

A Multistakeholder Approach to Value-Driven Co-Design of Recommender System Evaluation Metrics in Digital Archives

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Abstract

This paper presents the first multistakeholder approach for translating diverse stakeholder values into an evaluation metric setup for Recommender Systems (RecSys) in digital archives. While commercial platforms mainly rely on engagement metrics, cultural heritage domains require frameworks that balance competing priorities among archivists, platform owners, researchers, and other stakeholders. To address this challenge, we conducted high-profile focus groups (5 groups × 5 persons) with upstream, provider, system, consumer, and downstream stakeholders, identifying value priorities across critical dimensions: visibility/representation, expertise adaptation, and transparency/trust. Our analysis shows that stakeholder concerns naturally align with four sequential research funnel stages: discovery, interaction, integration, and impact. The resulting framework addresses domain-specific challenges including collection representation imbalances, non-linear research patterns, and tensions between specialized expertise and broader accessibility. We propose tailored metrics for each stage in this research journey, such as research path quality for discovery, contextual appropriateness for interaction, metadata-weighted relevance for integration, and cross-stakeholder value alignment for impact assessment. Our contributions extend beyond digital archives to the broader RecSys community, offering transferable evaluation approaches for domains where value emerges through sustained engagement rather than immediate consumption.

Keywords

multistakeholder recommender systems, value-aware evaluation, digital archives, cultural heritage

1 Introduction

Recommender Systems (RecSys) in cultural heritage contexts face distinct challenges that conventional evaluation approaches fail to address. Unlike commercial platforms where mainly engagement metrics suffice as proxies for success, digital archives, libraries, and repositories serve diverse stakeholders with competing values that standard metrics cannot capture.

Digital archives like Monasterium.net—the largest host of medieval charters with over 680,000 documents—exemplify these challenges through their complex stakeholder ecosystem [2]: upstream (archivists, curators, librarians); provider (aggregators, digitization

services); system (owners, developers, moderators); consumer (researchers, educators, students); and downstream (publishers, educational platforms, media). These groups can hold fundamentally different perspectives on what constitutes “good” recommendations, creating an inherently multistakeholder evaluation problem.

While the RecSys community increasingly recognizes multistakeholder approaches [5, 6], translating stakeholder values into concrete metrics remains challenging, particularly in non-commercial domains. Previous work has identified relevant stakeholders and values in cultural heritage RecSys [1], but has not operationalized these insights into comprehensive evaluation frameworks.

Our paper bridges this critical gap through three contributions:

- (1) The *first multistakeholder focus group study in cultural heritage*, involving 25 high-profile domain experts selected from 70 candidates. Our approach answers recent calls for comprehensive stakeholder analysis by incorporating perspectives beyond RecSys end-users.
- (2) The *first value-driven RecSys evaluation framework for digital archives* that addresses the challenges of less commercial recommendation contexts. Our metrics respond to specific needs of cultural heritage domains where value emerges through extended scholarly engagement.
- (3) A systematic approach for *generating RecSys evaluation metric setups* that identifies key measurement dimensions and value trade-offs in domains with complex (scholarly) information needs, while providing flexible implementation paths adaptable across digital archives, libraries, repositories.

These contributions can significantly advance RecSys for cultural heritage institutions in general. By prioritizing stakeholder values over simplistic engagement metrics, our work provides a foundation for systems that balance competing priorities in domains where recommendation value emerges through extended stakeholder engagement rather than immediate consumption.

2 Related Work and Background

Multistakeholder RecSys. Recent research has highlighted limitations of single-objective RecSys, with multistakeholder approaches gaining traction across various domains. In news recommendation, Vandenbroucke and Smets [29] identify disconnects between commercial metrics and stakeholder values, while Van Den Bogaert et al. [28] explore co-designing scaffolds for higher user agency. Similar challenges have been identified in tourism recommendation systems [3], where balancing the needs of tourists, local communities, and environmental sustainability requires careful consideration of societal impacts. Burke et al. [5] provide a comprehensive multistakeholder framework considering needs of consumers, providers,

platform owners, and society, while Smith et al. [25] emphasize that provider fairness requires different metrics than consumer fairness. However, despite this growing body of work, cultural heritage remains largely unexplored from a multistakeholder perspective, with recent work beginning to identify stakeholder tensions in digital archives, highlighting conflicts, e.g., between scholarly utility, collection representation, and platform growth [2].

