. In the AI age the key benefit becomes stable collaboration, calibrated reliance and the ability to seamlessly correct outcomes, because the potential productivity gains of AI support could be lost when users cannot confidently interpret or steer the system [4, 21, 35, 57]. In support and maintenance, classic benefit claims emphasize reduced support burden; in the AI age the benefit becomes diagnosability and organizational learning enabled by accountability traces, because troubleshooting and improvement depend on being able to reconstruct what happened and why [7, 16, 17, 24, 78]. This reframing preserves the lifecycle backbone while aligning benefit interpretation with the interaction realities of AI-augmented work [4, 27, 29].

Finally, this operationalization connects back to the persuasion problem that cost-justifying usability was originally meant to solve. Aly and Sturm's "cost of inaction" framing can be interpreted as complementary to the prerequisite view. In mature and risk-sensitive contexts, the most persuasive "benefit" may be avoiding predictable downstream losses (support escalation, rework, adoption failure) rather than promising incremental ROI gains that are hard to substantiate in advance [3, 5, 83]. In the updated framework (Table 1 & Table 2), this shift is not treated as rhetorical flair but as a practical reflection of where costs often materialize, late

discovery, operational disruption, and expensive repair, when interaction prerequisites are not met [12, 13, 17, 66]. The same logic is found in the human-automation literature. When systems are difficult to understand or manage, people become surprised by system behavior, rely inappropriately, or struggle to recover, patterns that translate into real operational costs and remediation work [21, 35, 57, 62, 74].

Table 1: Classic "Usability cost-benefit analysis" vs. "Usability as prerequisite in the AI Age"

Dimension	Classic usability cost-benefit analysis framing	Usability as prerequisite in the AI age framing
Main question	"Is usability worth paying for?" [7, 10, 11, 17]	Can humans understand, control, and recover in AI-augmented work? [22, 25, 47, 62]
Main paradigm	Usability work might be optional and skipping some usability work might avoid some costs [7]	Interaction costs are inevitable. The issue is depth of human-centeredness [17, 39, 44, 86]
Main benefits	Productivity, reduced errors, reduced training/support, sales [7, 17]	Legibility, controllability, recoverability, accountability, sustained adoption [15, 22, 39, 47, 62, 79].
Persuasion logic	ROI / goal-setting rhetoric [7, 10, 11, 17].	Cost-of-inaction / loss-avoidance rhetoric [2, 3, 30, 75]
Evidence given	Often assumption-heavy. Limited substantiated empirical evidence [5].	Continuous assurance mindset. Evaluate prerequisites across lifecycle [17, 35, 47]
Organizational risks	Costs visible earlier than benefits. A backlash risk [66]	Poor usability threatens trust and safe operation, governance-critical [35, 36, 39, 62, 73]

Table 2: Usability Benefits: An Update for an AI Age

Lifecycle phase	Classic usability cost-benefit analysis framing	Usability benefit adapted to AI age
Design and development	Find usability issues early. Reduce late rework/redesign.	Prevent opaque/uncontrollable interaction patterns before release. Avoid expensive downstream rework/redesign and stalled adoption.
Deployment	Stabilize rollout. Minimize disruption. Prepare support/training.	Avoid misplaced reliance and "automation surprises" at transition. Ensure steerability/override and intelligibility to prevent operational disruption.
Use	Productivity, fewer errors, satisfaction/acceptance.	Good human-AI interaction and collaboration: legibility, appropriate reliance, correction capability. Productivity gains could be lost without these prerequisites
Support & Maintenance	Reduce support costs, simplify maintenance.	Diagnosing and organizational learning via accountability traces/audits, troubleshoot

		and improve by reconstructing what happened and why.
Across lifecycle	ROI rhetoric: justify usability as optional investment.	"Cost of inaction" / penalties of not being usable. Avoid predictable downstream losses. Institutionalize these prerequisites so they aren't renegotiated as overhead.

4. Implications for socio-technical design practice and evaluation

To make the human-technology usability benefits in the AI age actionable, design principles operationalize the prerequisites in ways that can guide design and evaluation. These principles are summarized in List 1.

