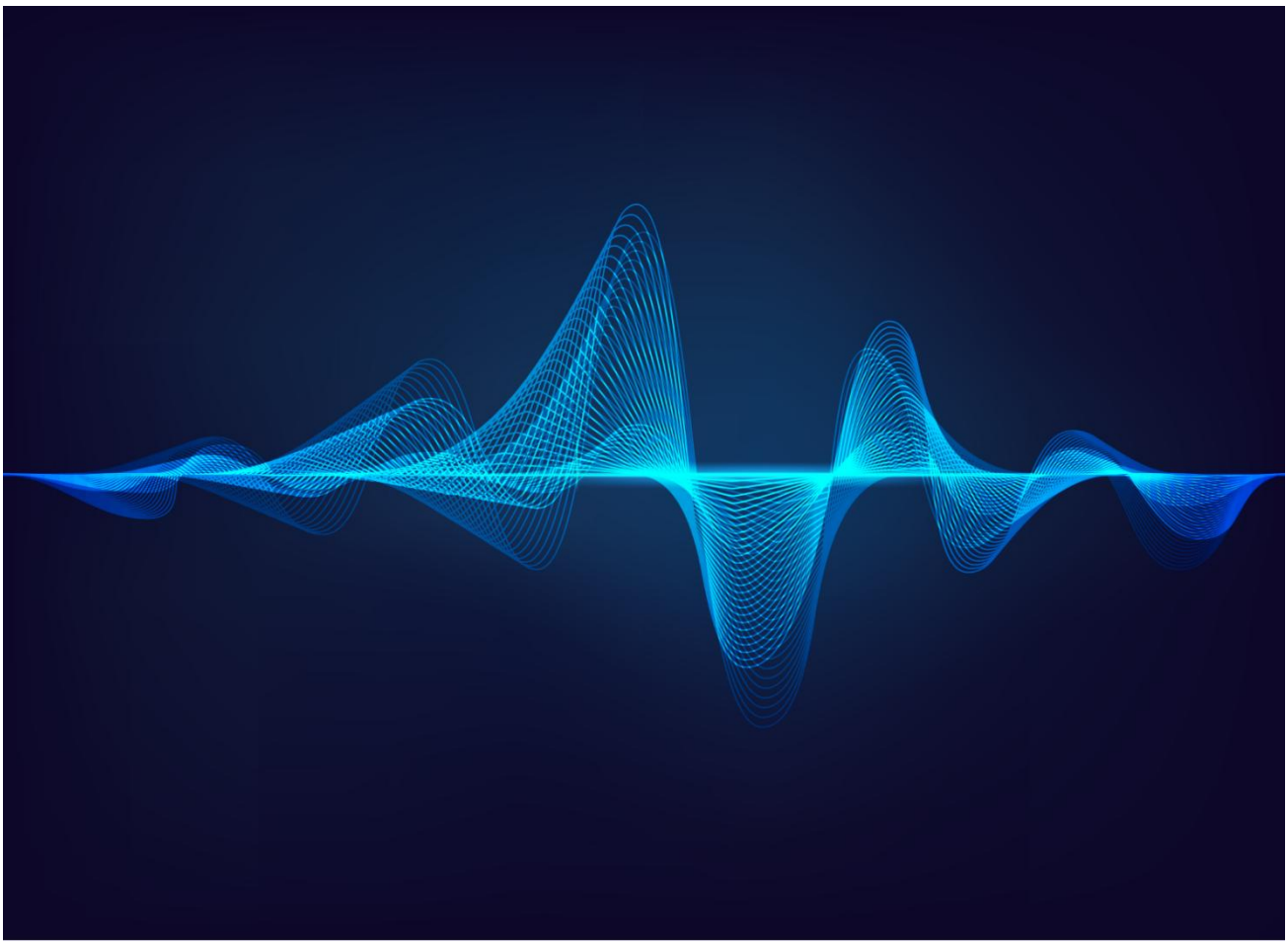

D4.5 – Open Policy Analysis on Innovation in Music

OpenMusE

An open, scalable data to-policy pipeline for European music ecosystems

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Contributor(s):	<Balázs Bodó, UVA; Andreas Schönrock, Heardis! >
Quality check:	< James Rhys Edwards, SINUS >
	< Leo Lahti, UTU >

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Executive Summary

This deliverable, D4.5 – Open Policy Analysis on Innovation in Music, presents a comprehensive examination of innovation trends in the music sector, with a specific focus on music technologies, data governance, and their cultural, economic and policy implications within European music ecosystems. Developed within OpenMusE Work Package 4 (Innovation and Future Trends), the report combines conceptual analysis, participatory knowledge production and applied research to support evidence-based policy reflection.

The first part of the deliverable outlines the broader context in which music-tech innovation is unfolding, highlighting global economic transitions, platformisation dynamics, and the growing influence of data-driven and AI-based systems. It identifies key tensions between technological acceleration and cultural sustainability, emphasising risks related to market concentration, algorithmic bias, fragmented rights infrastructures and unequal access to innovation. Across these analyses, the report consistently foregrounds the need for human-centric, ethical and transparent approaches to music technology development.

Building on this framework, the deliverable presents a structured analysis of insights emerging from the Linecheck Music Tech Summit 2024. By reconstructing the Summit as a knowledge ecosystem, the report captures shared industry concerns and emerging priorities, including the ethical use of AI, the limits of data-driven decision-making, the transformation of A&R practices, investment frictions in music tech, and the persistent gap between digital visibility and live engagement. The Summit analysis confirms that while innovation is advancing rapidly, it remains unevenly aligned with objectives of diversity, fairness and long-term sustainability.

The Annexes of the deliverable deepen this analysis through two complementary contributions:

- The first, developed by the University of Amsterdam – Institute for Information Law, provides an in-depth examination of the music metadata ecosystem, identifying structural, legal and institutional barriers to the creation of authoritative, interoperable and accessible metadata infrastructures. This Annex aligns strongly with D1.3 *Music Metadata Improvement and EU Law*.
- The second, developed by HEARDIS!, presents an applied, metadata-driven case study demonstrating how cultural concepts such as locality can be operationalised within curated in-store music environments through structured metadata enrichment and controlled filtering mechanisms. This Annex provides a public-facing view on the business-confidential work presented in D4.2 *Pilot Study on In-Store Playlist Localization*.

The Annexes provide concrete examples of how the topics discussed in the Music Tech Summit – ranging from metadata infrastructures to artificial intelligence to music information retrieval and music recommender systems – converge in practical research and innovation.

Taken together, the deliverable demonstrates that innovation in music is not solely a technological challenge, but a governance and data infrastructure issue requiring coordinated, collaborative and open approaches. By integrating policy analysis, academic research and applied experimentation, D4.5 contributes to OpenMusE's objectives of promoting FAIR-aligned data practices, supporting cultural diversity and enabling more transparent and equitable music ecosystems across Europe.

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1 Introduction: Global Economic Transitions and Digital Markets

Over the past decade, the music sector has been reshaped by profound shifts in the global digital economy. The transition from ownership-based models to access-based economies has redefined how cultural value is generated, distributed and monetized. This shift is part of a broader reconfiguration of global markets in which platform-based intermediaries have acquired a central and often dominant role. As a result, the contemporary music ecosystem operates within what scholars identify as the platformization of culture: a socio-technical process through which a small number of transnational digital platforms structure the conditions of visibility, discovery, compensation and participation.

Within this transformed environment, capital plays a decisive role in shaping innovation trajectories. Venture capital and private equity investment flows increasingly privilege scalable software solutions over hardware development, privileging business models capable of rapid growth, high automation and low marginal costs. This trend influences the type of technologies that are developed, the geographical distribution of innovation, the expectations placed on music-tech companies and the forms of cultural mediation that take shape as a result. The near-disappearance of hardware startups from recent European pipelines exemplifies this progression: innovation increasingly resides in algorithmic optimisation, data analytics, audience modelling, and AI-driven workflows rather than in tools that interact with the materiality of sound.

Market concentration reinforces these tendencies. A handful of digital platforms orchestrate the circulation of music at global scale, defining rules and parameters that influence production choices, curation strategies and economic outcomes. These dynamics are amplified by what is often referred to as the economics of attention: in a context of content overproduction, economic power does not derive solely from distributing music, but from controlling the infrastructures through which attention is allocated and monetized. As a consequence, the logic of visibility—rather than the logic of cultural relevance—tends to determine which artists, genres and regions become legible within the global market. This structural condition forms the macro-economic backdrop against which music-tech innovation must be interpreted.

1.1 Sociocultural Dimensions of Digital Music

Economic transformations intersect with equally significant sociocultural trends. Audiences – particularly the younger generations – have radically changed their modes of accessing, engaging with and valuing music (for empirical data on the role of platforms in music discovery, see OpenMusE D3.2, Section 2.2). Digital consumption habits have become fluid, hyper-personalized and continuous, producing a relationship with music that is increasingly shaped by context-aware technologies and algorithmic recommendation systems. Listeners oscillate between passive background consumption and highly intentional fandom, constructing hybrid forms of cultural participation that combine digital discovery, community-based interaction, and live experience (see OpenMusE D3.2, Section 2.8).

This hybridity reshapes the meaning of music consumption. On the one hand, streaming platforms enable a historically unprecedented breadth of access; on the other, this abundance generates a condition of saturation in which the sheer quantity of available content surpasses users' cognitive

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capacity to navigate it. The result is what many theorists describe as the paradox of abundance: more music than ever exists, yet attention becomes scarce, leading to hyper-concentration of visibility on a narrow segment of artists. This condition has important cultural implications: it challenges the sustainability of mid-sized careers, compresses audience exploration into narrow algorithmic pathways, and reinforces global patterns over local diversity.

Furthermore, cultural participation no longer occurs solely within the digital sphere. It has become a hybrid practice that includes playlist cultures, social media micro-communities, live performance rituals and digital fan identities. In this sense, music functions not only as a cultural product but as an infrastructure for social connection. Technology mediates these interactions, but it does not replace the underlying human dynamics that give rise to artistic meaning, collective identity and emotional resonance. The sociocultural transformation of music is therefore not simply a matter of new tools, but of new forms of relationality emerging within digital societies.

1.2 Policy Frameworks and Regulatory Pressure

As the music ecosystem evolves, policy frameworks struggle to keep pace with technological innovation. Copyright systems—designed for analog or early-digital environments—face increasing pressure to adapt to AI-generated content, new forms of derivative creativity, and the complexities of digital rights fragmentation. Metadata inconsistencies, attribution gaps and non-standardized practices generate inefficiencies that disproportionately affect independent creators and smaller markets (see OpenMusE D1.3, Section 2). Efforts toward modernization focus on improving transparency, clarifying responsibilities across the value chain, and addressing the structural asymmetries created by digital platforms.

Regulation of artificial intelligence is emerging as a central policy arena. The European Union, through the EU AI Act, is positioning itself as a global leader in regulating high-risk AI systems, transparency obligations, and accountability mechanisms for generative models. These debates have direct implications for the music sector, touching upon training data governance, authorship, creative labour, and the cultural consequences of algorithmic recommendation systems (see OpenMusE *Green Paper on AI, Data Governance, and Metadata Policies for Europe's Music Ecosystem*). Global discussions extend beyond Europe, involving questions of liability, explainability and the ethics of automated decision-making in cultural industries.