From Values to Metrics. Translating stakeholder values into evaluation metrics remains challenging. Stray et al. [27] catalogs 36 human values in algorithm design, noting many lack established measurement approaches and require domain-specific operationalization. In RecSys, Deldjoo et al. [9] has reviewed fairness-aware recommendation, highlighting tensions between different fairness concepts and challenges in selecting metrics that meaningfully represent normative goals. De Biasio et al. [8] has emphasized the need for metrics beyond accuracy to model recommendation impacts on human values. Comprehensive evaluation requires multiple dimensions simultaneously. Zangerle and Bauer [33] introduce FEVR (Framework for Evaluating RecSys), organizing the evaluation design space and offering guidance on appropriate evaluation configurations. Despite ample algorithmic approaches, Bauer et al. [4] find that conceptual frameworks for measuring values remain underdeveloped in news recommendation systems. This gap is arguably significant in cultural heritage domains, where conventional engagement metrics fail to capture long-term utility and impact.

Digital Libraries and Scholarly Recommendation. Digital libraries represent an important “precursor” to digital archives, with a lot of research on user needs and evaluation approaches. While having different foci, both face similar challenges in resource discovery. Dobрева et al. [10] highlight the importance of user-centered approaches, while Marchionini et al. [20] has long established frameworks addressing tensions between expert and novice users. A focus on considering diverse stakeholder needs has been recently alluded to in digital libraries contexts [19], simultaneously addressing digital archives. Our work addresses this gap through a comprehensive stakeholder analysis in the form of focus groups. Connected to this, scholarly RecSys face unique challenges that commercial systems do not. Zhang et al. [34] find content-based filtering dominates this domain due to specific information needs, while Champiri et al. [7] emphasize how situational factors critically affect research-oriented recommendations. Biases in these systems have received increasing attention, with Färber et al. [11] distinguishing between human-originated and system-induced biases that inform our collection representation evaluation metrics.

Recent work by Wecker et al. [32] suggests a broader perspective on RecSys in cultural heritage, arguing for systems that go beyond individual user interests to consider societal impact and encourage exploration of diverse perspectives. This aligns with our multistakeholder approach, emphasizing the need to balance individual research needs with broader cultural heritage goals.

Our work extends Atzenhofer et al.’s [1] identification of challenges in RecSys for historical research by developing a framework that translates the identified stakeholder values into concrete RecSys evaluation setups and towards metrics.

3 Methodology

Participatory Focus Groups. We conducted structured focus groups with five stakeholder groups (upstream, provider, system, consumer, and downstream) to identify values for RecSys in digital archives. Each group included five high-profile domain experts (N=25), partly representing major organizations affiliated with Monasterium.net, ensuring findings are representative and generalize to broader contexts. Table 1 gives an overview of our 25 participants in the groups, and to foster transparency and reproducibility [23] of our study results, we share detailed (but anonymized) information on these stakeholders in our GitHub repository¹.

Table 1: Overview of our stakeholder groups, including the roles of the 25 participants of our study.

Group	Roles
Upstream (U1-U5)	Archivist, Curator, Librarian
Provider (P1-P5)	Manager, Specialist, Researcher
System (S1-S5)	Developer, Director, Specialist
Consumer (C1-C5)	Researcher, Educator, Student
Downstream (D1-D5)	Publisher, Editor, Technologist

Sessions (March 2025) with scenario-based discussions lasted 60 minutes, were recorded, and transcribed using aTrain [13]/Whisper [21]. Discussions centered on three topics from previously identified priority areas [2]: visibility/representation, expertise adaptation, and transparency/trust. We employed provocative statements to elicit varied value positions through relevant scenarios [26].

