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Productive frictions: digital innovation at the intersection of creative economy and museum practice

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Museums are increasingly expected to contribute to Creative Economy agendas that frame digital innovation as a source of competitive advantage, audience growth, and increased economic value. Yet when these policy expectations enter museums, they create tensions with mandates grounded in preservation, contextual interpretation, and long-term knowledge production. The article explores these tensions through the concept of friction, understood not as failure or resistance, but as an encounter between distinct institutional logics, temporalities, and value systems. Drawing on twenty-seven semi-structured interviews, primarily from Estonia and supplemented by museum-sector perspectives from Finland and Latvia, as well as a reflexive case study, the article identifies four interrelated forms of friction: temporal, organisational, mediatisation, and translational. Temporal frictions arise from different scales, tempo and planning horizons of museum and technology partners during the implementation of digital projects. Organisational frictions expose misalignments in institutional logics and the roles and labour required for digital innovation. Mediatisation frictions concern how media and platform logics shape the presentation and interpretation of cultural content. Translational frictions emerge when seemingly shared concepts carry different meanings across professional and institutional contexts. Translational frictions become visible in the conceptual ambiguity of terms and words that are seemingly shared but mean different things to different partners in the innovation process. They point to the opportunity to reflect on how cultural content could be mediated in different contexts. Friction reveals the uneven distribution of decision-making authority, labour, and responsibility among collaborators. Technical partners and funding frameworks can exert greater influence over development priorities, while museums undertake often-invisible coordination and translation work and retain long-term responsibility for digital outputs and their cultural content. These asymmetries shape whose priorities prevail and whether friction creates opportunities to reconsider established practices. These frictions shape how cross-sector collaborations negotiate and implement digital innovation. Rather than considering these frictions merely as implementation challenges, this analysis argues that they reveal the work necessary to align innovation policy with museum practice. Friction becomes productive when collaboration enables participants to address institutional differences and negotiate the distribution of authority, labour, and responsibility. Therefore, effective digital innovation in museums requires arrangements that

acknowledge institutional differences, grant museums meaningful influence over development decisions, acknowledge their coordination and translation work, and align project commitments with their long-term responsibilities.

KEYWORDS
creative economy, cross-sector collaboration, cultural policy, digital innovation, museums

Introduction

European cultural policy positions digitalisation of cultural heritage as a catalyst for innovation, competitiveness, and economic growth in the Creative Economy (European Commission, 2018). Museums have been particularly encouraged to integrate digital technologies, with policy frameworks and funding mechanisms framing digitalisation as value-generating, enhancing efficiency, and audience engagement (Europeana Initiative Digital Transformation Task Force, 2022). This perspective assumes technological adoption will yield cultural and economic benefits, aligning museums with innovation agendas. However, earlier studies, as well as our empirical evidence, complicate the assumed relationship between collaboration, technological development and innovation. Research on museum–creative industry relations questions whether collaboration necessarily generates strong knowledge spillovers (Dalle Nogare and Murzyn-Kupisz, 2021), while studies of digital museum development identify discrepancies between funding expectations and practitioners' understandings of meaningful digital communication (Olesen, 2016), as well as organisational challenges in embedding and sustaining collaborative learning (Mortensen et al., 2024). While previous research has examined how cultural institutions adapt to Creative Economy pressures, less attention has been paid to how innovation frameworks themselves are negotiated and transformed when they encounter museum practice and how museums negotiate Creative Economy expectations in digital projects, including whether and how they can reshape the priorities and assumptions guiding collaboration.

This article examines digital innovation in museums through the concept of friction, understood as the awkward, unequal, and potentially creative qualities of interconnection across difference (Tsing, 2024). Rather than using friction as a general synonym for tension, we employ it to examine how the promise of digital innovation gains traction within particular institutional settings and is transformed in the process. From this perspective, challenges in museum digital development cannot be understood solely as implementation failures or institutional resistance.

Frictions emerge when Creative Economy policy expectations, project-based funding mechanisms, technology sector frameworks oriented toward market logics, rapid innovation cycles, and measurable economic impact meet museum practice grounded in preservation, long-term knowledge production, and public good mandates. These frictions reveal misalignments between how cultural policy imagines innovation and how cultural institutions operate. Such encounters are not necessarily symmetrical. Funders, technology partners, and museums do not share authority equally to define project timelines, roles, outputs, and criteria for success. Friction therefore reveals misalignments between how cultural policy imagines innovation and how cultural institutions operate, as well as the negotiation and translation work required to enable cross-sector collaboration. The article argues that such friction can be productive, as it challenges the pace of digital innovation and creates space to question its inevitability. At the same time, these encounters also challenge museum processes and allow for innovation/transformation.

To make this argument, we first introduce frictions as an analytical lens and outline the material and methods of this study. We present the results through four frictions that emerged from both the interviews and the case study. The discussion considers the broader implications of these frictions for understanding and governing digital innovation in museums.

Frictions as analytical lens

Creative Economy discourse has reshaped cultural policy and practice. O'Connor (2010) traces how creative industries thinking emerged as a policy paradigm that prioritises economic instrumentalisation over intrinsic cultural value, positioning culture mainly as an engine for innovation and growth. This framing profoundly affects how cultural institutions are governed and evaluated. Research spotlights how this framework directs policy attention toward measurable economic outputs while obscuring the material conditions of cultural production and structural inequalities (Oakley and O'Brien, 2016). It prioritises market-based metrics that cannot capture the full spectrum of cultural value (Throsby, 2010). These policy discourses also reshape institutional priorities, encouraging publicly funded cultural organisations to adopt more entrepreneurial models that sometimes conflict with their public service mandates (Banks and O'Connor, 2009). In digital innovation, they inform expectations that technological development and cross-sector collaboration will generate cultural and economic benefits.

Tsing's (2024) concept of friction shows how claims presented as universally applicable depend on particular encounters. In the context of digital innovation in museums, this means examining how expectations of digital transformation and value creation become actionable through funding arrangements, development decisions, and collaboration between partners with different commitments. These encounters shape innovation in practice: what is developed, whose knowledge informs it, and what counts as a successful outcome. Participants enter these encounters with unequal capacities to define the terms of collaboration and influence these decisions. Drawing on Tsing, we understand friction as productive insofar as encounters across difference generate relations, practices, and institutional arrangements. Such productivity does not imply mutual benefit or the resolution of tensions. Emerging arrangements may enable new possibilities, but they also may sustain inequalities or create additional burdens.