Parallel to copyright and AI debates, questions of data governance form a critical axis of regulatory attention. As data becomes the foundation of discovery, monetization and forecasting, concerns emerge around transparency, unequal access, and the risk that cultural diversity may be undermined by opaque and commercially-driven algorithmic systems. Regulatory frameworks increasingly recognize the need for equitable cultural representation, diversity of supply in recommendation pathways and accountability in the use of personal and non-personal data (see OpenMusE D2.2, Section 3.1). In this sense, regulatory efforts should not merely aim to constrain technology, but to reassert the cultural function of music as a public good and a shared resource (see OpenMusE D2.2, Section 4 and OpenMusE D5.7).

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1.3 The Need for Human-Centric Innovation

In light of these transformations, a recurring theme in contemporary research and industry discourse is the call for human-centric innovation (see OpenMusE D2.3 on “Application Layers and System Architecture”). This concept rejects a techno-deterministic approach and instead emphasises the need for technologies that reinforce, rather than replace, creative agency, artistic identity, collective belonging and cultural diversity. Human-centricity implies a set of normative principles—transparency, explainability, accessibility, fairness—that guide the development and deployment of digital tools within the cultural domain.

Ethical innovation models operate within this framework. They advocate for governance structures that consider long-term cultural impacts, inclusive design methodologies that reflect diverse communities, and business models that distribute value fairly across the ecosystem. In the music sector, this translates into promoting tools that enhance artistic autonomy, empower local ecosystems, support community-driven discovery and foster sustainable professional careers.

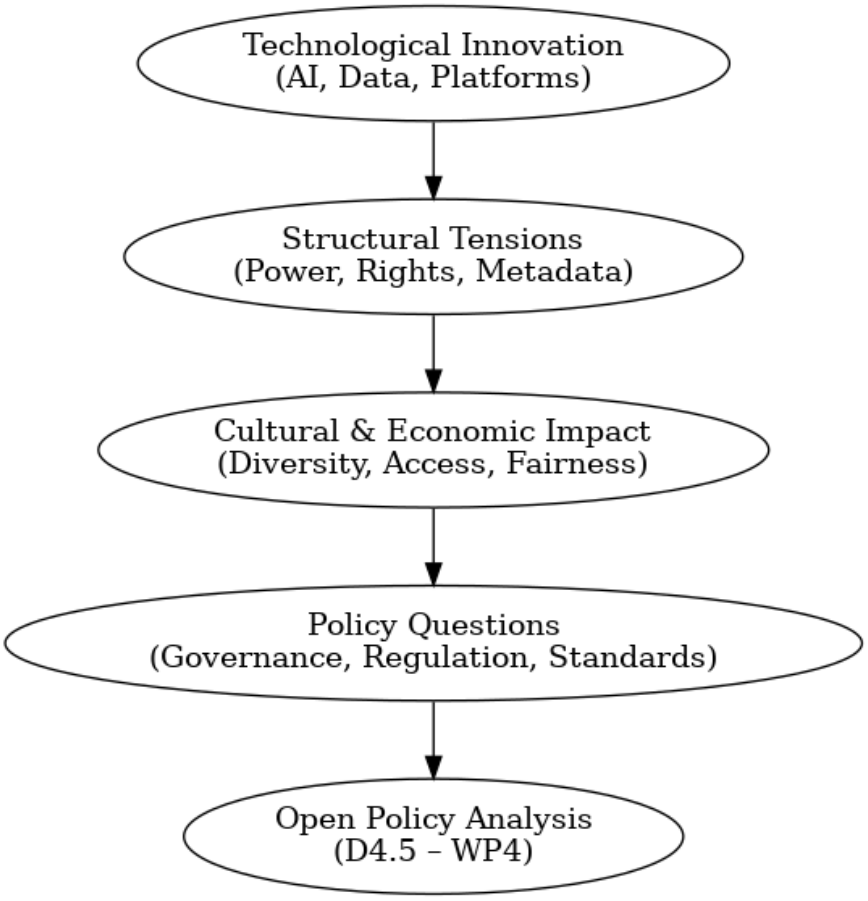

Figure 1 – Conceptual framework linking technological innovation to policy analysis within OpenMusE WP4

2 A Narrative and Analytical Reconstruction

2.1 A Methodological Note: Summits as Knowledge Ecosystems

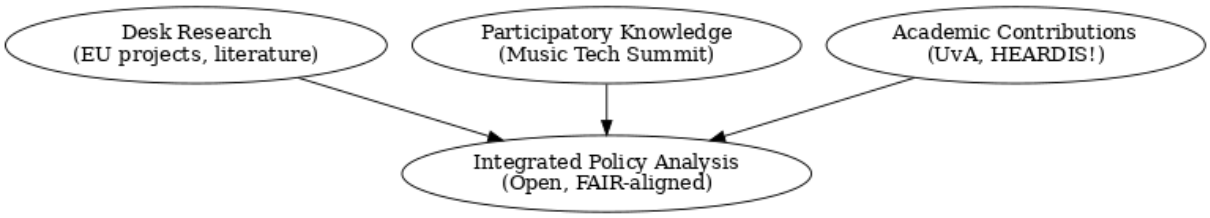

Figure 2 – Methodological framework adopted for the Open Policy Analysis on Innovation in Music.

The Linecheck Music Tech Summit, held in November 2024, can be interpreted not merely as a sequence of panels and presentations but as a **knowledge ecosystem** in which diverse actors—artists, entrepreneurs, researchers, policy-makers and technologists—co-produce discourses, priorities and imaginaries about the future of the music sector. From an analytical perspective, the Summit constitutes a privileged vantage point from which to observe how the industry understands its own moment of transition, how it frames emerging challenges, and how it articulates normative orientations for technological innovation.

This report reconstructs those discourses by adopting a qualitative, interpretive approach: instead of segmenting each session into independent topics, it identifies **recurring patterns, thematic convergences and cross-cutting concerns** that emerged throughout the Summit. The aim is not to provide an exhaustive chronicle of individual contributions, but to capture the conceptual tensions and shared reflections that collectively map the current state of music-tech innovation.

2.2 Human-Centricity as the Foundational Framework

Across the Summit's sessions, one interpretive thread emerged with remarkable consistency: the idea that music remains a human experience, and that technological systems—regardless of their sophistication—must remain subordinate to this principle.

Creativity as relational practice

Participants repeatedly emphasised that creativity cannot be reduced to computational outputs. While AI can recognise patterns, generate drafts, or optimise workflows, it cannot replace the emotional, cultural and relational dimensions that define artistic expression. The Summit presented creativity as a relational practice, involving not just individual artists but communities, contexts and shared cultural narratives.

Live music as the ultimate site of human connection

In discussions on audience engagement, a shared insight emerged: the transition from digital discovery to physical attendance cannot be automated. Live music operates on emotional resonance, social belonging and collective identity—phenomena that resist algorithmic quantification. This view positions technology as a support system for the live experience, rather than a substitute or determinative factor.

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Human-centric innovation as normative orientation

The Summit thus articulated human-centricity not simply as an ethical preference but as a necessary condition for the sustainability of music ecosystems. Tools that diminish human agency risk undermining the very cultural infrastructures they seek to optimise.

2.3 Ethics, Transparency and Equity: Structural Challenges in the Digital Music Economy

Ethics emerged as a transversal theme, cutting across discussions on AI, data, rights management and platform dynamics. The Summit repeatedly highlighted that the digital music ecosystem is characterised by structural inequities rooted in opacity, automation and the concentration of power.

Micropayments and value extraction

The current streaming economy was described as structurally misaligned with creators' needs. Micropayments and opaque royalty flows generate a value chain in which artists receive only a fraction of the revenue their work generates. Emerging technologies often inherit these inequities rather than remedy them.

Opaque algorithms and automated decision-making

Recommendation systems, central to digital music consumption, were criticised for their lack of transparency and accountability. Participants stressed that algorithmic optimisation—narrowly defined around engagement metrics—reinforces mainstream trends and reduces visibility for minoritized repertoires, local scenes and independent creators.

Concentration of power in global platforms

Multiple sessions underscored the dominance of a small number of digital intermediaries that control discovery, distribution and monetisation. These platforms shape cultural supply through proprietary algorithms, closed environments and value extraction mechanisms that leave little room for democratic governance.

Europe's potential role

In this landscape, the Summit positioned Europe as a region with the cultural, regulatory and institutional tools to propose alternative models grounded in transparency, diversity, fairness and sustainability. European values were invoked not as slogans but as operational criteria for future innovation.

2.4 Data: From Strategic Resource to Systemic Noise

The Summit depicted data as both essential and problematic. While data-driven insights are now indispensable for strategic planning, the current ecosystem suffers from data saturation, fragmentation and absence of standardisation.

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The paradox of data abundance

Music companies have access to unprecedented quantities of data—streams, skips, audience metrics, social trends, geospatial patterns—but this abundance often produces noise rather than knowledge. Participants expressed a shared frustration: more data does not equal better decision-making.

Data-informed intuition

A recurring concept was the shift toward "data-informed intuition." Rather than relying exclusively on analytics or on personal judgement, decision-makers increasingly integrate both perspectives, acknowledging that data requires contextual interpretation, cultural understanding and human sense-making.

Data for creativity and experiential design

Beyond strategic purposes, data is also being used as a creative resource. Discussions highlighted the potential of data to inform narrative design, immersive experiences, generative systems and hybrid digital–physical scenographies—reaffirming that data's role extends beyond optimisation into the realm of artistic exploration.

Quality, completeness and reliability

Participants stressed that innovation is limited not by the absence of data but by the absence of reliable, complete and interoperable data. Metadata inconsistencies, proprietary formats and non-standardised attribution frameworks remain persistent bottlenecks.

2.5 AI as Co-Creator, Assistant and Cultural Actor

AI was discussed not as a monolithic category but as a plural set of tools, practices and infrastructures. The Summit's discourse positioned AI primarily as a collaborative agent, capable of supporting creativity while preserving artistic intention.

AI as creative assistant

Emerging tools demonstrate AI's capacity to:

- generate sketches or variations
- assist in mixing and mastering
- support catalogue management
- enhance accessibility and reduce entry barriers

This positioning rejects narratives of replacement and instead emphasises augmentation, support and co-creation.

Transparency and legitimacy

Participants highlighted that the legitimacy of AI systems depends on transparency:

- clear information about training datasets

- explainability of system outputs
- clarity on authorship attribution
- respect for creators' rights

The ethical use of AI was thus framed not as a theoretical concern but as a precondition for sustainable adoption.

Democratisation vs. risk of homogenisation

AI has the potential to democratise creativity by lowering technical and economic barriers. Yet the Summit also warned of a countervailing risk: if trained on mainstream repertoires, AI models could reinforce aesthetic homogenisation and limit cultural diversity. This duality represents one of the central challenges for future innovation.

2.6 Evolving A&R Practices in a "Datafied" Industry

The Summit offered a nuanced view of how A&R is transforming in the age of data saturation.

From intuition to hybrid models

Traditional A&R relied on networks, intuition and long-term observation. Today, decision-making blends those practices with data-driven signals, enabling faster identification of emerging trends and microcultures.

The importance of localisation

Participants stressed that cultural phenomena emerge from specific contexts—cities, neighbourhoods, diasporic networks, linguistic communities. Data may reveal patterns, but understanding why those patterns matter requires cultural literacy and local embeddedness.

Cultural signals over raw metrics

A key insight was the shift from quantitative metrics (followers, streams) to qualitative signals (community engagement, narrative coherence, cultural relevance), which offer more reliable indicators of long-term potential.

2.7 Investment Frictions in the Music Tech Sector

Despite growing interest in music tech, the Summit emphasised that the investment landscape remains contradictory.

