D6.3

Final dissemination, communication, and exploitation report

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Author(s)	Bas van Gunst (Sound), Finn Kortenbrede (XRBB), Jeroen Prinsen (Sound), Tip Benameur (Sound), Nico Patz (DW), Olivia Stracke (DW) and Elle Langer (XRBB)
Reviewer(s)	Nico Patz (DW)
EC Project Officer	Andreea Popescu-El Adraoui

Abstract	D6.3 outlines the final dissemination, communication, and exploitation results of XReco spanning M19-M38 of the project. Special attention is given to market analysis, validation of exploitation pathways, identification of users, their willingness to pay, and our Dissemination and Communication results.
Keywords	Extended Reality, XR content creation, news media, tourism, automotive industry, mobility, data sharing, search and discovery, market analysis, exploitation, communication, dissemination, standardization, value chains, ecosystems, human-centered design, Business Models, Monetization Models, Value Proposition

Contributors to D6.3

Name	Organisation	E-mail
Bas van Gunst	Sound	bas@sound.team
Jeroen Prinsen	Sound	jeroen.prinsen@sound.team
Tip Benameur	Sound	tip@sound.team
Patrick de Lange	Sound	patrick@sound.team
Finn Kortenbrede	XRBB	finn.kortenbrede@extendedrealitybb.org
Elle Langer	XRBB	e.langer@extendedrealitybb.org
Olivia Stracke	DW	olivia.stracke@dw.com
Nicolas Patz	DW	nicolas.patz@dw.com

Glossary

Abbreviation	Meaning
AI	Artificial Intelligence
AR	Augmented Reality
B2B	Business to Business
B2C	Business to Consumer
C2B	Consumer to Business
CTA	Call to Action
DCC	Digital Content Creation
DNNs	Deep Neural Networks
DoA	Description of Action
EBU	European Broadcasting Union
EMEA	Europe, the Middle East and Africa
FVV	Free Viewpoint Video
HCD	Human-Centred Design
IP	Intellectual Property
IPR	Intellectual Property Rights
ISO	International Organization of Standardization (https://www.iso.org/)
JBC	Joint Business Clinic
KPI	Key Performance Indicator(s)
ML	Machine Learning

MR	Mixed Reality
MPEG	Moving Picture Experts Group
MVP	Minimum Viable Product
NeRF	Neural Radiance Field
NMR	Neural Media Repository
R&D	Research and Development
ROI	Return on Investment
SME	Small and Medium Enterprises
TRL	Technical Readiness Level
UCF	Unified Compute Framework
USD	Universal Scene Description
VFX	Visual Effects
VPC	Value Proposition Canvas
VQEG	Video Quality Experts Group
VR	Virtual Reality
WP	Work Package
XR	Extended Reality

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Executive summary

By 2025, the XR industry entered a period of cautious transition, where technological maturity outpaced large-scale market adoption. While global vendors refined hardware capabilities, investment patterns shifted toward generative AI, creating uncertainty but also new creative opportunities. In this landscape, Europe has positioned itself as a steady and values-driven innovator, building on initiatives such as Web 4.0 and the European Data Space for Cultural Heritage. These initiatives emphasize interoperability, inclusiveness, and trust—principles that XReco embodies through its focus on human-centred media ecosystems.

The rise of generative AI has reshaped the immersive media sector, introducing both challenges and strategic advantages for Europe. While global funding has concentrated on AI, XReco demonstrates that the integration of AI into creative and ethical data-sharing systems can yield sustainable benefits. We believe the project's ecosystem can contribute to Europe's ambition for digital sovereignty by operationalizing key EU priorities such as transparency, rights-aware data use, and privacy-by-design. In doing so, XReco could provide a European counter-model to the dominant U.S. and Chinese approaches, combining technological excellence with societal accountability.

The project's exploitation work has evolved from conceptual planning into an operational and validated framework. Through a structured Human-Centred Design process—empathize, define, ideate, prototype, and test—XReco continuously aligned technological development with user expectations. The three Joint Business Clinics played a crucial role in validating user needs and translating them into exploitable results, leading to the segmentation of user types into Givers, Searchers, Takers, Transformers, and Creators. This iterative co-creation process helped balance user and business objectives.

Despite strong technical validation and market interest, economic conditions limited the viability of establishing XReco as a centralized commercial platform at project's end. Subscription models did not attract sufficient early adoption, and investor engagement remained modest. In response, the consortium adopted a federated exploitation model, enabling each partner to continue exploiting their results individually while maintaining shared interoperability, branding, and governance principles. This transition from centralisation to federation reflects a key maturity milestone: XReco's sustainability will have to depend on distributed ownership and flexible collaboration mechanisms rather than a single commercial entity.

XReco's dissemination and communication activities achieved significant impact across research, media, and cultural sectors. The project exceeded its KPI targets for publications, events, and training, with over forty scientific contributions, multiple public demonstrations, and more than two hundred organizations engaged in workshops and tutorials. Its communication strategy emphasized openness and reusability, creating long-lasting visibility through digital channels and high-profile events such as Immersive Tech Week and Stereopsia. XReco's diversified outreach ensured stable community engagement and broad recognition within Europe's immersive technology landscape.

XReco has successfully laid the foundations for a sustainable European XR ecosystem. Its achievements extend beyond technical innovation to include community-building, market alignment, and standardization leadership. The project's legacy is a network of interoperable components, validated tools, and engaged partners committed to continuing collaboration beyond the project's

lifetime. By combining technological excellence with inclusiveness, transparency, and cultural awareness, XReco positions itself as a building block in Europe's ambition to lead the next generation of trustworthy, human-centric immersive media innovation.

The deliverable is divided into seven sections, supported by annexes:

1. **Introduction (Section 1):** Outlines the scope and objectives of Work Package 6 (WP6), linking them to KPI monitoring and overall impact maximization (Objective 5).

2. **Market Analysis (Section 2):** Provides an updated view of global and European XR markets to contextualize exploitation strategy.

3. **Exploitation (Section 3):** The core analytical section, describing the methodology, exploitation components, individual and joint strategies, value proposition, IP management, and human-centered design results.

4. **Dissemination and Communication (Section 4)**: Summarizes XReco's outreach, online and offline communication performance.

5. **Collaboration with other initiatives (Section 5):** Describes XReco's collaboration with other EU initiatives (TEMS, XR4Europe, VISION, etc.).

6. **Standardisation (Section 6):** Details XReco's active participation in international working groups (ISO/IEC, MPEG, ITU-T), supporting Europe's leadership in interoperable and trustworthy XR standards.

7. **Outcomes per Target Group (Section 7):** Summarizes the measurable benefits achieved across the 22 target groups, showing how XReco's dissemination, exploitation, and community-building activities translated into real-world impact for researchers, professionals, and policymakers.

8. **Annexes**: Contain KPI visualisations, dissemination analytics, publication lists, and events, functioning as supporting evidence for performance claims

1 Introduction

XReco establishes a **data-driven B2B ecosystem for the European media industry**, enabling seamless **data sharing, intelligent search, and collaborative content creation** across organizational and domain boundaries. The project addresses a key industry challenge: while media organizations increasingly explore interactive and non-linear storytelling, these experiences often remain siloed within individual departments or platforms. XReco's architecture and services lay the foundation for **cross-organizational reuse of 2D and 3D media assets** and the scalable production of immersive XR experiences for **news, entertainment, tourism, and automotive contexts**. The project's current use cases in media and tourism demonstrate these capabilities in practice, while the underlying platform is designed for future expansion into other creative and industrial sectors.

At the core of the ecosystem lies a **modular technology stack** that forms the foundation for exploitation and future market uptake.

- **Neural Media Repository (NMR):** an AI-powered system for advanced search, retrieval, and recommendation, enabling new forms of XR content creation and marketplace integration.

- **Rights and Monetization Management:** a blockchain-enabled component ensuring transparent IP tracking, rights ownership, and fair revenue distribution across contributors.

- **3D Reconstruction:** state-of-the-art Neural Radiance Field (NeRF) technology for generating 3D environments from 2D images, enhancing production pipelines and immersive storytelling.

- **Holoportation:** real-time volumetric capture for remote collaboration and presence, supporting hybrid production environments.

- **Free Viewpoint Video (FVV):** interactive scene navigation and real-time rendering from arbitrary perspectives, adding creative depth to XR experiences.

- **Authoring Tools:** intuitive, low-code creation interfaces tailored for media producers and tourism professionals, facilitating user-friendly XR content assembly.

Together, these components form the **technical backbone for XReco's exploitation strategy**. They support **secure inter-organizational content sharing**, promote **AI-assisted media transformation**, and enable **novel monetization pathways** through rights-aware data exchange. For users, XReco offers a set of clear benefits and unique selling points:

- **Simplified data organization:** AI-driven Neural Media Descriptors streamline content indexing and retrieval.

- **Transparent rights management:** Users gain instant clarity on asset ownership and permissible reuse.

- **Accessible content creation:** Low-code authoring tools empower creators without deep technical expertise.

- **Flexible content sharing:** Modular APIs allow easy distribution within or beyond the platform ecosystem.

- **Effortless monetization:** Integrated rights and revenue tracking support sustainable data-driven business models.

This deliverable presents the **results achieved** in exploitation, dissemination, communication, and standardization. It illustrates the consortium's progress toward market uptake, emphasizing XReco's **human-centered, two-way engagement approach** with potential users, industry stakeholders, and research communities—ensuring that the platform evolves in alignment with real market needs and ethical, European values.

1.1 WP6 overview and KPI tracking

The main objective of Work Package 6 (WP6) is to maximize the impact of XReco by ensuring that its technological, scientific, and societal outcomes are effectively communicated, disseminated, and exploited (objective 5). WP6 implements the project's pathways toward impact, as outlined in Section 2, by translating them into concrete and measurable actions across four interconnected tasks:

- T6.1 – Dissemination & Communication (M1–M36) [Lead: VRBB]
- T6.2 – Exploitation & Business Planning (M1–M36) [Lead: Sound]
- T6.3 – Community & Capacity Building (M1–M36) [Lead: Sound]
- T6.4 – Orchestration with Other Initiatives (M1–M36) [Lead: DW]

These tasks collectively ensure that scientific excellence (TG1), industrial uptake (TG2), and societal awareness (TG3) are all supported through coordinated actions. Each activity under WP6 is guided by a set of Key Performance Indicators (KPIs), designed to track communication reach, exploitation progress, and community engagement. The KPI framework has been monitored through a Power BI dashboard, allowing partners to track performance trends and measure alignment with the project's impact objectives. This structure enables periodic performance monitoring, adaptive management of dissemination activities, and evidence-based assessment of impact at project, partner, and ecosystem levels.

At the objective level, 4 KPI have been formulated (see Table 1: KPIs for Objective 5 "Impact maximisation"), with further Monitoring KPIs established for each task.

The KPI results demonstrate that XReco has met or exceeded expectations in terms of **media outreach, community building, and engagement** across multiple dissemination channels.

Under **KPI 5.1**, the project achieved strong visibility and uptake, surpassing its targets for conferences, trade shows, and training activities. With over 30 presentations and proceedings (120% completion) and more than five e-learning or workshop formats delivered (520% completion), XReco has effectively positioned itself within both the research and professional XR ecosystems. Although publication in scientific journals is lagging (40%), the strong performance in other formats reflects the consortium's strategic focus on interactive, high-visibility formats that enable rapid knowledge exchange and early feedback from the community.

Similarly, **KPI 5.2 and KPI 5.3** confirm full achievement of objectives regarding intellectual property and standardization impact. The required deliverables on IPR and exploitation were completed (100%), providing a clear framework for result protection and future commercialisation. In addition, XReco contributed actively to standardization, delivering at least three verified presentations in key international working groups.

Most notably, **KPI 5.4** shows that XReco has successfully established a thriving community—engaging over **200 European companies and organizations (105% of the target)** through co-creation sessions

and training events. These outcomes collectively demonstrate that WP6 has not only met but, in several areas, exceeded its targets for dissemination reach, industry engagement, and standardisation influence.

Table 1: KPIs for Objective 5 "Impact maximisation"

KPI 5.1: Maximum media outreach to identified Target Groups by M18 and M36 (WP6, T6.2, T6.3 - D6.1, D6.2) through publishing, presenting, and teaching XRECO's progress:	Completion
in science journals (>10)	40%
at conferences and industry trade shows (≥30 proceedings)	120%
and through (virtual) meetings, workshops and e-learning modules (≥5).	520%

KPI 5.2: Reporting the chances of dissemination and exploitation of intellectual property rights (XReco results) by M18 and M36 (WP6, T6.1, T6.2 - D6.1, D6.2)	Completion
in deliverables (=2)	100%

KPI 5.3: Contribution to standardisation of new media formats by M18 and M36 (WP6, T6.4 - D6.1, D6.2) through participation in working groups of relevant standardisation bodies	Completion
≥3 presentations at significant roundtables	100%

KPI 5.4: Creating a vivid community of ≥200 companies and organisations across Europe.	Completion
≥200 companies and organisations (participants in co-creation session)	105%

To ensure continuous alignment between activities and impact objectives, XReco adopted a three-tiered KPI-tracking system using Microsoft Power BI (see Annex). This system integrated quantitative and qualitative indicators across tasks and partner contributions.

- Level 1: Tracks all T6.1 communication and visibility metrics.
- Level 2: Consolidates KPIs for exploitation, capacity building, and orchestration (T6.2–T6.4).
- Level 3: Monitors individual partner outputs to ensure fair and balanced participation.

Through periodic monitoring and frequent feedback to the Coordinator, Work Package Leaders and the Consortium Members in general, we managed to broadly comply and, in some instances, significantly outperform our targets.

2 Market analysis

2.1 Introduction

This chapter provides an updated market analysis of the extended reality (XR) sector in 2025, focusing on trends relevant to XReco's target domains: media, culture, and tourism. Its purpose is to contextualise XReco's exploitation strategy within current global and European market dynamics, identifying key growth drivers, risks, and opportunities toward 2030. The analysis highlights two structural forces shaping the field: the present "holding pattern" in hardware adoption and the rapid diversion of investment toward generative AI, which is reshaping how XR content is produced and valued.

Building on deliverable D6.2, this chapter moves from descriptive mapping to a forward-looking assessment of market potential and policy alignment. The current analysis integrates economic indicators, investor sentiment, and the regulatory landscape to inform post-project sustainability planning and strategic positioning of XReco results.

The findings draw on a combination of industry reports, European Commission data, academic research, and recent press coverage.[1] Key references include market forecasts from IDC and MarketsandMarkets, EC communications under the *Web 4.0 and Virtual Worlds Initiative* and *Digital Europe Programme*, and trend analyses from the 2024 *Perkins Coie XR Report* and relevant scientific publications on AI-driven content creation.

This mixed-method approach combines quantitative projections with qualitative insight, interpreting global developments through a European lens. It underscores a market marked by cautious optimism, convergence between XR and AI, and growing emphasis on trust, accessibility, and cultural relevance, providing a concise evidence base for refining XReco's exploitation strategy and ensuring alignment with Europe's digital and creative economy objectives.

2.2 Global market overview

2.2.1 Market size and growth forecasts (2024–2030)

Published forecasts bracket the revenue trajectory for XR over the rest of the decade and highlight strong structural growth. Grand View Research values the global XR market at 193.98 billion USD in 2024 and projects it to reach 1.069 trillion USD by 2030, a 32.9 percent compound annual growth rate that includes hardware, software, and services across consumer and enterprise contexts (grandviewresearch, 2025). MarketsandMarkets works with a narrower scope and shorter horizon, estimating 24.42 billion USD in 2024 and 84.86 billion USD by 2029 at a 28.3 percent compound annual rate, which still implies sustained double-digit expansion through the period (marketsandmarkets, 2025). The definitional differences between the two firms explain much of the spread in absolute values, yet both point to a market that compounds in the high-twenties to low-thirties through 2030. On the unit side, the installed base and shipment dynamics support this revenue outlook. IDC reports that global AR and VR headset shipments returned to growth in 2024, rising 10 percent after two years

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[1] All sources are listed in section 8 References.

of declines. IDC expects a pause in 2025 due to delayed launches, followed by a strong rebound of about 87 percent growth in 2026, with a 38.6 percent compound annual growth rate over 2025 to 2029 as mixed reality (MR) headsets and consumer smart glasses mature (IDC, 2025). These device trends align with the revenue scenarios above and indicate that a broader installed base, rather than price inflation alone, is doing the work of market expansion.

2.2.2 XR segmentation: VR, AR, MR, and smart glasses

Across segments, virtual reality (VR) still anchors today's revenue. Grand View Research notes that VR accounted for the largest application share in 2023 and that hardware represented roughly two-thirds of the market at that time, implying that content and services monetization still trails device sales in the near term (grandviewresearch, 2025). AR remains smaller in absolute units but is accelerating in enterprise use cases such as field service and training, and the 2024 XR Report highlights IDC's expectation for fast AR growth through the second half of the decade, with AR headset shipments rising from a small base and expanding at high double-digit rates through 2028. Mixed Reality sits between these categories and is increasingly the default for new premium devices, giving users both immersive VR and high-quality passthrough AR in one device. IDC characterizes MR as serving both consumer and commercial users, a positioning that helps explain the pivot of many vendors toward MR-first designs (IDC, 2025; grandviewresearch, 2025).

Smart glasses deserve separate attention because they are expanding in two directions at once. First are display-less or notification-centric models that emphasise wearability and hands-free capture. Second are glasses with integrated displays that are markedly lighter than headsets. IDC expects more "glasses with displays" and multimodal AI in the 2025 product wave, which will diversify price points and form factors for consumers while giving enterprises lighter options for shift-length use (IDC, 2025). In parallel, the 2024 XR Report underscores that mass adoption still hinges on comfort and usability, with poor user experience cited as the top barrier, which directly influences form factor choices for glasses and headsets alike (Perkins Coie LLP, 2024).

2.2.3 Hardware and software trends

Three technology currents are shaping near-term demand. First is a broad movement toward thinner, lighter devices with high-quality passthrough and better optics. The 2024 XR Report captures the industry's candid view that ergonomics remain the primary adoption bottleneck, with user experience ranked the leading barrier and the cost of devices also weighing on uptake. At the same time, the survey shows pronounced enthusiasm for AI inside XR workflows, with a large majority of respondents expecting generative AI to improve content creation and creative exploration (Perkins Coie LLP, 2024).

Second is the platform shift toward MR-capable operating systems and toolchains. IDC anticipates a more competitive platform landscape as Android-based XR hardware enters the market, intensifying rivalries among Meta, Apple, and Google. This will matter for developers choosing between visionOS, Meta's Horizon-based stack, and forthcoming Android XR variants, and it should accelerate the availability of cross-segment apps and services that can move between VR, MR, and AR modes without a complete rebuild (IDC, 2025).

Third is the network side. Grand View Research points to 5G and, from 2025, 5G Advanced as enablers of cloud-rendered and latency-sensitive experiences. As these networks reach scale, expect more

streaming-class XR use cases that rely on edge rendering rather than local compute, which will also support lighter glasses and headsets over the period to 2030 (grandviewresearch, 2025).

2.2.4 Overview of leading vendors and platforms

The vendor landscape is consolidating around a few system makers and component suppliers while leaving room for specialised entrants. IDC's latest market view now reports that in 2Q25 Meta captured 60.6% of the combined AR/VR plus display-less smart-glasses market, with strength in lightweight smart glasses and continued leadership in mixed reality, both seen as stepping stones toward true AR glasses. Xiaomi followed with 7.7% (largely driven by its new AI Glasses and the earlier Mijia model, and mostly confined to China), with XREAL at 4.1%, RayNeo at 2.7%, and Huawei at 2.6% rounding out the top five. Alongside the share dynamics, IDC notes robust developer interest in mixed-reality experiences, particularly on Meta and Apple hardware, and growth in education deployments that helped lift commercial volumes in 2024–2025 (IDC, 2025).

Table 2: 2025 Q2 Historical ARVR Market Share (Adapted from IDC AR & VR Headsets Market Insights)

Quarter	ByteDance	Meta	RayNeo	Viture	XREAL	Others
2024Q2	59,769	696,067	30,897	20,531	48,555	339,601
2024Q3	89,096	1,178,127	31,659	30,978	56,449	308,776
2024Q4	100,524	3,503,948	36,970	48,811	90,631	294.479
2025Q1	62,982	333,195	39,615	40,918	79,624	114,288
2025Q2	52,52,738	549,014	68,809	40,326	103,774	122,155

Apple's entry with Vision Pro in early 2024 framed the premium end of mixed reality and validated spatial computing as a category. The 2024 XR Report documents how the device also brought usability trade-offs into sharper focus, including weight, bulk, and a price point that reinforces cost as a barrier to mainstream adoption. This has nudged the industry toward lighter MR devices and consumer smart glasses that are easier to wear for longer periods, while Apple's visionOS has accelerated expectations for high-fidelity passthrough and spatial UX patterns that will diffuse across platforms (Perkins Coie LLP, 2024).

Meta remains the volume leader through its Quest line, which targets the broadest consumer price bands and emphasises mixed reality modes and a large content library. IDC's analysis also calls out Meta's push into education as a catalyst for commercial growth in 2024, a signal that enterprise demand is re-accelerating where content and management tooling are mature (IDC, 2025). XREAL illustrates the adjacent path with lightweight display glasses that slot between audio-first smart glasses and full MR headsets. Its top-five position in 2024 suggests sustained appetite for glasses that emphasize portability and tethered use with phones and PCs, especially as multimodal AI assistance moves on-device (IDC, 2025).

The broader ecosystem remains diverse across hardware and software. Both Grand View Research and MarketsandMarkets list a familiar roster of core XR players and suppliers, including Meta, Apple, Microsoft, Sony, Google, HTC, Qualcomm, Samsung, PTC, and Epson.

2.3 European market overview

2.3.1 Market size and projected growth in Europe

Independent trackers suggest the European XR economy is entering a disciplined expansion phase after a reset in 2023. IDC's most recent regional spending guide projects EMEA XR spending to reach 8.4 billion dollars by 2029, a five-year compound annual growth rate of about 16 percent, with Western Europe remaining the largest submarket in the region (IDC, 2025). Taken together with IDC's near-term device outlook that shows a dip in 2025 followed by a strong rebound in 2026 as new devices and Android XR hardware arrive, the demand profile in Europe looks like a gradual step-up rather than a single inflection (IDC, 2025).

To give XReco a concrete planning baseline, we model two EU-27 scenarios by allocating a conservative share of EMEA spending to the EU and then applying IDC's growth profile. In the baseline scenario we assume the EU accounts for roughly two-thirds of EMEA XR spending because Western Europe is the region's largest market and most XR suppliers serving Europe are headquartered or concentrated in EU and EEA countries (IDC, 2025; XR4Europe, 2025). On that basis, EU XR spending is approximately 2.6 billion dollars in 2024 and rises toward 5.5 billion dollars by 2029, with a further extrapolated increase to roughly 6.3 billion dollars in 2030 if the same CAGR persisted for one additional year. These figures are estimates derived from IDC's EMEA total and should be interpreted as directional ranges to support consortium planning rather than as official forecasts (IDC, 2025).