Museums operate within what Bourdieu (1993) conceptualises as a relatively autonomous field of cultural production, which helps

to explain the competing principles of evaluation that museums encounter. Within the cultural field, museums derive legitimacy from professional expertise, scholarly authority, and responsibilities for preserving and interpreting heritage, but these value definitions are increasingly challenged by external economic and political forces. Pruulmann-Vengerfeldt and Runnel (2011) argue that museums increasingly find themselves positioned at the intersection of cultural, political, and economic fields, each of which brings distinct expectations concerning their purposes and performance. Such multi-directional influences challenge museums' traditional field position and professional authority Runnel and Pruulmann-Vengerfeldt, 2014. Bourdieu (1993) links the relative autonomy of cultural production to the capacity to establish its own criteria of evaluation. In museum practice, professional expertise, scholarly authority, and preservation responsibilities can be understood as informing these criteria and providing grounds for claims to institutional legitimacy. Creative Economy policies can, in turn, strengthen the influence of economic criteria within cultural institutions, shifting the balance between cultural and economic considerations in institutional decision-making (Alexander, 2018). Studies examining how cultural institutions are positioned within Creative Economy frameworks have identified several challenges to traditional institutional logics. Creative economy logics see culture as products and services that can be marketed. Ekström (2019) documents how marketisation has generated conflicts between museums' core missions of preservation, research, and public education and increasing pressure to demonstrate economic impact, audience growth, and revenue generation. This mission-market tension also manifests in what Alexander (2018) terms the emergence of "enterprise culture" in arts institutions, where commercial awareness shifts from being disparaged to becoming a survival necessity.

Digital innovation also becomes a site where these competing field principles are negotiated and evaluated simultaneously through the cultural field's own criteria (scholarly significance, preservation standards, educational value) and external measures (visitor numbers, revenue generation, innovation metrics). In digital innovation projects Bourdieu's perspective helps identify these positions and struggles over legitimate criteria of value, while Tsing's concept of friction directs attention to how they take practical form in encounters between collaborators.

Project-based funding gives innovation expectations a concrete organisational and temporal form. Short funding cycles demand demonstrable progress from museums whose research, collection development, and stewardship depend on cumulative work over longer periods (Geisler and Nieroba, 2022). Dalle Nogare and Murzyn-Kupisz (2021) question whether positioning museums as innovation catalysts within the Creative Economy adequately reflects their operational realities and institutional capacities. Research also describes museums' adoption of outsourcing, corporate management practices, and income-generating activities in response to economic pressures (Geisler and Nieroba, 2022). These adjustments raise questions about how expanded expectations align with the resources and organisational capacity available to meet them. For digital innovation, this underlines how project commitments fit within ongoing institutional responsibilities, what changes in working practices they require, and who takes on the additional work.

Digital transformation in museum studies is often framed as a technological and organisational challenge that promises to expand access to heritage and expose structural weaknesses in the sector. Cameron and Kenderdine (2007) theorise digital cultural heritage as raising fundamental questions about representation, authenticity, and institutional authority. Parry (2007), Parry (2013) collects authors who document how digital technologies require organisational restructuring and new professional competencies within museums. Kidd (2014) situates museums within the contemporary mediascape, foregrounding the ethical dimensions of digital participation and the labour needed to sustain meaningful engagement. Analysing digital transformation through organisational and managerial lenses has led to frameworks for assessing institutional readiness and performance in digital environments (Agostino and Chiara, 2022), while also highlighting the collaborative and networked nature of digital transformation across cultural organisations and partners (Olesen, 2015; Arrigoni et al., 2020). Research has explored how digital technologies reshape value creation within museums and digital cultural ecosystems (Simone et al., 2021). Studies of museum sectors show that digital innovation does not diffuse evenly across institutions but depends on organisational capacities, leadership priorities, professional competencies, and access to networks (Vikmane, 2023). Taken together, these studies show how digital transformation involves questions of interpretation, authority, organisational capacity, and collaboration within and across institutional boundaries. Building on these insights, this article examines how Creative Economy expectations enter collaborative digital development and how their encounters with museum practice shape project priorities, working arrangements, and the distribution of responsibilities.

More recently, digital transformation has been conceptualised as a distributed and collaborative socio-technical process unfolding across organisational boundaries and networks of partners, challenging the idea that transformation can be contained within the museum as a single organisational unit (Arrigoni et al., 2020). Digital transformation is part of broader structural conditions, and framing digital development primarily as a technical or managerial issue risks obscuring its entanglement with broader cultural economy frameworks that structure funding regimes, define innovation temporalities and determine which forms of value are recognised and rewarded (Hesmondhalgh, 2019; Oakley and O'Connor, 2015). Within these conditions, participation in a shared project does not necessarily give partners equal influence over its objectives, schedules, or criteria of success. The analysis examines how some priorities acquire greater authority than others, and who undertakes the work of translating between professional domains and adapting established practices. These distributions cannot be inferred from sectoral affiliation alone: they take shape through the roles, resources, and dependencies of particular collaborations.

The digital transformation has been described as a "post-digital" condition in which ongoing digital work reveals deeper tensions around sustainability, professional capacity and institutional resilience rather than discrete episodes of technological adoption (Nikolaou, 2024). Rather than constituting a self-contained organisational challenge, digital transformation unfolds within policy environments that shape institutional priorities and

operational possibilities (Valtysson, 2017; Henningsen and Larsen, 2020). To understand how this takes effect, it is necessary to examine the governance pathways through which Creative Economy logics are translated into museum practice. Cultural policy frameworks do not simply descend upon museums as abstract mandates; rather, they travel through interwoven pathways through which policy is translated into institutional practice. Drawing on Bennett's (1995), Bennett's (1998) governmentality perspective, museums operate within what he terms "governmental assemblages" where policy operates through specific mechanisms. Creative Economy policies reach museums through three primary channels: funding structures, governance arrangements, and accountability frameworks. Funding mechanisms function as what Gray (2007), Gray (2008) identifies as "instrumental policy" tools, where project-based grants, competitive calls, and output-based funding require museums to adopt Creative Economy logics as a condition of financial survival. By aligning with the funder's expectations, museums turn policy priorities into operational necessities. Governance arrangements influence museums through board compositions, strategic planning requirements, and accreditation standards; accountability mechanisms include impact assessments, performance indicators, and evaluation frameworks which align museum practice through institutional knowledge and self-monitoring.

Research on governance practices shows how digital transformation becomes embedded within these accountability regimes and entrepreneurial orientations, aligning museums with innovation and competitiveness discourses characteristic of the wider cultural industry (Agostino and Chiara, 2022; Raimo et al., 2022). At the same time, engagement with digital platforms and data infrastructures reconfigures how cultural value is produced, measured and legitimised, further entangling museums with the logics of the digital economy (Pesce et al., 2019; Simone et al., 2021). The technical requirements and available formats of these environments influence how heritage can be organised, presented, and used, while measures of visibility and engagement can intersect with institutional expectations of demonstrable impact. These conditions interact with funding and accountability arrangements, but also arise from the design and operation of the platforms themselves. In this study, these relationships are examined through the negotiation of heritage interpretation, audience expectations, and control over cultural content in game development and platform use.

Bringing these perspectives together, this article extends earlier work on digital frictions in museum practice (Runnel et al., 2025) by examining how Creative Economy expectations are enacted through cross-sector collaboration and how the resulting arrangements reshape or reinforce relationships in cross-sector collaboration. The study examines how differences in commitments and working practices shape development processes, giving rise to adjustments in project goals, divisions of labour, and responsibilities, while allowing existing arrangements to persist. We look into this by outlining four interrelated forms of friction: temporal, organisational, mediatisation, and translational. These categories are analytically distinct but overlap in practice and offer complementary ways to examine what encounters across institutional differences produce and how their consequences are distributed, without assuming that collaboration resolves those differences or benefits participants equally.