High growth potential, high perceived risk

Music tech is viewed as a growing market, yet investors encounter several barriers:

- lack of standardised KPIs
- fragmentation of markets
- long and opaque rights chains

- difficulty scaling culturally specific products

These conditions create a paradox: innovation is celebrated rhetorically but underfunded structurally.

Capital shaping innovation trajectories

Startups increasingly prioritise software models aligned with investor expectations—scalable, low-cost, automation-driven—reinforcing the decline of hardware innovation and shaping what "counts" as innovation in the sector.

Educating investors

Several sessions argued that meaningful progress requires educating investors about the complexity of cultural markets and the need for long-term, context-aware approaches.

2.8 The Streaming–Live Gap: Visibility Without Fandom

One of the most discussed issues was the persistent disconnect between **digital visibility** and **live engagement**.

Streaming ≠ fandom

The Summit underscored that high streaming numbers do not reliably predict ticket sales. Live engagement is driven by:

- emotional connection
- narrative and identity alignment
- community belonging
- local ecosystems

Digital-only strategies rarely translate into long-term fan relationships.

Lack of standardized live data

Live music suffers from limited or inconsistent data, making prediction and planning difficult. Unlike streaming—which is centralised and quantifiable—live performance data remains fragmented across venues, promoters and platforms.

Community-first models

Platforms like DICE were discussed as examples of community-oriented approaches that emphasise trust, transparency and emotional resonance over pure visibility metrics. This reinforces the broader human-centric narrative of the Summit.

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3 Technological Acceleration, Ethical Tensions and Structural Gaps in the Music Sector

3.1 A Sector in Transition

The contemporary music-tech landscape is marked by rapid and intersecting transformations that reshape how music is created, circulated and experienced. As digital markets mature and algorithmic systems acquire a central role in structuring cultural participation, the sector faces a combination of expanded opportunities and deepening structural tensions (see also OpenMusE D1.1 and D3.1). Innovation now operates across the entire value chain, influencing not only technical workflows but also artistic agency, economic models and governance structures. This evolving environment demands spaces for collective reflection capable of connecting technological developments with their cultural, social and ethical implications.

In this context, the Linecheck Music Tech Summit, held in November 2024, offered a timely and valuable opportunity to examine how industry stakeholders interpret and navigate the challenges of this evolving landscape. Rather than presenting isolated topics, the Summit functioned as a discursive arena where diverse themes - AI-assisted creativity, data governance, rights innovation, ethical design, investment dynamics, and the future of live engagement - were brought into dialogue. The conversations that unfolded across its sessions reveal the concerns, aspirations and emerging priorities that currently animate the music-tech ecosystem.

From a methodological perspective, the analysis does not rely on audio or video recordings of the individual sessions. For GDPR-related reasons, the sessions were not recorded or transcribed. Instead, a member of the Music Innovation Hub team attended all Music Tech Summit sessions, taking structured notes and systematically capturing key discussion points and takeaways. This approach enabled the production of an objective account of the debates that emerged, grounded in direct observation. The resulting synthesis is based on these memos, complemented by feedback from OpenMusE project partners who participated in the Summit, and cross-checked against publicly available materials such as panel abstracts, contributor biographies, and other non-personal and non-confidential information submitted during the event.

Building on this analytical framework, the following sections synthesize the insights generated during the Summit, situating them within broader technological and cultural transformations. They outline the key dimensions of the current technological conjuncture, identify the most pressing challenges, highlight promising practices, and reflect on the structural gaps that persist despite ongoing innovation.

3.2 The Technological Conjuncture: From Digital Tools to Cultural Infrastructures

AI, datafication and the reconfiguration of creative work

AI has moved rapidly from experimental frontier to embedded component of the music production and distribution pipeline. Tools supporting composition, mixing, mastering, catalog management and audience modelling illustrate how algorithmic processes increasingly mediate creative and professional practices. This shift reflects a broader trajectory toward datafication, whereby cultural

processes and aesthetic decisions are transformed into datasets to be analysed, interpreted and recombined.

In more than one conversation held in the Music Tech Summit at Linecheck ("Tools and Data for Creative Storytelling"; "Scouting On Data"; "AI Forum") emerged that AI is not only a technological innovation but a cultural actor. From the panel "Predicting the Sound of Tomorrow: Cultural Intelligence and the Future of Music" abstract:

Music is a direct expression of cultural evolution, a living reflection of the ideas, emotions, and movements that define our time. As new technologies enable deeper forms of cultural analysis, the music industry is gaining powerful tools to understand and anticipate these transformations. (From "Predicting the Sound of Tomorrow: Cultural Intelligence and the Future of Music" abstract)

It shapes workflows, influences creative direction and introduces new forms of authorship negotiation. More importantly, it reorganises the conditions under which artistic labour is valued: AI's capacity to recognise patterns or generate preliminary creative ideas prompts reflection on what aspects of creativity should remain irreducibly human.

The decline of hardware and the rise of scalable software ecosystems

A significant pattern emerging from the Summit is the near-absence of hardware in the current innovation pipeline. Whereas music technology historically developed through improvements in instruments, controllers and sound systems, the contemporary landscape is dominated by software solutions designed for scalability, automation and cost-efficiency. This shift aligns with wider investment logics: venture capital tends to favour hyper-scalable platforms over physical tools, shaping the type of solutions that reach the market.

While this evolution democratizes access—software tools are more easily distributed and updated—it simultaneously distances innovation from the embodied experience of sound creation and performance. Participants of two very interesting panels at Linecheck ("From stream to stage: When digital listening turns into live performance"; "Tools and Data for Creative Storytelling") noted that hardware's disappearance has cultural consequences: it narrows the sensory and material dimensions of music-making, focusing innovation on optimisation rather than on expressivity.

Digital infrastructures as cultural infrastructures

The Summit highlighted that the most influential technologies in today's music ecosystem are not tools in a traditional sense but infrastructures. Recommendation systems, metadata architectures, platform governance protocols and rights management databases operate as cultural infrastructures: they organise visibility, access, remuneration and meaning.

These systems embed commercial, algorithmic and regulatory logics that shape cultural trajectories. As one recurring thread in the Summit stressed, the question is no longer whether these infrastructures affect cultural production, but how to govern them in ways that align with cultural diversity, fairness and human agency. These Summit discussions, in which multiple OpenMusE partners took part, were taken into account when drafting OpenMusE D1.3, D2.2, and D5.7.

3.3 Pressing Challenges: Ethical and Structural Tensions in the Digital Music Ecosystem

The ethics of AI in cultural production

Ethical concerns surrounding AI were a central focus across Summit sessions. Key challenges include:

- **opacity of training datasets**, which often contain copyrighted or culturally sensitive material
- **difficulty in attributing authorship** when creative works emerge from hybrid human–machine processes
- **risk of cultural homogenisation**, as AI models trained on mainstream repertoires tend to reproduce dominant patterns
- **asymmetries in access**, where only well-resourced actors can meaningfully influence or audit large models
- **uncertainty in rights ownership**, especially in derivative or AI-assisted works

The Summit's discourse consistently affirmed that AI should function as a **collaborative agent**, supporting rather than replacing human creativity. Based on the main discussions held at Linecheck (and in particular the one on AI "Tools and Data for Creative Storytelling"; "Scouting On Data") it clearly emerges the need of both artists and audience to keep the human factor, keeping technology as a tool more than an actor of the making process:

Often, tech solutions are treated as limited to analytics, used to help to understand the data that is already there. But there is much more. Data can also serve as a bridge between creativity and strategy, inspiring new ways to design, distribute and scale cultural experiences. Instead of replacing artistic vision with 'what resonates best with fans', tools can enhance impact, reach and audience engagement, be enjoyable for artists and their teams, and be part of a unique storytelling process from the very beginning. (From "Tools and Data for Creative Storytelling" abstract)

Maintaining human-in-the-loop frameworks is seen as essential for artistic integrity, diversity, and ethical practice.

Power asymmetries and platform dominance

The concentration of power within a small group of global digital platforms emerged as a structural challenge. These platforms influence which artists become visible, which repertoires circulate globally, and how value is distributed. Their opaque algorithmic systems and proprietary environments create conditions of dependency for creators and intermediaries, restricting their ability to shape their own trajectories.

The Summit revealed a deep unease with these asymmetries:

- smaller ecosystems are structurally disadvantaged
- cultural diversity is subordinated to engagement-driven optimisation

- value extraction mechanisms limit equitable remuneration
- transparency is minimal and governance is external to cultural actors

These conditions create an urgent need for alternative infrastructures that embed transparency, accountability and cultural equity.

Algorithmic bias and the erosion of diversity

A recurrent theme across discussions was the risk that algorithmic recommendation systems exacerbate cultural inequality. As algorithms prioritise efficiency and predictability, they amplify dominant repertoires, invisibilise minority languages and flatten local specificities.

The cultural risks identified include:

- decreased visibility for independent and regional artists
- narrowing of audience discovery pathways
- reinforcement of aesthetic homogenisation
- reduced circulation of niche genres and non-mainstream scenes

Europe, with its plural cultural identity, was often cited (especially in two conversations: “MusicTech and Digital Culture Radical Futures” and “From Stream to Stage: When digital listening turns into live performance”) as having a unique responsibility to counteract these dynamics through diversity-oriented design.

Data saturation and epistemic opacity

The industry is overwhelmed by data—streams, skips, plays, social metrics, sentiment analysis, fragments from TikTok, metadata flows—yet this abundance frequently produces noise rather than insight. The Summit reflected a shared frustration: **more data has not produced proportional clarity**.

Professionals increasingly rely on “data-informed intuition”: a hybrid mode in which human experience interprets patterns and signals that algorithms alone cannot contextualize. This epistemic condition suggests that the challenge is not acquiring more data but improving **data quality, standardization and interpretability**.

Rights fragmentation and metadata instability

Despite its centrality, rights management remains one of the least resolved areas of music innovation. Metadata inconsistencies, incomplete attribution, territorial fragmentation and opaque licensing systems continue to hinder accurate remuneration and complicate the introduction of new technologies.

The Summit highlighted that innovation in this area requires:

- interoperable standards
- transparent attribution frameworks
- decentralised rights registries

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- cross-industry collaboration

Without structural reform, technological innovation risks reinforcing existing inefficiencies. Summit discussions on this topic contributed to policy recommendations made in OpenMusE D1.3 and D2.2.

3.4 Emerging Good Practices: Toward Ethical and Inclusive Innovation

Open-source cultural infrastructures

Open-source models were repeatedly cited as a promising pathway toward a fairer and more accessible ecosystem. Their benefits include:

- transparency in data and code
- shared governance models
- decentralised and collaborative innovation
- reduction of dependency on proprietary systems

For rights management, algorithmic tools, and metadata architectures, open-source solutions offer both cultural and technical advantages. Summit discussions on this topic contributed to policy recommendations made in OpenMusE D1.3 and D2.2.

Human-in-the-loop AI and ethical design practices

Emerging tools reflect a shift from automation to collaboration. Rather than replacing creative agency, well-designed AI systems enhance it by:

- exposing new creative possibilities
- reducing technical barriers
- supporting decision-making without prescribing outcomes
- enabling diverse cultural expressions

Ethical design is positioned as a central criterion for future adoption.

Decentralised governance models

Beyond blockchain as a technology, the Summit foregrounded decentralisation as a governance principle. Its potential lies in redistributing decision-making power, increasing transparency in transactions, and designing rights systems capable of cross-border interoperability.