In an optimistic scenario we keep the same 2024 starting point but allow for faster adoption driven by three policy and market tailwinds that are specific to Europe in 2025 and beyond. First, new EU funding lines in Digital Europe and Horizon Europe are being deployed to skills, infrastructure and R&I for virtual worlds and immersive media. Second, 5G and edge cloud rollouts continue to improve coverage and latency for streaming XR. Third, the maturing regulatory framework increases trust for public sector and enterprise buyers. If these tailwinds materialise, EU XR spending would plausibly grow nearer 20 to 22 percent per year through 2030, which implies a 2029 range around 6.0 to 6.7 billion dollars and a 2030 range around 7.2 to 8.2 billion dollars. This scenario is XReco's analytical construct anchored to official EU initiatives and IDC's regional baseline rather than a revision of IDC's forecast (IDC, 2025; European Commission, 2025).

2.3.2 European Commission initiatives shaping the XR environment

The Commission's Web 4.0 and Virtual Worlds initiative sets a strategic frame for immersive technologies in Europe. The Communication defines Web 4.0 as an immersive, interconnected evolution of the internet and outlines actions on skills, interoperability and public sector pilots that are relevant to XR in media, culture and tourism (European Commission, 2023). The 2025 to 2027 Work Programme of the Digital Europe Programme will spend about 1.3 billion euro on the deployment of critical digital technologies and includes new calls that directly reference virtual worlds skills and infrastructure, such as a sectoral Virtual Worlds Skills Academy announced in April 2025 (European Commission, 2025).

Horizon Europe complements deployment funding with research and innovation calls. The Commission adopted the 2025 Work Programme with more than 7.3 billion euro of investment and specific topics across Clusters 2 and 4 that target virtual worlds, core technologies and human-centric

interaction. Examples include "Core technologies for virtual worlds" in Cluster 4 and "Evolution of culture in a virtualising world" in Cluster 2, as well as coordination actions to support a proposed European Partnership on Virtual Worlds (European Commission, 2025).

2.3.3 XR innovation across media, culture and tourism

European cultural and media innovation is increasingly anchored in shared infrastructure and open data. The common European data space for cultural heritage, stewarded by the Europeana Initiative and financed through Digital Europe, is building capacity for high-quality 3D and XR assets that museums and creative SMEs can reuse for storytelling, education and tourism experiences. Recent programme updates highlight a priority push on 3D content pipelines, training for institutions and cross-border reuse of assets (Europeana, 2023; HaDEA, 2025).

EU-funded projects illustrate how XR is being operationalised for culture and destinations. XRCulture, launched in 2025, applies AI to difficult 3D digitisation tasks and targets reuse of assets in immersive cultural applications, while Europeana's project page emphasises the role of XR applications that ride on the data space to deliver public value. These projects are designed to strengthen supply chains for museums and creative studios and to seed content libraries that tourism boards can activate (Europeana, 2025).

Tourism demand provides a receptive market for these experiences. The European Travel Commission reports that European tourism exceeded pre-pandemic arrival levels in 2024 and projects stronger spend growth than arrivals in 2025, indicating a shift to higher value experiences where immersive previews, on-site AR guidance and accessible virtual tours can differentiate a destination offering. These indicators support the case for XR pilots with measurable impact on visitor engagement and seasonality management (ETC, 2025).

Grass-roots industry mapping also shows that European XR companies already serve these sectors. The European XR Industry Report 2025, compiled by XR4Europe, identifies education, arts and culture, healthcare, advertising and industrial manufacturing as top sectors served, and documents the export orientation of European XR SMEs. This points to a robust base of suppliers that can execute Commission calls and exploit tourism and cultural demand (XR4Europe, 2025).

2.3.4 Key policy, investment and regulatory efforts that affect XR

The EU's digital rulebook is now largely in force and sets clear guardrails for immersive media. The Digital Services Act applies to all online platforms since February 2024 and introduces obligations on systemic platforms that are important for distribution of XR content in app stores and social ecosystems. Enforcement is shared by national coordinators and the Commission (European Commission, 2024 and 2025). The Digital Markets Act has applied to designated gatekeepers since March 2024, with Apple, Alphabet, Meta, Amazon, Microsoft and ByteDance required to comply with obligations that include fair access to platforms and app stores. This matters for XR because it affects operating system rules, in-app payments and interoperability (European Commission, 2024).

Trust and safety obligations are complemented by cybersecurity and accessibility rules that directly touch XR devices and services. The Cyber Resilience Act entered into force on 10 December 2024, sets horizontal security requirements for products with digital elements and becomes fully applicable by December 2027, with some earlier reporting duties for manufacturers. XR headsets, wearables and

connected accessories fall within scope, so vendors and integrators will need secure-by-design processes and vulnerability handling in place (European Commission and European Parliament services, 2024 to 2025). The Radio Equipment Directive delegated act on cybersecurity applies from 1 August 2025 and imposes essential requirements for internet-connected radio equipment, which includes many XR devices with wireless radios. Harmonised standards EN 18031-1, -2 and -3 support compliance (CEN-CENELEC and EUR-Lex, 2024 to 2025). The European Accessibility Act began applying on 28 June 2025 and introduces accessibility requirements for a broad set of digital products and services, including consumer electronics, e-commerce and ticketing. XR content and storefronts that touch these channels will need to reflect accessibility-by-design (AccessibleEU and SGS, 2025).

Data protection remains foundational. GDPR governs biometric, location and other sensitive signals that XR devices and services often process, which places emphasis on privacy-by-design, data minimisation and lawful bases for eye tracking, hand tracking and spatial mapping data in immersive apps (European Union, 2016). The EU AI Act entered into force on 1 August 2024 and will phase in obligations through 2026 for most provisions, with earlier deadlines for some model transparency and later ones for high-risk systems. Generative and recommendation features that power XR authoring and personalisation will need to align with these timelines, which will be supported by codes of practice and standards the Commission is preparing (European Commission and European Parliament services, 2024 to 2025).

Public investment aligns with these rules to grow capacity. The Digital Europe Programme's 2025 to 2027 work programme deploys 1.3 billion euro into critical technologies that include the Web 4.0 skills pipeline and interoperable virtual worlds infrastructure. Horizon Europe's 2025 work programme provides 7.3 billion euro across missions and clusters and contains virtual worlds topics in Clusters 2 and 4 that are directly relevant to media, culture and tourism use cases (European Commission, 2025).

Finally, EU industry and investor sentiment remains constructive about XR's convergence with AI and the shift from metaverse hype to practical applications. Perkins Coie's 2024 XR Report, based on a large industry survey, documents renewed optimism tied to AI-enabled content creation and a pivot to near-term return on investment in training, retail and media experiences. This sentiment evidence, although global, is consistent with European project pipelines in 2025 and helps explain the optimistic growth scenario above (Perkins Coie LLP, 2024).

2.4   Key market trends

2.4.1   Convergence of XR with AI

XR is folding AI into both devices and content pipelines, which is shifting how users discover, control, and create experiences. Google's Android XR platform puts Gemini at the centre of a new OS for headsets and glasses, signalling that voice, vision, and agentic assistance will be native affordances rather than add-ons (Google, 2024). Meta's latest Ray-Ban glasses updates brought multimodal AI, live translation, and first-person video calling to a mainstream form factor, illustrating how on-device perception and low-latency inference can drive everyday use rather than occasional demos (Meta, 2024; Hicks, 2024). Industry sentiment mirrors this turn: in a 2024 survey of 305 insiders, 83 percent said generative AI will benefit XR, chiefly by speeding content creation and creative exploration

(Perkins Coie LLP, 2024). IDC likewise expects "more glasses with displays and multi-modal AI" in the 2025 product wave, which aligns device roadmaps with the AI-first software stack (IDC, 2025).

2.4.2   Democratisation of XR creation

Creation is getting faster and more accessible as toolchains add low- and no-code workflows plus built-in generative models. Snap released Lens Studio 5.0 with a GenAI suite, an AI assistant, and text or image prompts to generate assets, and reported that the new tools cut production cycles from weeks to hours (Snap Inc., 2024; Reuters, 2024). Niantic introduced Niantic Studio, a visual WebXR editor in public beta, and lowered 8th Wall commercial license pricing to reduce entry barriers for agencies and SMEs (Niantic, 2024). TikTok's Effect House broadened advanced capabilities such as 3D hand tracking while continuing rapid update cadence through 2025 (TikTok, 2025). In game-engine pipelines, Unity's AI suite and Epic's AI assistant for UEFN aim to automate boilerplate tasks and help non-experts assemble shippable interactive scenes, which narrows the gap between ideation and publishable XR content (Unity, 2024–2025; Epic Games, 2025). For Europe, the most represented XR SMEs already operate as service studios across several sectors, so these lower-friction tools are directly relevant to their revenue models (XR4Europe, 2025).

2.4.3   Rise of consumer-friendly form factors

Recent cycles favour lighter devices and familiar styles that people can wear in public without friction. IDC characterises 2025 as a year of "more glasses with displays," alongside a temporary shipment pause before a strong 2026 rebound, which underscores the pivot from bulky headsets to everyday eyewear and mixed reality designs with high-quality passthrough (IDC, 2025). Meta's new Ray-Ban "Display" model puts a heads-up display into classic frames, while earlier Ray-Ban lines added multimodal AI and first-person video calling, demonstrating how practical functions can anchor daily use (Meta, 2024; Hern, 2025; Hicks, 2024). XREAL's Air 2 Ultra targets spatial computing in a sub-150 g package with environmental sensors and 6DoF input, reinforcing the trend toward glasses that can handle both entertainment and productivity when tethered to a phone or PC (XREAL, 2024). In parallel, Samsung, Google, and Qualcomm introduced Android XR and previewed a Samsung mixed reality headset, adding platform diversity that should broaden price points and industrial design options for consumers (Google, 2024; Samsung, 2024).

2.4.4   5G, cloud rendering, and edge computing as enablers

Network evolution is a critical lever for comfort, cost, and content breadth. 3GPP Release 18 introduced 5G-Advanced, with vendor and operator briefs highlighting XR as a key beneficiary through better mobility, coverage, and capacity, and with deployments expected from late 2025 into 2026 (3GPP, 2024; GSMA, 2024; Ericsson, 2023). At the workload level, cloud and edge rendering let thin clients display high-fidelity scenes while pushing most compute to GPUs in the network, a pattern exemplified by NVIDIA's CloudXR stack and validated in recent academic evaluations of edge rendering architectures for multiuser XR (NVIDIA, 2025; Xhafa et al., 2024). ETSI's MEC work provides the API and discovery layer for locating low-latency compute at the edge and has continued to publish developer guidance in 2024 and 2025, which helps integrators align XR services with operator infrastructure (ETSI, 2024–2025). Together, these shifts support lighter glasses, longer sessions, and streaming-class experiences that are not gated by local silicon constraints.

2.4.5   Evolution from metaverse hype to tangible applications

The market is rotating from abstract "metaverse" narratives to use cases that deliver measurable outcomes. In the 2024 XR Report, investment and development in Web3, NFTs, and cryptogaming fell sharply compared with the prior survey, while 59 percent of respondents reported active AI investment and 83 percent expected generative AI to improve XR content pipelines. The same survey identified workforce training, education, healthcare, and defence as the non-gaming sectors most transformed by XR and cited user experience and device cost as the top adoption brakes, a framing that aligns with today's practical deployments and hardware priorities (Perkins Coie LLP, 2024). European data shows a similar shape. XR4Europe's 2025 industry mapping finds SMEs concentrated in education, arts and culture, healthcare, advertising, and industrial manufacturing, with most firms serving multiple sectors and exporting beyond the EU. This profile points to content and services that can scale now, rather than speculative social worlds (XR4Europe, 2025). IDC's near-term device view adds texture, noting a 2025 lull ahead of a strong 2026 rebound, and a platform race in mixed reality that privileges comfort, price, and app ecosystems over hype (IDC, 2025).

2.5   Use cases

2.5.1   Media and entertainment

Immersive media has moved from experiments to repeatable formats in live music, social viewing and data-rich news presentation. In Meta's Horizon Worlds, purpose-built venues such as Music Valley have hosted headline VR concerts that are shot and edited for 180-degree viewing and replay, for example Sabrina Carpenter's 45-minute show produced with Meta and Gunpowder & Sky in July 2024. These events were distributed to Quest headsets inside Horizon Worlds and positioned as a continuing strand of music programming, signalling that VR concerts are now a recognised release format rather than one-off stunts (People, 2024; Mixed News, 2024; UploadVR, 2025).

News and journalism are also adopting immersive production toolchains. Major European broadcasters used real-time graphics, augmented displays and virtual studios to explain complex election data throughout 2024, with Sky News anchoring Election Night Live from a 360-degree immersive studio and BBC News blending HTML and 3D graphics into its set pieces. Trade coverage shows how virtual production, LED volumes and real-time engines have become standard parts of election broadcasting toolkits across the UK and beyond, underlining the shift from "trial" to workflow (TVBEurope, 2024; NewscastStudio, 2024; Vizrt, 2024).

Short-form social platforms are expanding creator-led XR formats in parallel. TikTok's Effect House has added AI creation skills, workspace customisation and advanced AR capabilities such as a 3D Hand Tracker, enabling sophisticated gesture-driven effects that can be produced by non-specialists and deployed to mass audiences inside the TikTok app. The May 2025 release notes describe trending analytics, AI mini-games and visual scripting improvements aimed at increasing effect quality and throughput for creators, which is why brand pilots and "XR trials" often start on TikTok before moving to stand-alone apps or museum kiosks (TikTok, 2025a; TikTok, 2025b).

From a market-wide vantage point, industry insiders expect generative AI to accelerate immersive content supply, with 83 percent saying GenAI will benefit XR and a majority naming enhanced content creation and cost efficiency as the main reasons. The same survey highlights UX and content scarcity

as the biggest adoption hurdles, which explains why platforms and studios are investing in better tools and live formats to keep audiences engaged across film, gaming and social VR (Perkins Coie LLP, 2024).

2.5.2   Cultural heritage and museums

Europe has become a proving ground for XR in conservation-grade storytelling. The Louvre's "Mona Lisa: Beyond the Glass," produced with HTC VIVE Arts and Emissive, established a museum-quality VR exhibition model, combining an on-site installation with a home version for broader access. Subsequent large-scale narrative installations such as "Éternelle Notre-Dame" have run in Paris through 2025, offering 45-minute room-scale VR tours through the cathedral's history and restoration. These experiences demonstrate how VR can present fragile or inaccessible sites with curatorial control while reaching new audiences during long restoration cycles (Louvre Museum, 2019; VIVE Arts, 2019; Paris Je T'Aime, 2025).

Travelling and permanent XR exhibitions now extend across Europe. Emissive's "Horizon of Khufu" opened in London with multi-user free-roam VR exploring the Great Pyramid, a format that blends scholarship with entertainment and can be exported between cities as a turnkey venue. Ticketing and venue partners market it as an "immersive expedition", reinforcing the category's commercial viability for museums, heritage attractions and destination marketing organisations alike (Horizon of Khufu, 2025).

Public policy is reinforcing this momentum. The European Commission and Europeana have launched the common European data space for cultural heritage, prioritising 3D assets and encouraging reuse in education, tourism and creative industries, while the "Twin it! 3D for Europe's Culture" campaign entered a second phase in 2025 to accelerate high-quality 3D digitisation by Member States. Europeana's professional guidance also documents concrete XR building blocks for cultural tours, from AR Tour Builder to AI-assisted 3D reconstruction pipelines, which can feed museum apps and on-site experiences (Europeana, 2025a; Europeana, 2025b; European Commission, 2025).

The sector focus reported by European XR SMEs aligns with these deployments. Survey data collected across 2024 shows arts and culture, alongside education, among the most frequently served sectors in Europe, with SMEs delivering research, content production and software services to museums and cultural bodies. That pattern helps explain why cultural XR remains a prominent early adopter within the European market structure (XR4Europe, 2025).

2.5.3   Tourism and destination experiences

Tourism boards and cities are using XR at three key stages of the visitor journey. For pre-trip inspiration and planning, virtual tours and venue-quality VR exhibitions offer "try before you go" experiences that support itinerary building and reduce uncertainty for first-time or accessibility-needs travellers. During the trip, official destination apps and AR tour builders overlay wayfinding, heritage stories and 3D reconstructions on-site. After the trip, shareable AR effects extend campaign reach on social channels and support seasonal engagement during shoulder months. The European Travel Commission's quarterly updates for 2025 describe robust demand and larger budgets, a context in which immersive tools can help destinations differentiate and manage seasonality through targeted digital storytelling (ETC, 2025a; ETC, 2025b).

There are concrete European examples at national and municipal scale. Malta's official VisitMalta+ app continues to package attractions, routes and live information in a mobile guide that the government updates on iOS and Android stores. Spain's CultuAR initiative demonstrates how an AR layer can scale across more than 120 municipalities as a free destination information hub, combining points of interest, 3D content and on-site prompts. Both models show how AR can be deployed using existing smartphones rather than dedicated hardware, lowering barriers for Destination Management Organisations (DMO) and visitors (Visit Malta, 2025; EU Tourism Platform, 2025).

XR can also improve accessibility and inclusion in travel. The AccessibleEU platform and its 2025 events with UN Tourism foreground accessible tourism practices, and EU-funded projects focused on inclusion provide practical frameworks that destinations can pair with virtual tours and AR guidance to support travellers with mobility, sensory or cognitive needs. Academic reviews likewise point to VR's potential for accessible pre-experience and stress reduction, though they note the importance of addressing usability barriers in immersive tech for people with disabilities (AccessibleEU, 2025; ENAT, 2024; Creed et al., 2024).

2.5.4 Creative industries and storytelling

Creative tooling has shifted decisively toward hybrid pipelines that blend 2D, 3D, game engines and AI, while emphasising open standards for portability. On the social side, Snap released Lens Studio 5.0 with a GenAI Suite that turns prompts into lens-ready assets and ships real-time ML features for face, body and scene understanding, reducing the time from idea to deployable AR effect from weeks to hours. These enhancements, backed by AI-assisted authoring and plugin support, were launched publicly in mid-2024 and continue to mature through 2025 (Snap, 2024; Reuters, 2024).

Game engines have deepened their XR and virtual-production feature sets. Unreal Engine 5.5 introduced improvements across animation, rendering and virtual production, and remains the anchor for LED-volume and broadcast-graphics workflows that spill back into museum installations and live events. Unity has consolidated its generative tools under "Unity AI," retiring Muse in favour of editor-native AI that accelerates asset generation and scene assembly, reflecting the mainstreaming of AI-assisted XR content production inside established DCC tools (Epic Games, 2025; Unity, 2025; Unity, 2025).

Interoperability is improving across devices and pipelines. The Khronos Group's OpenXR 1.1 specification, released in 2024, streamlines cross-platform access to VR, AR and MR runtimes and is the backbone for multi-device deployments. In parallel, the Alliance for OpenUSD reported new members and working-group progress in 2025, signalling continued momentum for USD as a scene description that connects DCC tools, game engines and real-time runtimes. For asset interchange, glTF plus KTX 2.0 compressed textures are now widely documented and supported, including in Blender's LTS releases, which have expanded collection-based exporters for glTF and USD to simplify multi-format deliverables for XR (Khronos, 2024; AOUSD, 2025; Khronos, 2025;).

These creative and technical shifts feed back into audience impact. Industry respondents in the 2024 XR survey expect generative AI to benefit XR primarily through enhanced content creation, creative exploration and cost efficiency, and they identify training, education and healthcare as non-entertainment domains likely to grow fastest in the near term. For media and culture specifically, the same survey stresses that content availability and quality are still gating adoption, which is

precisely what the new creator funds, engine updates and AR platforms are designed to address (Perkins Coie LLP, 2024).

2.6 Recent product launches and ecosystem developments

2.6.1 Apple Vision Pro

Apple moved Vision Pro from a US-only debut to a global device in mid-2024, opening sales in China, Japan, Singapore, Canada, the UK, Germany, and France, and previewed visionOS 2 with spatial photo creation from 2D images, new hand-gesture shortcuts, and refinements to core apps and Mac Virtual Display. This positioning continues to frame Vision Pro as a premium canvas for productivity and high-value media rather than a pure gaming headset (Apple, 2024a; Apple, 2024b).

XR Today's 2025 outlook adds forward-looking detail that is relevant for enterprise planning. The publication reports that Apple's second-generation headset is expected between late 2025 and early 2026, with mass production rumoured to begin in the third quarter of 2025. It highlights a likely move to a next-generation Apple silicon platform with stronger on-device AI performance, visionOS updates aligned with Apple Intelligence, and a redesigned head strap to improve comfort during multi-hour sessions. XR Today also notes industry chatter about a potential two-tier strategy that would pair an enterprise-oriented Vision Pro 2 with a lighter and more affordable "Vision Air," which could lower the per-seat cost for scaled deployments. Across these reports, the business question remains return on investment, since many buyers held back on the first generation and will want clearer productivity gains before committing to larger fleets (XR Today, 2025).

2.6.2 Galaxy XR

Samsung's Galaxy XR debuts as the first headset built on Android XR, pairing spatial apps with Google's Gemini assistant and natural voice/hand/eye input. At launch, Google re-imagined Maps, Photos (2D-to-3D conversions), YouTube (180°/360° + a spatial tab), Chrome, Meet and Google TV, with support for millions of Android apps plus OpenXR/WebXR/Unity to seed a wider developer ecosystem (Google, 2025). Galaxy XR is positioned as an AI-native, general-purpose spatial computer: an "infinite screen" for media and multi-app productivity (windowing, keyboard/mouse, PC link) rather than a pure gaming play, and it's on sale initially in the U.S. and Korea at $1,799, with an optional Explorer Pack bundling subscriptions like Google AI Pro, YouTube Premium/TV, NBA League Pass (Google, 2025; Samsung, 2025).

Looking ahead, early coverage frames Galaxy XR as the anchor for an Android-XR push co-developed with Google and Qualcomm, emphasising on-device AI (Gemini Live), a rich launch catalogue (Adobe's Project Pulsar, Concepts, major streaming apps), and developer pathways (Snapdragon Spaces) as Samsung builds toward enterprise scenarios and future form factors (e.g., glasses) (Android Central, 2025; Google, 2025). Price/performance and comfort are positioned to undercut Apple's Vision Pro while targeting mixed workloads, media, collaborative calls, and design tools, leaving the key business question as ROI through real productivity gains and manageable per-seat costs for fleet rollouts (Android Central, 2025; Wareable, 2025).

2.6.3   Meta Quest 3 and the 3S family extension

Meta's Quest 3, introduced in late 2023, set the company's baseline for consumer mixed reality. In September 2024 Meta formally extended the line with Quest 3S at 299 dollars, keeping full-colour passthrough and the Snapdragon XR2 Gen 2 while reducing price to broaden adoption. Meta's own description of 2024 platform work emphasises that Horizon OS was "rebuilt for spatial computing," with better 2D app support, spatial audio and improved passthrough, and that these improvements land on both Quest 3 and 3S, setting the stage for continued OS-level iteration through 2025 (Meta, 2024).