Materials and methods

This study is based on qualitative fieldwork conducted in 2024–2025, primarily in Estonia (17 informants), with additional interviews involving museum professionals in Finland (6 participants) and Latvia (4 participants) (Table 1). Together, the 27 participants represented 22 museums, technology companies, and creative-sector organisations. The Estonian participants represented the museum, creative, and technology sectors, many of whom operate internationally, particularly in Finland and Latvia. Finnish and Latvian participants were drawn exclusively from the museum sector. The interviews contributed to two related research initiatives: a national project on digital cultural heritage as a societal resource and a Horizon Europe project. Despite the multi-country setup, the study does not aim to provide country comparisons, but to show that these trends are visible within a single national context.

Participants were chosen based on their direct professional experience with digital development processes from diverse institutional perspectives and recruited via professional networks. The objective was to engage with practitioners whose experience enabled them to articulate specific challenges and practical solutions in digital innovation. The interviews examined how museums plan, manage, and integrate digital projects into operations. A flexible, semi-structured interview guide addressed topics such as institutional digital capacity, project planning and management, applications of digital heritage, collaboration with external partners, audience and community engagement, sustainability, accessibility, and legal and ethical responsibilities. We conducted interviews as open-ended professional conversations, allowing participants to use their own terminology and describe scenarios from their daily practice. We adapted the sequence and emphasis of topics to each participant's professional role and experience.

This article analyses interview data concerning museums' digital development, cross-sector collaboration, technological advancement, and the organisational conditions that influence digital innovation. We transcribed all recordings and pseudonymised the transcripts before analysis. We stored identifying information separately from the research material used in the analysis.

Interview data were processed in accordance with participants' informed consent. Audio recordings were deleted after transcription. Transcripts were pseudonymised and stored in a secure institutional repository accessible only to research team members directly involved in the analysis and will be deleted at the end of the research project. Contact information and identifying information were stored separately from the research data.

We analysed the material using an iterative abductive thematic analysis. The process began with an open reading of the interview transcripts to identify recurring problems and points of contestation. At the first reading, themes including temporality, maintenance, workload, professional roles, procurement, intellectual property, platform logics, and conceptual ambiguity emerged. We compared themes across interviews with museum professionals, technology-sector partners, creative-sector partners, and reflexive case-study notes. We identified initial themes from the interviews and refined them by comparing them with existing literature and theoretical discussions, particularly Tsing's concept of friction. Bourdieu's field theory and Bennett's governmentality practices provided a relevant theoretical backdrop to the initial

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TABLE 1 List of interviewees.

Nr	Position	Field	Expertise	Country	Date	Duration (h:mm)	Language	Mode	Interviewer(s)
M01	Creative manager of exhibition projects	Museum sector	Exhibition development and digital interpretation	EST	02.01.2024	02:09	EST	In person	AA, PR*
M02	Research director	Museum sector	Museum research and digital development	EST	02.01.2024	01:38	EST	In person	AA, PR
M03	Head of exhibitions and education centre	Museum sector	Exhibitions, education and audience engagement	EST	04.01.2024	01:19	EST	In person	AA, PR
M04	Director	Museum sector	Museum management and digital strategy	EST	14.10.2024	01:07	EST	In person	AA, PR
M05	Director	Museum sector	Museum management and digital strategy	EST	15.10.2024	01:03	EST	In person	AA, PR
T06	UX/UI designer	Technology and creative industries	Digital product and interface design	EST	15.10.2024	02:12	EST	In person	AA, PR
M07	Head of exhibitions	Museum sector	Exhibition development and digital interpretation	EST	Joint interview T06, M07		EST	In person	AA, PR
M08	Director	Museum sector	Museum management and digital strategy	EST	29.10.2024	01:24	EST	In person	AA, PR
M09	Curator	Museum sector	Curatorial work and digital interpretation	EST	01.11.2024	00:56	EST	In person	AA, PR
M10	Product manager	Museum sector	Digital product and learning-platform development	EST	05.11.2024	01:08	EST	Online	AA, PR
T11	Chief technology officer	Technology and creative industries	Interactive technologies and digital exhibition solutions	EST	16.10.2024	02:14	EST	In person	AA, PR
T12	Architect	Technology and creative industries	Exhibition architecture and spatial design	EST	23.10.2024	00:47	EST	In person	AA, PR
T13	Director	Technology and creative industries	VR and immersive digital experiences	EST	01.11.2024	01:24	EST	In person	AA, PR
T14	Director	Technology and creative industries	Data visualisation and digital interpretation	EST	03.11.2024	01:05	EST	Online	AA, PR
T15	Content producer	Technology and creative industries	Content production and digital interpretation	EST	31.10.2024	01:05	EST	Online	AA, PR

(*Continued*)

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TABLE 1 Continued

Nr	Position	Field	Expertise	Country	Date	Duration (h:mm)	Language	Mode	Interviewer(s)
T16	Project manager	Technology and creative industries	Exhibition and digital-project management	EST	Joint interview T15, T16		EST	Online	AA, PR
T17	Business development manager	Technology and creative industries	VR development and cross-sector collaboration	EST	02.11.2024	01:12	EST	Online	AA, PR
M18	Director of digital gallery programme	Museum sector	Digital strategy and programme development	FIN	11.12.2024	02:14	ENG	In person	AA, PR
M19	Digital producer	Museum sector	Digital production and audience engagement	FIN	Joint interview M18, M19		ENG	In person	AA, PR
M20	Development manager	Museum sector	Organisational and digital development	FIN	12.12.2024	02:05	ENG	In person	AA, PR
M21	Researcher	Museum sector	Museum research and digital development	FIN	12.12.2024	02:32	ENG	In person	AA, PR
M22	Digital heritage expert	Museum sector	Digital heritage, access and infrastructure	FIN	Joint interview M21, M22, M23		ENG	In person	AA, PR
M23	Digital cultural heritage expert	Museum sector	Digital cultural heritage, access and use	FIN	Joint interview M21, M22, M23		ENG	In person	AA, PR
M24	Researcher	Museum sector	Museum research and digital heritage	LV	28.05.2025	02:13	ENG	In person	AA
M25	Head of communication	Museum sector	Communication, audience engagement and digital development	LV	28.05.2025	01:45	ENG	In person	AA
M26	Head of digital communications	Museum sector	Digital communication and audience engagement	LV	29.09.2025	01:37	ENG	In person	AA
M27	Research director	Museum sector	Museum research and digital development	LV	29.09.2025	01:03	ENG	In person	AA

AA and PR refer to the interviewers Agnes Aljas and Pille Runnel.

thematic categories. This iterative approach enabled us to distinguish recurring frictions between museum practice and broader expectations regarding digital development, consolidating them into four analytical categories: temporal, organisational, mediatisation, and translational friction. We treated these categories as analytically distinct yet empirically overlapping. We also considered cases that complicated or contradicted the emerging interpretation. Two authors led the initial reading and thematic analysis, while a third author contributed to refining and theoretically interpreting the themes.