Analysis and Framework Development. We analyzed transcripts using an abductive coding approach [29], combining deductive coding (using pre-established value categories from scholarly literature) with inductive analysis to identify emerging patterns. The deductive framework incorporated five value categories: functional (relevance, serendipity), user experience (satisfaction, engagement), responsibility (fairness, transparency), human/social (equity, dignity), and technical (personalization, efficiency). Initial analysis revealed recurring references to research and interaction stages, prompting a secondary coding round examining how values related to these stages. Cross-stakeholder comparative analysis identified patterns across groups, and values aligned with four sequential stages we termed the “research funnel”: discovery, interaction, integration, and impact. This emergent pattern provided a framework for organizing metrics grounded in stakeholders’ concerns.

4 Results

4.1 Key Value Priorities and Controversies

Universal Values. All stakeholders emphasize *relevance* and *context awareness*, though with varying interpretations. *Transparency* and *trust* receive broad support, particularly from consumer and downstream groups concerned with scholarly credibility.

Collection Representation vs. Quality Highlighting. Controversy emerges regarding whether to prioritize equal representation of collections or visibility for high-quality items. An upstream archivist (U2) states, “I never understood Monasterium.net as a

¹<https://github.com/atzenhofer/multistakeholder-archives-recsys>

kind of competition between archives or collections, so I always thought about it as a tool for opening up archives”, reflecting a different focus than perspectives emphasizing notable documents.

Popularity vs. Scholarly Merit. Popularity-based recommendations face strong rejection across groups. A downstream stakeholder (D3) states: “Why do I care if the charter is trending or not?”, and another (D2) notes, “If you have something that nobody looked at the last 150 years, I think this is at least one criteria for interesting research questions”. This reflects a fundamental difference between scholarly and commercial recommendation approaches.

Scholarly Accuracy vs. Broader Accessibility. Tension emerges between maintaining scholarly integrity and accessibility. Upstream stakeholders debate whether simplifying interfaces sacrifices scholarly value, with one (U3) arguing, “I don’t really think you’re sacrificing accuracy by having a simpler initial interface”, while another (U4) emphasizes, “The crucial question would be: What is the aim of Monasterium.net? As I understand it and use it until now, it is for scholarly purposes”.

System Learning vs. User Control. Different views emerge on balancing adaptive behavior and explicit control. A consumer stakeholder (C1) notes, “If I get the impression that the system is learning with my input, I would make the efforts to put in my opinion”, emphasizing implicit personalization benefits. In contrast, system stakeholders prefer explicit control mechanisms, advocating for configurable interfaces with multiple recommendation modes; this is a clear tension regarding RecSys and interface design.

Research Focus vs. Serendipity. Tension between focused research and serendipitous discovery is evident among consumer stakeholders. While one researcher (C2) states, “I’m just looking for specific charters, and I don’t want to see very interesting things without any of those features,” another (C3) emphasizes, “I think we need constantly to be challenged, so that we don’t pursue the wrong, where we think we’re going.” An upstream stakeholder (U5) highlights unexpected discoveries: “The most beautiful finds you make are the findings that you would not expect, and you will [rather] find them by equal representation”.

Metadata Quality and Bias. Providers and system stakeholders demonstrate awareness of metadata quality variations and structural biases. A consumer (C5) notes, “The main problem I see here is the available data at Monasterium.net, because there is, of course, a structural bias,” while a provider (P1) observes, “It moves the focus away from very interesting areas, it basically just perpetuates the interests of the scientists of the 19th and early 20th century.”

Trust through Transparency. Trust emerges critical to explanation and transparency. An upstream archivist (U2) states, “Trust and transparency is a key value for us. And that’s why I always want to understand why something is recommended for me,” while a system stakeholder (S3) notes, “In my experience with academics, they frequently ask: “Why am I getting this recommendation? I need to understand how the system works”.