2.6.4   XREAL Air 2 Ultra and developer stack

XREAL used CES 2024 to unveil Air 2 Ultra, a 6DoF AR glasses design priced at 699 dollars and targeted at developers and early adopters, with shipments beginning March 2024. The company paired the hardware with a developer push that modernised its toolchain, including XREAL SDK 3.0 that aligns with Unity's XR Plugin architecture and AR Foundation, improving cross-platform portability for creators building spatial experiences (XREAL, 2024).

2.7   Software tools and platforms

Unity shipped Unity 6 as its new baseline release and then delivered Unity 6.1 as a supported update to accelerate new functionality and platform support. For XR teams, the Unity 6 family concentrates on performance improvements and standardized XR integration, and it remains tightly aligned with OpenXR through engine-level support (Unity, 2024; Unity, 2025). Epic Games followed with Unreal Engine 5.6 in 2025, expanding on UE5's virtual production, animation, world-building and MetaHuman workflows that are widely used for immersive media and real-time content pipelines (Epic Games, 2025).

Creator-facing social AR is in transition. Snap advanced Lens Studio 5.0 out of beta in June 2024 with a generative AI toolset, faster authoring, and an assistant that compresses creation cycles from weeks to hours. Reuters' coverage underscored the intent to make sophisticated AR creation more accessible to both artists and developers (Snap Inc., 2024; Reuters, 2024). By contrast Meta shut down the Spark AR platform for third-party effects on 14 January 2025, a strategic move that affected brands and independent creators that had relied on Instagram and Facebook effects, and that Meta framed as a resource shift toward new devices and experiences such as smart glasses (Meta, 2024; Reuters, 2024).

2.8   Market consolidation and strategic pivots

Two structural shifts defined the past 18 months. First, platform realignment accelerated. Meta rebranded its Quest software as Meta Horizon OS and opened it to third-party hardware partners such as ASUS and Lenovo, signalling an Android-like licensing strategy in XR. The company positioned Horizon OS as a full stack for gesture input, scene understanding, and spatial anchors, with a Horizon Store and a companion mobile app. Reuters framed this as a bid to grow the ecosystem beyond Meta's own headsets and to counter both Apple and Google's moves (Meta, 2024; Reuters, 2024).

Second, several vendors pulled back or re-scoped their bets. Microsoft formally removed Windows Mixed Reality from Windows 11 24H2, ending support for WMR PC headsets and consolidating its XR

efforts around enterprise use cases like IVAS for defence, HoloLens 2 support, and partner ecosystems. UploadVR documented the removal and its impact on legacy headsets such as HP Reverb G2 (UploadVR, 2024). ByteDance's Pico downsized in late 2023, with confirmed layoffs and restructuring that analysts read as a retreat from a costly global push, which in turn influenced content and distribution in Europe through 2024 (UploadVR, 2023).

At the same time, new entrants and bridges emerged. Google introduced Android XR in 2025 as a dedicated platform for headsets and glasses built with Samsung, an explicit attempt to seed a multi-OEM ecosystem in spatial computing. Reporting through Google's own product blog and independent coverage points to Samsung's Project Moohan as the first marquee device, which indicates a 2025 hardware cycle for Android-based MR headsets (Google, 2025). Sony broadened PS VR2's addressable market by shipping an official PC adapter in August 2024, allowing SteamVR use and effectively turning a console peripheral into a hybrid PC VR device, a notable interoperability pivot for a previously closed system (Sony Interactive Entertainment, 2024).

Importantly, industry sentiment captured in 2024 flagged user experience and device cost as the top barriers to mass adoption, a backdrop that helps explain why vendors experimented with lower-price hardware, cross-platform operating systems, and creator-tool consolidation in 2024 and 2025 (Perkins Coie LLP, 2024).

2.9 Platform openness and interoperability

OpenXR matured with the 1.1 specification in April 2024, which folded widely used extensions into the core and reduced fragmentation for developers. Khronos highlighted that most major XR platforms now have conformant OpenXR implementations, naming vendors such as Meta, Microsoft, Sony, XREAL, Varjo, HTC, Magic Leap, and Valve, and that engines including Unity and Unreal support OpenXR. The same statement underlined ongoing work on hand and full-body tracking standardization. Apple is not listed among conformant OpenXR implementations, and Apple's developer documentation for visionOS continues to centre on RealityKit and ARKit as the primary APIs for spatial apps, which preserves a distinct Apple-specific developer path alongside the broader OpenXR ecosystem (Khronos Group, 2024; Apple, 2025).

Interoperability also advanced at the content layer. The Alliance for OpenUSD expanded membership and working group activity in 2025, reinforcing OpenUSD's role as a common 3D scene description for pipelines that bridge DCC tools, real-time engines, and XR runtimes. These developments help media, culture, and tourism projects share assets more easily across engines and devices through 2030 (Alliance for OpenUSD, 2025; Alliance for OpenUSD, 2025).

2.10 Economic and Regulatory Influences

2.10.1 EU policy landscape: Web 4.0, ethics-by-design, and digital sovereignty

The European Commission's Web 4.0 and Virtual Worlds strategy frames immersive technologies as part of the next internet transition, with a human-centric approach that embeds fundamental rights and ethics-by-design into immersive environments while promoting openness, interoperability, and European digital sovereignty (European Commission, 2023; European Commission, 2025). This policy line continued in 2025 through high-level multi-stakeholder dialogues on Web 4.0 governance that

explicitly prioritized accessibility, trust, security, and fair competition as foundations for virtual-world ecosystems that serve citizens, creators, and industry in Europe (European Commission, 2025).

Two funding pillars operationalize this policy vision. The Digital Europe Programme 2025–2027 allocates 1.3 billion euro to AI deployment, cybersecurity, data spaces, cloud and advanced digital skills, explicitly tying investment to Europe's tech sovereignty objectives and to public-sector adoption of trustworthy AI and data infrastructure relevant to immersive services (European Commission, 2025). In parallel, the Horizon Europe 2025 work programme commits 7.3 billion euro to research and innovation that advances the green and digital transitions, with calls that encompass creative industries, media technologies, and human-centric digital experiences that can include XR (European Commission, 2025).

2.10.2 GDPR, safety standards, and accessibility in immersive media

Processing in XR routinely involves highly sensitive signals such as gaze, body-motion traces, and spatial audio-video, which fall within the GDPR's strict data-protection regime; special categories like biometric data for uniquely identifying a person require heightened safeguards and lawful bases, and privacy-by-design and by default are mandated for controllers operating immersive services in the EU (European Parliament and Council, 2016; European Data Protection Board, 2025). Complementing GDPR, the General Product Safety Regulation applies to consumer XR devices and accessories placed on the EU market and has been applicable since December 2024, updating safety duties for online and connected products sold across the single market (European Parliament and Council, 2023). Cybersecurity obligations affecting connected XR headsets and accessories tighten further as the Radio Equipment Directive's delegated cybersecurity requirements begin to apply from 1 August 2025 to radio-equipped devices, including many wearables and IoT products relevant to XR ecosystems (European Commission, 2025). The longer-horizon Cyber Resilience Act, which entered into force in December 2024, phases in mandatory security-by-design and vulnerability handling obligations for products with digital elements, with full application in December 2027, shaping vendor roadmaps for XR hardware, firmware, and companion apps (European Parliament and Council, 2024).

Accessibility becomes a binding design constraint for immersive media services in 2025. The European Accessibility Act applies from 28 June 2025 to covered products and services, including e-commerce and a broad range of consumer digital services, reinforcing requirements for perceivability, operability, and understandable user interfaces that XR content and distribution platforms must reflect when serving EU consumers (European Parliament and Council, 2019; European Commission, 2025).

2.11 Role of public funding: Horizon Europe and Digital Europe

From 2025 to 2027, the Digital Europe Programme drives deployment-oriented projects in AI, cybersecurity, cloud and data spaces, which are foundational for XR content pipelines, real-time rendering, and trustworthy identity in virtual environments, while also funding GenAI pilots for public administrations that intersect with immersive public-service use cases (European Commission, 2025). The Horizon Europe 2025 work programme's 7.3-billion-euro budget supports R&I across clusters including Culture, Creativity and Inclusive Society and Digital, Industry and Space, enabling university-industry consortia to advance XR authoring tools, interaction design, and media-tech testbeds that can translate to cultural heritage, tourism, and creative-industries pilots (European Commission,

2025). Together, these instruments reinforce a policy emphasis on human-centric, interoperable Web 4.0 ecosystems and European competitiveness in immersive media supply chains (European Commission, 2023; European Commission, 2025).

2.11.1 Tariffs, inflation, and consumer-spending trends

Macro-conditions in 2025 are stabilising but still shape XR demand. Eurostat's flash estimates put euro-area HICP inflation around the European Central Bank's target range, with September 2025 at an estimated 2.2 percent, up slightly from August, which eases real-income pressure relative to 2023–2024 and supports a gradual recovery in discretionary spending categories relevant to XR (Eurostat, 2025). Consumer confidence has improved through 2025 but remains below long-run averages, with the Commission's flash indicator at −14.9 for the euro area in September, implying continued caution in non-essential purchases and price-sensitivity for XR hardware and premium content (European Commission, 2025). Retail-trade data show modest year-over-year gains by late summer 2025, consistent with a slowly recovering consumption backdrop for electronics and entertainment (Eurostat, 2025).

Trade policy also matters for device bill-of-materials and pricing. The EU participates in the WTO Information Technology Agreement, which eliminates tariffs on many IT components used in XR supply chains, though classification and origin rules still determine duty exposure for specific finished goods (WTO, 2025). ECB staff projections in September 2025 incorporated higher assumed foreign tariffs in global trade and found a small cumulative drag on euro-area growth in 2025–2027 from tariff and uncertainty channels, suggesting limited but non-zero macro spillovers to consumer durables and electronics categories, including XR (European Central Bank, 2025).

2.11.2 Regulatory co-determinants for XR platforms and services

Cyber-resilience and network-security rules also shape cloud, edge, and content-delivery dependencies behind XR. NIS2 entered into application in October 2024, expanding cybersecurity risk-management and incident-reporting obligations for essential and important entities that include cloud, data-center, and content-delivery providers that XR services rely on (European Commission, 2024). The EU Data Act entered into application on 12 September 2025 and establishes fair-access and portability rules for data, which can affect multi-tenant XR platforms, device-generated telemetry, and cross-service portability of 3D assets and user profiles (European Commission, 2025).

2.12 Conclusion & Strategic Outlook

By 2025, the XR market remains in a holding pattern, with hardware cycles pausing between generations and a cautious investment climate defined by uncertain returns. Vendors like Meta, Apple, and Samsung are refining mixed-reality and smart-glasses form factors, but mass adoption is still constrained by cost, comfort, and content scarcity. This circular dependency, hardware adoption hinging on content demand, and content creation dependent on installed hardware, has slowed momentum. While public policy and EU programmes such as Digital Europe and Horizon Europe inject optimism, private investors remain tentative, waiting for clearer signals of market consolidation and sustainable consumer uptake.

Looking toward 2030, Europe's XR outlook across media, culture, and tourism remains promising. The Web 4.0 and Virtual Worlds initiative and the common European data space for cultural heritage are strengthening the content backbone that will power immersive storytelling, virtual museums, and destination-based XR experiences. Tourism boards and creative industries increasingly deploy XR to enhance accessibility, differentiate destinations, and preserve heritage digitally, with pilots showing measurable impact on engagement and seasonality. If the current ecosystem maintains its investment in interoperability and accessibility, Europe can achieve steady, human-centric growth in XR production and reuse, even as global markets oscillate between hype and retrenchment.

Amid this steady progression, the Generative AI boom has created both opportunity and turbulence. Industry surveys show that over 80% of XR professionals see GenAI as a driver of faster and cheaper content creation, but the global surge in GenAI investment, much of it concentrated in the United States and Asia, has drawn risk capital away from other immersive and metaverse-related ventures. The hype cycle around GenAI fuels optimism but also amplifies uncertainty, as venture funding follows short-term AI platform plays instead of longer-horizon spatial computing. For Europe, this imbalance underscores the need to pivot from chasing scale in foundational models to securing strategic value in applied creativity and trusted content ecosystems.

This context makes a strong case for European investment in content-creation platforms that embed regional values, privacy, inclusiveness, cultural diversity, and ethical AI, into the next generation of XR experiences. Rather than competing head-to-head with U.S. and Chinese AI giants, Europe's comparative advantage lies in building interoperable, rights-aware creative infrastructures that empower its museums, media organizations, and SMEs to produce and monetize immersive works safely and sustainably. Such a platform would translate Europe's regulatory leadership under the AI Act, GDPR, and Accessibility Act into a competitive differentiator, enabling trustworthy generative content aligned with European cultural richness and digital sovereignty. In doing so, Europe could redefine XR not through hardware dominance, but through human-centred innovation, transforming its current holding pattern into a launchpad for inclusive, sustainable growth by 2030.

3   Exploitation

Europe has a longstanding tradition of fostering innovation through entrepreneurship, rooted in a culture that values creativity, collaboration, and the continuous renewal of industries. This tradition aligns closely with the Schumpeterian notion of "creative destruction," where innovation emerges through the transformation or replacement of existing structures, technologies, and business models. Such an approach not only drives competitiveness and growth but also ensures that research and technological advancements translate into tangible economic and societal benefits.

In this context, pursuing a commercially viable joint exploitation strategy represents one of the most effective paths toward ensuring the long-term impact and sustainability of the XReco project. By leveraging market mechanisms and entrepreneurial collaboration, the consortium can transform project outcomes into real-world solutions that generate value for both industry and society. This strategy reinforces the European innovation model, where public research, private initiative, and cross-sector collaboration converge to stimulate continuous renewal and market-driven impact.

Since the project's inception in September 2022, and continuing through its conclusion in October 2025, the consortium's collective efforts have been directed toward developing a comprehensive Joint Exploitation strategy. Guided by the principles of Human-Centred Design, all partners have collaborated over three years to align and integrate their individual contributions into a cohesive framework. Together, we have assessed the feasibility of the XReco platform, validated its desirability with end users, and engaged in extensive discussions to evaluate its long-term viability. The following section outlines how this collaborative journey evolved, and the key milestones achieved along the way.

3.1   Methodology

The main challenge in any design project lies in maintaining a process that is both flexible and user-centred. A successful design approach must remain responsive to user needs and insights gathered from real-world testing. By continuously revisiting and refining the product based on user feedback, the result is a solution that not only aligns with the intended audience but also evolves alongside their changing preferences and expectations.
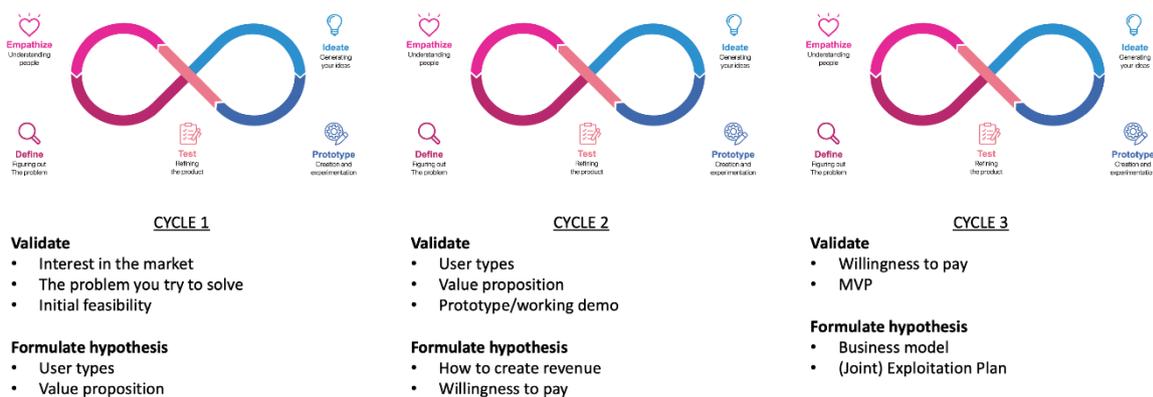
Figure 1: XReco's methodology for user validation and exploitation

The exploitation methodology implemented in XReco was built upon the principles of **Human-Centred Design (HCD)** and refined throughout the project by applying a structured, iterative process of validation and co-creation. Recognising the complexity of building a modular, multi-stakeholder XR ecosystem, the consortium adopted a **cyclical development model** organised around three 10-month validation loops, each culminating in a **Joint Business Clinic (JBC)**. These cycles enabled the consortium to incrementally align the project's value propositions, technical capabilities, and commercial strategies with evolving user needs and market conditions.

The methodological backbone of WP6 was rooted in a five-step HCD loop: **empathize, define, ideate, prototype, and test**. This loop was applied across all exploitation components, ensuring that user feedback directly informed successive iterations of both the technical platform and the exploitation approach. Each cycle generated specific hypotheses, initially around user segmentation, then around platform use modes, and finally around business viability, that were explicitly validated or revised during the JBCs. Between each cycle, user inputs were mapped onto updated **Value Proposition Canvasses (VPC)**, MVP refinements, and business model options.

The three validation loops can be summarised as follows:

- **Cycle 1 (M1–M10)** focused on identifying early user needs and distinguishing between use cases in media, tourism, and mobility. This culminated in **JBC#1**, which revealed that sector-specific distinctions were insufficient, as many pain points (e.g. licensing clarity, asset quality) and gains (e.g. workflow efficiency, reusability) were shared across domains.
- **Cycle 2 (M11–M20)** introduced a novel user segmentation based on roles within the XR value chain enabling more precise alignment between platform services and user behaviours. **JBC#2** validated this segmentation and produced refined VPCs and a clearer ecosystem architecture.
- **Cycle 3 (M21–M30)** focused on the **business and monetization dimension**, assessing willingness to pay, perceived value, and minimum viable offerings. During **JBC#3**, selected test users were given access to a working MVP and asked to provide feedback on usability, pricing models, licensing, and potential integration into their workflows. This final loop consolidated the joint exploitation pathways and informed the commercial strategy detailed in Section 3.6.
- **Results consolidation (M31-M38)**: This last step finalised the integrated exploitation framework and confirmed component ownership, maturity, and commercialisation routes. This final phase defined the **end game** for XReco, transitioning from a research prototype to a sustainable ecosystem ready for post-project exploitation and potential market deployment.

In addition to the JBCs, the exploitation methodology was supported by complementary methods, including:

- **Partner interviews and surveys** to capture individual exploitation ambitions
- User personas and ad-lib testing scripts to simulate real-world interactions
- **Feedback loops** within the MVP to capture live user behaviour and bottlenecks
- External validation workshops and public showcases, including immersive demos

Throughout, the Work Package maintained a close integration with the other Work Packages, ensuring that insights from exploitation were reflected in technical planning, and vice versa. This iterative alignment was essential in steering XReco from a concept-level ecosystem vision to a user-tested, modular service platform with validated value propositions and a credible exploitation pathway.

In summary, the XReco exploitation methodology balanced **exploratory innovation** with structured feedback loops. It translated abstract platform ambitions into tangible services by continuously engaging the community of future users, thereby maximizing the project's impact potential and reducing post-project uncertainty.

3.2 Exploitation components

This section provides an overview of the key exploitation components developed and implemented by the XReco WP6 team to maximize the use and impact of project outcomes throughout its duration. The execution of these steps is supported by targeted communication activities led by the dissemination team and complemented by one-to-one demonstrations with potential partners and customers.

Since September 2022, these components, rooted in Human-Centred Design (HCD) principles, have been developed and refined in parallel, with the ambitious goal of building an integrated strategy for exploiting project results at both individual and collaborative levels. Each component contributes to a coherent approach that ensures outcomes are aligned with user needs and market opportunities.

In practice, these components are closely interconnected and mutually reinforcing. The results presented for each element in this deliverable often overlap and influence one another. Therefore, the following sections should be viewed as part of an integrated framework contributing collectively to the creation of comprehensive joint exploitation strategies, rather than as distinct or isolated activities.

To maximise the long-term impact of the XReco project, WP6 defined a set of interrelated exploitation components that collectively support the transition from research results to sustainable value creation. These components were introduced at project outset and maintained throughout the 38-month duration. While each has a distinct scope and methodology, they were intentionally designed to **mutually inform and reinforce one another**, reflecting the cross-cutting nature of exploitation in a platform-based innovation action.

All components were implemented in parallel and aligned with the project's three-cycle Human-Centred Design framework described in Section 3.1. They served as structuring elements for exploitation-related activities, stakeholder engagement, and decision-making. Their interdependence was particularly visible during the preparation and execution of the Joint Business Clinics (JBCs), which integrated insights from all six.

Together, these components enabled XReco to move from early-stage concepts to a validated, multi-user ecosystem model, with a set of outcomes, and multiple exploitation pathways. In the following sections, each component is described in more detail, including both the methodological approach and the concrete outcomes achieved during the M1–M38 period.

3.2.1 Component 1: market and customer analysis

Aligned with the Human-Centred Design (HCD) methodology, the first phase of the exploitation strategy focuses on a thorough analysis of the current XR market to identify customer gaps, needs, and emerging opportunities. This stage places strong emphasis on understanding end users and customers, their requirements, preferences, and pain points, to ensure that the strategy is grounded in real-world demand. The insights gained from this analysis form the foundation for developing a

robust and targeted exploitation strategy, setting the scene for how XReco's results can be effectively positioned and leveraged within the market.

This component focused on understanding the evolving landscape of XR technologies, value chains, and stakeholder communities across target sectors. In the absence of consistent quantitative market data for XR in Europe, proxy indicators were used to assess technological maturity, adoption trends, and potential drivers of uptake. The analysis also mapped emerging needs across media, tourism, and cultural heritage domains, with emphasis on identifying points of friction in existing workflows that XReco could alleviate. This component is detailed in Section 3.3.

3.2.2   Component 2: creation of exploitation strategies

The exploitation strategies provide a comprehensive overview of the project elements relevant to market uptake, outlining approaches for stakeholder identification, engagement, and eventual technology transfer. To capture how each consortium member intends to apply the project outcomes within their business or research activities, dedicated individual exploitation plans have been developed. This process follows a co-design approach, actively involving consortium partners in shaping the strategy and ensuring that their objectives, expectations, and perspectives are fully integrated into the overall exploitation framework.

This component involved developing individual and joint exploitation strategies based on the validated project results. Individual strategies focused on how partners would apply or commercialise specific assets or expertise, while the joint strategy addressed collective pathways for sustaining shared infrastructure and services. Key activities included internal partner interviews, exploitation plan drafting, and the exploration of spinout or federated models. Detailed outcomes are provided in Sections 3.4.1 and 3.4.2.

3.2.3   Component 3: Joint Business Clinics

To develop an integrated strategy for exploiting XReco's results, three Joint Business Clinics (JBCs) have been organised. These workshops are designed to showcase and demonstrate XReco's core assets to business experts from various markets, gather insights into their needs and challenges, and evaluate how XReco can create value for specific customer segments. In addition, the JBCs serve as a platform to initiate dialogue with potential early adopters and explore strategic partnerships with external companies interested in supporting future technological and market developments. By applying a co-creation approach, the JBCs ensure that business experts are actively involved in shaping the strategy, with their perspectives and requirements directly informing the exploitation process.