As a second empirical source, the article draws on a reflexive case study of the Horizon Europe project. The project consortium comprised technology and game developers, museum partners, and experts in digital inclusion, intellectual property, ethics, and impact assessment. Their collaboration focused on developing and testing tools for co-creating games that utilise cultural heritage. This reflexive case study documents negotiations over priorities related to heritage interpretation, playability, platform functionality, accessibility, legal responsibility, and societal impact, as well as the types of friction that arose during daily collaboration.

As a case study, the project offers opportunities to reflect on translating Creative Economy expectations into practice through project-based funding and consortium governance. These can be seen exemplifying Bennett's governmental assemblages (1995, 1998), as the project-based funding provides both direction and accountability frameworks. The work packages, milestones, deliverables, and funding arrangements established the formal structures within which partners collaborated and negotiated their respective priorities, providing contextual information about the collaboration's formal organisation for the article. As museum partners within the consortium, the authors provide a reflexive analysis based on observations of work processes, negotiations, and the expectations articulated by various partners.

Authors PR and AA held dual roles as project partners and researchers, which provided direct access to everyday work processes. This dual positioning necessitated reflexive consideration of how their institutional roles and museum-sector perspectives influenced both observation and interpretation. Participant observation was conducted throughout the project's 24-month duration. Observations were documented in two separate working field diaries, compiled during and immediately after meetings, planning sessions, workshops, and collaborative processes. Together, the two diaries contained approximately 30 entries, including reflexive notes and descriptive observations on co-creation, target groups, accessibility and inclusion, community building, project sustainability, and understandings of the project's aims and methods.

To address the authors' dual role as project partners and researchers, we compared the two field diaries during analysis, discussed interpretations with the third author, and paid attention to observations and interview accounts that complicated a museum-centred reading. The case-study material was treated as situated evidence from the museum partners' perspective rather than as a neutral account of the consortium.

The interviews constituted the primary dataset. After the initial thematic analysis of the interviews, the field diaries were examined against the same themes to trace how differences in timelines, roles, terminology, and expectations emerged and evolved during the ongoing collaboration. The case-study material was used to identify points of convergence and divergence between participants' retrospective interview accounts and the authors' observations of project processes. Observations from the diaries were regarded as not specific to the consortium and situated within the museum partners' perspective.

Results

Temporal frictions

Temporal frictions arise from the mismatch between accelerated short-term funding cycles and museums' long-term timelines. While digital innovation policies prioritise rapid experimentation and novelty, museums operate through slower cycles of research, preservation, and knowledge accumulation. Digital systems used in museum innovation projects (web frameworks, game engines, cloud services) mostly follow fast and externally governed cycles of update and obsolescence (major updates every few months, end-of-life decisions made by companies, etc.). Museums operate on longer timeframes: collection-building takes decades and centuries, and interpretative frameworks evolve gradually. Museums build long-term knowledge infrastructures using technologies designed for continuous replacement rather than durability. This misalignment creates practical burdens: digital skills become obsolete quickly, project-based approaches prioritise developing and implementing new digital solutions over maintenance, which often remains unfunded, and digital initiatives struggle to stabilise beyond their initial implementation phase. *"Developing a museum or a permanent exhibition takes years - sometimes as long as 10 years. A game conceived at the beginning of that process may already be outdated by the time the exhibition opens." (T11)*

Our interviews showed that many institutions still depend on unsupported software, outdated catalogues, and other infrastructure technologies that tie them to earlier technological regimes. As one technology-sector partner explained: *"Twenty years later, organisations describe themselves as being full of legacy systems. Increased IT investment no longer creates new value; it is used to keep old systems running"* (T14). Many organisations remain dependent on these systems because rapid technological evolution leaves them struggling to integrate with modern ecosystems, despite their willingness to participate (Pereda et al., 2025). Legacy systems therefore require slow, cumulative maintenance work, while digital policy frameworks continue to frame innovation as fast, novel, and project-based (Pereda et al., 2025). This contrast creates digital transformation friction because the policy "success model" and the museum's "survival model" pull in opposite directions: policies support project-based novelty, while core systems and maintenance work often remain underfunded.

In the project consortium, the temporal friction became visible through Horizon Europe governance mechanisms that organise work around predefined milestones, deliverables, and pilot releases. These project management structures require demonstrable progress at regular intervals and encourage the rapid translation of ideas into visible artefacts such as prototypes or testable platform features. For museum partner, this pacing meant heritage materials and expertise had to be mobilised quickly to support fast-paced development driven by short-term project funding. Museum contributed in the project with narratives, images, and historical content that could be integrated into gameplay and platform demonstrations, while also organising testing activities and collecting user feedback needed to validate project outputs. As a result, heritage expertise was reduced to content provision and piloting support, while deeper processes of contextualisation, interpretation, and ethical reflection were compromised to fit the development schedule. The field diary noted: "*The technical team has already progressed considerably, while our input is moving more slowly—we are still conducting interviews to identify users' needs and the challenges they have encountered*" (field diary, September 2024). As a result of this uneven pacing, input that could be applied quickly was incorporated more readily than contextualisation, interpretation, and ethical reflection that required slower analysis.

Interviews with technology partners reveal the other side of temporal frictions related to digital development. Developers prefer to work with software as an evolving system that requires continuous maintenance, updates, and iterative improvement.

Museums, by contrast, can often afford to commission digital solutions as discrete projects tied to exhibitions or specific services, treating them as one-off deliverables rather than infrastructure requiring long-term collaboration. Another interview described the changing model: *"They used to hand over a one-off project and say: display it on this computer and never connect it to the internet, because an update might break everything. But contemporary games are no longer boxed products. They are expected to remain alive, develop, receive updates, and gain new content. This turns them into a service, which is much harder to manage" (M02)*. The friction thus concerned not only different development speeds but also incompatible assumptions about when a digital project is considered complete.

Procurement procedures enforced by public spending governance further intensify this mismatch. As one interviewee explained: *"We had 3 years to do it, and it was still rushed. Procurement rules prevent you from beginning to prototype with a partner before the contract is awarded. The process is divided into developing the idea and then procuring its implementation, which does not really work" (M05)*. Procurement thus separates collaborative experimentation from implementation: the parties cannot develop and test the idea together before completing the formal commissioning process. Because public tendering processes may take several years, the technological solutions specified at the beginning of a project can already be outdated by the time development finishes. Rapid technological change therefore creates friction with the slower planning cycles through which museums organise exhibitions, budgets, and institutional priorities.