4.2 Research Funnel Alignment

Stakeholder concerns aligned with four sequential stages of the scholarly research funnel, coinciding with information seeking behavior and progressive stages of researcher involvement [17]:

Discovery Stage. Upstream stakeholders emphasized serendipity and unexpected connections, while providers showed awareness of structural biases. The system perspective was captured by S3: “You can think about different stages of interaction - new users not too familiar with what’s inside might benefit most from popularity, and see what is most known about that.” demonstrating how recommendation approaches should adapt to different expertise levels or research stages.

Interaction Stage. System stakeholders offered sophisticated understanding of progressive disclosure and adaptive interfaces. S1 emphasized content relationships: “I’m currently missing one specific part, and that is the similarity of documents [...] based on content.” Consumers emphasized control and agency, with C1 stating, “For me, the central topic is relevance. Whatever I get, it must interest me. If not, I lose interest in the recommendations.”

Integration Stage. Consumer stakeholders focused on document relationship understanding and research context maintenance. A system stakeholder (S4) hypothesized long-term goals: “If we think deeper about the user: they’re not interested in items; they explore a specific question and they look for historical evidence.” Downstream stakeholders highlighted challenges in understanding contexts, with D5 noting, “We don’t really know which topic people are studying - are they using sources for historical analysis, for linguistics, for material questions?”

Impact Stage. System stakeholders raised questions about attribution and collaboration, with S4 asking, “There is also the question: if researchers have done some exploration of sources, and discovered something, should they count Monasterium.net and the RecSys as a collaborator?” Provider stakeholders emphasized metrics beyond engagement, noting the challenge of popularity metrics in specialized collections that at several levels suffer from data sparsity.

4.3 Proposed Evaluation Framework

Based on our cross-stakeholder analysis, we propose a framework organized around the four stages of a scholarly research funnel. Unlike conventional RecSys metrics that focus on immediate consumer satisfaction, our framework addresses cultural heritage domains where recommendation value unfolds across extended research journeys. For each stage, we identify metric directions that reflect shared stakeholder values or provide mechanisms to balance competing priorities—an advancement for domains where traditional engagement metrics fall short.

For the discovery stage, we propose *Research Path Quality*, which evaluates research trajectories rather than isolated item relevance, measuring topic coherence and informational progression through sequences of recommendations. This relies on and extends session-based metrics [30] and sequential recommendation approaches [30] to scholarly contexts where research develops across multiple interactions. *Collection Representation* addresses structural biases by measuring distribution of recommendations across contributing archives, time periods, and document types. It requires identifying imbalances relative to collection composition. This pertains to coverage metrics [33] and popularity bias mitigation techniques [16], and is extended to incorporate humanities-specific research patterns that differ significantly from typical e-commerce sequences.

For the interaction stage, we propose *Contextual Appropriateness*, which assesses how recommendations align with shifting research contexts, measuring adaptation to evolving queries and expertise development in real-time. This extends beyond simple relevance to evaluate recommendations' responsiveness to user behavior. We also propose *Control Effectiveness*, which evaluates how user control mechanisms (filtering, refinement, rejection) impact recommendation quality over time, measuring both immediate adaptation and system learning across sessions and contexts. These metrics align with intent-aware and context-aware RS [15], emphasizing adaptation to shifting scholarly contexts over pure recommendation accuracy.

For the integration stage, we propose to use *Metadata Quality Weighted Relevance*, which adapts traditional precision/recall metrics to account for varying metadata completeness across collections, addressing concerns about algorithmic bias toward better-documented materials. We also propose *Document Relationship Insight*, which measures how effectively recommendations support comparative analysis between documents, extending beyond item-level relevance to evaluate support for scholarly synthesis and argument development. These metrics connect to graph-based and knowledge-enhanced recommendation approaches [12], addressing the gap in traditional evaluation approaches that assume uniform data quality—an assumption that fails in cultural heritage contexts due to significant variations in digitization quality.