The three JBCs formed the backbone of user validation and co-creation within XReco. Each JBC marked the end of a 10-month iteration cycle and provided a structured format to test hypotheses related to desirability, feasibility, and viability. Participants included external stakeholders representing the identified user types (Searcher, Taker, Transformer, Creator). JBCs played a pivotal role in validating the platform architecture, defining user-type-specific value propositions, and assessing pricing models. A comprehensive summary of the JBC process and results is presented in Section 3.5.

3.2.4   Component 4: XReco value proposition & commercial strategy

Drawing on the insights gathered from the Joint Business Clinics (JBCs) and the comprehensive market analysis, a Minimum Viable Product (MVP) and a high-level business model are to be developed. This phase follows a user-centred approach, ensuring that the design of the MVP and business model is informed by real user input and market evidence. The workshops enable (1) the evaluation of XReco's applicability across different market contexts, (2) the identification of key features and functionalities valued by customers in specific use cases, and (3) the formulation of clear value propositions tailored to distinct customer segments. Business models for several prioritized use cases will be created, embedding Human-Centred Design (HCD) principles directly into XReco's commercial strategy.

This component focused on the articulation and testing of value propositions per user type, the definition of monetization models, and the alignment of technical capabilities with business expectations. It consolidated insights from JBCs, MVP feedback, and stakeholder interviews into a coherent commercial strategy. Outputs included updated Value Proposition Canvasses (VPCs), monetization canvasses, and a pricing framework. The results of this component are documented in Section 3.6.

3.2.5   Component 5: IP management

Before the results of an EU-funded collaborative project can be effectively exploited, it is crucial to establish a clear understanding of each participant's contributions, the shared objectives, and the expected outcomes. Equally important is reaching a mutual agreement on the terms and conditions governing the use and access of intellectual property (IP) generated within the project. This process minimises potential conflicts and facilitates both individual and joint exploitation of results. During interviews and the development of individual exploitation plans, consortium members are asked to identify and describe their respective IP assets. The IP management process follows a collaboration-driven approach, ensuring that all participants have a transparent and shared understanding of the generated IP and its associated usage rights.[2]

Intellectual property considerations were managed throughout the project to ensure that results with commercial or collaborative potential could be exploited securely and transparently. The focus was on clarifying ownership of jointly developed components, exploring licensing strategies for shared services, and aligning internal IP rules with the exploitation intentions of the partners. A summary of the IP management approach and open issues is provided in Section 3.7.

3.2.6   Component 6: results consolidation with human-centred approach

This component brings together the key outcomes and insights from all other workstreams to deliver a comprehensive overview of the available exploitation pathways for the XReco project. Guided by the Human-Centred Design (HCD) approach, it prioritises the needs and perspectives of customers and users, ensuring that the XReco solution is developed and positioned to deliver meaningful value and market relevance. The results consolidation phase includes an in-depth assessment of XReco's

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[2] XReco deliverable D1.2 Data Management Plan gives further details to selected readers. This document is not public.

potential impact across different user groups, along with an evaluation of its ethical and societal implications to guarantee that the solution remains socially responsible and sustainable. Ultimately, this step defines a clear roadmap for the continued development, market introduction, and long-term commercialisation of the XReco solution.

The final component served as a synthesis layer, integrating validated feedback, service maturity levels, and business logic into a coherent exploitation package. It tracked how user insights shaped successive iterations of the platform, and how these inputs led to concrete changes in the MVP, documentation, and go-to-market configurations. This component also captured lessons learned about exploitation governance in open ecosystems. It is further described in Section 3.8.

3.3   Market and customer analysis (component 1)

3.3.1   Market analysis

For our market analysis see Section 2 Market analysis.

3.3.2   Customer analysis

The XReco project initially explored user segmentation by vertical markets, attempting to categorize participants based on their industry sector, such as media, heritage, or creative industries. However, this approach was found to be ineffective. During the first Joint Business Clinic (JBC#1), it became evident that participants across different sectors shared many of the same challenges, expectations, and goals. As a result, the hypothesis that users should be distinguished by their line of business was rejected.

The team then shifted its focus to a more functional segmentation, exploring how users interacted with the platform rather than which sector they came from. This new approach was tested and validated during JBC#2. It proved to be far more insightful because it reflected the different ways in which people derived value from XReco's tools and services.

Five primary user types emerged from this functional segmentation: the **Giver**, the **Searcher**, the **Taker**, the **Transformer**, and the **Creator**. Each of these represents a distinct behaviour pattern and value proposition in relation to the XReco ecosystem:

- Givers are users who contribute content to the XReco ecosystem but do not necessarily transform or use it themselves. They typically represent cultural institutions, archives, public projects or individuals that hold large 2D or 3D datasets. Their primary goal is to make assets available for reuse. Givers value ease of upload, clear attribution mechanisms, and robust metadata management. They often face usability barriers and rely on simple, guided workflows. Their willingness to pay is limited, they are more motivated by visibility, credit, and social or institutional recognition than by direct financial return.

- The Searcher is a user type primarily driven by the need to organize and access large datasets that they own or control. Their motivation stems from the desire to make their assets more accessible, actionable or useful. For them, having an efficient upload service or connector is crucial. They also value accurate and comprehensive search functionality, as it enables them to leverage the full value of their dataset.

- The Taker integrates existing 3D assets into ongoing production processes. This group includes broadcasters, studios, and institutions experimenting with virtual production environments. Their main concern is compatibility with existing pipelines, clear usage rights, and a stable, professional-grade service. They are less focused on asset creation but depend on the platform's reliability.
- The Transformer operates at the intersection of creativity and technical experimentation. These users reuse, adapt, and enhance digital assets using XReco's reconstruction and transformation services. Their expectations centre on quality, metadata integrity, and workflow efficiency.
- The Creator is the most technically self-sufficient user group. Creators generate or upload their own 3D content using the XReco authoring tools. They value rapid prototyping, automation, and streamlined user interfaces that allow them to produce tangible results without extensive manual work. The Creator type is also sensitive to how intuitive and stable the user interface is.

By validating these five user types, XReco established a more reliable framework for both product development and commercialisation. This understanding helped identify which aspects of the platform were most valuable and where improvements in usability or pricing models were needed.

After the second Joint Business Clinic, the consortium decided to concentrate on 3 user types and create an MVP considering the needs of these users: the Taker, the Transformer and the Creator. In terms of interaction with the platform these users form a natural ecosystem in the sense that contributions from one user type, could quite naturally be used by the other user types as input for the engagement with the platform. However, the internal evaluation was that Searchers and Givers are most likely to be institutional users, which would require a separate approach, and the team therefore decided not to emphasize efforts on the other user types.

The findings from JBC#3 focused strongly on the users' willingness to pay for the platform's services.

The overall hypothesis that users would accept a monthly subscription for access to the full XReco platform was tested and eventually rejected. We asked participants in this Joint Business Clinic a number of identification questions, based on which we could establish that four of five user types were represented: Givers, Takers, Transformers & Creators. There were no Searchers among the participants (consistent with the decision to deemphasize this user type).

While participants agreed that the platform delivered clear value, they did not find a flat subscription model attractive. The key reason was the variability in how different users engaged with the platform. Some used it only occasionally for specific projects, while others relied on it intensively for short bursts of activity.

As a result, a strong preference emerged for a pay-per-use or credit-based system. Users showed readiness to pay for specialized services such as NeRF reconstructions or Gaussian Splatting, where each use has a direct and measurable outcome. They preferred the flexibility to purchase credits as needed rather than committing to recurring monthly payments.

Transaction-based fees were also broadly accepted. Users understood that XReco, as a marketplace, could charge commissions on transactions between buyers and sellers of 3D assets, similar to how platforms like Uber operate. This model was seen as fair because it linked payment directly to value creation.

However, users were strongly opposed to paying for the act of searching or discovering content. They viewed content exploration as an essential and free entry point. One participant summarized this view by saying, "you should not have to pay just to go into the showroom."

Institutional users, such as museums or public broadcasters, expressed particular sensitivity to pricing. They operate under budget constraints and often rely on project-based funding. For them, usage-based billing or tiered models were the only viable options, as these allow them to allocate costs to specific funded activities. This creates a tension between users' preference for flexible, on-demand payments and the platform's need for stable revenue streams to sustain operations.

Beyond monetization, JBC#3 provided rich insights into how different user types experienced the platform. Across all groups, there was appreciation for the technical capabilities of XReco, particularly the integration of AI-based 3D reconstruction tools. However, usability and workflow clarity remained recurring concerns.

- Users frequently mentioned that the platform interface felt complex and lacked clear guidance. Many expected prominent, task-oriented buttons or prompts that would guide them through the creation process step by step. The absence of visible error messages or feedback during failed processes also frustrated testers, limiting their ability to learn from mistakes.
- Another recurring issue was the need for improved metadata and file organization. Some users highlighted the importance of clear licensing information and automatic generation of metadata files accompanying downloads. These improvements were seen as crucial for trust and reusability.
- Team collaboration also surfaced as an emerging need. Several users expressed interest in features that would allow small groups to share and manage content collectively within the platform. This points to a potential growth area for XReco as it moves from serving individual testers to supporting organizational teams.
- Privacy and data governance were also emphasized as important decision factors. Users indicated that they would freely use the platform for research or internal projects but would need stronger assurances on hosting, data security, and AI model training before applying it in commercial or client-facing contexts.

Despite these concerns, the overall sentiment remained positive. Users saw the platform as a promising environment for innovation in 3D and XR content generation. Many expressed enthusiasm to continue testing and collaborating as XReco evolves.

From these collective insights, a clear ideal customer profile emerged. The most promising user segment is the semi-experienced XR developer or researcher who values rapid prototyping. This user appreciates automation and convenience, is comfortable with technical concepts like Unity integration, and seeks to streamline repetitive tasks through a simple, intuitive interface.

This ideal user type represents a bridge between the Creator and Transformer categories. They have enough technical expertise to use the platform's more advanced functions but still require accessible workflows. Their willingness to pay depends on visible and immediate results rather than on access alone.

Table 3: JBC3 Feedback per user type

	GIVER	TAKER	TRANSFORMER	TRANSFORMER / CREATOR
Desirability	**High** – Strong interest in cultural asset transformation and public heritage exposure.	**High** – Interested in accessing quality 3D assets for production use.	**Medium to High** – Keen to use new tools for heritage and spatial data reuse.	**High** – Motivated to prototype and build full XR experiences with autonomy.
Usefulness	**Low** – Limited success due to failed workflows and unintuitive UI.	**Medium to High** – Interface clear; usage light but valuable.	**Low** – Service failures and missing spatial metadata limited productivity.	**Medium to High** – Success with asset creation, some issues with complexity.
Key Concerns	UX barriers, unclear onboarding, lack of perceived value.	Must integrate easily with media workflows.	Failed services, no feedback, lack of coordinate metadata in models.	Workflow friction, lack of collaboration tools.

In summary, XReco has confirmed that functional segmentation of users provides the best foundation for product and market development. The platform delivers value in transforming and creating 3D assets, yet its commercial success will depend on a hybrid pricing strategy and continuous improvements in user experience.

3.4   Creation of exploitation strategies (component 2)

The creation of exploitation strategies within the XReco project has been driven by the overarching goal of identifying a viable Joint Exploitation strategy that ensures the long-term sustainability and market relevance of the project results. This joint approach seeks to combine the complementary strengths, resources, and expertise of all consortium partners to deliver greater collective impact than any single partner could achieve independently.

At the same time, the consortium recognizes that each partner maintains its own strategic interests, operational focus, and commercialisation pathways. Therefore, while the emphasis has been on developing an integrated, market-driven exploitation model, individual partners retain the flexibility to pursue individual exploitation strategies where appropriate. These may include licensing intellectual property (IP), spinning off owned IP into new ventures, offering consultancy services based on project results, or pursuing further research and development collaborations.

This section outlines the process and rationale behind the creation of these exploitation strategies, how the consortium worked collaboratively to define joint opportunities while ensuring that individual exploitation options remain viable and aligned with the broader objectives of the XReco project.

3.4.1 Individual exploitation

In order to capture the evolution of individual exploitation plans, the consortium initially designed and distributed detailed surveys, as documented in D6.1, to understand each partner's individual exploitation intentions, target markets, and expected business or research outcomes.

This documentation was complemented by individual interviews, establishing the baseline exploitation perspectives per partner, which were synthesized in D6.2. Since then, partners have had the opportunity to refine their strategies in line with technological progress, market feedback, and internal capacity-building. Through continued bilateral consultations between the exploitation lead and each partner, these plans have evolved into the final exploitation profiles captured in D6.3. Finally, partners were surveyed on post-project exploitation pathways in a structured way, using "The End Game"-form.

The original plans, collected through surveys outlined in D6.1, were primarily focused on research valorisation, exploratory market positioning, and preliminary business intentions. The updated plans now show a clear maturation across partners, from research dissemination to operational commercialisation, aligning with XReco's overarching objective to ensure sustainable exploitation of project results.

3.4.1.1 Summary of Individual Exploitation Plan Updates

A number of partners have made significant progress in developing commercial pathways and concrete implementation plans, especially the technology partners in the consortium (see Table 4: XReco Component Stack for a summary list of individual components and Annex II: Component/IP Tracker for an annotated table of opportunities for exploitation per component in the stack).

DW are currently exploring the integration of the 3D Infographics into the portfolio of features in their CMS and thus to become a part of journalistic articles on dw.com.

FINC evolved from an exploratory stance on blockchain-based rights management to active integration of XReco results into its commercial media rights management platform. It now targets not only broadcasters but also cultural heritage and creative industries, demonstrating readiness for pilot deployments and collaborative IP management through partnership agreements.

i2CAT transformed from a research-driven exploitation approach into a fully entrepreneurial model. Its newly established spin-off company operationalises XReco results through commercial XR and volumetric media services. The plan now includes defined service lines such as Gaussian Splatting and GDGFS, investor engagement, and a clear funding and scaling strategy, marking a complete transition from technology validation to market entry. i2CAT also presented a patent that describes the compression and decompression system that they are using to stream volumetric video in real time. The patent describes the method and the different transformations they use to convert geometry into pixels and how this format allows to have interactive immersive experiences using 3D video. At this moment the process is pending the final decision which may take several months.

JRS consolidated its focus on AI-based content understanding and metadata generation, now combining commercial licensing of containerised AI services with open-source contributions for standardisation. The partner also broadened its scope to mobility and journalism use cases, reinforcing European sovereignty in AI-driven media analysis.

UPM refined its dual-track strategy of academic and commercial exploitation. It strengthened its visibility through a live web-based demonstrator of its SfM-based 3D reconstruction service, aligning academic outputs with commercialisation potential through service-based models such as pay-per-use and licensing.

CERTH moved decisively from academic dissemination to commercialisation readiness. Both its Unimodal Cross-Modal Retrieval and Volumetric NeRF plans now converge in a market-oriented strategy, centred around a spin-off company offering volumetric reconstruction and NeRF-based services. With defined customer segments, measurable marketing KPIs, and a comprehensive SaaS model, CERTH exemplifies XReco's successful transition from research excellence to entrepreneurial deployment.

MOG advanced from leveraging XReco components within its existing broadcast technology portfolio to a leadership position in XR ecosystem orchestration. Its updated plan separates exploitation across three streams, architecture, marketplace, and knowledge integration, with pilots and partnerships reinforcing its commercialisation readiness. The introduction of a decentralised XR marketplace and potential new XR engineering department mark MOG's transformation from integrator to ecosystem enabler.

Table 4: XReco Component Stack

Key feature	Attribute	Owner	Component
Orchestrator-as-a-Service			
Multi Modal search & retrieval			
ATOS, JRS, CERTH, UNIBAS, MOG, FINCONS	*Data adapters*	ATOS, I2CAT	Connectors to DW Feed, RAI Archive, Wikimedia, Sketchfab, Europeana
	Neural cross-modal descriptors	JRS	Landmark classification and few-shot object detection
		JRS	Shot-boundary detection
		CERTH	Cross-model content descriptors
		I2CAT	Object detection and tracking
		UNIBAS	Temporal video segmentation and keyframe embedding
	Content sourcing & filtering	JRS	Multimodal relevance and novelty detection
		RAI	News Tagger
	Neural Media repository	UNIBAS	vitrivr Multimedia retrieval framework
		I2CAT	Metasearch
		MOG	Retrieval frontend
Marketplace interface			
FINCONS, MOG	*Rights & monetization management*	FINCONS	License definition and notarisation
		FINCONS	Monetization manager
		MOG	Marketplace

Key feature	Attribute	Owner	Component
Partner-owned service modules			
3D Reconstruction Services			
CERTH, I2CAT, UPM	*Neural radiance Fields (NeRF)*	CERTH	Octree-NeRF-in-the-wild
		I2CAT	GDNeRF: Human-centred sparse view NeRF
	Gaussian Splatting	I2CAT	GDGS: human-centric Generalizable Depth Gaussian Splatting
		I2CAT	3DGS
	Structure from Motion (SfM) 3D reconstruction	UPM	occlusion-aware Structure from Motion
3D Optimization Services			
CERTH, I2CAT, RAI	*Neural Reconstruction in the wild*	CERTH	Octree-NeUS-in-the-wild
	Human-centric 3D data enhancement	I2CAT	3D Data Enhancement
	Blind face restoration	RAI	Blind face restoration
	Video based Super Resolution	RAI	2D video upscale
Volumetric video services			
UPM, i2CAT	*Holoportation*	i2CAT	Holoportation
	Free Viewpoint Video	UPM	RGB-D based FVV
AR CMS			
ZAUBAR	*XR mobile based experience*	ZAUBAR	CMS
Virtual production capsules			
Unity, MOG, Visyon	*Authoring tool*	Unity / Capgemini	Authoring Tool
		MOG	Orchestrator
	XR Capsules	Visyon	Authoring Tool
Demonstrators			
ZAUBAR, CAR, ATOS, RAI, DW	*Mobile Tourist Experience*	ZAUBAR	ZAUBAR's CMS
	In-cabin experience (self-driving cars)	CAR	Hardware: Car, computer in car, camera
		ATOS	ATOS automotive VR app
	XR-based broadcasting productions	RAI	
		DW	3D Infographics

Across the consortium, the evolution of individual exploitation plans reflects a strong shift from exploration to execution. Early research-driven intentions have matured into market-validated business strategies, spin-off creation, and active commercialisation of XReco assets. Partners now demonstrate increased confidence in their value propositions, clearer customer segmentation, and diversified models of exploitation including SaaS, licensing, consulting, and standardization.

This collective progress reinforces XReco's impact pathway from research innovation to market adoption, confirming that the consortium has laid the groundwork for long-term sustainability. The updated plans not only showcase technological maturity but also establish organizational readiness, ensuring that XReco's outcomes continue to generate economic, scientific, and societal value well beyond the project's lifetime.

3.4.1.2 Summary of survey of partners about post-project exploitation ("The End Game")

In addition to the updated exploitation plans, the inquiry confirmed the **breadth and diversity of exploitable results** emerging from the project. Partners identified specific assets that reflect their role in the XReco value chain and their individual market trajectories, for example:

- **DW** focuses on integrating 3D infographics into journalistic workflows to enhance user engagement and web traffic.

- **CERTH** developed its **Octree NeRF and volumetric rendering services**, forming the basis for a spin-off company targeting VFX, content creation, and post-production markets.

- **ZAUBAR** continues refining its **AR editor for location-based storytelling**, addressing the tourism and cultural heritage sectors.

- **XRBB** aims to reuse XReco technologies within **European innovation initiatives and museum applications**, demonstrating cross-sector interoperability.

- **IPR** capitalizes on its expertise in **copyright and data governance for AI and XR**, extending into advisory and policy roles.

- **Continental (CAR)** explores application of AI-driven models within **automotive use cases**, illustrating the broader industrial relevance of XReco outcomes.

Collectively, these assets reflect XReco's **cross-domain reach**, spanning creative industries, cultural heritage, mobility, and legal frameworks, and demonstrate that the project's results have both **standalone and synergistic value** across Europe's digital innovation landscape.

3.4.2 Joint exploitation

Building on the methodology outlined in Section 3.1 and the progressive implementation of Joint Business Clinics, the XReco project has developed a shared understanding of how selected project results can be jointly exploited beyond the duration of the project. This section provides an overview of the key outcomes related to joint exploitation, as well as the process that led to their definition and consolidation.

Joint exploitation was approached as a co-creative process involving all partners, structured around three cycles of user validation. Each cycle concluded with a Joint Business Clinic (JBC), which brought together internal stakeholders and external users across target domains to test assumptions, collect feedback, and validate potential value propositions and business models.

In JBC#1 (M9), the consortium validated the concept of developing a shared platform that could support different vertical use cases through a modular architecture. JBC#2 (M17) introduced and tested an updated segmentation model based on user roles across the XR value chain, moving away

from strictly domain-specific exploitation tracks. JBC#3 (M36) served to consolidate validated insights, focusing on monetization, willingness to pay, and collaborative exploitation pathways. The approach taken in JBC#3 followed a structured format, using persona canvases, monetization canvases, and feedback loops during live co-creation sessions to assess business viability for shared components.

Throughout the clinics and technical work, several shared assets and technical enablers were identified as candidates for joint exploitation. These include:

- The **XReco Orchestrator** as a technical backbone enabling service integration, asset flow management, and user interfacing.
- The **Neural Media Repository (NMR)** for shared media asset storage and distribution.
- Various **XR content transformation and creation services**, including NeRF and Gaussian Splatting-based modules, CMS tooling (e.g. ZAUBAR), and XR Capsules for publishing.
- **Marketplace functionality**, particularly the service licensing interface, purchase tracking, and modular API architecture.

3.4.2.1   Pathways for Joint Exploitation

Based on insights from JBC#3 and internal alignment discussions, three possible joint exploitation routes were considered:

1. **Spin-off vehicle**: establishing a legal entity to manage the orchestrator, joint services, and community development (medium complexity, long-term).
2. **Consortium-based coordination**: continued informal collaboration under a Memorandum of Understanding, where shared results are made available under joint governance, and commercial activities remain partner-led.
3. **Federated licensing and deployment model**: enabling partners to integrate selected modules into their own product stacks while ensuring interoperability and shared branding/maintenance standards.

Considering the challenges of the exploitation of XReco as a commercial business, there has not been significant appetite to explore option 1. As of M38, the consortium is converging on a hybrid pathway combining elements of options 2 and 3. In this model, core infrastructure (e.g. orchestrator, NMR) is maintained as a jointly governed, open or semi-open asset, while individual services are monetized directly by partners with shared technical support and branding guidelines.

3.4.2.2   Insights from the post-project exploitation inquiry ("The End Game")

A central insight emerging from the aforementioned post-project exploitation inquiry ("The End Game") is the way partners balance their **individual exploitation ambitions** with a shared recognition of the **collective value of the XReco ecosystem**. Most organisations confirmed that they will continue to pursue **individual commercialisation pathways** based on their proprietary technologies, expertise, or market positioning, while remaining open to **collaborative forms of exploitation** that enhance visibility and access to users.

Several partners highlighted that joint exploitation can amplify market reach and strengthen XReco's brand identity, particularly if it operates as a federated and interoperable ecosystem rather than a centralised platform. This dual-track approach, preserving autonomy while enabling interconnection, reflects the maturity of the consortium's exploitation thinking. For many, **collaboration now**

complements rather than competes with individual exploitation, illustrating XReco's evolution into a flexible and sustainable ecosystem model.