Participants emphasised that the promise of decentralisation is not purely technical. It is also a normative mandate aligned with the principle of subsidiarity (see article 5(2) of the Maastricht Treaty (ECC) and Article 167 TFEU, analysed in OpenMusE D2.2 Section 3.1). And even more broadly, it is a cultural reimagining of how value, attribution and decision-making circulate in the music sector. In accordance with the Summit participants' informal consensus, OpenMusE D5.7 recommends the

decentralised participatory governance of a future EU musical and cultural data infrastructure, while the OpenMusE *Green Paper on AI, Data Governance, and Metadata Policies for Europe's Music Ecosystem* outlines some concepts of how this could unfold in practice.

3.5 Structural Gaps and Long-Term Challenges

In nearly all panels, regardless of their specific focus, the following structural gaps and long-term challenges were discussed.

Digital literacy and access disparities

Despite growing innovation, access and knowledge remain unevenly distributed. Many artists, small labels and cultural workers lack the expertise to navigate complex tools—limiting the democratising potential of technology. In response to this challenge, OpenMusE suggests engaging the public and rightsholders to improve understanding of both legal and technical dimensions of music data and metadata landscapes (e.g., D2.2, Section 4.3).

Misaligned innovation incentives

Investment models prioritise scalability and monetisation over cultural value, producing innovation that often responds to market pressures rather than artistic or social needs. In response to this challenge, OpenMusE suggests improved coordination of investments across cultural policy domains, including innovation funding (e.g., D5.7, Section 2.2).

Lack of standardisation

Metadata, rights frameworks and technical protocols remain fragmented, inhibiting cross-platform collaboration and slowing the growth of emerging technologies. OpenMusE places a high priority on standardisation of metadata infrastructures on the basis of more assertive interpretations of existing EU laws (e.g., D1.3).

Disconnect between tech development and cultural knowledge

Across the Summit, participants highlighted a pervasive gap between technological development and the cultural ecosystems it affects. Addressing this requires interdisciplinary competence, sector-wide training and new governance approaches. Deliverables D1.3, D2.2, D2.3, and D3.2, in addition to this deliverable, will be handed over to the EU Culture Compass team as materials for interdisciplinary stakeholder engagement leading up to the creation of the EU Cultural Data Hub.

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4 Conclusion

This deliverable has addressed the objectives of OpenMusE WP4 by providing a structured and critical analysis of innovation and future trends in the music sector, with a specific focus on the implications of music technologies for cultural, economic and policy frameworks. By combining desk research, cross-project data validation and direct engagement with the music-tech ecosystem, the Open Policy Analysis on Innovation in Music offers an evidence-based overview of the current state of music-tech innovation in Europe, highlighting both its transformative potential and its structural limitations. The analysis confirms that technological innovation in the music sector is advancing rapidly, yet remains unevenly aligned with broader objectives of cultural diversity, fairness, transparency and sustainability, which are central to the OpenMusE project.

The results achieved in this deliverable demonstrate that while data-driven systems, AI tools and platform infrastructures are increasingly embedded in music creation, distribution and consumption, they also reinforce existing asymmetries in power, access and visibility. The findings underline that innovation trajectories are still predominantly shaped by capital-driven logics and scalability imperatives, often privileging software-based solutions over culturally grounded or community-oriented models. At the same time, the deliverable identifies emerging good practices—such as open-source infrastructures, human-in-the-loop AI models, decentralised rights frameworks and diversity-oriented design approaches—that point toward alternative, more human-centric pathways for innovation. These practices align closely with OpenMusE's objectives of fostering interoperability, accessibility and reuse of knowledge, and contribute to a clearer understanding of how technology can support, rather than undermine, cultural ecosystems (see OpenMusE D1.3, D2.2, D3.2, and D5.7).

From a methodological perspective, the work confirms the value of participatory and network-based approaches to policy analysis. The integration of insights from the Music Tech Summit, together with contributions from European research initiatives, enabled a multi-perspective reading of innovation trends that goes beyond purely technical or market-driven analyses. This approach strengthened the robustness and relevance of the deliverable, ensuring that policy considerations are grounded in lived professional practices and diverse cultural contexts.

Looking ahead, the outcomes of this deliverable suggest several directions for future work within OpenMusE. Further interaction between WP4 and other work packages could deepen the translation of policy insights into practical guidelines, tools and recommendations for stakeholders across the music value chain. In particular, the themes of metadata governance, ethical AI, and data interoperability offer clear opportunities for cross-WP collaboration, especially in relation to capacity building, dissemination and the development of open resources. Moreover, continued dialogue with industry actors, cultural institutions and policymakers will be essential to test and refine the models identified in this report, ensuring their relevance beyond the project's duration.

In conclusion, this deliverable contributes to OpenMusE by framing music-tech innovation not only as a technological challenge, but as a cultural and governance issue that requires coordinated, human-centric and policy-aware responses. The insights generated provide a foundation for future project activities and for broader European discussions on how innovation in music can be aligned with values of openness, diversity and long-term sustainability.

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References

Antal, D. (2025). “A Green Paper on AI, Data Governance, and Metadata Policies for Europe’s Music Ecosystem.” Open Music Observatory. https://doi.org/10.5281/zenodo.17244314

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Annexes

The annexes include background papers that provide additional context and analytical depth. They are shared as complementary materials and do not change the scope, methodology, or conclusions of the main deliverable.

Annex A – Music Metadata: State of Play, Challenges, and Paths Forward

Authors: Prof. Balazs Bodo; University of Amsterdam, Institute for Information Law
Work Package: WP4
Date: 29.12.2025

Executive Summary

The central question of this report is the following: can recent technological innovations, such as blockchains and AI pave the way towards a trustworthy, up-to-date, comprehensive, authoritative, preferably open and accessible music metadata ecosystem?

The report focuses on the currently existing practices, their promises, and limitations. It discusses three different mechanisms of metadata creation and maintenance: closed, institutional; open, peer-produced; and decentralized, trustless forms of metadata curation and their relationship to recent technological innovations, such as blockchain-based decentralized databases, and AI.

In our recommendations we emphasize that:

- High-quality, authoritative, and accessible music metadata underpins discoverability, attribution, licensing, and remuneration.
- Today's ecosystem remains fragmented, inconsistent, and power-imbalanced, with rights-related metadata posing the hardest challenge.
- New technologies (AI, digital distribution) both exacerbate and partially alleviate these issues.
- Past solutions -centralized institutional registries, open peer-produced datasets, and blockchain-based approaches- have delivered partial gains but have not solved rights-metadata at scale.
- A pragmatic way forward combines open collaboration with strong institutional governance and API-based infrastructure.

1 Music metadata – the current state of affairs

In today's digital landscape, metadata is as vital as the content itself. Whether images, audiovisual works, text, or music: comprehensive documentation is essential for discoverability and proper remuneration.

Metadata plays an especially important role in two dimensions. First it is used by algorithmic recommender systems to select and distribute content to end users. Second, without high quality metadata it is impossible to attribute creators, and remunerate rights holders for the use of their works. Use in this context includes pretty much everything, from the use by AI developers during training (Guadamuz 2025a, 2025b) , via the use of works by various middlemen, like digital service providers and venues, to the enjoyment by end-users via various online services, such as Spotify, YouTube, etc (IFPI 2025).

To enable all these different functions, metadata needs to describe as many aspects of a creative work as possible (Muñiz 2025), including, but not limited to:

- authorship related information, such as, in case of music, who is lyricist, songwriter, composer, performer of a piece of music
- descriptive characteristics of a creative work, such as genre, tempo, pitch, language, etc.
- (digital) copy related descriptive information, such as format, quality, DRM status, etc.
- copyright and licensing related information, such as copyright status, rights holders, licenses and licensees, license terms, etc.

Good quality, authoritative, up-to date, consistent, accessible authorship related metadata is necessary to attribute works to their authors, so they can exercise their moral and economic rights. Descriptive, work-, and copy-specific information are used by recommender systems to recommend the works for relevant audiences, contributing to their discoverability (Park 2009; Vellucci 1999). Last but not least, copyright and licensing specific metadata makes remuneration possible, allowing creators and rights holders to enjoy fair compensation for their efforts.

Attribution-, and rights-related metadata occupy a special position among the four different metadata categories. Descriptive, and copy-related metadata are directly observable: it is possible to extract them by deploying various algorithmic tools on a piece of music. This is not the case with the first two types, which describe a relationship between a piece of music and something else, namely the creators and economic beneficiaries of the work. Such metadata is not directly observable, and the relations between works and the creators and rights holders needs to be established, maintained and updated by a dedicated intermediary. This requires special expertise, resources, as well as something, which -for the lack of a better word- we'll call authority: the commonly accepted capacity of an actor to establish the truthfulness, veracity of the piece of information.

1.1 The current state of music metadata ecosystem

The current state of music metadata is highly problematic. On the one hand, existing metadata can be incomplete or incorrect. There are substantial, especially archival and niche repertoires, where metadata is completely missing. For other works metadata is incorrect, or differs across different data sources. These shortcomings result in works not being in circulation, because digital

recommender systems don't have enough information to include them in their recommendations. Missing and incorrect metadata also hiders the distribution of royalties, and licensing.

On the other hand, existing metadata is maintained in a fractured system, where various stakeholders, such as Collective Right Management Organizations (CMOs), digital service providers (DPSs), various private intermediaries (such as distributors, agents, publishers, labels, as well as public database maintainers such as Musicbrains or Discogs etc.) maintain metadata on various fragments of the global repertoire. Fragmentation is both the product old, and the cause of new power imbalances between various stakeholders in the value chain. As we discuss this topic in more detail later, in the age of physical distribution, local, broadcast technology based media markets, and a few, vertically integrated global media conglomerates, collecting societies, and recording companies enjoyed an outsized economic power, and a corresponding capacity to build and maintain music metadata. This system, despite repeated efforts, failed to produce a unified global repertoire database (Andersen, Kozul-Wright, and Kozul-Wright 2000; Berklee College of Music 2015). Since the digital revolution, a few oligopolistic DSPs emerged as dominant players in the streaming market which now dominates global music industry revenues. On their path to dominance they built comprehensive metadata sets on the repertoires they distribute globally, but just like their predecessors, they also lack economic or legal incentives to make that information accessible to others. In other words there are substantial economic and power-related incentives to preserve the current situation across very different technological and economic situations, where metadata, especially rights related metadata is concentrated in the hands of a few stakeholders, which have little reason to either interconnect, or open their datasets as an openly accessible public resource.

We should also note a third, related development in the music industry, which is the transformation of music rights into a financialized commodity. Rights, which have originally been vested in creators are increasingly gobbled up by financial investors, who see them as any other commodity, where financial investment can yield reliable returns. This process removes rights from within the music traditional domain of the music industry (recording companies, publishers) and transfers them to the domain of financial investment and speculation, further weakening the chances of the emergence of open, shared metadata as a public resource.

1.2 The problem in context: the original sin of music metadata

The current, hyper-fragmented metadata situation has deep legal and historic roots, leading back to 1886, the establishment of the Berne Convention for the Protection of Literary and Artistic Works. This international agreement harmonizes the protection of literary and artistic works among the currently 181 signatory countries. Its provisions are now also embedded in a number of other copyright- and authors rights-relevant global agreements, such as the World Trade Organisation's Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS).

Article 5(2) of the Berne Convention states that the "enjoyment and the exercise of these rights shall not be subject to any formality". The rights in this provision refer to the rights of authors, including their economic rights, while formality, in practice means any act of registration. In other words, authors can enjoy their rights without them having to register their creations before making them public. As a consequence, only a few public copyright registries exist (van Gompel 2011).