We see temporal frictions not merely as a mismatch between "fast technology" and "slow institutions," but as an effect of Creative Economy governance that normalises acceleration as a condition of institutional legitimacy. Funding structures, competitive calls, and innovation assessment frameworks privilege novelty, experimentation, and demonstrable short-term impact, while maintenance, infrastructural care, and long-term knowledge stewardship remain structurally marginal within evaluation regimes. This friction reflects the difference between policy-induced innovation time and the time of the heritage institution. These are not simply different speeds that can be managed by increasing efficiency, but competing normative interpretations of what counts as responsible and valuable institutional development.

Looking for the productive dimension of temporal frictions, we argue that these do not only signal misalignment between institutional rhythms but can also create opportunities to reflect critically on how time structures digital heritage development. The slower, research-oriented pace of museums that foregrounds contextualisation, ethical review, and long-term stewardship often remains marginal in innovation frameworks focused on rapid delivery. Yet, these considerations can stop museums from making crucial mistakes. At the same time, collaboration with technology and game development partners exposes museums to iterative development practices that emphasise experimentation, prototyping, and continuous improvement, daring museums to move away from considering their work as "permanent" and encouraging experimentation (Haldrup et al., 2021). Awareness of these different temporalities should prompt partners to structure project timelines and identify meaningful progress milestones. Temporal friction became productive where partners translated the need for longer-term development into concrete practices, including repeated prototyping, continued collaboration, and post-launch maintenance agreements (M01, M02). These practices did not resolve the structural mismatch between short-term funding and long-term responsibility, but they made iteration and maintenance more visible as necessary parts of digital development.

Organisational frictions

Digital projects increase coordination, administrative, and managerial demands, which existing staff often absorb without organisational restructuring or added resources. This exposes frictions between policy expectations of innovation and institutional capacity to sustain it. Organisational frictions reflect a structural conflict between competing organisational models. They become particularly visible when digital development remains peripheral to an organisation's core activities. Creative Economy policy ideals promote flexible, competitive, partnership-oriented organisational practices structured around project logics and measurable outputs, deriving legitimacy from agility and cross-sector collaboration. Museums, by contrast, are organisations with long-term public accountability. Their legitimacy stems from expertise, trust and stable governance frameworks rather than market responsiveness. Organisational friction thus emerges not necessarily from insufficient digital skills or management deficits, but from a misalignment between the entrepreneurial institutional logics presupposed by Creative Economy policy and the mandate-bound logics through which museums operate.

Within the project consortium, organisational frictions appear in how partners structure roles and responsibilities. Although the project focuses on developing a collaborative co-creation platform, museum partners mainly operated as pilot partners, providing use cases, heritage content, testing environments, and user feedback. The field diary often recorded uncertainty about how museums' research-based contributions would enter the technical development process and who was responsible for connecting knowledge across different work packages. This does not mean museums were entirely excluded from technical decision-making. Instead, the material suggests that input easily transformed into a testable function or pilot activity was easier to incorporate than open-ended cultural, interpretative, and ethical questions.

The technology-partner interviews, in turn, showed that organisational responsibility does not necessarily end when a contractually defined task is completed. As one interviewee explained: *"At first, we thought we were only one narrow link in a longer chain: we would provide the commissioned content, and others would take care of everything else. We quickly discovered that this approach was not sustainable. If the solution was later displayed on the wrong computer, with the wrong headset, or under unsuitable conditions, we still received the calls asking why it did not work" (T17)*. As a result, the company expanded its role to include designing and installing the physical exhibition setting, furniture, computers, and other equipment. The friction did not disappear, but it changed the developer's understanding of a digital solution: instead of treating it as a discrete digital product, the company began to approach it as an integrated configuration of space, technology, and use practices.

Procurement structures further complicate early partner dialogue. Interviewees described public procurement procedures as a form of "blind bidding," in which strict rules and an emphasis on price competition limit opportunities for meaningful communication before contracts are awarded (T11, T14, T15, T16, T17). Under these conditions, both museums and developers must commit to solutions without fully understanding the proposed system's practical implications. As one museum professional explained: *"An average museum may commission a game only once every 10 years. By then, the people with previous experience have often left the organisation, and both the museum and the staff involved have to start learning the process again from the beginning" (M26).*

Another organisational challenge stems from the lack of shared infrastructure or standards in the heritage sector. Without widely adopted technical frameworks or reusable components, museums often commission bespoke systems tailored to individual projects. While such custom development may respond to specific institutional needs, it also increases costs and technical complexity, making it difficult to reuse solutions across institutions or projects. In addition, interviewees noted that museums sometimes fail to secure full intellectual property rights for the digital solutions they commission, leaving them dependent on the original developer for future modifications or extensions. (M01, M02, M07, M08, M20, M21, M23, M25, T11, T15, T17) Taken together, these patterns illustrate how organisational arrangements surrounding digital projects can reinforce asymmetries in expertise, resources, and long-term control over technological infrastructures.

These examples show that organisational capacity for digital innovation does not require museums to have all technical skills in-house. It also depends on their capacity to act as informed commiss/ioners: to define objectives, formulate a brief, understand the development process and the roles of different professionals, and participate in decisions about the solution. One interviewee emphasised that museums have a significant responsibility to understand what they are requesting and commissioning, as well as what the partners are ultimately seeking to achieve together (M07). In this context, a technology partner's role is not limited to delivering a completed solution; it also involves explaining available options, technical constraints, and the stages of development.

Organisational frictions reveal how Creative Economy governance structures privilege particular forms of expertise, problem definition, and value creation, and how labour, expertise, decision-making authority, and long-term responsibility are distributed within digital projects. Their productivity does not necessarily lie in resolving inequalities in roles and resources through collaboration. Rather, they expose forms of labour that would otherwise remain concealed behind the language of automation, project management, or technical implementation. In some cases, friction also produced a concrete adjustment, as illustrated by the technology partner's expansion of its role from delivering digital content to taking responsibility for the broader environment in which the solution was used. More broadly, recognising organisational frictions makes them open to negotiation and provides a vocabulary for negotiating who participates in development decisions, whose labour remains invisible, and who is responsible for using and maintaining a digital solution after the project ends.

Mediatisation frictions

Mediatisation frictions emerge as museums become increasingly embedded in digital media ecosystems structured by platform logics of visibility, circulation, and engagement (Poell et al., 2022). In these contexts, algorithmic systems filter, rank, and amplify cultural content by prioritising attention, frequency, and interaction. Museum professionals adapt heritage content to formats optimised for reach and shareability, navigating the mismatch between algorithmic visibility and institutional commitments to contextualisation, accuracy, and long-term stewardship (Wilson-Barnao, 2022). The labour involved in content adaptation, community management, and reputational risk remains largely unrecognised within institutional frameworks.

Mediatisation frictions are not only a consequence of platform technologies, but are reinforced by the Creative Economy's increasing alignment with digital visibility and data-driven value creation (European Commission, 2018). Cultural policy frameworks that position museums as actors within the creative industries emphasise audience growth, measurable engagement and brand competitiveness as indicators of public relevance and economic contribution (Gray, 2007). As museums become embedded in ecosystems governed by platform logics, heritage content is reshaped to fit formats optimised for reach and engagement (Pruulmann-Vengerfeldt, 2022). Mediatisation also refers to the process by which the formats and operational logics of particular media (including games, virtual environments, and interactive platforms) begin to influence which heritage content is selected, how it is structured, and what forms of audience activity are anticipated. Friction emerges when playability, interactivity, or conformity with a platform's technical and formal requirements becomes a condition shaping cultural content.