The responses also revealed clear **conditions under which partners would engage in joint exploitation**. Several partners expressed openness to joining a **steering group or advisory board**, supporting the continuity of platform oversight, standards alignment, and coordination of joint services. However, many maintained a cautious stance, indicating that participation would only be feasible if accompanied by **direct financial or strategic benefit**.

The feedback emphasises that governance should be aligned with the **federated model** underpinning XReco: partners retain ownership of their own assets while contributing to a shared framework for interoperability, metadata standards, and access protocols. Such a structure allows both commercial and non-commercial participants to engage flexibly, sustaining XReco as a living, multi-actor ecosystem.

3.4.3 Conclusion about Individual and Joint Exploitation

In summary, both the updated individual exploitation plans and "the End Game"-survey reveal that XReco's strength lies in its **balance between autonomy and collaboration**. As a consequence of XReco's strong emphasis on fostering community engagement and user-centric validation of the value proposition, partners have achieved substantial individual exploitation maturity. At the same time, there is broad acknowledgment that the **ecosystem's collective identity amplifies individual results**, offering shared visibility, interoperability, and a credible European alternative to proprietary XR solutions. Therefore, what emerges is an ecosystem that functions as a **network of empowered actors**, each with their own commercial strategy yet united by a common technical and strategic foundation.

However, the XReco exploitation process also highlights the critical importance of engaging **venture and innovation funding partners early** in the project lifecycle. The consortium actively engaged users, industry representatives, and researchers to refine its value propositions and confirm customer desirability across multiple domains. However, the project **underestimated the importance of cultivating early relationships with venture and innovation funding partners**. Without sustained dialogue with investors or financial intermediaries, the consortium's validated concepts lacked a pathway to capitalisation. Future projects can build on XReco's strengths by coupling its user-centric validation methods with proactive outreach to investors and funding ecosystems from an early stage, ensuring that technological excellence and market desirability are matched by financial and institutional readiness.

In the end, while the consortium has come to **fully appreciate the value of collaboration**, particularly in relation to **developing business models within a shared ecosystem**, the creation of a jointly governed commercial structure proved unfeasible. The experience demonstrated that co-creation and interoperability can generate significant collective value, yet the **diversity in funding mechanisms, institutional mandates, and strategic objectives** among partners, ranging from academic excellence and research-driven missions to SME agility and market-oriented goals, posed structural barriers to joint governance. These differences influenced investment horizons, risk tolerance, and decision-making autonomy, ultimately making it difficult to align around a unified business model.

Nevertheless, this diversity remains a defining strength of XReco's federated ecosystem: it ensures that collaboration continues through **interoperable, complementary exploitation pathways**, even without a single shared legal or financial entity.

3.5 Joint Business Clinics (component 3)

The Joint Business Clinics (JBCs) were the cornerstone of the project's exploitation validation process. Designed as structured co-creation and feedback sessions, the JBCs marked the conclusion of each Human-Centred Design cycle and provided critical input for refining user segmentation, value propositions, service design, and commercialisation strategies. Across the three clinics, the consortium engaged directly with over 100 participants, including domain experts, prospective users, and internal stakeholders, enabling a longitudinal validation approach that tracked evolving expectations and reactions to successive versions of the XReco platform.

Each JBC served a distinct purpose and produced tangible outputs that directly influenced the exploitation strategy. The structure and facilitation format evolved over time to reflect increasing platform maturity and the shift from early ideation to business validation.

3.5.1 The First Joint Business Clinic (JBC#1)

The first Joint Business Clinic was organised during the initial exploration phase of the project and aimed to test the validity of the early use-case-driven segmentation (media, tourism, mobility). The clinic was held as a hybrid session and included approximately 40 participants representing different parts of the extended XR value chain.

Key outcomes of JBC#1 included:

- Recognition that **vertical segmentation by sector was too rigid**, as user needs around asset reuse, rights management, and content transformation were shared across domains;
- Identification of recurring pain points related to **fragmented workflows**, lack of licensing clarity, and the **technical barriers to using AI-enabled services**;
- Emergence of initial **persona archetypes**, particularly distinguishing users focused on content discovery and reuse (Searchers and Takers) from those engaged in production (Transformers and Creators).

This clinic laid the groundwork for redefining the user model in Cycle 2 and informed the design of more inclusive platform components, such as metadata search and modular service routing.

3.5.2 The Second Joint Business Clinic (JBC#2)

The second Joint Business Clinic built on the findings of JBC#1 and focused on validating the updated user-type-based segmentation. This session was held fully online and adopted a persona-driven format, using collaborative tools and predefined canvasses to gather feedback from a broad mix of participants.

Participants were grouped around the four validated user types:

- **Searcher**: exploring and curating assets,
- **Taker**: integrating existing content into new works,

- **Transformer**: converting or enhancing content,
- **Creator**: building immersive or XR-native experiences.

Each group was guided through a set of co-creation exercises using Value Proposition Canvasses (VPCs) tailored to their user type. Participants provided detailed insights into:

- Pains and gains associated with their current workflows;
- Desired features and service expectations from a platform like XReco;
- Levels of technical expertise and willingness to interact with AI-driven tools.

The clinic confirmed the relevance and clarity of the user-type segmentation and validated a number of design assumptions regarding interface simplicity, service modularity, and integration with third-party tools. Outcomes were directly incorporated into the MVP prioritization plan, particularly regarding orchestration workflows and metadata handling.

3.5.3   The Third Joint Business Clinic (JBC#3)

Planned for the 3rd cycle spanning month 20-30 of the project, JBC#3 aims to present a compelling business pitch for the XReco platform, showcasing the value it will deliver to target markets. The workshop will validate willingness to pay, our MVP, identify high-priority use cases, and discuss further functionalities required to meet market needs and drive sales of the XReco solution. This event will bring together a comprehensive understanding of customer needs, market challenges, and the potential of XReco to create a winning proposition. This will be used to formulate hypotheses concerning XReco Business Models and (Joint) Exploitation Plans that will be developed and validated during the last months of the project to ensure a lasting impact by XReco.

The third Joint Business Clinic represented the culmination of the exploitation validation process. Held in Basel and co-facilitated by WP6 and WP5 leads, the session provided hands-on access to the functioning MVP and structured feedback mechanisms targeting monetization models, pricing acceptability, and service readiness.

JBC#3 included a series of focused breakout sessions where participants, many of whom had been engaged since JBC#2, tested platform features based on predefined tasks. The MVP demonstrated:

- Core orchestrator functionality (upload, transform, preview),
- Access to transformation services (e.g. NeRF, Gaussian Splatting),
- Authoring workflows via XR Capsules and ZAUBAR CMS,
- Marketplace functionality with basic licensing metadata.

Participants evaluated the platform using monetization canvasses and were asked to assess five pricing models: flat-rate subscription, pay-per-use, credit-based access, transaction commission, and freemium structures. The feedback was rich and detailed, indicating a clear preference for **flexible, usage-based pricing models**, with strong support for credit systems and cautious acceptance of transaction-based commissions. Flat-rate subscriptions were generally rejected (see Section 3.6 for further analysis).

Additional feedback from JBC#3 addressed:

- The need for clearer onboarding and documentation,
- Concerns over service stability and performance consistency,

- Positive reception of licensing transparency and modular workflows.

The results of JBC#3 were instrumental in shaping the final joint exploitation pathways and provided the basis for selecting the federated commercial model described in Section 3.4.2. They also informed the go-to-market packaging of MVP components and helped establish the viability thresholds for partner-level exploitation.

3.5.4   Conclusion and Value of the JBC Approach

The JBC format proved to be an effective mechanism for combining structured co-creation with deep user validation across the entire exploitation lifecycle. By engaging real users early and repeatedly, the project was able to refine not only its technical offering, but also the supporting business logic and governance assumptions. The longitudinal nature of the clinics allowed the consortium to observe how user expectations evolved over time and to validate the robustness of the exploitation model under real-world constraints.

The insights generated through the JBCs form a critical part of the project's legacy and provide a strong foundation for future collaboration, platform adoption, and post-project sustainability planning.

3.6   XReco value proposition & commercial strategy (component 4)

This section presents the consolidated value proposition of the XReco ecosystem and outlines the strategic approach towards the commercialisation of its results. The analysis is grounded in the project's co-creation methodology and user validation cycles, with particular emphasis on the outcomes of the third Joint Business Clinic (JBC#3). It articulates the key differentiators of the XReco platform, how its modular services respond to user needs, and how different monetization mechanisms were explored and validated with external stakeholders. It also highlights the intended go-to-market configuration, with a view towards post-project sustainability.

3.6.1   Evolution of the Value Proposition

The initial value proposition of XReco was structured along vertical domains corresponding to the project's use case demonstrations, namely media production, tourism, and cultural heritage. While this domain-based segmentation proved useful during the early stages of requirements gathering, it became increasingly evident that the actual user needs cut across sectors and could be more effectively addressed through role-based user types along the digital content value chain.

As a result, following the first and second Joint Business Clinics, the consortium adopted a typology distinguishing five key user roles:

- **Givers**, interested in making their 2D or 3D assets accessible for reuse through the marketplace, thereby creating an opportunity for revenue generation.
- **Searchers**, who require access to high-quality, searchable and licensable content to initiate XR projects.
- **Takers**, who use existing assets in downstream applications and need guarantees about technical quality and licensing conditions.
- **Transformers**, who apply tools and services to convert, enhance or generate content (e.g., from 2D to 3D, or low-fidelity to high-fidelity formats).

- **Creators**, who combine assets and services to build immersive experiences and require user-friendly authoring environments, publication workflows, and long-term rights management.

The value propositions developed for each of these types were co-designed and validated through dedicated persona canvasses and feedback collection during JBC#2 and JBC#3. This framework enabled the consortium to align technical developments with user expectations and helped guide the packaging of services into commercially relevant offerings. It also facilitated the definition of monetization pathways tailored to different usage intensities, sector profiles, and business models.

3.6.2   MVP Testing and Feedback

A minimal viable version of the XReco platform was made available in advance of the final Joint Business Clinic, combining essential orchestration functions with selected content transformation and authoring services. The MVP included:

- A functional **orchestrator**, enabling user registration, asset upload, and service routing;
- Access to **modular transformation services**, such as NeRF-based reconstruction, Structure-for-Motion and Gaussian Splatting;
- Basic **authoring and publishing capabilities**, through integration with XR Capsules and ZAUBAR's CMS editor;
- A preliminary **marketplace interface**, including metadata display, rights information, and browsing functionality.

Test users confirmed the value of simplifying complex XR production workflows, particularly the ability to manage content, services, and metadata within a single orchestration layer. Users praised the transparency of the licensing information and the convenience of accessing transformation services without having to manage the underlying tools or code.

Nonetheless, several limitations were noted: the lack of onboarding documentation for non-technical users, inconsistent service performance due to different TRLs of the integrated components, and an unclear distinction between experimental services and production-ready tools. These insights will/can inform the prioritization of post-project development and commercialisation efforts.

3.6.3   Monetization Models

To evaluate the business viability of the platform and its services, the consortium tested a set of five monetization models, presented to external stakeholders during JBC#3 using structured monetization canvasses. The models were:

- **Flat-rate subscription**: Users pay a fixed monthly or annual fee for access to a predefined set of services and storage limits. For example, a Creator might pay €150/month to access reconstruction tools, CMS publishing, and asset storage, regardless of usage volume.
- **Pay-per-use model**: Services are metered individually, with users charged per transformation, export, or API call. A Transformer might pay €8–10 per reconstructed asset or €1 per API access to a conversion service.
- **Tiered usage credits**: Users purchase credit packages (e.g., 100, 500, or 1.000 credits), which can be exchanged flexibly for different services. This model accommodates variable usage and budgeting. For instance, a research institution might buy 1.000 credits upfront and distribute them internally across departments.

- **Marketplace transaction commission**: A percentage-based fee is applied to every successful transaction conducted on the marketplace (e.g., 10–15% of the price of a purchased 3D model or service bundle). This model generates revenue for the orchestrator operator and incentivizes high-quality listings.
- **Freemium model with premium add-ons**: Core functionality (e.g., search, preview, upload) is offered free of charge, while advanced features such as high-resolution exports, rights-clearing, or premium services are monetized. This is particularly suited to Searchers and early-stage Creators.

3.6.3.1 Feedback from users on monetization models

Results from the third Joint Business Clinic (JBC#3) provided the consortium with crucial insights into user expectations regarding monetization. Through structured interviews and the use of monetization canvases, participants were asked to assess the appeal, feasibility, and fairness of various pricing models in the context of their typical usage patterns and institutional or commercial constraints.

A clear consensus emerged against the use of **flat-rate subscriptions**. This model, which proposed fixed monthly or annual payments (e.g. €100–€250/month or €1.000–€2.500/year) for unlimited or capped access to platform services, was deemed too rigid. Participants from academic, cultural, and public heritage institutions noted that their usage is typically **project-based and seasonal**, with high activity periods during grant-funded digitization campaigns or summer programming, followed by long intervals of minimal usage. These users found it difficult to justify ongoing subscription costs during inactive periods, particularly given institutional budgeting constraints that do not allow for unused services to remain on the books. One participant, representing a university lab engaged in digital reconstruction of heritage sites, explicitly stated that while the XReco platform would be extremely valuable during the summer research window, there would be no use for it between October and March. For such actors, flat subscriptions were considered inefficient and potentially exclusionary.

Commercial users also expressed hesitation. Independent professionals and SMEs working in XR journalism and immersive storytelling emphasized the **unpredictability of client work** and the need to match costs closely to deliverables. A fixed monthly fee, especially if charged upfront, was perceived as a barrier to adoption, particularly when combined with still-limited predictability of the platform's service maturity and stability. Several test users mentioned that they would only consider a subscription after sustained hands-on experience with the platform's full toolset.

By contrast, the **credit-based model** was met with strong support across user types. This approach, in which users purchase packages of credits that can be spent flexibly on different services (e.g. 3D reconstruction, metadata tagging, export tools), was seen as transparent, adaptable, and aligned with real-world workflows. Creators and Transformers in particular appreciated that this model allowed for **granular control of expenditure**, clear cost forecasting per project, and budget distribution across teams or departments. For example, a cultural production house noted that credit packages could be purchased centrally and then distributed to multiple collaborators via individual accounts, an approach well-suited to EU-funded or regional collaborative projects. Moreover, credits could be aligned with output metrics (e.g. cost per usable 3D asset), simplifying reporting and value-for-money calculations.

Feedback on the **marketplace commission model,** in which a small percentage (e.g. 10–15%) of every transaction is retained by the platform, was generally positive. Content and service providers found

this model familiar, as it mirrors existing licensing or app store frameworks, and were open to it under two conditions: (1) the commission is clearly communicated and factored into their pricing strategy, and (2) the marketplace provides sufficient **visibility and traffic** to justify the fee. However, concerns were raised about discoverability in a crowded environment, particularly by small or first-time providers. Participants noted the need for effective asset tagging, ranking algorithms, and possibly editorial curation to avoid a "race to the bottom" in pricing or visibility.

Finally, a hybrid approach combining **freemium access to core features** (e.g. searching the repository, basic previews) with **premium paid services** (e.g. volumetric reconstruction, full XR authoring workflows) was welcomed by public users and non-commercial institutions. This model would allow low-barrier entry and foster engagement while offering upgrade paths for power users.

Overall, JBC#3 provided robust validation for a flexible, modular pricing strategy. The findings support the implementation of a **mixed model** that accommodates different usage profiles.

3.6.3.2 Challenges in relation to monetization

We have demonstrated that commercializing the XReco platform could present an appealing opportunity. However, a complex set of challenges must be managed carefully to achieve sustainable profitability. The platform's potential lies in its ability to orchestrate advanced XR services and marketplace transactions, yet these depend on a stable technical and business infrastructure. Maintaining such an environment entails significant fixed costs, including software development, user support, and business operations, before a large enough paying user base can offset these expenses. Even though the basic cost structure can be predicted, the early phase of commercialisation will demand considerable upfront investment without immediate financial return.

A central challenge arises from the balance between user expectations and the platform's revenue model. Feedback from the Joint Business Cases indicates that users accept paying for specific, value-adding XR services such as NeRF or 3D Gaussian Splatting, and are also open to commission-based models for marketplace transactions. However, users resist paying for access to search and discovery functions, which they perceive as basic utilities rather than premium features. This sentiment limits the feasibility of a subscription-based model, one that would otherwise offer steady income, forcing reliance on transaction-based or usage-based revenue streams that grow more slowly.

Profitability scenarios illustrate the tension between cost and growth. Under optimistic conditions, the platform could reach break-even after approximately two years, assuming consistent user growth and steady engagement with paid services. In more realistic terms, profitability may not be achieved for four to five years, as income per user may remain modest while fixed operational costs persist. This means that the project will experience a prolonged period of cumulative losses before achieving financial stability. Patience and financial endurance will therefore be essential to bridge the gap between the early-stage investment phase and eventual positive returns (see next page).

Unfortunately, this challenge turns out to be too big to be overcome by the XReco consortium. For all but two of the partners in this consortium, the option to continue dedicating resources to this project, without equivalent revenue streams is not a possibility. Considering the uncertainties about the timeline towards profitability, internal policies will require that the relevant staff be reallocated to other projects within their respective organizations. Despite the interest of at least 9 partners in the continuation of XReco's development and commercialisation beyond the project's duration, we have been unable to cobble together a working coalition of parties to achieve this.

This is especially unfortunate considering the consortium had verbal agreements in place with 4 potential launching customers:

- Europeana, the European Union's online multimedia library that provides access to Europe's cultural heritage, was interested to connect their database of 2D assets to the XReco platform (Giver) to enable reconstruction of 3D models of cultural artifacts.
- The Ethnological Museum and the Humboldt Forum in Berlin were both interested in exploring creative options with regards to both the acquisition (Taker) and reconstruction of 3D models (Transformer) as well as the authoring of XR experiences (Creator).
- XReco had an agreement in principle with TNO in the Netherlands to further investigate and improve the output quality of 3D reconstruction services (Transformer).

The interest from potential launching customers such as Europeana, the Ethnological Museum and Humboldt Forum in Berlin, and TNO in the Netherlands demonstrates clear market validation for XReco's value proposition. These institutions collectively represented all major ecosystem roles— Giver, Taker, Transformer, and Creator—highlighting XReco's relevance across the XR value chain, from data contribution and 3D reconstruction to immersive content creation. Their willingness to collaborate upon launch confirmed the platform's potential to serve as a credible integrator of XR workflows for cultural heritage, research, and creative industries.

The consortium's decision not to activate the Marketplace functionality during the project period ultimately limited these collaborations to verbal agreements. However, this setback also underscored a key insight: incipient demand for XReco's capabilities from early adopters already exists ahead of full market readiness. Institutions across Europe are actively seeking interoperable and trustworthy solutions for transforming digital heritage and media assets into immersive experiences. The early engagement of these four launching customers thus serves as tangible evidence of XReco's cross-sector appeal and as a strong foundation for eventual future commercialisation.

Monetization and Growth Scenario for the XReco Platform

To explore the commercial sustainability of the XReco ecosystem, a **monetization scenario** was developed to simulate organic market growth and assess the revenue potential of the platform under realistic adoption conditions. The model assumes a steady increase in paying users combined with income streams from marketplace transactions and XR service requests.

In this simulation, the platform operates with a fixed cost of **EUR 20,000 per month**, a **user growth rate of 640 new paying users per month**, and an average income of **EUR 2.50 per user per month**. Additional revenue is generated through a **10% commission on marketplace transactions** (worth approximately EUR 10 per user per month) and a **EUR 0.50 margin per XR service request**, with an average of three service requests per user each month.

Over a 24-month period, this scenario projects a user base of approximately **15,300 paying users**, generating an estimated **EUR 38,000 in monthly income** by the end of year two. Platform activity at that point would include roughly **46,000 XR service requests per month**, equivalent to about 1,500 per day, and total marketplace transactions of around **EUR 153,000 per month**.
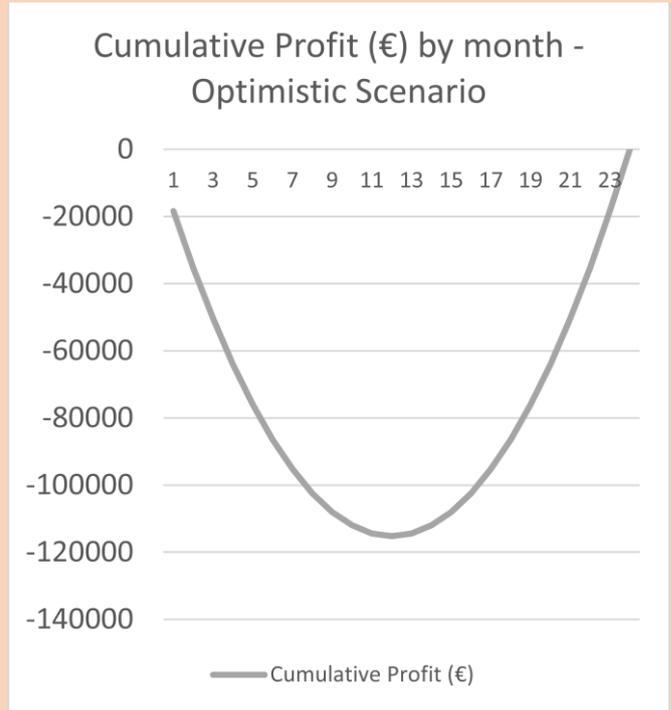
Figure 2: Cumulative Profit projection - Optimistic scenario
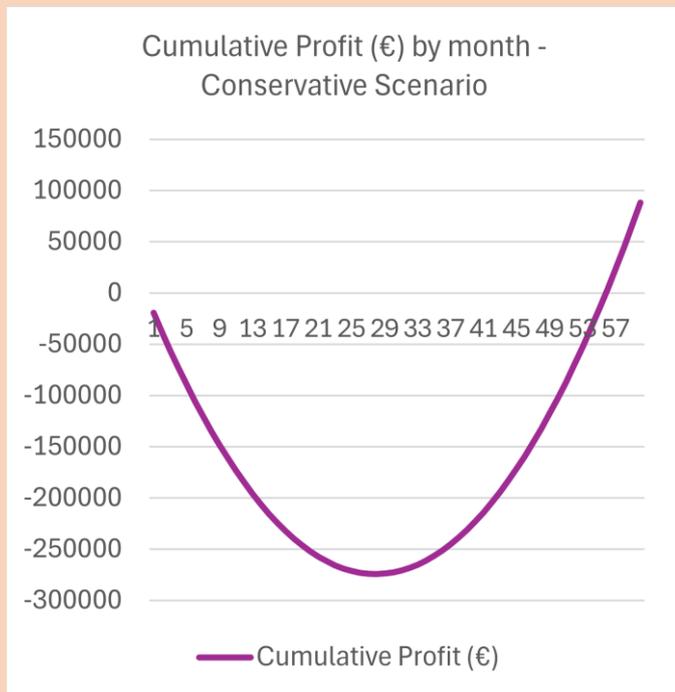
Figure 3: Cumulative Profit projection - Conservative scenario

With the assumed service pricing of EUR 4 per request plus an XReco margin of EUR 0.50, total XR service turnover would reach approximately **EUR 207,000 per month**, with all transactions conducted via a virtual credit system (e.g. 100 credits = 1 EUR). The model indicates that after an initial investment phase with cumulative losses in the first year, **profitability would be achieved from month 13 onwards**, and **break-even by month 24**, under stable cost assumptions.