One exception is the USA, where, due to the particularities of its copyright laws, the Library of Congress still acts as the copyright registrar. That, however, doesn't mean that the country has a comprehensive copyright registry. Since 1989, the US is also member of the Berne Convention, meaning that registration is not mandatory. As the Berne Convention it the de facto international

framework spelling out the legal conditions of authors' rights, even if there are countries where copyright registries exist, if they have also joined the Convention, such registration is not mandatory, and therefore the existing public registries are incomplete.

In sum, we lack the global legal frameworks, incentives or obligations to create public registries of copyrighted works. This creates problems for the whole spectrum of music metadata: there is no authoritative and public knowledge of neither the works, nor the authors, neither the descriptive, nor the rights related metadata. In absence of such registries, only private initiatives can fill in the gap. Which of the private parties are best positioned to know who owns what, depends on economic, and technological factors. AS we mentioned earlier, various bottlenecks in the value chain of the production and distribution of musical works can create powerful intermediaries in oligopolistic positions who have the economic resources, incentives, and technical capabilities to build up comprehensive metadata-sets, both descriptive and rights related.

This brief overview also points to the oversize importance of rights-related metadata in the overall metadata domain. Since there is no remuneration without rights-related information, the biggest (economic) incentives are around the production of that kind of metadata, but mostly at the most valuable parts of the repertoires, and at the most powerful intermediaries. Less valuable works, and less resourceful intermediaries are struggling with creating high quality datasets, as the persistent problem of "black box royalties" suggest. Black box royalties are those which have been collected, but cannot be attributed to the appropriate rights holders due to the lack of data (Rumalla 2017). This is an especially acute problem for smaller CMOs, who, lacking expertise and resources are struggling to claim and remunerate repertoires they manage, perpetuating and amplifying long-standing inefficiencies (Arenal et al. 2024).

Building reliable rights-related metadata in theory also produces authorship and descriptive metadata as well. But this effect doesn't work the other way. As we'll see, descriptive and attribution related metadata can be collected and maintained in a number of ways, but these efforts cannot reliably build a rights-related dataset. For this reason, we'll first focus on the complexities around building rights metadata sets, and in the next step we review how other sorts of metadata are being produced.

1.3 A brief overview of the music copyright landscape

In order to understand the full depth of the problems related to the lack of good copyright right based metadata, we need to briefly understand the extreme complexities of copyrights in the music sector.

First, there is a complexity around all the rights that emerge with each song which is produced. Various international agreements and different national jurisdictions assign exclusive economic and/or moral rights to

1. The songwriters and composers of a song,
2. the music publisher (in case the authors have publishing agreements)
3. the performers featured in the recording, and
4. the owner of the sound recording (for example a label or record company).

In some cases, some of these rights are exercised individually, in other cases (such as radio play) they are exercised through an intermediary, such as CMOs, usually an association of creators, but in some jurisdictions independent economic entities. In some cases the collective management of rights is

mandated by law, in other cases they are arranged voluntarily through contract. Some of these rights, in certain jurisdictions are transferable (meaning they can be alienated), in other cases, the right holder can only license certain uses. (Liebowitz and Watt 2006; Loren 2002; Quintais 2017).

A right related metadata system thus would thus need to fulfill multiple functions: the documentation of the original allocation of rights; tracking how these rights have been assigned to different intermediaries with regards to different works; keeping track of all the licenses the different rights rights holders granted. This last exercise is especially complex. The use of music can be licensed in a myriad ways: different uses, in different territories, for different lengths of time, with different restrictions and financial conditions. For example, a song can be used in one territory, for a limited time, by a particular actor, for a specific purpose – think of a popular song being used in an advertising campaign; while the same song is licensed to a theater production or a symphonic orchestra touring another part of the world, while a DSP is streaming it a third territory. Since such licensing agreements can conflict with each other, knowing who the relevant rights holders are is often only one piece in a complex information landscape, and may tell little about whether a work is available for licensing certain uses. Keeping track of who, where, under what conditions, for how long, for what purposes has an exclusive or non-exclusive right to use which parts of a recording/musical composition adds an immense amount of complexity to the licensing landscape, especially that many of these licensing agreements are taking place through both through legal mandates (as is European CMOs licensing broadcast use) and private, contractual arrangements. (Bodó et al. 2018; Guibault 2009; Guibault, Salamanca, and van Gompel 2015) . In summary, the legal landscape around music suffers from:

- a fragmentation of rights related to musical works
- a fragmented, heterogeneous regulatory landscape consisting of multiple, not fully overlapping international agreements, and different rules in national jurisdictions
- a fragmented institutional landscape, where multiple organizations administer different (bundle of) rights for different uses, creating a tragedy of anti commons (Heller 1998)
- a fragmented economic landscape where different uses require different bundle of rights from controlled by different stakeholders.

This (at least) four-dimensional fragmentation is the main cause of the problems in the rights related metadata-space, manifesting in inefficiencies, lost opportunities and revenues. Arguably, right related metadata represents the worst case scenario in terms of the complexity of the data to keep track of. But even in simpler cases, problems of incomplete, conflicting or missing data persists.

In the following we list some of the main characteristics and problems of the current metadata system, with a special emphasis on the rights-related metadata.

Metadata is inconsistent and incomplete. Data has often been manually entered into numerous siloed databases across various intermediaries, leading to significant human error, inconsistencies, and omissions. For instance, it may be difficult to standardize the orthography of names, as is the case with Tchaikovsky having over 70 different spellings (Torbensen and Ciriello 2019). Despite industry standardization efforts, such as the International Standard Musical Work Code (ISWC), the International Standard Music Number (ISMN), the Global Release Identifier (Grid), or the International Standard Recording Code (IRSC), inconsistencies and data conflicts are persistent, and there are still aren't any single points of truth or universally agreed-upon standards which could make these errors possible to detect and correct (Ciriello et al. 2023)

This inaccurate data generates problems for attribution and remuneration. Inaccurate metadata makes it difficult or impossible for collection societies to match music usage data to the correct rights holders. This results in massive delays in royalty payouts, with various estimates ranging from several million to billions of US dollars annually in various markets for various uses.

Data fragmentation results in opaque and inefficient royalty pipelines. The process of collecting and distributing royalties is notoriously complex, slow, and non-transparent, involving a multitude of intermediaries, including record labels, music publishers, Collective Management Organizations (CMOs), Performance Rights Organizations (PROs), and digital service providers (DSPs), each storing song data differently and taking a share of the revenue (Pech 2020; Sharp and Lobel 2022) These parties are sometimes locked in outdated data-sharing structures, such as sending large data files back and forth between different entities, create massive overhead. Ciriello et al (2023) quotes one business expert saying, "...the same amount of data is being transported every month [multiple] times, instead of just having one repository that you query every time you get something new" . This leads to payment delays even when the royalties can be attributed. Fragmentation is also limiting transparency. Rights holders often receive little to no information on how often their works are used or how revenues are calculated, preventing them from verifying royalty payments

Data fragmentation results in problems with rights holder remuneration. The combination of industry structure and technological platforms results in creators receiving a reduced share of the value their work generates. Bottlenecks at the last mile, controlled by a few DSPs limit the price setting power of rights holders, while the growing layer of intermediaries are eating into rights holders' revenues.

Fragmentation creates the institutional roadblocks to data sharing. Withing this fragmented landscape entities controlling the information over the largest markets, and/or repertoires have little incentives to enter into data sharing agreements with smaller stakeholders representing low-value markets and/or smaller, niche repertoires (such as collecting societies in Central and Eastern Europe). As they see their control over metadata as a moat around their economic power, they may also have limited interesting in cooperative with each other.

1.4 New challenges posed by technological innovation in a rapidly shifting industry

So far we have discussed the challenges that have plagued the creation and maintenance of a comprehensive and accessible music metadata system up until recently. These problems have not been solved, and in the meanwhile a number of transformations are underway which further complicate and already difficult institutional, political, economic, and technological landscape. These include 1) the emergence of AI systems which can be used to identify existing works; 2) generative AI systems which can generate music *en masse* with very little costs; 3) the further fragmentation of the music industry landscape due to the democratization of music creation on the one hand; and the 4) extreme concentration of economic and symbolic power at certain points in the value chain.

The emergence of Artificial Intelligence systems is both an opportunity and a threat for the music industry. AI systems can be used in their analytical or generative capacities in the music sector. AI as an analytical tool can be used to generate some of the missing descriptive metadata, such as the digital fingerprinting of works, and the detection some of the basic characteristics of a work, such as pitch, tempo, genre, instrumentation, potentially the lyrics, its language, transcription, etc. AI systems can also identify new recordings if there is a match with an already existing entry in its fingerprint database, as is the case with systems operated by Shazam, or YouTube. Though a useful tool, AI generated information can be unreliable, and therefore cannot be used without some level of

human oversight to be authoritative. Such need for ex-post human verification requires either centralized, institutional, or peer-produced resources (Bonjack and Trujillo 2024; Yang et al. 2025).

Generative AI systems can produce new music. In recent news, AI produced, or AI assisted works have been increasingly present in various charts (Molloy 2025; Zellner 2025). AI generated music has several “advantages” over the traditional repertoire: it can be cheaper to produce thus license, it can be produced *en masse*, which means that AI generated works can flood digital distribution channels, and they come with complete metadata (Robinson 2025). This may create a situation where – unless some conscious action is taken against such AI generated work – traditional, human creativity is competing against AI generated works both for distribution (visibility) and remuneration (CISAC 2025).

The democratization of music production knowledge and technologies, alongside with the easily accessible digital distribution channels generated vast opportunities for the digital native generations, who can create high-production-value music and distribute it globally unlike any other generation before. This development was partly also made possible by the fact that the traditional gatekeepers of the industry, mainly recording companies, but also radio stations and physical distributors could be bypassed. This, on the one hand has brought immense amount of creativity to the market, on the other hand came with the hidden costs of further fragmenting the metadata-space.

Meanwhile, the new, digital distribution technological and value chains started to consolidate. At the “last mile”, digital service providers such as Spotify amassed immense market power through their control of the “ears” of music consumers; through their access to both legacy and new creative works; through their recommender systems; and their capacity to provide immense revenues to rights holders. Below them, new intermediaries who provide digital-distribution-related services to creators are also starting to concentrate. Digital distributors, such as DistroKid, TuneCore, CDBaby, AWAL provide comprehensive services to unsigned artists from getting music to streaming services to distribution and marketing on social media. They are emerging as private - and often more transparent and responsive - alternatives to traditional CMOs, with the undesirable externality of the further fragmentation of the metadata-space.

In summary, the rapid technological innovation in music production and distribution created a paradoxical situation, which can be described both by fragmentation and concentration. The democratization of music production, and the ease with which AI can “create” music created a rapdily goring influx of new music; the slow decline of traditional intermediaries, such as radio stations and record companies created a power vacuum, quickly filled by a myriad of entrepreneurs trying to provide digital services for creators. On the other hand, new bottlenecks emerged in the value chains, especially at the last-mile, shifting relative economic, negotiation and data power. The newly emerged fragmentation in other parts of the value chain also generates strong incentives of centralization, with cut-throat competition to be the dominant player in these markets.

2 A problem (still) looking for its solution

Under these conditions, it is quite clear that the music industry as a whole, and especially the less powerful stakeholders, which include individual artists, custodians of smaller repertoires, as well as innovators and new entrants to the music distribution, or rights management domains would benefit strongly from a publicly accessible, comprehensive, authoritative, up-to-date database which can reliably identify and link together creators, rights holders, works, and various copies. Such a public dataset would create a level-playing field, where competition would not be defined by who has

access to better data, but on the quality of services: recommendations, revenue streams, ease and cost of doing business, customer service, etc.