The digital transformation challenge emerging from mediatisation friction lies in the pressure to equate audience metrics with cultural value, narrowing the space for people-centred, dialogic, and context-rich digital practice. As long as policy and accountability frameworks privilege visibility and audience quantification over qualitative forms of participation and knowledge production, digital transformation risks reinforcing platform dependency rather than strengthening institutional autonomy and public mission. These differences were also apparent in the interviews. One museum professional criticised the assumption that heritage content needs to be made highly playful, particularly when museums seek to engage younger audiences: *"Museums sometimes seem to assume that if the audience includes children, there must be screens and interactive elements. But if children want to play, they already have access to GTA and Super Mario. Museums cannot compete with decades of investment in commercial games; they should focus on the stories and spatial experiences that only they can provide." (M04)* Children are imagined as an audience that necessarily expects screens, interaction, and game-like experiences even before their actual needs and practices have been examined (M09, M19, M22). The interviewees' criticism was not directed at games themselves, but at the assumption that playfulness automatically makes cultural content more relevant or accessible.

Within the project, mediatisation frictions appear in how heritage content is adapted to the design requirements of games and digital platforms. Engagement mechanics, playability, and user interaction were defined as key success criteria. In practice, heritage material must be translated into formats compatible with gameplay structures, such as quests, characters, collectable objects, or narrative fragments integrated into game mechanics. These transformations enable cultural content to circulate within interactive environments but can reduce opportunities for contextual explanation or interpretive nuance. The field diary shows how familiar platform conventions entered the development process before their relevance to museum needs was clearly established. Points, rewards, unlockable levels, avatars, progress bars, and automated challenges were discussed as possible platform features, although their significance was not yet grounded in identified user needs (field diary, January 2025). The field notes also recorded that young people repeatedly emerged as the default audience for museum games, while questions of inclusion and possible exclusion of other audience groups were introduced later. Platform design therefore structured not only how content was presented but also who was imagined as its expected user.

The need to balance playability and historical representation emerged in interviews with technology partners. Developers emphasised that excessive factual density can undermine a game's playability. When large amounts of academic or historical information are embedded directly in gameplay, the experience risks becoming overly complex or demanding, reducing the chance that players will stay engaged (T06, also M07, M27). From a technology development perspective, historical material must be carefully selected and integrated into simple interactive activities that evoke curiosity or emotion without overwhelming the player with detail (T13). These observations complicate a simple opposition where museums represent accuracy and developers represent entertainment. Developers also reflected on how to retain historical and cultural meaning while making the experience accessible and engaging.

At the same time, adapting heritage content to a game format entails reputational and ethical responsibilities for museums. One technology partner stressed that historical inaccuracies could damage a museum's credibility, although artistic choices are unavoidable when precise historical evidence is unavailable (T12). Friction does not necessarily arise from a straightforward opposition between historical truth and fiction. Instead, it concerns negotiating which elements must be grounded in evidence, where creative interpretation is permissible, and how to communicate the distinction to users.

Museums' commitment to inclusive public engagement may lead them to resist designing for a narrow audience of dedicated gamers. This can conflict with gaming conventions that privilege technical sophistication and genre-specific knowledge. Mediatisation frictions emerge as partners negotiate how cultural content should be structured, simplified, and experienced within interactive media environments.

One museum professional described an art hunt on a global online gaming platform where players searched for artworks from museum collections and placed them in a virtual gallery. Approximately 170,000 players participated over six hours. The interviewee described its educational aim as largely limited to creating a "memory trace" that might help players recognise the artworks or artists later (M18). This example shows how a platform environment can reshape a museum's educational ambition. Instead of extensive contextualisation, reach, recognition, and visibility become criteria of cultural value. This does not mean the museum's educational purpose disappears entirely. Instead, the meaning of learning changes based on the forms of encounter with cultural content that the platform enables. A related initiative revealed the museum's dependency on an external platform. While the museum provided the heritage content, the platform owner controlled the technical environment and the conditions governing the digital material's continued availability. Mediatisation friction also reflected the partners' unequal capacity to determine how and for how long heritage content remained accessible.

Game logic does not always simplify heritage content. Often the museum supplies the historical framework while the developer shapes the gameplay. "*The game inevitably became partly fictional. Yet this was also one of its strengths: the historian could let the imagination work instead of remaining entirely confined by historical evidence. The journey included dangers, dragons, and other clearly fictional elements." (M02)*. Through this narrative, children encountered medieval trade, travel, and worldviews. This demonstrates how mediatisation friction can productively combine historical knowledge with imaginative engagement. Mediatisation frictions reflect difficulties in adapting heritage content to digital media environments. They also provide an opportunity to critically examine how cultural meaning is shaped through different communication formats. When museums question the simplification or gamification of heritage material, they highlight issues of context, interpretation, and ethical representation that might otherwise remain implicit within design processes. Interactions with game designers and developers introduce museums to alternative narrative structures and interaction models that can make cultural content accessible and emotionally resonant for broader audiences. Rather than resulting in the straightforward dominance of either educational or entertainment logics, these negotiations can generate hybrid forms of storytelling that combine elements of interpretation, play, and participation. Mediatisation frictions can serve as productive sites where collaborators experiment with new ways to translate cultural knowledge into interactive formats while reflecting on the limits and responsibilities of representing heritage through digital media.

Translational frictions

Translational frictions arise in collaborative digital projects where actors with different professional commitments, responsibilities and working practices must establish shared professional objectives. Such cross-sectoral collaborations promoted by Creative Economy policy as an engine for innovation assume that value emerges from combining heterogeneous expertise. The interviews, however, revealed differences in emphasis, rather than fixed sectoral positions. Priorities overlapped and shifted with particular projects and professional roles. Making these priorities compatible required continuing conceptual, ethical and professional mediation that was not always recognised as a distinct task in project planning or funding. Translational friction therefore

concerns the work through which partners clarify terminology, negotiate standards, and establish workable and shared objectives. As one interviewee explained: *"You cannot simply ask someone to 'make something exciting' when you do not know what you want. The client must provide an objective or something concrete to work from" (M01).* A cultural objective must be translated into a visitor experience, functional requirements, and finally a technical solution, although partners may initially assume this translation will happen by itself.

Translational frictions appear in the conceptual ambiguity of key terms used in the collaboration. Concepts like community building and game act as flexible boundary objects (Star and Griesemer, 1989) that let actors from different sectors cooperate while attaching different meanings to the same vocabulary. Within the project, community building may refer to expanding user visibility, recruiting developers, fostering participatory co-creation, or strengthening networks across cultural and creative sectors (field diary, March 2025). The term enables collaboration while postponing clarification about the specific social relations the project seeks to establish.