An **alternative, more conservative scenario**, with income per user reduced to **EUR 1.20 per month** while maintaining the same growth rate (consistent with data from 2024 on average spent per paying user in XR related services of $13,30 per year), extends the **break-even point to month 56** (approximately four years and eight months). Even in this lower-revenue case, the model demonstrates that sustained user growth and diversified income streams can yield a viable long-term business model. Together, these projections confirm that XReco's **integrator role**—linking marketplace activity, service orchestration, and user-driven credit transactions—has the potential to generate steady recurring revenues once user engagement scales beyond early pilot adoption.

3.6.3.3 Alternative approach – the infrastructure ecosystem

An **alternative approach to exploitation** considered during the final stages of XReco was to position the platform not solely as an **integrator ecosystem**, but also as an **infrastructure ecosystem** (as described in D6.1). While the integrator model, linking content producers, service providers, and distributors, was validated by users as the most immediate route to market, the infrastructure perspective offered a longer-term strategic pathway. In this model, XReco would serve as a foundational layer providing standardized tools, data services, and computational infrastructure for third-party projects and organizations. Such a role might align XReco with other European data and media infrastructures, emphasizing openness, interoperability, and scalability, while creating value through shared resources and technical enablement rather than direct transactions or integrations.

This perspective gained relevance through discussions with the **TEMS project** (Trusted European Media Dataspace), a Horizon Europe initiative exploring trusted data sharing and technical frameworks for media organizations. TEMS was seeking a technical solution for one of its demonstrators dealing with **3D model management and visualisation**, an area closely aligned with XReco's capabilities. The XReco consortium proposed to supply its **infrastructure layer**, including its orchestration environment and data handling modules, to enable TEMS to manage and distribute 3D content in a secure, standards-compliant way.

This would have effectively positioned XReco as a reusable infrastructure blueprint, allowing other EU-funded media and data projects to leverage its components without recreating similar capabilities from scratch. However, this integration was **not implemented before the close of the XReco project**. Despite mutual recognition of the potential synergy, practical constraints, such as hosting responsibilities, long-term maintenance costs, and alignment of project timelines, prevented deployment.

Nonetheless, the exchange demonstrated that XReco's architecture has the maturity and flexibility to operate as a **shared European infrastructure for media innovation**. The experience provided valuable insight into how the platform could support broader data space initiatives, and it underscored the importance of establishing sustainable hosting, governance, and funding models early if infrastructure-level exploitation is to be pursued in future projects.

3.6.3.4 Thought experiment: What would an entrepreneur do?

The next phase of this project would require the mindset of a startup company. Ultimately, the exploitation challenge is less about technical feasibility than about pacing growth in a financially disciplined manner. The platform's success will rely on the ability to cultivate a steady, loyal user base while keeping operational costs under control and gradually expanding monetization avenues. This demands a long-term strategic approach that balances optimism with pragmatism, building credibility, managing expectations, and ensuring the financial runway necessary to "climb the mountain" of commercialisation. This is not the challenge of an engineer or of a researcher, this is the challenge of an entrepreneur.

An entrepreneur approaching this next phase would treat the platform not as a research outcome, but as a business opportunity that must prove its market viability step by step. They would focus on capturing the most promising user segments through targeted pilots and early adopters. Rather than maintaining the broad, multi-partner structure of the consortium, the entrepreneur would streamline

operations, secure seed funding or strategic investors, and concentrate resources on the features and services that generate the highest traction.

At the same time, the entrepreneur would implement financial discipline and adaptability as core principles. This means controlling fixed costs, pursuing flexible partnerships, and leveraging existing infrastructure only where it supports growth efficiency. They would design monetization experiments, test credit and commission models, and adjust pricing or positioning based on real market feedback. Beyond product and finance, the entrepreneur would invest in storytelling and credibility, building a narrative that attracts customers, investors, and talent around a shared vision. In essence, they would turn the technical achievement of XReco into a focused, lean venture driven by clear market logic and a willingness to take calculated risks.

An entrepreneur could explore how one of the platform's core asset, its search and orchestration capability, can generate immediate revenue streams beyond direct user subscriptions. One option would be to introduce advertising or sponsored results within the search interface, following a model similar to Google's. This approach could allow for monetization of user attention without charging for basic access, aligning with user sentiment that discovery should remain free. Carefully designed, this could include promoted content from creators or companies seeking visibility, providing an organic source of income that grows alongside platform traffic.

Also, the entrepreneur might offer the search and discovery functionality itself as a white-label or institutional service, allowing organizations with large, underutilized asset databases, such as broadcasters, cultural archives, or universities, to adopt XReco's technology to make their own content discoverable. This "Search-as-a-Service" approach could position XReco as an enabling layer for institutions struggling with digital asset management.

In parallel, the entrepreneur could reassess what part of the XReco ecosystem holds the greatest scalable value. If the underlying infrastructure, the hosting, orchestration, and GPU-intensive XR processing environment, proves more commercially promising than the front-end platform, the focus could shift toward an infrastructure-as-a-service model (e.g. the aforementioned collaboration with the TEMS project). In this case, XReco could follow a path similar to Amazon's evolution from an online retailer to a provider of cloud infrastructure through AWS. By renting out its compute and orchestration capacity to other XR developers, studios, or research entities, the entrepreneur could turn fixed operational costs into a source of recurring income.

Any of these options would potentially open a pathway to long-term sustainability while preserving the innovative core of the XReco technology stack. It would also move XReco away from the vision of democratizing access to advanced XR tools for the general public, which has been the driving force for the consortium during the duration of the project. Confronted with the thought experiment of what might an entrepreneur do with XReco, ultimately the partners in this consortium concluded that they are neither equipped with the skills to undertake the necessary job to be done, neither do they support the underlying pivot in the vision of what XReco may need to become.

3.6.4   Go-to-Market Configuration

The commercialisation approach ultimately adopted by the consortium reflects the modular architecture of the platform and the diversity of its contributors and the challenges identified. Rather than launching a monolithic, centralised platform, our recommendation is for the go-to-market model

to follow a **federated structure**, allowing for differentiated entry points and exploitation paths, while ensuring alignment through shared standards and governance.

Key elements of the commercial strategy include:

- **Orchestrator-as-a-Service**: A central, potentially jointly governed infrastructure offering service routing, user authentication, metadata management, and marketplace integration. This component is the most likely candidate for spin-out or neutral governance.
- **Partner-owned service modules**: High-TRL components developed by individual partners (e.g. ZAUBAR's CMS, UPM's reconstruction services) will be commercialised independently, but integrated into the orchestrator via APIs and listed in the shared service catalogue.
- **Marketplace and licensing interface on stand-by**: The marketplace would allow users not only to discover, but purchase, or license content and services. It will support multiple license types, including open access, Creative Commons, and possibly proprietary commercial terms. This module is ready and has been tested as an MVP. However, activating this module would mean starting to process actual monetary transactions. This would necessarily imply maintenance of a payment processing integration with the platform and maintenance of a minimum support staff for customer inquiries. This is currently considered undesirable, and therefore the consortium decided to have this module on stand-by, rather than as an active module of the platform.
- **Branding and user experience layer**: While developing the MVP, the consortium has set an example for UI/UX design and onboarding documentation (tutorials). To ensure a coherent ecosystem identity, these standards are available to be applied across partner deployments.

The model allows each partner to pursue exploitation in line with their strategic priorities, while benefiting from a unified user experience, shared infrastructure, and coordinated outreach efforts. This configuration could also facilitate the entry of new third-party services, promoting openness and long-term sustainability.

3.7   IP Management (component 5)

Before any exploitation of results from an EU-funded collaborative project can take place, it is crucial to establish a clear overview of the background inputs contributed by each partner and to understand how these elements of XReco are connected and interact as part of an integrated system. To support this process, the consortium developed a Component Tracker (see Annex II: Component/IP Tracker), a structured tool designed to identify, assess, and document all exploitable results. The tracker provides an overview of XReco's key attributes, detailing the components that comprise them, their respective owners, functional descriptions, interdependencies, and preliminary ideas for exploitation and commercialisation.

Over the course of the project, this tracker evolved into a core element of the IP Management framework, which has matured into a robust mechanism supporting XReco's federated commercialisation model. What began as an administrative record has become a comprehensive registry that maps each technical component, its ownership, and its links to other assets. Today, it serves as both an IP management instrument and a business coordination layer, ensuring that partner-owned assets align with the shared infrastructure, common APIs, and interoperability standards that underpin the sustainable exploitation of XReco results.

By M36, all components have been reviewed and validated in terms of technology readiness, ownership, and opportunity for exploitation. The tracker distinguishes between modules to be commercialized independently by partners and those contributing to joint infrastructure under shared governance. This structure mirrors the federated commercialisation approach:

- Components forming part of the Orchestrator-as-a-Service (e.g., metadata management, routing, and authentication) are candidates for joint exploitation, ensuring continuity and standardization.
- Partner-owned service modules (e.g., UPM's 3D reconstruction, ZAUBAR's CMS, CERTH's NeRF pipelines, FINC's rights management tools) retain individual IP and commercialisation rights, while remaining interoperable through documented APIs and metadata standards.
- The Marketplace interface, although currently on stand-by, is fully integrated in the tracker as a potential revenue layer, with IP provisions ready to support content and service licensing once operational conditions are met.

All background and foreground IP have been confirmed in accordance with the Consortium Agreement, and exploitation rights have been clarified. The tracker will remain accessible to partners beyond the project's lifetime as a living document, supporting potential licensing, integration, and co-development opportunities across the consortium.

3.8   Results consolidation with Human-Centred approach (component 6)
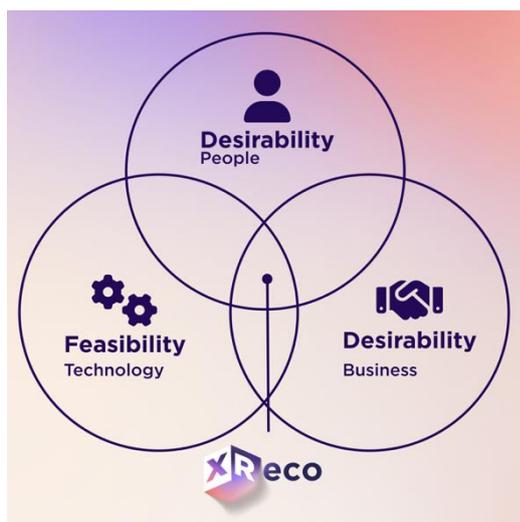
Figure 4: The 'sweet spot'

XReco puts the needs and perspectives of the customers and users at the forefront, to ensure that the XReco solution is designed and marketed in a way that meets their needs and provides value. The results consolidation set for M36 in deliverable D6.3 includes a thorough evaluation of the potential impact of the XReco project on various user groups, as well as a consideration of ethical and societal implications to ensure that the solution is socially responsible and sustainable. This step provides a roadmap for the future development and commercialisation of the XReco solution.

The current deliverable already gives insights into the first results at Month 18 of the project and the ways in which XReco can impact user groups and types, over the coming 18 months we will set out to further identify the 'sweet spot' of XReco (see Figure 4: The 'sweet spot'). To do so, we will answer the following questions and validate the results:

- **Desirability**: Are we solving for the right pain points?
- **Feasibility**: How can we build XReco to make our product/service healthier and stronger?
- **Viability:** Does our business model fit with the way XReco customers want to use and pay for our solution?

Throughout the XReco project, Human-Centred Design (HCD) was not only applied as a methodological framework during the early design phases but maintained as an ongoing principle for consolidating results and aligning them with real user needs. This section outlines how insights gathered through the three HCD cycles were systematically integrated into the technical platform, value proposition development, and exploitation strategy. It also reflects on how this approach contributed to the project's overall maturity and readiness for post-project uptake.

Human-Centred Design in XReco served not only as a methodological tool, but as a strategic enabler for exploitation. By consolidating results across user feedback loops, technical iterations, and business testing, the project was able to align innovation with adoption pathways. This approach not only increased the robustness of the platform offering but also positioned XReco as a viable ecosystem for continued development and commercial uptake beyond the project's funded duration, even though challenges remain for this consortium to have an active role in the commercialisation of XReco.

3.8.1 Integration of User Insights Across Cycles

Each of the three validation cycles (see Section 3.1) produced specific insights that shaped successive iterations of the platform and exploitation logic. These insights were consolidated across four dimensions: (1) user segmentation, (2) service design, (3) value proposition refinement, and (4) commercialisation planning.

- **Cycle 1** led to a critical reframing of the user model. The initial segmentation along domain lines (media, tourism, mobility) was replaced with a value-chain-based user-type framework: Searchers, Takers, Transformers, and Creators. This shift enabled more meaningful clustering of needs, particularly regarding asset discovery, transformation workflows, and authoring complexity.
- **Cycle 2** focused on translating these user types into tailored **Value Proposition Canvasses (VPCs)**. These canvasses were iteratively developed and refined using co-creation tools during JBC#2 and subsequent design reviews. Feedback from different user types was translated into functional requirements, such as simplified interfaces, modular access to services, and embedded licensing metadata, that were prioritized in the MVP roadmap.
- **Cycle 3** integrated **business viability testing** into the HCD process. During JBC#3, test users interacted with a near-complete MVP and provided feedback not only on usability and feature set, but also on pricing models, willingness to pay, and perceived value. This input was essential for consolidating the commercial strategy and validating the feasibility of the federated exploitation model.

In each cycle, insights were documented, synthesized, and fed into cross-WP alignment meetings. The feedback loops were bidirectional: technical developments informed by user needs were tested again in the next round of interaction, and business assumptions were validated or revised in real time.

3.8.2   Platform Adjustments Based on HCD Feedback

Several concrete improvements were implemented in response to user feedback collected through the HCD process:

- **Metadata clarity and licensing display**: Searchers and Takers emphasized the importance of understanding rights and usage conditions. The MVP was updated to show clear licensing metadata, including Creative Commons types, commercial rights, and attribution terms.
- **Workflow modularity**: Transformers and Creators required flexibility in chaining services without being forced into rigid workflows. This led to improvements in the orchestrator's service routing layer, enabling customized workflows with fewer technical constraints.
- **Preview and verification tools**: Early user feedback highlighted the need to validate transformed content before committing resources. MVP iterations incorporated preview capabilities for assets processed through services like Gaussian Splatting and NeRF.
- **Low-code authoring support**: For Creators with limited technical expertise, the need for accessible publishing tools was clear. Integration with XR Capsules and CMS-based editors (e.g. ZAUBAR) was prioritized and validated with users during live demonstrations.
- **Simplified onboarding**: Several stakeholders flagged the need for clearer documentation and onboarding flows, especially for first-time users. This triggered the creation of interface guides, demo walkthroughs, and service explanation layers (e.g. tooltips, info popups).
- **Cloud-based infrastructure over federated deployment:** Feedback from both technical and non-technical users underscored the importance of scalability and ease of access. The platform architecture was adapted toward a cloud-based infrastructure, providing improved performance, unified access, and simplified maintenance while retaining secure interoperability with institutional systems.
- **"Plug-and-play" architecture for XR services:** Users and developers expressed a need for flexibility in integrating new XR tools as they become available now and in the future. This led to the adoption of a modular implementation, enabling XR services to be added or updated as "plug-and-play" components. This change in architecture enabled the reasonably frictionless addition of a Gaussian Splatting service.

3.8.3   Value Proposition Maturity

The consolidated value propositions resulting from this process reached a high level of maturity by the end of Cycle 3. Each user type had:

- A validated VPC reflecting pains, gains, and service enablers;
- A proposed pricing structure aligned with their usage expectations;
- A mapped set of platform components relevant to their workflow.

This maturity enabled the consortium to move from exploratory design towards actionable business logic and service packaging. It also helped reduce uncertainty around post-project adoption and facilitated the articulation of Key Exploitable Results (KERs) for both individual and joint exploitation (see Sections 3.4.1 and 3.4.2).

3.8.4 Impact on Exploitation Strategy

The sustained use of Human-Centred Design principles ensured that the XReco exploitation strategy was **evidence-based, user-validated, and grounded in actual usage scenarios**. Rather than pursuing theoretical business models, the consortium was able to co-develop services and commercialisation pathways with representative users. This alignment increased the credibility of the creation of an exploitation model (see Section 3.6).

Moreover, the HCD process reinforced internal alignment among partners by creating a shared language around user needs and service value. It facilitated clearer decision-making regarding technical priorities, MVP scope, and spin-out potential.

3.9 Concluding remarks on exploitation

The exploitation work conducted throughout the XReco project shows a clear and deliberate continuation of the pathways envisioned in the impact section of the original proposal. These pathways, designed around inclusiveness and the creation of sustainable, high-quality jobs, were not only conceptually upheld but translated into operational processes through the adoption of a Human-Centred Design (HCD) approach.

By structuring exploitation around iterative validation cycles, empathize, define, ideate, prototype, and test, the project effectively bridged its strategic ambitions with tangible implementation. This transformation of theoretical pathways into a structured co-creation methodology ensured that exploitation remained aligned with XReco's broader societal goals, embedding inclusiveness and ethics at the core of its impact generation process.

The use of Human-Centred Design provided the foundation for the project's iterative learning process, enabling the pathways to evolve into actionable mechanisms for engagement and validation. Through the three Joint Business Clinics (JBCs) and continuous stakeholder involvement, the exploitation work refined its understanding of user needs across diverse application domains. Notably, the evolution from sector-based user analysis to role-based segmentation (Searcher, Taker, Transformer, Creator) demonstrates a maturation of the pathway's co-creation logic. This evolution corresponds directly with XReco's initial commitment to design transparency, inclusiveness, and adaptability. In this sense, the exploitation activities not only implemented but expanded upon the pathways, providing a repeatable methodology for co-creation that extends beyond the project's lifetime.

In line with the impact trajectories described, namely, the progression from project results to outcomes and ultimately to wider impacts, the exploitation work established a coherent process for testing market viability. The integration of value propositions, user validation, and business model experimentation directly operationalized the pathways towards sustainable exploitation.

The transition from subscription-based to pay-per-use and credit-based monetization models illustrates an adaptive response to market realities, echoing the proposal's ambition to foster new organizing layers in Europe's digital economy. This adaptability reflects an applied understanding of innovation dynamics, balancing the long-term vision of an open, European XR ecosystem with short-term feasibility and stakeholder commitment.

Ultimately, the exploitation results validate and enrich the pathways set out in the impact section. The deliberate focus on inclusiveness, ethics, and empowerment remained consistent throughout the

process, while practical challenges, particularly regarding post-project sustainability and governance, provided critical insights into how such pathways can be strengthened in future initiatives.

One significant barrier that XReco was unable to overcome was the economic challenge of sustaining a centralized commercial platform beyond the project's funded duration taking into account the high fixed costs for XR solutions. Despite strong technical results and validated user interest, the consortium had to conclude that they lacked the financial and organizational capacity to maintain the infrastructure, customer support, and business operations required for long-term commercialisation.

The anticipated "spin-off vehicle" pathway proved unfeasible at this moment in time due to the high fixed costs of running the platform and the absence of immediate, predictable revenue streams, particularly after users rejected subscription-based pricing models in favour of flexible, low-commitment alternatives. This economic limitation prevented XReco from transitioning from a research-driven ecosystem to a self-sustaining enterprise. Consequently, the project pivoted toward a federated exploitation model, where individual partners exploit results independently under shared technical and branding guidelines, rather than through a unified commercial entity.

This reflection underscores a key lesson: achieving systemic impact requires both structured co-creation and entrepreneurial agility. The XReco project concludes with a high degree of **technical and methodological readiness for handover**, yet with clear limitations regarding immediate commercial sustainability. The platform's modular architecture, validated user segmentation, and refined exploitation components demonstrate that XReco is functionally mature and conceptually robust.

The iterative Human-Centred Design process has ensured that the platform aligns closely with user needs and market expectations, while the three Joint Business Clinics provided extensive validation of both the technical offer and its perceived value. However, the absence of a unified governance or financing mechanism limits the consortium's ability to further develop the platform post-project. Thus, while the assets are ready for transfer, their long-term success depends on identifying suitable institutional or entrepreneurial stewards capable of assuming operational and financial responsibility.

In terms of **sustainability of the ecosystem**, XReco has succeeded in building a connected network of partners, early adopters, and external stakeholders, forming a strong foundation for continued collaboration. The ecosystem's strength lies in its openness, shared standards, and interoperability across services rather than in centralized ownership. This federated structure allows individual partners to exploit their results independently while preserving the coherence of the broader ecosystem.

For **post-project continuation**, the next phase should prioritize exploring public–private partnerships or Horizon follow-up actions for funding, aimed at developing targeted business pilots to generate short-term revenue sources. In this way, XReco's innovative groundwork can transition from a research consortium achievement to a **living, evolving European XR ecosystem**.

4 Dissemination and communication

In the final phase, the focus was primarily on promoting the platform and its various tools and services among the target groups. To this end, high-quality blog posts and videos were published, explaining the technical development and special features of the XReco platform and the practical use cases realised in the Demonstrators in a simple and intelligible way. This also helped to recruit testers and increase the reach of the XReco channels.

4.1 The XReco dissemination & communication strategy

4.1.1 Starting Point M18

In previous project phases, the communication strategy mainly centred on LinkedIn and X posts about the teams' activities. Postings from the XReco partner channels were reposted, too. As a result, by M19, the KPI goal of 150 LinkedIn followers (M18: 408 followers) and the KPI goal of 100 followers on X had already been achieved (M18: 118 followers). The website also had an impressive total of 2,600 page views since September 2022. The time spent on the site repeatedly reached 2:00 minutes. Thus, the KPI for the XReco website was fulfilled at the end of the first reporting period.

4.1.2 Communication Goals for the Final Project Phase

In the final phase, the strategy focused on achieving the outstanding KPIs (numbers in brackets were the states at M18):

- Increase the number of blog articles published (17) to 50.
- Increase the number of newsletters (2) to 12.
- Increase the number of newsletter subscribers (145) to 300.
- Increase the video views on YouTube (263) to 700.
- Increase the distribution of brochures and fact sheets (leaflets) (84) to 800.
- In addition, different types of users should be recruited for testing.

4.1.3 Communication Strategy for the Final Phase of the Project

To achieve all KPIs, two main communication strategies were put in focus:

1. **Networked and Linked Communication System:**
   The new communication strategy was designed to ensure that all channels are influenced by each communication activity. First, an individual strategy was defined for each channel, and then they were interlinked. The main channel was LinkedIn, which is already a strong social media platform. Single communications on this channel can create a larger effect and thus increase the reach of the other channels. Details are provided in the respective sections below.