List 1: Design Principles for Usability Benefits in the AI Age

1. **Design for legibility:** Make system behavior understandable in the interaction [1, 29, 38, 40].
2. **Maintain meaningful human control:** Ensure steerability and override [4, 21, 57].
3. **Support trust calibration:** Avoid creating blind trust or blanket distrust [35, 57, 81].
4. **Design for failure and recovery:** Provide error detection and correction. Avoid "testing by users" post-release [17, 52, 74].
5. **Make uncertainty and limits actionable:** Communicate limits in ways that guide next steps [33, 40, 84].
6. **Embed accountability in interaction:** Provide usable traces that support responsibility and improvement [16, 78, 81].
7. **Treat accessibility and inclusion as baseline:** Remember the diversity of your users [28, 64, 70, 85].
8. **Make evaluation continuous:** Combine pre-release evaluation with operational feedback loops [24, 29, 41].
9. **Make ethical design:** The HCI design should follow good ethical principles and guidelines [64, 71, 89]

5. Discussion

In practice, the discussion points toward a concrete organizational implication: institutionalization matters more than repeated renegotiation. If usability (and now human-AI interaction prerequisites) must be renegotiated in each project as optional overhead, the organization repeatedly recreates the political vulnerability documented in the cases where the cost-justification has backfired [66]. Classic cost-justification resources already implicitly addressed this by offering tools to "win" resources, but the AI-age framing suggests a safer strategy by embedding usability activities into routine socio-technical systems design and development workflows, namely to requirements, design and development iterations, and post-deployment monitoring, so that usability is treated as part of normal delivery and assurance rather than a discretionary add-on. This is also where governance-oriented human-centered AI work becomes valuable. Practices such as audit trails, accountability mechanisms, and documented oversight procedures improve the diagnosability of human-AI interaction

failures and support organizational learning, extending classical usability concerns with feedback and error recovery into the governance domain [54, 79,]. As a result, prerequisites such as legibility, meaningful human control, recoverability, and accountability become operational capabilities that can be monitored, evaluated, and improved rather than remaining merely aspirational design objectives. Usability of the human-AI interaction should be seen as a non-negotiable prerequisite that is not just "nice to have" or an operational shield, but a fundamental ethical requirement for preserving worker agency, autonomy, and psychological safety in the workplace.

However, while bringing the usability benefits in the AI-age, this paper also understands that there are under-resourced companies and organizations, as well as small charities, community-run digital projects, etc., which might still benefit from the classical usability ROI perspective. A development organization with just a handful of staff and no design budget at all would still have to very carefully justify where they put their time and effort, usability work included. Therefore, the classical usability ROI perspective is not obsolete.

Finally, the update suggests a shift in what counts as "evidence" for usability benefit realization. Rather than relying on universal ROI formulas that are hard to substantiate and apply across contexts, teams can evaluate whether prerequisites for viable human-AI collaboration are met and sustained. The intelligibility literature shows that users demand different explanation types under different circumstances and that intelligibility supports understanding and acceptability; practitioner-centered Explainable AI (XAI) work similarly suggests designing explanation features around the questions users actually ask and based on the language that they use [38, 40]. Organizational usability evaluation work emphasizes that benefits must also be evaluated in situ across pilot, go-live, and design-in-use contexts, because real work conditions and emergent effects determine whether value is realized and sustained [24]. In this sense, the updated framework strengthens, rather than weakens, the original goal of cost-justification: it makes benefit claims more defensible by anchoring them in observable prerequisites and lifecycle-appropriate evaluation practices, while acknowledging that the most persuasive argument in risk-sensitive settings may be the avoidance of predictable downstream losses rather than speculative ROI gains [3, 17].

6. Limitations and future work

This paper is conceptual and synthesizes prior frameworks to create insights, rather than reporting new empirical or theoretical results. The updated framework therefore requires validation in organizational settings, as well as further theoretical development. Future work should examine how designers, organizations and researchers operationalize prerequisites such as legibility and controllability, and how these relate to adoption, support burden, and failure recovery [5]. Furthermore, there should be conceptual studies on the benefits specific to user experience design and service design perspectives in the AI age.

Future research should also investigate the organizational politics of usability discourse in AI projects, including whether "cost of inaction" arguments motivate sustained user-centered actions or whether they produce fear-driven compliance that fails to really protect user interests [3, 66].

7. Conclusion

Therefore, it can be argued that in the AI age, usability is not an optional expense to be defended. It is a prerequisite for safe, trustworthy, and effective human-technology collaboration. AI-augmented systems routinely operate under uncertainty and can behave in ways that are difficult for users to anticipate or to understand, so interaction quality in both input and output becomes a condition for viable use rather than a discretionary enhancement. Accordingly, updating classic usability benefit categories around legibility, meaningful human control, recoverability, and accountability provides a contemporary framework for understanding and communicating usability benefits in contexts where the penalties of software, system, or service not being usable may have far-reaching downstream consequences, including costly redesign, stalled adoption, inappropriate reliance, reduced trust, degraded decision quality, accountability gaps, and avoidable organizational risks.

Declaration on Generative AI

The author(s) have not employed any Generative AI tools.

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