A similar ambiguity surrounds the concept of the game itself. For game designers and developers, a game's defining criteria are mechanics, interaction, and playability. Museums, by contrast, often see games as one medium among many to communicate cultural narratives. The category of the 'serious game' often emerges as a compromise between these perspectives, signalling both educational intent and interactive design (M04, M05, M10). Yet this compromise does not fully resolve the differences between the expectations of cultural heritage interpretation and the conventions of game production, as games applicable in museum contexts do not equal educational games only.

As the project experience showed, cultural and technology sectors also differ in how they understand co-creation, a central organising principle of this particular project. For museum professionals, co-creation implies shared authority in shaping narratives, interpretive frameworks, and the representation of heritage content throughout development. For partners responsible for technical development, the concept may refer more narrowly to participatory activities such as playtesting or user feedback on mechanics. While both interpretations support collaborative participation, they reflect different expectations about the scope and depth of stakeholder involvement in shaping final outcomes.

Similar translational frictions were described in interviews with technology and design partners collaborating with museums in digital development projects. Several interviewees pointed to the absence of a shared vocabulary for describing development processes, system architecture, and design requirements. This can lead to misunderstandings about the complexity, cost, or feasibility of proposed solutions. Visually compelling early concepts or storyboards may create expectations that do not match the technical work required in later development stages. Several interviewees noted that project budgets are sometimes largely consumed during early design phases, leaving insufficient resources for the technically demanding stages of functional specification and coding that follow (M01, T11, T15). In productive terms, these frictions mean that, particularly in long-term partnerships, both sides learn each other's languages and become more aware of the differences (M07, M26, T11). Over time, translational friction can become shared vocabularies, but externally funded projects are often too short a time for that to happen.

Finally, translational frictions also appear in debates over standardisation and creativity. While technology partners emphasise the benefits of standardised infrastructures that reduce costs and support sustainability, museum and creative partners sometimes fear that excessive standardisation may limit the uniqueness and interpretive flexibility of cultural projects (M04, T11). The disagreement is therefore not simply about choosing between standardised and bespoke solutions. It also concerns which elements can be standardised without standardising cultural interpretation and visitor experience.

The concept of platform changed during the project, as reflected in the field diary. It was discussed at different stages as an environment for creating games, a co-creation platform, a collection of tools, and a service for different sectors. Following the pilots, it was reframed more modestly as a tool for understanding and planning games rather than as a ready-made application for producing them (field diary, 5 March 2025). This provides a concrete example of productive translational friction: the ambiguity was not entirely resolved, but the project's central object acquired a more specific and realistic definition.

Seen in this light, translational frictions do not merely represent communication problems between sectors but can function as productive moments in which different forms of expertise become visible and open to negotiation. When museums articulate concepts such as provenance, uncertainty, or interpretive responsibility within development processes, they introduce considerations that might otherwise remain marginal in technically driven workflows. At the same time, interactions with developers expose heritage professionals to modes of thinking centred on iteration, prototyping, and modular design, which can reshape how digital heritage initiatives are conceptualised and implemented. These encounters rarely eliminate differences in vocabulary or success criteria, but they encourage partners to clarify their assumptions and make their expectations explicit. In this sense, translational frictions can contribute to the emergence of shared working practices and hybrid vocabularies that enable collaboration across sectors.

Discussion

This study argues that the tensions observed in cross-sector digital innovation projects should not be understood as implementation failures but as potentially productive frictions generated by the encounter between Creative Economy governance and museum institutional practice. When innovation policies bring together actors operating under different value systems, professional mandates and logics of their operational fields, collaboration inevitably produces moments of misalignment (Geisler and Nieroba, 2022; Arrigoni et al., 2020). Rather than signalling dysfunction, these moments reveal the negotiation work required to translate policy ambitions into institutional realities. Examining digital innovation through the lens of friction therefore shifts attention from technological adoption to the governance conditions under which collaboration

unfolds (Tsing, 2024). This perspective allows us to see cross-sector innovation not as a smooth process of alignment but as an ongoing process in which cultural policy frameworks, technological development practices, and museum mandates are continuously reinterpreted and renegotiated (Olesen, 2015; Arrigoni et al., 2020).

Friction as a site of negotiation for policy implementation

The analysis suggests that challenges with digital innovation in museums cannot be explained only by technological limits or institutional resistance. Instead, they reflect deeper differences between Creative Economy governance frameworks and the institutional logics museums follow (O'Connor, 2010; Bourdieu, 1993; Pruulmann-Vengerfeldt and Runnel, 2011). Cultural innovation policies often assume organisations pursue growth, measurable innovation, and economic impact, privileging demonstrators, visibility, and short-term outputs as success indicators. This follows the governance logics of economic and policy fields. Museums, however, derive legitimacy from mandates focused on public value, long-term knowledge stewardship, contextual interpretation, and societal service that cannot be reduced to economic or engagement metrics. These have a stronger hold on the cultural field. These differences in field logics create friction over what counts as fundable, valuable, and measurable.

Viewed through the lens of friction, these tensions become analytically visible. Instead of treating implementation challenges as failures of coordination or capacity, the concept of friction highlights how different institutional logics, temporalities, and value systems collide in cross-sector innovation processes. The empirical findings show that the dynamics shaping digital innovation projects are not neutral organisational arrangements but reflect underlying policy assumptions about how cultural innovation should function. Frictions reveal how Creative Economy governance models encounter and reshape institutional practice within museums.

Productive frictions in cross-sector collaboration

Importantly, the frictions identified in this study should not be seen simply as obstacles to eliminate. They are core features of cross-sector collaboration, emerging because innovation projects bring together actors with different professional cultures, institutional responsibilities, and expectations of value (Olesen, 2015; Arrigoni et al., 2020). In the projects, these differences appeared in the alignment of timelines, governance structures, media formats, and evaluation criteria, resonating with Bennett's (1995), Bennett's (1998) on funding structures, governance arrangements, and accountability frameworks. Frictions related to mediatisation could be seen as a new area of investigation, as they relate to technological developments and digital transformations.

These differences generate substantial coordination work, much of which remains invisible and is ignored or forgotten when planning projects. Yet they also create spaces where institutional assumptions can be questioned and negotiated. When museums raise concerns about ethical representation, sustainability, or contextualisation, they introduce considerations that might otherwise remain marginal in innovation-driven development processes. Similarly, interactions with technology partners expose museums to iterative design practices and platform thinking that challenge traditional organisational routines. In this sense, frictions can become productive encounters where competing value systems are articulated and partially reconfigured rather than simply suppressed.

Implications for digital transformation in museums

The findings challenge the widespread assumption that participation in innovation ecosystems or adopting new technologies alone will secure museums' digital transformation (Dalle Nogare and Murzyn-Kupisz, 2021; Agostino and Chiara, 2022). Digital transformation in museums is not primarily a technological process but an institutional one unfolding across organisational structures, professional practices, and governance frameworks (Kidd, 2014; Arrigoni et al., 2020). The frictions observed in this study show how digital innovation projects often remain external to core institutional structures, implemented as short-term initiatives rather than integrated into long-term organisational development.