2.1 Prior efforts to create comprehensive music metadata spaces

This recognition has fueled several efforts to create such a database. These efforts can be grouped into three categories: 1) centralized, institutional efforts; 2) open, peer-reviewed efforts; and 3) primarily technological, decentralized efforts.

Centralized, institutional efforts include multiple, ultimately failed projects by CMOs to aggregate music metadata into a shared dataset. Past efforts include the International Music Joint Venture (1998-2001), founded by the Dutch CMO BUMA/STEMRA and its UK and US counterparts PRS and ASCAP; the International Music Registry (2011), founded by the World Intellectual Property Organisation (WIPO); or the Global Repertoire Database, which included PRS, and other European and US CMOs, as well as Google and iTunes amongs its 80 members. All of these initiatives failed mostly due to organizational infighting, and the fundamental disincentive of powerful stakeholders to weaken their relative position by sharing the information under their exclusive control (Andersen, Kozul-Wright, and Kozul-Wright 2000; Berklee College of Music 2015).

While all of the rights holders' initiatives have failed, there has been significant concentration of rights and metadata processing expertise in the hands of a number of other intermediaries. These include, of course the growing power of digital service providers such as Google (YouTube), Apple (iTunes), or Spotify, who, as distributors, have to deal with, therefore had to build up powerful capacities to identify musical works, and maintain metadata for the purposes of identification and rights management. In addition, a number of private intermediaries emerged which provide matching technical expertise to process DSP data, while acting as rights management and licensing intermediaries. Blokur is a UK based music rights and data platform providing global music reporting and licensing for digital products and services. Mint is a joint venture between SESAC the US Music Rights Organization, and SUISA. the Swiss collective management organization. Mint provides multi-territorial licenses for online music services on behalf of publishers, CMOs and Independent Management Entities (IMEs). Unlike European CMOs, which are under the control of their artist members, SESAC is owned by the Blackstone group, a private equity company with more than US$1.13 trillion worth of assets under management.

The developments in this category are pointing to two trends. On the one hand, traditional CMOs who are closest to individual artists, and have the biggest stake in the health of the music ecosystem proved to be unable to overcome the economic and political hurdles which would position them as a central player in the music metadata ecosystem. On the other hand, new, private intermediaries have managed to build up and successfully market the infrastructure and expertise required to process data from the digital distribution pipeline, and used this as a leverage to build up substantial and growing metadata and licensing power. This signifies a slow but steady shift of power away from the traditional stakeholders in the ecosystem towards intermediaries which often follow incentives independent from the overall industry, and its least powerful players.

Open, peer-produced datasets constitute the second group of efforts to create a comprehensive metadata set. With the advent of CDs, internet, online file-sharing and web2, a number of initiatives sprung up to help individual users to identify the music they ripped from CDs or downloaded from the internet. In the spirit of the times, these efforts rely on open collaboration, the same way as Wikipedia (Benkler 2006; Lessig 2004). A few entrepreneurs realized that they can crowd-source the creation of comprehensive metadata sets to internet users if they open up both the dataset and the

ability for individuals to add, edit, rectify or amend the information in these datasets. Fully open and peer produced datasets such as those maintained by Wikidata, Musicbrainz, Discogs, or the now-defunct CDDB and its successors, as well as freely accessible, but commercial datasets such as AllMusic or WorldCat allow both the interconnection of these datasets, and the necessary resources to provide authoritative, and up-to-date metadata over millions of artists, works and recordings. The shortcoming of these efforts, however, is that they do not contain rights related information, only descriptive data, making them an indispensable, but in and by themselves incomplete solution to the metadata problem.

Blockchain and smart-contract based efforts constitute the third set of approaches which tried to address the metadata problem in recent years. Blockchains are a set of technologies which allow the maintenance of a shared database without relying on a central authority. Some variants, such as the Ethereum system allows the definition of data standards spelling out the exact format of metadata that can be stored on the system, as well as the automation of certain transactions based on the data and external information. In technical terms, such a system was envisioned to be capable of providing the technological infrastructure for a global metadata database, containing both descriptive and rights-related metadata, with the added benefit of automating rights management transactions and remuneration after uses (Arenal et al. 2024; Bodó et al. 2018; Bonnet and Teuteberg 2023; Buoni Pineda 2024; Buzu 2020; Ciriello et al. 2023; Finck and Moscon 2019; Gupta, Yadav, and Jain 2021; Hardjono et al. 2019; Krasikov 2022; Mohsin and Muhajjar 2025; Morrill 2021; Pech 2020; Torbensen and Ciriello 2019). As we discuss later, blockchain based efforts also proved to be a dead-end, not only because of the unresolved technological issues, but also because the metadata problem is not primarily a technological one, but an institutional, and therefore a purely technical solution without the accompanying institutional changes was doomed to fail.

2.2 A comparison of the three different approaches

What these aforementioned three approaches have in common is the recognition that a comprehensive metadata database can only be the result of a collaboration between a wide set of stakeholders. What they differ in is how they envision the technological and institutional design of such a collaboration. The different design choices also have a fundamental impact on the value of the resulting dataset, defined as the comprehensiveness and veracity of the data contained in the database, the authority of the dataset.

The creation and maintenance of truthful and authoritative datasets is a resource-intensive enterprise. The institutional approach relies on resources within the institution, while peer-produced and blockchain-based approaches rely on external resources: the expertise, time, enthusiasm, engagement of every- and anyone who is willing to add, review, curate data in an open database. At the time when Wikipedia first emerged, the main debate was whether such an open knowledge base can be as authoritative as traditional encyclopedias with their dedicated experts and editors. In the years since, it has transpired that the answer is yes: peer-produced, shared and open knowledge bases can emerge as authoritative sources of information, but not without reproducing the same internal quality assurance mechanisms (vetted editors, serious budgets, detailed and comprehensive rules, error correcting and dispute resolution mechanisms) as their more centralized counterparts from a previous era (O'Neil 2011).

In short, successful peer production requires both suitable, easy-to-use, frictionless technological infrastructures, which can successfully facilitate collaboration, and a substantial degree of institutionalization, with corresponding formalization of the governance of the resource, and the organization of the collaboration processes. Easy, open collaboration is vulnerable to abuse (in forms

of spam, vandalism, malicious injection of misleading information), therefore good and comprehensive institutional safeguards are needed to maintain the quality of the information, and the authority of the dataset as a whole.

Blockchain-based innovation focused on disintermediation, and automating as much of the governance process as possible. Its main starting point is open collaboration between anonymous parties to create a shared data resource, however, it aimed to replace institutional governance structures with automated, or automatable ones. This, in practice meant the creation of data standards tailored to the copyright metadata space, and the smart-contract based automation of transactions. Though there was much initial interest in this approach, by now we can safely say that such a solely technology focused approach is a dead-end. First, the copyright-relevant metadata standard initiatives failed to pass the proposal stage (Grimmelmann, Ji, and Kell 2022; Patka and COALA Licensing Taskforce 2022). Second, it turned out that blockchain technology is still too burdensome and complicated to facilitate a frictionless maintenance of a shared database. It is relatively easy to add new information to the shared database stored on the blockchain, especially if one goes through a dedicated intermediary, but it is much harder to alter, edit, rectify, update that information if it is incomplete or incorrect. This task is much easier to do on other technical infrastructures, such as centralized databases or wikis. Which leads to the third, and probably the biggest problem: without institutional gatekeepers, who can check the veracity of the information added to the dataset; and without an easy way to correct mistakes, there is no straightforward way to create an authoritative information source on the platform (Bodó et al. 2018; Bodó and Poort 2024). Lastly, while the technology was designed to facilitate cooperation between parties who do not trust each other, the unavoidable need for institutional support brought the need of parties having to trust each other. The failure of blockchain based projects among big institutional stakeholders proved that a trustless technical infrastructure cannot address the lack of trust among institutions which still need to trust each other in order to collaborate on a trustless platform.

3 Conclusions and recommendations

Based on the overview above, we can start to summarize the technological and institutional conditions which could pave the way towards some sort of solution of the metadata-problem. In particular, our focus will be on what institutional actors with less resources can do to strengthen their position in the global ecosystem.

Comprehensive and authoritative music metadata is a collaborative enterprise. Due to the fragmented ecosystem, and the extremely resource-intensive nature of the task at hand, no party alone can hope to produce an authoritative metadata database, neither purely descriptive, and especially not one focusing on rights-related information. Collaboration efforts far have followed three dominant patterns. First, closed, institutional efforts seem to suffer from so far insurmountable hurdles of mistrust and lack of proper incentives among parties, and consequently they failed. Peer production was able to achieve stellar results in terms of data volume and quality, but only in metadata domains where the collaborative production and aggregation of metadata was possible without relying only on creators and rights holders, and allowed the participation of the wider public.

Lack of collaboration strengthens third parties with interests potentially misaligned with authors and rights holders. The lack of collaboration and resource sharing, especially among CMOs, resulted in the emergence of private parties who are able to aggregate the fragmented resources (expertise, data, rights). In essence they achieve what a collaboration between these parties could achieve, with the not inconsequential difference that CMOs which in a cooperation would be (more or less) equal

partners, in such an arrangement are price-taking clients, still isolated from each other, and also in a much weaker governance position, when it comes to setting the terms of agreements.

Collaboration, conducted under the right conditions can mobilize substantial external resources. Peer-produced metadata resources are made possible by a large number of voluntary contributors donating time and expertise to a shared resource. This requires openness both in practice and spirit: an open technological infrastructure, and a governance approach which allows and encourages external contributions in exchange for the use of the collaboratively produced resource.

Collaborative efforts still need strong institutions and suitable technologies at their cores. Without dedicated institutional resources, peer-produced resources remain vulnerable in terms of data quality and sustainability. The technological infrastructures must be suitable for open collaboration, but cannot be trustless, i.e. fully decentralized and disintermediated. By all accounts, an open API based centrally maintained and appropriately mirrored database is the way forward in infrastructural terms.

Based on these observations we can formulate some recommendations, which may be helpful to navigate a rapidly changing music ecosystem, especially for smaller stakeholders:

While outsourcing technical and rights management services to commercial third parties may seem an attractive proposition, it should not replace internal capacity- building at creator controlled organizations, especially in the long term. In the mid- to long-term, traditional CMOs need to maintain existing, and build up new technical capacities and expertise in the digital music ecosystem, including data management and analysis expertise.

Open collaboration is an extremely powerful modus operandi, and can bring in substantial additional resources, but it requires a shift in institutional attitudes. Openness can mobilize substantial external resources through peer production. Contrary to expectations, it doesn't need to come at the expense of relinquishing control over a peer-produced dataset. On the contrary, such data still needs strong, authoritative institutions, which can safeguard the quality of the peer produced dataset. But it is true, only an open dataset can be peer produced, and such openness may require the reevaluation of institutional priorities, especially for smaller players.

AI can be a powerful tool, but without proper control, and supervision it can do more harm than benefit. Peer production can provide that oversight. AI systems can do a lot of the work that still needs to be done, from enriching existing metadata, to suggesting new ones. But AI systems are not reliable enough to do that work without proper supervision and human oversight. This needs, again, resources which smaller players may or may not have. AI, coupled with peer production, however may allow the extensive use of AI systems without the feer of data quality degradation.

Create an institutionally controlled, but API accessible comprehensive metadata database. Such an approach would allow both control and collaboration through interconnection. APIs, or Application Programming Interfaces allow controlled access to a resource. It allows third parties to contribute to and use a resource, if they match certain criteria both technical (data formats and standards) and institutional. It also allows the interconnection of different systems, and data replication.