2. **The FOMO Communication Strategy:**
   The aim of this approach was to expand the XReco community and activate followers and non-followers. The Fear-Of-Missing-Out (FOMO) strategy treats followers as part of the XReco community, while non-followers are invited to become part of it. Targeted user groups are offered relevant incentives that arouse curiosity and, above all, are available only to XReco

community members. This motivates people to become active, such as following the LinkedIn channel or subscribing to the newsletter. This strategy was specifically applied to recruit different user types for the MVP tests in May and June 2025. More on this in the sections below.

The associated tasks were:

A) Supporting the XReco consortium in achieving the project goals and milestones through targeted communication measures:

- Content consulting for XReco members
- Standardisation of the blog structure to ensure a consistent high standard
- Ensuring blog articles are highly comprehensible and reader-friendly for the target user group
- Publishing videos and integrating them into blog articles and the newsletter

B) Supporting offline activities (see #4.4)

- Participation in 64 international events in the EU and worldwide (4.4.3)
- Online and offline at events, acquisition of different user types for testing

C) Regular analysis and adjustment of communication strategies

The revised communication strategy was implemented using agile project management. Through weekly analyses and exchange with the task leaders of WP6 (Sound and DW), the channel-specific communication activities could be refined and improved continuously.

4.1.4   Target Audience

The target groups were professionals from the fields of media (technology as well as content creators) and museums and culture (e.g., for location-based Edutainment with XR).

For the target group/user analysis, the existing user personas were refined for the communication strategy to steer and activate the outreach in a targeted way.

4.2   Online actions report

4.2.1   Website XReco.eu

In February 2024 (M18), a total of 17 blog articles had been published. To ensure high quality for the remaining 33 blog articles, a standard template was developed which improved readability and simultaneously enhanced SEO quality and AI search compatibility. The focus was on SEO-relevant subheadings and lists with strong keywords.
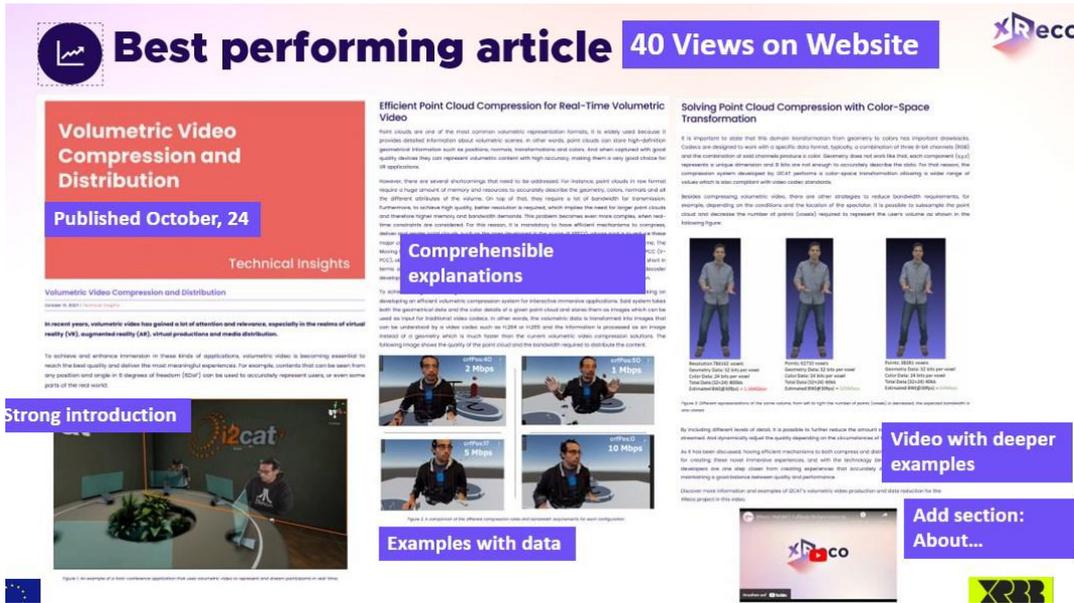
Figure 5: Visualisation of the blog article template

The new sections "Conclusion or Summary" and "About the Authors" also increased the readers' understanding and traceability of the authors and sources. In addition, some articles included internal links referring to older articles, which supported the visibility of the XReco website and the interlinking strategy.

Additional activities for the strategic interlinking of the XReco channels included integrating new buttons in every article beginning October 2024:

- XReco Newsletter subscription
- Relevant videos integrated into the articles via XReco YouTube and an additional button to the XReco YouTube channel
- Button for downloading the brochure and fact sheets (matching each article)

With an additional social media share button, readers could now re-post the article on their own channels.

Supporting the FOMO Strategy, the buttons were labelled with call-to-action (CTA) teaser texts, like:

- "Don't miss out on exclusive news anymore…" (button > newsletter)
- "Be the first to know how the XReco platform works" (button > YouTube tutorials)

This approach was also used for tester recruitment on the homepage, where a button led to the registration form, with the CTA:

- "Become part of the XReco community" and "Be the first to test the XReco platform."
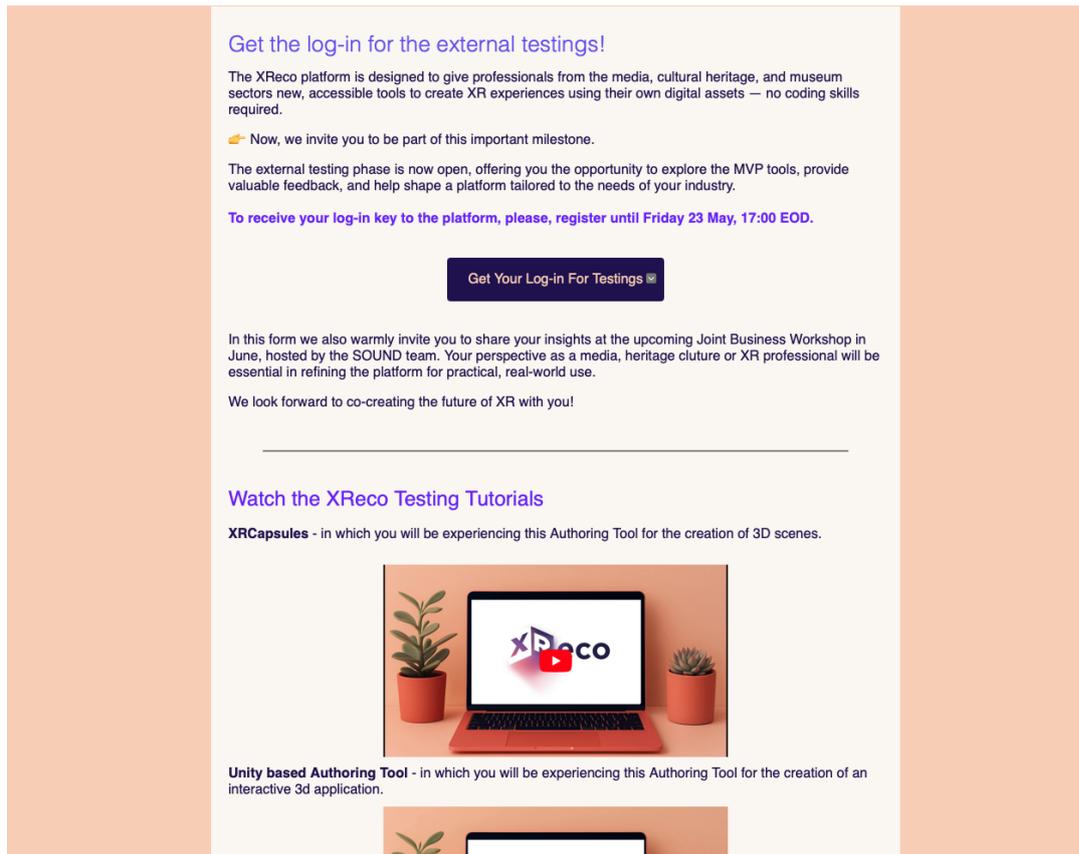
Figure 6: The tester strategy in the newsletter

4.2.1.1   Results and Figures for the XReco.eu Website

Table 5: Website Analytics

Domain	Target	Results Final Phase	Project Results
Blog articles	Publication of 50 blog articles	33 new blog articles	52 blog articles
Visitors	> 800 visitors by M12	2,587 visitors (in M19-38 alone)	6606 visitors in total
Duration	average dwell time of 2:00 minutes per visitor and session	average 0:57 minutes	average 7:01 minutes per session

The analytics of the results are structured in order to describe individual phases first and then the entire project duration. Figure 7 shows stats for the final phase of the project. Figure 8 shows stats for the entire duration of the project.

From March 2024 (M19) to October 2025 (M38), 2,587 unique users visited the website. During their visits, users performed 3,595 actions (sessions) with 2 pageviews per session. Despite the sensible strategy of embedding videos in posts wherever possible to keep visitors on the site, the dwell time per visitor and session was 0:57 minutes, which is -1:03 below the set KPI target (see Figure 7).
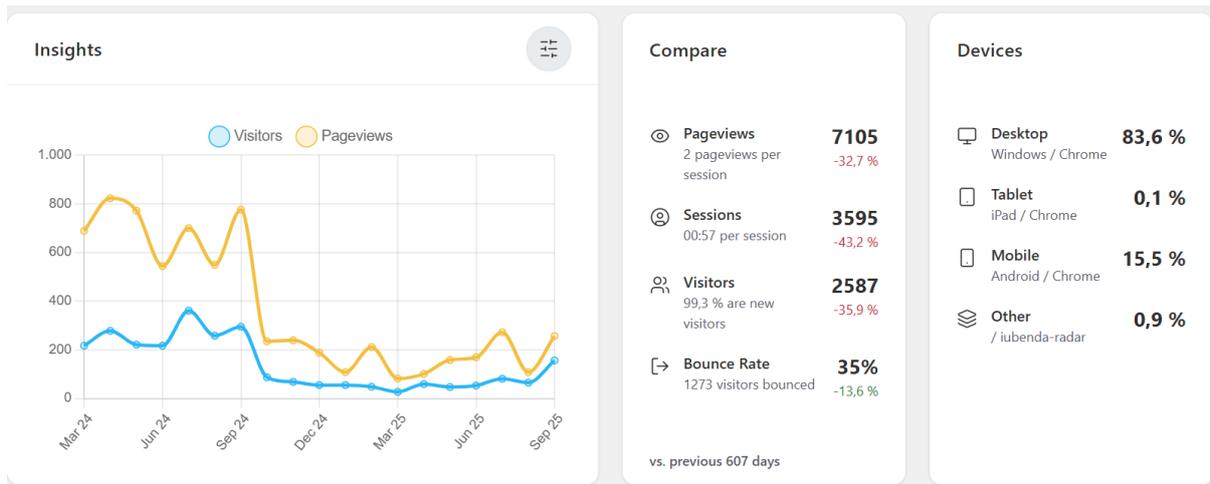
Figure 7: Analytics of XReco website 01.03.2024—28.10.2025 (Screenshot)
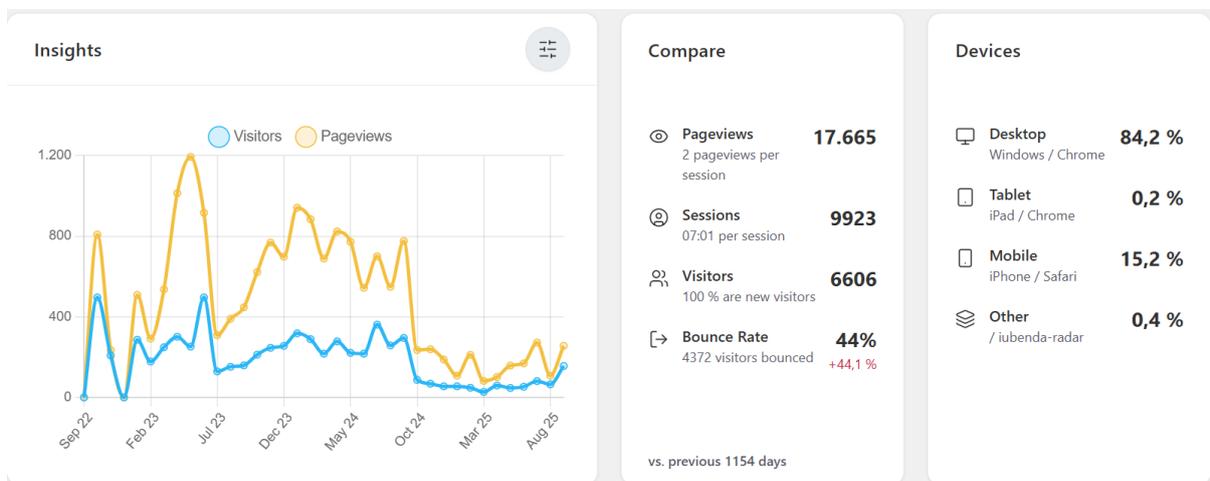
Figure 8: Analytics of XReco website 01.09.2022—28.10.2025 (Screenshot)

In August 2024, Google Core launched an SEO algorithm update, which was repeated several times until June 2025. Google does not communicate the benefits of a Google Core update. It happens automatically. The result is that the visibility of numerous websites worldwide is restricted. Due to the lack of a missing HTML document, the site can no longer be crawled. As a result, the visibility of XReco.eu dropped significantly. This can be remedied after each update by re-indexing your website. This is done with an HTML document that can be accessed via Google Core and integrated into the DNS.

This was only noticed in June 2025 after the last Google Core update. Since indexing often takes several weeks for Google, the visibility of the XReco website increased only slowly. Thanks to the networked communication strategy, it was nevertheless possible to attract more visitors to XReco.eu via social media and at least achieve the visitor target set for this phase.

Although nowadays AI search and SEO massively influence search results and the findability of a website, XReco achieved a good ranking for AI search queries. We attribute this to the very good structure of the website, the setup of the articles, and the keywords used.

The result of the AI search test with Gemini: Based on a prompt to "search for the best XR tool for 3D content creation and monetization", XReco was recommended and one XReco article appears in second position (see Annex III, Figure 25).

4.2.1.2   Summary XReco website

Throughout the entire project duration of 38 months (M1–M38), 6,606 visitors accessed the website. There were 9,923 sessions with an average session duration of 7:01 minutes (see Figure 8). Thus, the set KPI target was achieved.

4.2.2   The XReco YouTube Channel

By the end of the project, the KPI target was to have produced two short promotional videos (under 5 minutes long) with 700 views.

4.2.2.1   Situation M18

As of April 2024, the XReco YouTube channel had released a total of 3 videos. Due to this low number of videos, the channel (https://www.youtube.com/@xreco2856) had not previously been a focus of communication efforts.

4.2.2.2   Actions:

From September 2024, the XReco YouTube channel was expanded as part of the networking strategy. The following goals were pursued:

- Consistent and eye-catching, appealing titles
- Categorization into playlists: Tutorials, Talks and Presentations, Technology and Research, Events, and Partner Activities
- Meaningful video descriptions
- Linking to all XReco channels with CTA
- References to relevant blog articles

These activities aimed to increase the number of videos available for the networking and FOMO strategy. The objective was twofold: to increase targeted YouTube views to 700 and to boost website visitor numbers and dwell time. The videos and the XReco YouTube channel were extensively promoted through social media posts and newsletters.

4.2.2.3   Results Final Phase:

Thanks to the tutorials and technical insights, the XReco YouTube channel offers high value for XR enthusiasts such as XR content creators, media professionals, and experts in the field of culture heritage. Via various links, the channel also refers to more in-depth information in the blog articles.

We started with 3 videos at M18. In 2024, a total of 14 videos were published. By the end of the project in October 2025, a total of 34 videos had been published on YouTube. Additionally, there are 9 short videos that are not listed on the channel as they are only intended for inclusion in a blog article, e.g. short clips in the style of Instagram boomerangs).
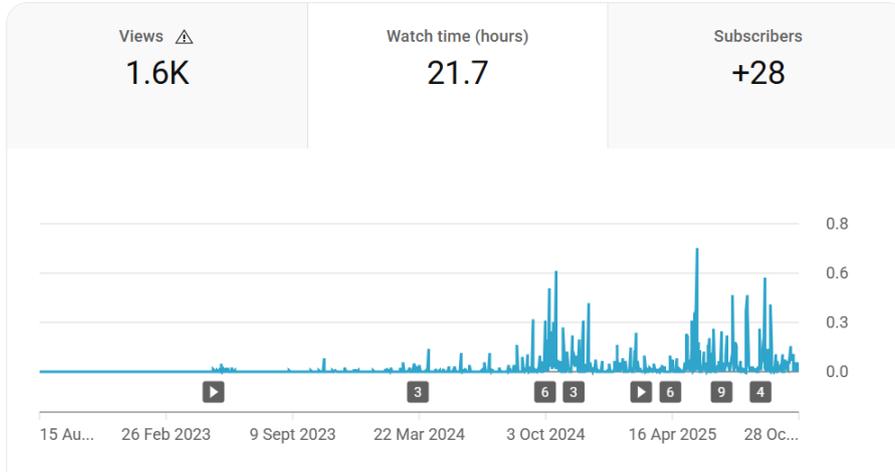
Figure 9: Screenshot YouTube Analytics in total 2022 – 2025

At M18, the videos had 79 views and a viewing time of 30 minutes. In total (2022-2025), the number of views increased to 1,631 (+1,552) views with 21.7 hours viewing time (see Figure 9).

A total of 34 published videos plus another +9 hidden videos for the blog articles translates to +43 videos over the targeted KPIs.

Table 6: Video Analytics

Domain	Target	Results Final Phase	Project Results
Videos	2 Videos	32 new videos 9 unlisted for blog articles	34 published videos plus 9 unlisted >> 45
Views	700 video views	+1,552 views	1,631 video views
Viewing Time	Not defined	21.2h	21.7h viewing time

4.2.3   XReco Newsletter

The KPI target by the end of the project was: 12 newsletters and 300 subscribers.

4.2.3.1   Situation M18

As of March 2024, 2 newsletters had been published, with 157 subscribers.

4.2.3.2   Actions

In the final phase, 10 newsletters had to be published, and the number of subscribers had to be increased to 300. The newsletter sign-up form was therefore integrated into every social media post, every blog article, and in every video description on YouTube.

Conversely, all other XReco channels were linked in the newsletter, including downloads for the brochure and fact sheets.

Following the FOMO strategy, special offers for XReco were published via social media, which were initially reserved for newsletter subscribers only, e.g., exclusive access to the tester registration form and the latest blog articles.

An important driver for the FOMO and XReco community strategy was the new section: "Meet the XReco Teams". This new section offered an overview of upcoming events, where the XReco teams would be present. Anybody who subscribed newly, received the exclusive offer to arrange a meeting with an XReco team member in advance for meeting them in person at these events. Since March 2024, 25 events were communicated in the newsletter in that way (see Event Participation).

To increase newsletter subscriptions, QR codes were displayed at events at the XReco booths, inviting visitors to sign up directly for the newsletter. This QR code was also used in presentations, leading to notable increases in subscriber numbers.

4.2.3.3   Results Final Phase

10 newsletters were published within the 20-month period, thus achieving the KPI target of 12. Based on open and click rates, improvements were made to the newsletter continuously, and the publication time varied.

Newsletters #7, #10, #11 and #12 received the highest open rates, ranging from 49.8% to 60% (see Annex III, Figure 26-27).

Table 7: Newsletter Analytics

Domain	Target	Results Final Phase	Project Results
Newsletter	12 Newsletters	10 Newsletters	12 Newsletters
Subscribers	300 Subscribers	from 159 + 63 new Subscribers	222 Active Subscriber (-78)

The number of subscribers grew from 159 in October 2024 (newsletter #3) to a total of 222 active subscribers by the end of the project. This is an increase of +63 new active subscribers. Despite a careful strategy, the KPI target of 300 subscribers was missed by -78 subscribers.

Overall, 12 newsletters were sent out with a total of 1,748 emails. The opening rates were estimated at over 46,4% on average, which is not unusual for newsletters. The click-through rate, however, was 68,6%, which demonstrates the relevance of the content for subscribers.

Figure 10: Newsletter Analytics (Screenshot Total 9. 2022 – 9. 2025)

Versendet	Öffnungen (geschätzt)	Klicks (eindeutig)
1.748	46,38 %	68,57 %

It became clear that presentations at events using QR codes and exclusive community offers were the most effective in increasing subscriber numbers.

4.3 Social Media

4.3.1 LinkedIn

For the integration and FOMO strategy to achieve the KPI targets, especially for the newsletter, website and YouTube, the LinkedIn channel (https://www.linkedin.com/company/xreco/) became the main communication channel. A typical XReco LinkedIn post looks like this:
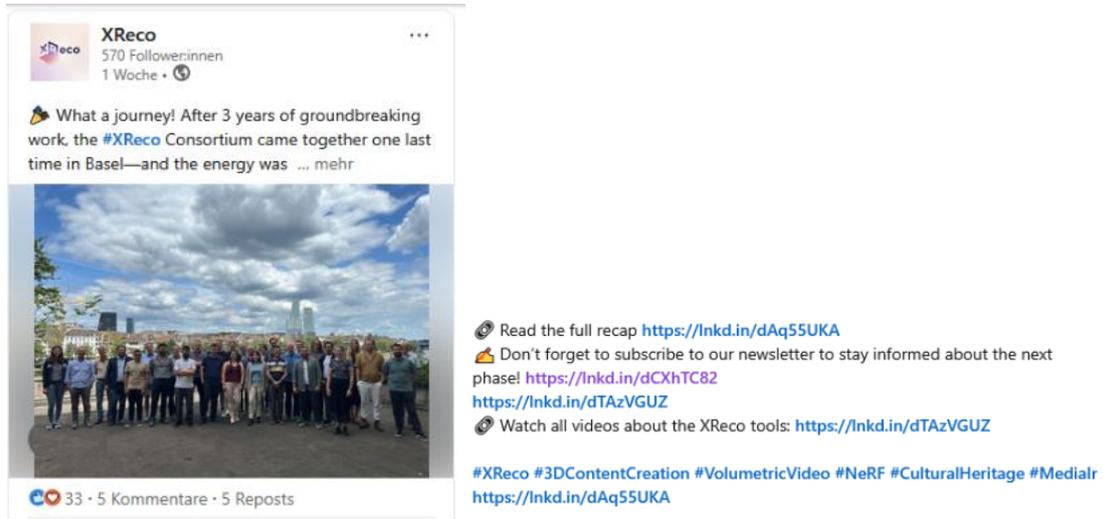
Figure 11: Example post on LinkedIn

4.3.1.1 Situation M18

At the end of the first period, the reach on LinkedIn was 408 followers (KPI target 150 followers).

4.3.1.2 Actions

The previous social media strategy was maintained and, for example, new publications on the XReco website, such as blog posts and videos on the YouTube channel, were communicated via social media. In addition, posts by XReco team members were liked, commented on and reposted on their channels.

All other XReco channels were communicated in a standardised manner:

Figure 12: Example for post on LinkedIn in FOMO Strategy-style

The XReco members were tagged in the comment section of every new post to inform them so that they could comment on it or repost it. In addition, the people who appeared in the photos were tagged in each post.