For the impact stage, we propose *Research Integration*, which measures how recommended items are incorporated into scholarly outputs, including citations, teaching materials, curated collections, or acknowledgments. This extends evaluation beyond immediate interactions to assess the system's longer-term influence on knowledge creation. We also propose *Multistakeholder Value Alignment*, which measures balanced optimization across competing priorities using weighted satisfaction metrics based on stakeholder values. These metrics connect to multi-objective optimization approaches in RecSys [14], making trade-offs between priorities explicit and measurable while recognizing that in scholarly contexts, value often emerges only through extended engagement.

4.4 Implementation Paths and Discussion

Our framework addresses limitations in current RecSys evaluation while building upon established research directions. We discuss implementation paths and implications for cultural heritage domains and RecSys generally.

User Agency and Explainability. A central theme was the importance of user agency and transparency. Focus group participants emphasized that researchers need to understand recommendations and maintain control. This aligns with findings that explanation and control affect both experience and recommendation quality [22, 31]. Intent-aware systems enhance user agency through multiple interest profiles [18], intent signaling, adjustable parameters, and context-appropriate explanations. Control Effectiveness metrics address how these mechanisms support scholarly research.

Temporal and Context-Aware Evaluation. Scholarly research involves extended timelines and shifting contexts that traditional evaluation approaches miss. The research funnel provides a structure to address these temporal dimensions by evaluating support for

phase transitions, adaptation to evolving questions, and contribution to longer-term goals. This addresses a key limitation of current RecSys evaluation focused on immediate consumption. Our framework acknowledges that recommendation value often emerges through extended engagement and workflow integration.

Balancing Stakeholder Priorities. Multistakeholder recommendation involves trade-offs between competing objectives. Our framework makes these trade-offs explicit through multi-objective optimization, configurable dashboards, and value alignment tracking. This approach could consider item, collection, process, and impact-level performance simultaneously, which addresses the need for deeper value integration in RecSys [27].

The framework addresses domain-specific challenges identified by Atzenhofer et al. [2], including varying metadata richness, historical collection biases, and non-linear information-seeking patterns, while also addressing several (value-driven) stakeholder conflicts they identified. Our framework extends to domains with complex decision-making processes.

5 Conclusion and Future Work

This paper presents a multistakeholder approach for translating values into evaluation metrics for RecSys in cultural heritage contexts. By synthesizing insights from diverse stakeholder groups—including archivists, platform owners, researchers, and publishers—we bridge the gap between abstract value discussions and concrete metric implementation. Our framework organizes stakeholder values along a research funnel, providing a structure for developing metrics that address the challenges of cultural heritage domains.

Our contributions extend beyond theoretical frameworks to practical evaluation approaches. The metric setups of research path quality, contextual appropriateness, and value alignment reimagine traditional RecSys evaluation to address scholarly processes, collection biases, and professional ethics. This framework balances competing priorities while prioritizing scholarly utility: it can be used as a blueprint for recommendation systems that respect both information-seeking needs and institutional missions.

While developed for digital archives, our approach has broader implications for domains where recommendations support complex decision-making processes. By connecting stakeholder values to concrete metrics, we successfully demonstrate how participatory approaches can transform abstract values into practical evaluation frameworks—an issue the RecSys community continues to address.

Limitations and Future Work. Some limitations require further investigation. First, our stakeholder sample focused on domain experts but underrepresents non-expert users and third-party stakeholders. Second, the multi-role nature of participants creates challenges for stakeholder-specific value analysis that future studies should address. Third, our proposed metrics require validation through implementation and user studies to assess correlation with actual stakeholder satisfaction.

Future work should implement these metrics in real-world cultural heritage institutions, explore additional stakeholder perspectives, and adapt the framework to other contexts beyond scholarly research. The framework could benefit from recent work on reproducibility challenges [24] and joint modeling approaches that integrate multiple aspects of user behavior and content [35].

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