2 References

Andersen, Birgitte, Zeljka Kozul-Wright, and Richard Kozul-Wright. 2000. *Copyrights, Competition and Development*. *UNCTAD Discussion Paper*. UNCTAD/OSG/DP/145. Geneva, Switzerland: UN Trade and Development.

Arenal, Alberto, Cristina Armuna, Sergio Ramos, Claudio Feijoo, and Juan Miguel Aguado. 2024. "Digital Transformation, Blockchain, and the Music Industry: A Review from the Perspective of Performers' Collective Management Organizations." *Telecommunications Policy* 48(8):102817. doi:10.1016/j.telpol.2024.102817.

Benkler, Yochai. 2006. *The Wealth of Networks : How Social Production Transforms Markets and Freedom*. New Haven: Yale University Press.

Berklee College of Music. 2015. "GRD's Failure – Music Business Journal." https://www.thembj.org/2015/08/grds-failure/.

Bodó, B., D. Gervais, and J. P. Quintais. 2018. "Blockchain and Smart Contracts: The Missing Link in Copyright Licensing?" *International Journal of Law and Information Technology* 26(4):311–36. doi:10.1093/ijlit/eay014.

Bodó, Balázs, and Joost Poort. 2024. "The Emperor's New Collectibles." Pp. 234–48 in *NFTs, Creativity and the Law*. United States: Taylor and Francis Inc.

Bonjack, Stephanie, and Nicole Trujillo. 2024. "Artificial Intelligence and Music Discovery." *Music Reference Services Quarterly* 27(1):1–9. doi:10.1080/10588167.2023.2287924.

Bonnet, Severin, and Frank Teuteberg. 2023. "Impact of Blockchain and Distributed Ledger Technology for the Management, Protection, Enforcement and Monetization of Intellectual Property: A Systematic Literature Review." *Information Systems and E-Business Management* 21(2):229–75. doi:10.1007/s10257-022-00579-y.

Buoni Pineda, Marianna Vanessa. 2024. "New Entrepreneurial Strategies Using the New Technologies of Artificial Intelligence and NFT in the Field of the Music Industry." *Journal of Digital Economy* 3:260–74. doi:10.1016/j.jdec.2025.05.001.

Buzu, Irina. 2020. "Blockchain, Smart Contracts and Copyright Management Disruption Protection of IP Rights." *Intellectus: Journal of Intellectual Property, Science and Education* 2020(3–4):63–70.

Ciriello, Raffaele Fabio, Alexandra Cecilie Gjøl Torbensen, Magnus Rotvit Perlt Hansen, and Christoph Müller-Bloch. 2023. "Blockchain-Based Digital Rights Management Systems: Design Principles for the Music Industry." *Electronic Markets* 33(1):5. doi:10.1007/s12525-023-00628-5.

CISAC. 2025. *Global Collections Report*. Neuilly-sur-Seine, France: International Confederation of Societies of Authors and Composers.

Finck, Michèle, and Valentina Moscon. 2019. "Copyright Law on Blockchains: Between New Forms of Rights Administration and Digital Rights Management 2.0." *IIC - International Review of Intellectual Property and Competition Law* 50(1):77–108. doi:10.1007/s40319-018-00776-8.

van Gompel, Stef. 2011. *Formalities in Copyright Law: An Analysis of Their History, Rationales and Possible Future*. Alphen aan den Rijn: Kluwer Law International.

Grimmelmann, James, Yan Ji, and Tyler Kell. 2022. "ERC-5218: NFT Rights Management." https://eips.ethereum.org/EIPS/eip-5218.

Guadamuz, Andres. 2025a. "Communication to the Public Is about to Shape the Future of AI Copyright." https://www.technollama.co.uk/communication-to-the-public-is-about-to-shape-the-future-of-ai-copyright.

Guadamuz, Andres. 2025b. “Victory for GEMA in Germany against OpenAI.” https://www.technollama.co.uk/victory-for-gema-in-germany-against-openai.

Guibault, L., O. Salamanca, and S. van Gompel. 2015. *Remuneration of Authors and Performers for the Use of Their Works and the Fixations of Their Performances*. http://www.ivir.nl/publicaties/download/1593.pdf.

Guibault, Lucie. 2009. “Relationship between Copyright and Contract Law.” Pp. 517–42 in *Research Handbook on the Future of EU Copyright*, edited by Estelle Derclaye. Cheltenham: Edward Elgar.

Gupta, Nirmal Kumar, Anil Kumar Yadav, and Ashish Jain. 2021. “Using Blockchain for Digital Copyrights Management.” in *Blockchain for Information Security and Privacy*. Auerbach Publications.

Hardjono, Thomas, George Howard, Eric Scace, Mizan Chowdury, Lucas Novak, Meghan Gaudet, Justin Anderson, Nicole d’avis, Christopher Kulis, Edward Sweeney, and Chandler Vaughan. 2019. “Towards an Open and Scalable Music Metadata Layer.”

Heller, Michael A. 1998. “The Tragedy of the Anticommons: Property in the Transition from Marx to Markets.” *Harvard Law Review* 111(3):621–88.

IFPI. 2025. *IFPI Global Music Report 2025*. https://www.ifpi.org/wp-content/uploads/2024/03/GMR2025_SOTI.pdf.

Krasikov, Hannah N. 2022. “The NFT Boom and Bust: Musicians as Productive Laborers in the Post-Streaming Music Industry.” *Journal of Popular Music Studies* 34(4):39–60. doi:10.1525/jpms.2022.34.4.39.

Lessig, Lawrence. 2004. *Free Culture : How Big Media Uses Technology and the Law to Lock down Culture and Control Creativity*. New York: Penguin Press.

Liebowitz, Stan J., and Richard Watt. 2006. “HOW TO BEST ENSURE REMUNERATION FOR CREATORS IN THE MARKET FOR MUSIC? COPYRIGHT AND ITS ALTERNATIVES.” *Journal of Economic Surveys* 20(4):513–45. doi:10.1111/j.1467-6419.2006.00259.x.

Loren, Lydia Pallas. 2002. “Untangling the Web of Music Copyrights.” *Case W. Res. L. Rev.* 53:673.

Mohsin, Sajjad Abdulkareem, and Raad A. Muhajjar. 2025. “A Review of Blockchain Based Solutions for Intellectual Property Rights Protection and Management.” *Iraqi Journal of Intelligent Computing and Informatics (IJICI)* 4(2):90–102. doi:10.52940/ijici.v4i2.103.

Molloy, Laura. 2025. “AI-Generated Country Track ‘Walk My Walk’ Tops US Billboard Chart.” https://www.nme.com/news/music/ai-generated-country-track-walk-my-walk-tops-us-billboard-chart-3908829.

Morrill, Kristen. 2021. “Smart Contracts: The Future of Blockchain in the Entertainment Industry.” *Arizona State University Sports and Entertainment Law Journal* 11(1):43–71.

Muñiz, Jessica. 2025. “Beyond Keywords: AI and the Semantic Understanding of Music Metadata.”

O’Neil, Mathieu. 2011. “Wikipedia and Authority.” in *Critical point of view: a wikipedia reader*, *INC READER*, edited by G. Lovink and N. Tkacz. Amsterdam: Institute of Network Cultures.

Park, Jung-Ran. 2009. “Metadata Quality in Digital Repositories: A Survey of the Current State of the Art.” *Cataloging & Classification Quarterly* 47(3–4):213–28.

Patka, Isaac and COALA Licensing Taskforce. 2022. “ERC-5554: NFT Legal Use, Repurposing, and Remixing.” https://eips.ethereum.org/EIPS/eip-5554.

Pech, Sebastian. 2020. “Copyright Unchained: How Blockchain Technology Can Change the Administration and Distribution of Copyright Protected Works.” *Northwestern Journal of Technology and Intellectual Property* 18(1):1–50.

Quintais, JP. 2017. “Alternative Compensation Models for Large-Scale Non-Commercial Online Use of Works.”

Robinson, Kristin. 2025. “Suno Creates an Entire Spotify Catalog’s Worth of Music Every Two Weeks, Says Investor Pitch Deck for $250M Fundraise.” https://www.billboard.com/pro/suno-creates-spotify-catalog-music-two-weeks-pitch-deck/.

Rumalla, Rahul. 2017. “UNPAID & MISSING ROYALTIES OF THE MUSIC INDUSTRY: FINDING THE BLACK BOX.” Berklee College of Music, Boston, Mass.

Sharp, Amanda J., and Orly Lobel. 2022. “Smart Royalties: Tackling the Music Industry’s Copyright Data Discrepancies through Blockchain Technology, Smart Contracts, and Non-Fungible Tokens IP in the Metaverse: Protecting IP Rights in the Virtual World.” *IDEA: The Law Review of the Franklin Pierce Center for Intellectual Property* 63(3):518–54.

Torbensen, Alexandra, and Raffaele Ciriello. 2019. “Tuning into Blockchain: Challenges and Opportunities of Blockchain-Based Music Platforms.”

Vellucci, Sherry L. 1999. “Metadata for Music: Issues and Directions.” *Fontes Artis Musicae* 205–17.

Yang, Wenli, Rui Fu, Muhammad Bilal Amin, and Byeong Kang. 2025. “The Impact of Modern AI in Metadata Management.” *Human-Centric Intelligent Systems* 5(3):323–50. doi:10.1007/s44230-025-00106-5.

Zellner, Xander. 2025. “How Many AI Artists Have Debuted on Billboard’s Charts?” https://www.billboard.com/lists/ai-artists-on-billboard-charts/.

Annex B – Deep-dive on innovation in the in-store music space

Authors: Andreas Schoenrock; HearDis!
Work Package: WP4
Date: 29.12.2025

1 Metadata-Driven Approaches to Integrating Local Music in Curated In-Store Music Environments

The integration of local music into curated in-store audio environments represents a complex challenge at the intersection of cultural representation, technological feasibility, and brand-oriented music curation. While the notion of "local music" is intuitively understood, its operationalization within automated or semi-automated music systems requires precise, machine-readable definitions. This chapter outlines a metadata-driven approach that enables the systematic identification, classification, and controlled deployment of location-related music within existing in-store music programs, without compromising their overarching curatorial and brand-related coherence. It is based on the work for the pilot study on in-store music localization (Task 4.3, Deliverable 4.2). The pilot aimed at measuring the impact of including location-related music in in-store environments. Impact was thus operationalized into dependent variables referring to sense of place (i.e., perceived connection to city and/or country as well as the hotel environment), overall on-site experience as well as inspirational potential to explore new music. Our study was executed in a quasi-experimental design, conducting a matched set of surveys (customer and employee) during two study periods (T1, April 2025: playlists excluding local content; T2, May and June 2025: playlists including local content). It was thus possible to measure the differences of including location-related music content in in-store environments as opposed to not including location-related content on the defined dependent variables. It was carried out at six locations (4 cities, 3 countries) of an international hotel chain.

2 Operationalizing Local Music Through Metadata

A fundamental prerequisite for the technical implementation of local music was the development of a clear and practicable definition of "locality" in musical content. Rather than relying on subjective or stylistic interpretations, the approach focused on attributes that are either directly perceivable by listeners or culturally recognizable through association.

Based on these considerations, three primary metadata dimensions were identified as suitable indicators of local relevance:

1. **Language of song lyrics**, particularly the national language of the respective country;
2. **Lyrical references to specific locations**, operationalized through the occurrence of city-related keywords within song lyrics;
3. **City affiliation of performing artists**, defined by their current place of residence or professional activity.