Temporal frictions reveal how innovation funding cycles favour rapid experimentation and novelty, while museum work relies on slow processes of research, rights clearance, contextualisation, and sustainability planning. Organisational frictions highlight how digital initiatives are added to existing responsibilities without changes in authority, resources, or institutional structures. Mediatisation frictions show how the growing importance of visibility and engagement metrics reshapes cultural production, often obscuring ethical and reputational considerations. Translational frictions expose the extensive interpretive and coordination work needed to align different professional logics within collaborative innovation projects. Together, these dynamics suggest that digital transformation in museums cannot be seen as a sequence of discrete innovation projects but must be approached as a broader institutional transition.

Policy implications for governing digital innovation

These findings have important implications for cultural policy and innovation governance. Instead of trying to eliminate frictions through more efficient project management or technological standardisation, policy frameworks should recognise them as inevitable features of cross-sector collaboration. These frictions require resources, time, and institutional support. Effective governance of digital innovation depends on creating conditions that allow museums to participate as equal partners in shaping innovation processes.

This includes funding structures that support project development, long-term infrastructure maintenance, organisational capacity building, and integrating digital initiatives into everyday institutional practice. It also requires recognising translation, coordination, and mediatisation as essential forms of digital labour needing dedicated roles, authority, and resources. It should also not be solely the museum partner's responsibility to learn and adapt to the language of their commercial partners. Evaluation

frameworks should move beyond narrow metrics of visibility or growth to consider contributions to public value, institutional learning, and societal impact. Designing innovation policies that acknowledge these dynamics would allow cross-sector collaborations to become spaces of productive friction where cultural institutions and technology partners jointly negotiate sustainable pathways for digital transformation. Building long-term collaborations that move beyond short-cycle public procurement collaborations allows for building shared vocabulary and better mutual understanding of processes. Ensuring project timelines include time to learn organisational practices and vocabularies may mean shorter production cycles, but better cross-sectoral awareness also makes digital innovation meaningful and more sustainable over time.

By theorising digital innovation through frictions, this article contributes to understanding how Creative Economy frameworks reshape cultural institutions. It offers a framework and evidence for why museums struggle to sustain digital initiatives. Following Tsing (2024), frictions are not necessarily productive in the sense of generating positive outcomes. Their analytical value lies in revealing how institutional differences are negotiated and whether they lead to new arrangements, hybrid practices, or revised understandings of cultural value. Such outcomes remain contingent and uneven.

Limitations and further research

This study offers context-specific insights into frictions in collaboration between the museum and technology sectors. The sample was centred on Estonia, while the Finnish and Latvian participants represented only the museum sector and the international collaborative project provided a reflexive backdrop. All technology- and creative-sector interviewees were based in Estonia, although several also operated internationally. The reflexive case study was analysed from the situated perspective of the museum partners and should not be understood as a neutral account of the entire consortium. The paper outlines four frictions that emerged from these contexts, but in practice additional frictions may not have become visible in this interview material. Further research should examine whether the identified frictions also arise in other institutional and national contexts and whether the adjustments negotiated during funded projects persist after project funding ends.

Conclusion

This study examined how Creative Economy expectations are negotiated in museums' digital innovation practices. Drawing on interviews and a reflexive project case study, it identified four interrelated frictions: temporal, organisational, mediatisation, and translational. These reveal how funding arrangements, development schedules, professional roles, media formats, and shared terminology shape what digital innovation becomes in practice. Their interconnections matter. Differences in timing, for example, can determine whether museum knowledge informs development decisions or enters only after key choices have been made.

The study examined how Creative Economy policy ambitions are implemented and adjusted the perspective of everyday practices. The concept of friction provided an analytical lens to examine these encounters, including whose expertise shapes project priorities and how labour and responsibility are shared in collaborations. In museum and technology sector collaborations, museums have long-term responsibilities regarding heritage. They may contribute content and coordinate participation but have limited influence over development priorities. Interviews suggested technology partners can also assume responsibilities beyond their original remit. These findings show that improving communication alone cannot fix arrangements where decision-making authority, resources, and obligations remain misaligned.

The study also shows opportunities for mutual learning and adjustments. Museum contributions in these collaborations highlight the need for contextual interpretation, ethical representation, and long-term stewardship. Collaboration with developers foregrounds experimentation, iterative development, and recognition of digital solutions as systems needing ongoing care. Adjustments made in the course of the project showed that balanced contributions can bring relevant changes to the process, such as a more specific definition of a platform's purpose and a broader understanding of developers' responsibilities for the environment where solutions are expected to be used with particular groups of users. These examples show how collaboration can reshape objectives and practices without eliminating institutional differences.

For cultural policy and museum management, the study confirms that digital transformation of museums requires more sustained institutional support beyond individual projects than museum sector informants had experienced in their daily work. Funding and governance arrangements should also recognise coordination and translation as substantive work, enable museums to influence development decisions, and link project commitments with resources for maintenance and continued use. Evaluation should consider institutional learning and public value alongside demonstrable outputs and audience metrics determined by the project logic.

The study offers situated insights rather than evidence of sector-wide prevalence. Further research should examine if negotiated adjustments persist beyond project funding and become part of institutional practice.

Ultimately, digital innovation in museums takes shape through the "awkward, unequal" (Tsing, 2024) and potentially creative encounters between different institutional commitments and practices. Friction is productive when these encounters generate collaboration, reshape priorities, and configure relationships between technologies, users, and cultural (heritage) knowledge. The effects of friction do not necessarily resolve differences between participants equally. New possibilities and learning may emerge, along with additional burdens and dependencies. Understanding what friction produces requires attention to whose priorities become embedded in digital development, whose labour enables collaboration, and who bears responsibility for its outcomes. For museum practice, the challenge is to create conditions where museums can meaningfully influence these emerging arrangements.

Data availability statement

The qualitative datasets are not publicly available because the interview transcripts and reflexive field diaries contain potentially identifiable information and were collected under conditions that do

not permit public deposition. Requests for further information should be directed to the corresponding author.

Ethics statement

The interview study was approved by the Estonian National Museum Ethics Committee and conducted in accordance with local legislation and institutional requirements. Interview participants provided written informed consent. The reflexive case study concerned the authors' own participation in the project; consortium partners were informed that the collaboration was being documented and analysed reflexively.

Author contributions

All authors contributed to the design and theoretical framework of the study. PR and AA conducted empirical data collection, PP assisted with data analysis. All authors contributed to the writing and editing of the manuscript.

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Conflict of interest

The author(s) declared that this work was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Generative AI statement

The author(s) declared that generative AI was used in the creation of this manuscript. Authors used Claude.ai, web version, model Opus 4.6 and Chat GPT web version 5.3 in order to identify relevant literature and improve the language and readability of the article. Authors have verified all the sources and take full responsibility for the content and expressions.

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