Other conceivable dimensions, such as artists' places of birth, historically rooted musical styles, or locally characteristic instrumentation, were deliberately excluded. These dimensions either proved difficult to operationalize reliably at scale or conflicted with the requirement of maintaining a consistent musical identity across branded environments. The selected categories therefore represent a balance between cultural expressiveness, data availability, and technical feasibility.

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3 Metadata Enrichment as an Innovation Layer

The central innovation of the presented approach lies in the systematic enrichment of existing music catalogues with novel, location-related metadata. Rather than altering musical content itself, the method introduces an additional informational layer that enables new forms of filtering, selection, and contextualization.

Text-based metadata played a crucial role in this process. By leveraging external, GDPR-compliant data sources (e.g., LyricFind), song lyrics could be analyzed and associated with structured metadata fields. This enabled not only the identification of the language used in a track, but also the detection of explicit references to cities through predefined keyword sets. These keyword sets were developed iteratively for each location, accounting for alternative spellings, linguistic variations, and symbolic place names. While not exhaustive, they provided a robust foundation for the automated identification of location-referential lyrical content.

In parallel, artist-related metadata was expanded to include information on geographic affiliation at the city level. As such data is often incomplete or inconsistently maintained in commonly available music databases, suitable external sources were evaluated and integrated to ensure a sufficient degree of reliability (e.g., Soundcharts). Where automated attribution was not possible, curated manual enrichment complemented the dataset, particularly for musically and contextually relevant content.

4 Filtering Logic and Controlled Localization

The enriched metadata enabled the implementation of advanced filtering mechanisms that allow local music to be incorporated into playlists in a controlled and scalable manner. Crucially, local content was not treated as a standalone program category but as a modular extension of existing music profiles.

This architecture allows global program structures to remain intact while enabling location-specific variation through the activation of dedicated metadata-based filters. Depending on the location, these filters can be adjusted to include different proportions and combinations of language-based, lyric-based, or artist-based local references. As a result, playlists can be automatically generated that exhibit a discernible local character while preserving the overall stylistic and aesthetic consistency of the music program.

Determining the appropriate share of local content for the in-store pilot constituted an additional methodological consideration. A sufficient proportion was required to ensure perceptibility and relevance, yet excessive localization risked undermining musical coherence. The final configuration (a minimum of 30 % of location-related music in respective playlists) therefore reflects a balance between empirical research requirements, content availability, and curatorial quality standards.

5 Scalability and Transferability

A key strength of the metadata-driven approach is its scalability. Once the underlying metadata schema and filtering logic are established, the model can be transferred to additional cities, regions, or countries with comparatively low incremental effort. The conceptual framework remains stable, while only location-specific reference data (e.g., keyword lists or artist affiliations) need to be adapted.

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Beyond its immediate application in in-store environments, the approach also holds broader implications for music information research and contextual media studies. The structured representation of locality through metadata enables novel analytical perspectives on cultural identity, geographic diversity in music consumption, and the role of place-based cues in mediated listening experiences.

6 Conclusion

The integration of local music into curated audio environments is fundamentally a metadata challenge rather than a purely musical one. By extending existing metadata models with carefully selected, location-related dimensions, it becomes possible to translate an inherently cultural concept – locality – into an operational, machine-readable form. This enables scalable, controllable, and brand-consistent localization of music programs. The presented approach illustrates how metadata can function as a central innovation layer, bridging cultural meaning and technical implementation in contemporary audio curation systems.

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Annex C – Linecheck 2025 Music Tech Summit Agenda

Authors: Sarah Parisio, Anna Zò, Filippo Crescenzi; Music Innovation Hub
Work Package: WP4
Date: November 2025 – v1.1

Music Tech Summit

The Tech Summit explores how the intersection of Music and Technology can shape how music is created, experienced and monetized.
AI, Web3, VR/AR, Spatial Audio, all these new technologies influence what is happening with music in today's world and will continue to shape the future of the music industry. How can we use these technologies to their full potential? How do we ensure they are implemented in a fair and ethical way? What new opportunities can they unlock for entrepreneurs, and how can they attract investment?

The Tech Summit dives deep into these topics, with a series of panels, workshops, roundtables and more, all designed to explore the evolving relationship between music and technology.
We invite you to join professionals who view technology as a catalyst for artistic expression and business growth, and connect, exchange insights, and be inspired by the next developments of music-tech innovation.
This Summit will host the Kick-off meeting of Music Tech Europe Academy, the pan-European acceleration program for startups in the music-tech industry.

November 20th

Red Theater

11:00-12:00 | **From Data to Discovery: Towards the Future European Music Landscape (Presented by OpenMusE)**

How does music shape the social and cultural fabric of Europe? What can patterns of music consumption reveal about policies, inclusion, and everyday life? Music is not only a mirror of culture, but also a living indicator of how communities evolve and interact.
Today, the growing availability of music-related data opens new perspectives to understand the social value of music and its potential to build fairer and more sustainable ecosystems. When used responsibly, data can help policymakers, researchers, and professionals identify gaps, measure impact, and support better decision-making.
By turning open data into collective knowledge, projects like OpenMusE aim to bring more transparency, visibility, and fairness to Europe's music landscape, bridging analysis, policy, and creativity. Can data really become a common good for music? And how can openness drive the next phase of Europe's cultural development

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14:30-15:30 | **Capital meets creativity: building the next generation of Music Tech**

Merging creativity, capital and innovation, the music tech industry continues to expand. Investment becomes the lever that can turn bold ideas into global ventures. With the right strategies, this ecosystem has the potential to generate not only strong financial returns but also meaningful and lasting impact.
Yet, some questions arise: What challenges and opportunities do investors face today? How can we attract more capital to support startups and help them scale?
In this panel, industry experts from across Europe, will share insights into the current investment landscape and debate what the future may hold for music tech entrepreneurship.

15:45-16:45 | **MusicTech and Digital Culture Radical Futures**

How can we redesign music tech around the values of fairness, openness, accountability and diversity? Radical Futures invites artists and founders to rethink the digital mindset shaping today's music industry, and to imagine new systems that are more reliable and transparent — combining automation with human vision. Featuring Fem Founders and LiveMX projects, this session explores how creative innovation can become a model for ethical and exportable digital culture. After the session, attendees will be invited to an informal get-together with some snacks to continue the conversation.

17:00-17:45 | **Predicting the Sound of Tomorrow: Cultural Intelligence and the Future of Music**

Music is a direct expression of cultural evolution, a living reflection of the ideas, emotions, and movements that define our time. As new technologies enable deeper forms of cultural analysis, the music industry is gaining powerful tools to understand and anticipate these transformations.

To demonstrate how this process works, the panel will draw on the expertise of ForeSound, a startup that is actively exploring how data and cultural insight can reveal the signals shaping the future of music.

This discussion will examine how data-driven cultural insight can help the music industry anticipate genre evolution, recognize early signals of change, and better connect with audiences. By interpreting cultural patterns and translating them into meaningful foresight, it is possible to build frameworks that support artists, labels, and brands in navigating the sounds that will shape the future.

14:15-15:15 | **Is All Diversity Created Equal? Reckoning with Representation in Music Law and Practice**

We'd like to explore the (often overlooked) disconnect between: High-level legal and policy frameworks – often focused on the right to take part in cultural
life, i.e. the possibility for individuals (especially from minority groups) to access and participate in the cultural life of the community. Industry practice and data – which tend to focus more on content diversity (i.e. what is

being created). The idea is to bring together both conceptual thinking and lived experience – examining how diversity shows up in content, how it's tracked (or not), and what gets lost in translation.

La Capsula

15:00-16:00 | **DeepSoundMe: AI-assisted emotional intelligence for wellbeing**

What happens when emotional intelligence meets sound design? Can we build a fair and innovative catalogue of AI-assisted music compositions designed to enhance well-being? Innereo is shaping a new frontier where artificial intelligence listens to human emotions and translates them into immersive, data-driven audio experiences. Through its DeepSoundMe tool, the company merges neuroscience, creativity and technology to craft personalized sound environments that foster balance, focus and performance. At Linecheck, Innereo presents the outcomes of its first hackathon for music producers and composers, revealing how artists, technologists and researchers can co-create the next wave of sound-driven well-being and unlock new business opportunities across the health, entertainment, and lifestyle industries.

November 21st

12:15 - 13:15 | **Passive music consumption - embracing technology and human Genius**

AI-generated music, be it moody ambient nothingness or sound-alikes, has been gradually finding its way into public and private spaces: annoying people worldwide in shopping malls, dental clinics, cars, TVs, and hotel elevators. A rights- and risk-free substitution for human creativity? It seems, the sound of brands goes well along with technological innovation.

How can the industry find a balance between technology and human genius, in search of more original beauty, stronger cultural impact through outstanding creativity, and ultimately, real value for brands, artists, rightsholders, and audiences alike?

Blue Theater

10:30-12:00 | **Scouting on Data**

Having access to data is great, but finding what you really want, up-to-date and from trusted sources, is even better. AI tools therefore have the potential to create new opportunities across the music value chain. Ideally, they lead to decisions and discoveries one wouldn't have made otherwise. Whether it's inspiration for exposure and revenue for an artist you represent, updating a label or publishing roster, finding the soundtrack that's missing that perfect sync, or filling a few open slots in a festival lineup… What will resonate with target

audiences and generate streams, syncs, and sales? Be it the courageous choices nobody has heard of (yet), or the established names. How can we use data tools to scout artists at an early stage, those who don't yet have a large digital footprint? How do we find the cool underdog, the hidden gem, the next big thing? This discussion explores what actually works on the ground, what the industry truly needs, and where AI can (or can't) make a difference.

12:15 - 13:30 | **From stream to stage: When digital listening turns into live performance**

As streaming remains the primary gateway to music discovery, this panel explores how digital listening habits shape – and sometimes challenge – the way audiences connect with artists on stage.
In the context of Linecheck 2025 and its focus on music as a living, emotional, and transformative presence, we want to explore how the data-driven logic of platforms can (or cannot) translate into meaningful, real-world connections.
How do artists move from being streamed to being booked on stage?
And how can we rethink the transition from digital visibility to embodied presence?
This conversation brings together professionals from across the spectrum – streaming platforms, live programmers, artists and managers – to examine the tension and synergy between phono and live.

15:00 - 16:00 | **Tools and Data for Creative Storytelling**

Fans today expect more than passive experiences: they seek emotional connection, immersion, involvement and discovery. Often, tech solutions are treated as limited to analytics, used to help to understand the data that is already there. But there is much more. Data can also serve as a bridge between creativity and strategy, inspiring new ways to design, distribute and scale cultural experiences.Instead of replacing artistic vision with 'what resonates best with fans', tools can enhance impact, reach and audience engagement, be enjoyable for artists and their teams, and be part of a unique storytelling process from the very beginning.

16:15 - 16:45 | **Meet EIT Culture & Creativity**

EIT Culture & Creativity is the European institutional partnership dedicated to strengthening and promoting the Cultural and Creative Industries. It brings together entrepreneurs, researchers, and institutions to foster sustainable, resilient, and responsible growth, positioning culture and creativity as a strategic driver for Europe's economy. This session will introduce its identity and vision, as well as current and upcoming opportunities for the ecosystem.

White Room

9:00-11:00 | **Music & AI Forum - Step 0 (Invitation Only)**

The Music & AI Forum – Step 0 is a strategic workshop designed to define the framework and roadmap for future Music x AI initiative promoted by Music Tech Europe partners. The forum aims to produce a practical prototype for future Music & AI forums, connecting tech players, music industry, research and institutions. The

session focuses on identifying forum topics, aligning with upcoming events and establishing collaboration models among key stakeholders. Through structured discussion and validation, participants will co-design actionable plans for dissemination, engagement, and implementation.