FOMO Strategy 'XReco Team Campaign'

Following the new FOMO strategy, the (audio) visual communication tools for social media were expanded and adapted to the XReco brand design. The aim was to make the XReco brand more visible on all channels, increase recognition and promote the other XReco channels through targeted campaigns to increase their reach. For example, through

- **Personal team campaign for the category 'Meet the XReco Teams'**
- **Slide posts**
- **Videos** about successes

The aim of the FOMO strategy is to showcase the XReco community and invite others to become part of it. This was achieved with the 'Meet the XReco Teams' campaign, which focuses on XReco members as likeable personalities and experts. The communication medium is graphics in the XReco design with a uniform structure (see Figure 13):

- Headline: 'Meet the XReco Team'
- Logo of the event
- Photo of the XReco team member
- Name, job title or role in the XReco project
- Mission statement about XReco and what the motivation or task is.

Figure 13: Example from the "Meet the XReco Team" campaign

For the iteration, the photos of the team members were left in colour to portray their personalities more naturally.

Newsletter campaign with slide posts

The 'Meet the XReco Team' campaign was specifically used to promote the other channels. For example, in slide posts with playful questions and a CTA to subscribe to the newsletter. This is because

the newsletter contains exclusive offers, such as the opportunity to meet members in person at an event.

Promotional Videos

Three videos were produced specifically for promotional purposes about the successes of XReco members. They contained information, e.g., about the testers who had already registered and about further developments regarding the XReco tools:

- **XReco I IMMERSIVE TECH WEEK 2024 - Results**
- **XReco I Work in progress for the MVP testings**
- **XReco I Promo Reel XReco and EBU at IBC #xreco**

4.3.1.3   Results Final Phase

With 426 organic followers already in M19 (March 2024), LinkedIn is the strongest XReco channel. By the end of the project, 588 people had subscribed to the XReco LinkedIn page.

Table 8: LinkedIn Analytics

Domain	Target	Results Final Phase	Project Results
Follower	150 Followers	426 + 162 new organic Followers *(i.e. without advertising)*	588 organic Followers + 438 Followers beyond target
Impressions	0	Oct 27, 2024—Oct 26, 2025 22,423 Impressions	> 26,109 Impressions
Postings	0	14 postings + 55 postings	69 postings

A total of 69 posts were published, achieving high impressions, for example 3,696 impressions in October 2024 (see Annex III, Figure 28).

The LinkedIn impressions from M26-M38 (Oct 27, 2024—Oct 26, 2025) reached 22,423 (see Annex III, Figure 29).[3]

4.3.2   Social Media Platform X

The @XRECO_EU channel on platform X was the second social media channel.

4.3.2.1   Situation M18

The KPIs for X were to publish 200 posts and gain 100 followers. In March 2024, XReco had 118 followers, meaning that the KPI target had already been achieved.

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[3] The LinkedIn Analytics tool only allows you to view data from up to 12 months ago. Therefore, the figures shown here are for October 2025 (the end of the project) minus 12 months.

4.3.2.2   Activities

The posts on LinkedIn were also posted on X in its specified short version with a few days' delay. The focus here was on tagging the partner channels as well.

At the end of November 2024, the number of followers had risen to 122. Due to X's political role in the US election campaign and afterwards, many members left the channel.

At the consortium meeting in Turin in February 2025, the consortium decided to reduce the activities on X in line with the EU's position on the situation relating to the platform. The XReco LinkedIn channel was to be expanded instead. Results Final Phase:

Table 9: X Analytics

Domain	Target	Results Final Phase	Project Results
Followers	100 Followers	118 + 4 new organic Followers	112 organic Followers + 12 Followers
Postings	200	29 postings	189 postings

In the final phase, a total of 29 posts were published on the X platform. The number of followers rose to 120 in November 2024. This fell to 111 between December 2024 and May 2025. Today, the channel has 112 followers, although it has not been used for XReco communication since March 2025. A total of 189 posts were published on X.

4.3.3   Overall Results Social Media

The strategy of focusing on and further expanding the LinkedIn channel has proven successful, as this channel has generated the most growth and reach. There was consideration of establishing a new channel instead of X, e.g. on Mastodon. This was rejected by the consortium on the grounds that the effort required to set it up for the last 5 or 7 months would be too great and that it would not support or guarantee the achievement of the KPIs.

4.4   Offline Actions Report

The offline activities mainly included events, workshops and conferences where the XReco project was presented to the target audience and where there were opportunities to test the MVPs and exchange ideas with the XReco Consortium partners.

In the final phase, the offline activities were primarily aimed at raising awareness about the EU project among multipliers and the target user groups to recruit testers for the XReco platform and the individual tools for May-June 2025.

4.4.1   Event Participation

In the second reporting period, the XReco members attended over 30 events and conferences in Europe and beyond, where they presented the XReco project and their work within it, such as IBC2024, XR Summit, Immersive Tech Week 2024, Stereopsia 2024, NUMIX LAB, and many more (for full list of events, see

Annex IV: Full Event List (M19-M38)).

4.4.1.1 Actions

All these events were promoted over all online channels. Offline, the XReco members either had an XReco booth and/or a speaker slot to present the XReco project and their work within it. As the conferences and events covered topics ranging from media production and broadcasting to research on XR and AI/technology to the tourism industry, XReco was able to be presented to a broad cross-industry B2B audience.

The booths were very well equipped, and XReco was prominently presented. Monitors showed videos about the XReco project and the tools. In addition, extensive material on XReco was made available, such as brochures and fact sheets.

The XReco channels were promoted directly via QR codes at the stand and in the presentations.

For example:

- The newsletter registration form
- The overview of the XReco channels via Linktr.ee/xreco
- Direct download of the brochures via the website

This strategy enabled us to gain 28 new newsletter subscribers ad hoc at the NUMIXLAB event, which was co-organized by XRBB and presented exclusively by XReco. This was possible because the QR code was integrated into the presentation.

4.4.1.2 Results Final Phase

Members of the XReco consortium participated in numerous high-ranked events reaching a broad audience of researchers, industry and general public.

IBC 2024 and 2025, Immersive Tech Week 2024, Production Technology Seminar 2025, and ACM International Conference on Multimedia (ACM MM 2025) have been among the many highlights where XReco made an impression and recruited MVP testers.

The table in Annex IV: Full Event List (M19-M38) lists all events in which XReco was represented, naming the activities in a designated column.

Below you can see some of the event highlights where XReco was (re-)presented by its members:

Figure 14: Mihail Gaianu (CAR) presenting at the 2025 ACM Multimedia conference

Figure 15: Coordinator Nico Patz presenting XReco on AI Stage at IBC 2024

Figure 16: XReco Booth at IBC 2024

Figure 17: FVV Live demo at Production Technology Seminar 2025

Figure 18: XReco Booth at IBC 2025

4.4.2   User Acquisition for Testing (offline)

Wherever XReco was represented with a booth or demo, interested parties were invited to test the first prototypes right at the stand and use a QR code to sign up for the subsequent MVP testing. In this way, over 50 people were recruited for the testing.

4.4.2.1   Situation M18

The KPI target for distributing brochures was 800 copies in two versions. The XReco project brochure was created as a brochure, and five additional factsheets (leaflets) were published presenting descriptions of technology focus and their respective tools and services.

4.4.2.2   Actions

Several partners had raised concerns and reluctance towards printing brochures. Visitors at fairs and events tend to collect paper a lot less than they used to in the past, and many organisations, including most of the consortium partners, have changed their policies towards more sustainable solutions.

Therefore, the focus was put on digital distribution of materials. Download buttons for the brochure and factsheets were integrated on the XReco website. At each booth and in presentations, a QR code was provided so visitors could easily download the brochure and factsheets. Another QR code referred to the XReco channel Linktr.ee/xreco.

Table 10: Brochures and prints distributed

Domain	Target	Results Final Phase	Project Results
Brochures	800 brochures distributed	756 downloads 144 shared prints	900 shared Brochures
Factsheet Authoring Tools		317 downloads 31 shared prints	351 shared Factsheets
Factsheet NMR		484 downloads 37 shared prints	521 shared Factsheets
Factsheet 3D Object Reconstruction		496 downloads 41 shared prints	537 shared Factsheets
Factsheet 3D Humans		295 downloads 28 shared Prints	323 shared Factsheets 3D Humans

4.4.2.3   Results Final Phase

In summary, 2,632 brochures and factsheets were shared as downloads or printed copies throughout the entire XReco project. The KPIs have been achieved.

4.4.3   Press Releases

During IBC2024, XReco was featured in three prominent articles with great messages:

1. Transform Your Media: Create and Share XR content with AI-Powered Tools[4]: A 20-minute presentation of the XReco platform by the Coordinator
2. Experience the Transformative Power of AI[5] in IBCDaily 2024, Day 1
3. XReco participated as a so-called Champion in the award-winning Accelerator "Evolution of the Control Room wins Project of the Year"[6] led by sibling project TRANSMIXR, contributing a use case demo of Free Viewpoint Video in a completely virtual production setting using Unity3D as the virtual control room. Together with all other contributors to the Accelerator, XReco was mentioned in several articles and press releases.[7]

After the big success of the first release in January 2029 (see D5.1), FFP initiated another press release[8] in August 2025 which was taken up by 142 portals so far in the USA and in Asia.

4.5   Capacity Building and workshops

The consortium's capacity-building strategy forms a core element of its mission to strengthen digital competence across Europe, directly supporting the uptake and application of XReco results. The strategy combines general skill development in digital and immersive media technologies with specific training on XReco components and workflows. By empowering students, professionals, and researchers with future-ready skills, the consortium contributes to European technological and data sovereignty. This approach ensures that the knowledge generated within XReco is transferred effectively to a growing community capable of driving innovation and competitiveness in the extended reality (XR) and AI domains.

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[4]   https://www.ibc.org/artificial-intelligence/ibc-conference/transform-your-media-create-and-share-xr-content-with-ai-powered-tools/21008

[5] https://www.ibc.org/ibc-show/news/the-ibc-daily-2024-day-1/21224, p.28.

[6]   https://www.ibc.org/accelerating-innovation/news/kickstart-day-2025-evolution-of-the-control-room-wins-project-of-the-year/21655

[7]   https://www.ibc.org/ibc-show/news/ibc-innovation-awards-celebrate-global-media-and-technology-breakthroughs/22465,   https://www.ibc.org/immersive-tech/features/ibc2024-accelerator-project-evolution-of-the-control-room/21308

[8]   https://www.issuewire.com/the-future-of-music-videos-art-multiview-xr-arrives-on-mobile-and-vr-headsets-1841805622730988

4.5.1 Framework and Planning Approach

The capacity-building framework developed early in the project (see Figure 19: Capacity Building Framework) provides the conceptual and operational basis for all activities. It distinguishes two primary dimensions:

- **Scope of capacity development**, differentiating between general skill-building activities and XReco-specific training; and

- **Timing of implementation**, dividing activities between Year 2 (general workshops and seminars) and Year 3 (technical tutorials and platform-focused training).

Figure 19: XReco's Capacity-Building Framework

This framework results in a two-by-two matrix guiding the systematic rollout of activities. Year 2 focused on general awareness, community-building, and methodological development, while Year 3 emphasised hands-on engagement and technical training in XReco's tools and methods. This sequencing ensured a progressive deepening of knowledge and user capability across the project timeline.

4.5.2 Implementation of Workshops

Since the initial planning phase, the consortium has successfully delivered a broad range of workshops addressing both technological and methodological themes. Early events included a **Human-Centred Design workshop** at Stereopsia 2023 (Brussels) and a follow-up at **Immersive Tech Week 2023** (Rotterdam), together engaging more than 60 participants.

Workshop sessions such as **"Innovation and XR in the Media"** (DW, Berlin, March 2024) and the EURASIP International Summer Schools on eXtended Reality Technology and eXperience (UPM and i2CAT, in July 2024 and July 2025) expanded the scope to encompass innovation transfer, AI applications, and digital media workflows. These workshops, complemented by legal and policy sessions (e.g. on AI and Copyright), have reached diverse audiences including startup representatives, postgraduate students, researchers, and creative professionals. Each activity combined knowledge sharing with practical exercises, fostering both understanding and application of XReco's principles.

4.5.3   Academic and Thematic Outreach

In parallel, several academic and conference-based sessions have amplified XReco's visibility in the research community. Partners such as CAR, KUL, IPR, and JRS organised thematic workshops and special sessions at international venues including **ACM Multimedia**, **ACIIDS 2025**, and the **Association for European Policy in Intellectual Property (AEPIP) 2024**. These activities addressed advanced topics such as intelligent multimedia processing, data governance, and copyright in the age of generative AI. By engaging interdisciplinary audiences, the consortium has bridged scientific, legal, and creative perspectives, aligning technical research with broader societal and ethical considerations. This mix of academic engagement and public dissemination ensures that XReco's insights contribute to ongoing debates on responsible and sustainable digital innovation.

4.5.4   Tutorials and Practical Learning

The consortium published **five tutorials** demonstrating the practical use of XReco tools and related technologies. Topics covered multimedia retrieval in VR environments, content search for XR production, and evaluation of immersive datasets. The tutorials served as an effective bridge between research outcomes and end-user application, enabling participants to directly experience the XReco prototype.

Table 11: XReco's Online Tutorials

Title	YouTube URL	Views
XReco I Tutorial – 2D/3D Asset Management and Sharing on the XReco Platform (MOG, Fincons)	Watch on YouTube	43 views
XReco I Tutorial – 3D Reconstruction by UPM 2025	Watch on YouTube	57 views
XReco I Tutorial – UNITY Authoring Tool by Capgemini 2025	Watch on YouTube	60 views
XReco I Tutorial – AR CMS Creator Tool by ZAUBAR 2025	Watch on YouTube	54 views
XReco I Tutorial – XR Capsules by VISYON 2025	Watch on YouTube	17 views

4.5.5   Estimated Reach

The cumulative reach of 1,000+ participants and viewers across all capacity-building activities has exceeded initial expectations. Early in the project, the consortium anticipated a modest participation base, primarily drawn from academic and professional networks within XR research and development.

However, the combined effect of workshops, summer schools, and online tutorials led to a broad and diverse audience. The introduction of open-access video tutorials, in particular, extended engagement far beyond physical events, reaching an international online community and ensuring continued visibility beyond the live sessions.

This outcome demonstrates the strong demand for practical, interdisciplinary learning on XR topics and confirms that the project's capacity-building approach, blending academic rigor, industrial relevance, and accessible digital learning, has been both scalable and impactful.

Table 12: Estimated Reach per audience type

AUDIENCE TYPE	REPRESENTATIVE ACTIVITIES / EVENTS	NUMBER OF EVENTS	APPROX. PARTICIPANTS OR VIEWS	MAIN LEARNING FOCUS
POSTGRADUATE & PhD STUDENTS / ACADEMIC RESEARCHERS	International Summer Schools (UPM / i2Cat 2023–2025) Academic Workshops at ICCCI, ACIIDS, ACM Multimedia	5	≈ 250	XR systems, AI methods, multimedia retrieval, scientific exchange
INDUSTRY PROFESSIONALS & STARTUPS	Human-Centred Design Workshops (Stereopsia 2023, ITW 2023) TADAM Workshop 2025 "Innovation and XR in the Media" (DW 2024)	4	≈ 120	Human-centred design, XR innovation, copyright and AI application
LEGAL & POLICY EXPERTS / LAW STUDENTS	Guest Lectures (IHU 2024, AUTH 2025) KUL Legal Sessions on Data Governance and AI Law	8	≈ 180	AI & copyright law, data intermediation, EU digital regulation
INTERDISCIPLINARY ACADEMIC & INDUSTRIAL AUDIENCES	Tutorials at ACM ICMR and ACM Multimedia (2024–2025)	4	≈ 150	Multimedia retrieval in XR, content search methods, XR datasets
Online Viewers / General XR Community	XReco I Tutorial Series (May 2025): UNITY Authoring Tool (Cap Gemini), 3D Reconstruction (UPM), AR CMS Creator (ZAUBAR), XR Capsules (Visyon), 2D/3D Asset Management (MOG/FINC)	5	≈ 230 views	Practical hands-on training on XReco authoring and asset tools
General Public / Ambassadors & Community Building	Co-creation sessions (Joint Business Clinics), tester network	3	≈ 90	Awareness and community engagement in XR and digital skills

4.6   Dissemination

In the second reporting period (March 2024 - October 2025) the XReco consortium **published 25** scientific papers as contributions to either **books or journals (4)** or **conference proceedings (21)**. Some scientific papers have been **accepted/ submitted (11)** but not published at the delivery date of this document. Regarded as valuable achievements, these were still added to the full list of publications in Annex V: Full List of Publications (M19-M38). The total number of scientific contributions for the second reporting period is **36**, comprising both published and (currently) unpublished papers.

Altogether, this means that **42** scientific publications have been made during the project (September 2022 – October 2024).

4.7   Summary

Throughout the project, interest in XReco grew thanks to high-quality publications. This was achieved primarily through regular and consistent communication across various channels, ensuring that followers and subscribers were constantly made aware of new developments.

The challenges of increasing or maintaining reach lay primarily in the fact that AI-driven updates and changes in search technology and behaviours required a reform of traditional content marketing. In terms of the website, reach was lost that could not be recovered despite countermeasures.

Nevertheless, targeted communication strategies enabled the targeted user groups to be reached and the reach of the other channels to be successfully expanded.

In Summary: The XReco project was presented to the target user groups and a broad interested public from the XR and B2B media and technology sectors, as well as tourism. The content created is a high-quality database that is available to other EU projects.

5   Collaboration with other initiatives

As Task Lead, DW took responsibility for initiating collaborations with other projects, networks, initiatives, and external experts, and coordinating such activities by other members of the consortium.

5.1   Related projects

In the final phase of the project, XReco continued the fruitful exchange with the sibling projects, MAXR, EMIL-XR and, most notably, TRANSMIXR.

On 23 April 2024, the sibling projects shared a panel at fmx[9] in Stuttgart (see Event list on p.75). The panel was organised by Filmakademie Baden-Wuerttemberg on behalf of EMIL-XR and MAXR and enabled an inspiring exchange about the present and future of XR media production in the light of AI.

On 11 June 2025, Task Lead Nico Patz hosted and chaired a 45-minute panel at Europeana Conference[10] in Warsaw (see Event list in 9.4 Annex IV: Full Event List (M19-M38)). In this panel discussion representatives of five projects were presented - XReco, TRANSMIXR, PRESENCE, EUreka3D-XR, and 5Dculture - whose diverse use cases show how content from Europeana.eu and other resources have been reused in impressive 3D and XR experiences. The session presented and discussed examples and learnings of how advanced tech can reuse cultural heritage data in digital 3D experiences. The panel had been initiated by XReco, first inviting the TRANSMIXR and PRESENCE projects. Later, the Europeana Foundation suggested adding the other two projects who added relevant contributions. Beyond the fruitful and inspiring discussion, the panel also raised interest in the platform so that participants from the audience asked to be added to the list of MVP testers.

Figure 20: Panel session on re-use of content in XR

Furthermore, many projects have been featured in the XReco Newsletters, providing short descriptions of these projects to our readers and, where relevant, links to their events or publications.

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[9] https://fmx.de/en/home

[10] https://europeana.zohobackstage.eu/Europeana2025#/agenda?day=2&lang=en

Table 13: List of partner projects featured in XReco Newsletters

Project name	Newsletter number and date
EMIL, the European Media and Immersion Lab	Newsletter #2 – 16.02.2024
XR 4 Human	Newsletter #3 – 25.06.2024
TRANSMIXR	Newsletter #4 – 04.10.2024
The EMERALD Project	Newsletter #5 – 08.11.2024
PRESENCE	Newsletter #6 – 03.12.2024
IMPULSE	Newsletter #7 – 21.01.2025
Trusted European Media Space TEMS	Newsletter #8 – 12.03.2025
Social and Human-Centered XR project SUN	Newsletter #9 – 17.04.2025
EUreka3D-XR	Newsletter #10 – 21.052025
REEVALUATE	Newsletter #11 - 04.07.2025
DIDYMOS-XR	Newsletter #12 - 12.09.2025

5.2   XR-related initiatives

XRBB and DW managed to connect with more XR-related initiatives as elaborated in the sections below.

5.2.1   XR Synergy Summit, Berlin 2024

On October 24, 2024, XRBB organised the XR Synergy Summit in collaboration with the Fraunhofer Institute HHI. This industry meeting focused on current trends in areas such as gamification and digital twins. The target audience was scientists and XR experts from all over Germany.

XRBB gave a detailed presentation on the XReco Project and the work on Gaussian splatting and 3D reconstruction of objects and environments. Details were discussed in depth in one-on-one conversations afterwards.

5.2.2   NUMIXLAB Event, from Munich to Berlin 2024

On November 28, 2024, XReco was presented at the international conference NUMIXLAB[11] in Berlin. The event was co-produced by the XRBB. NUMIXLAB is an annual conference that focuses on immersive media art. Originally a French-Canadian co-production, it brings together a highly select group of over 200 experts from 20 countries who are key players in the field.

The presentation of XReco generated significant interest among these high-level participants. It was a perfect opportunity to prominently position the project and its capabilities in front of a large number

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[11] https://xreco.eu/xreco-project-presented-at-numix-lab-2024/

of potential clients and collaborators. The feedback received was extremely positive, validating the project's potential on a global stage. The QR code in the presentation slides increased the number of newsletter subscribers by 28 new subscribers.

5.2.3   Stereopsia, Brussels 2024

Europe's leading XR event, known for bringing together industry and academia, took place from December 9 to 11, 2024, and attracted 1,000 participants from around the world, including developers, researchers, investors, and policymakers.

XRBB represented XReco project and discussed the transformative potential of XReco for the creation, exchange, and use of XR content in numerous exciting conversations. The exchange of ideas showed that XReco can change the media landscape and generated great interest among event participants. Many visitors expressed great interest in testing XReco's services and applied for access to the Minimal Viable Product (MVP) and testing in 2025.

5.2.4   XR/Virtual Worlds Meeting of DG CNCT and AR/VR Industrial Coalition

On 11 February 2025, DW and CERTH participated in the XR/Virtual Worlds Meeting of DG CNCT in Brussels. In a first session, both participated in a discussion on the future of EU Research with a focus on XR technologies and Virtual Worlds, and in the afternoon CERTH presented a short pitch of the project to members of the VRAR Industrial Coalition.

5.2.5   XR-Day Tourisms

At one of the most important events for the German tourism industry[12], the XRBB presented the XReco project, focusing on technical developments for the simple development of AR experiences for histotainment. The project by ZAUBAR and Continental in Timisoara was presented as an example of the future of tourism. ZAUBAR also presented the AR authoring tool used for the XReco application.

6   Standardisation

Four of XReco's technology partners contributed to numerous standard committees. UPM, RAI and JRS contributed to the development of standards in ISO/IEC JTC1 SC29 WG2 and WG4 (MPEG Technical Requirements and Video Coding), VQEG/ITU-T (Q10/SG12) and 5G-MAG. In addition, comments were provided on standards in ISO/IEC JTC1 SC42 (Artificial Intelligence) and IEC/TC 100/TA 1/WG 1 (Terminals for VR/AR/MR) via the respective national standards bodies. In total, 30 meeting inputs and comment documents have been submitted, and 19 meetings of working groups and committees have been attended (not counting regular/preparatory online sessions). The following table presents the list of all contributions in the second reporting period (M19-38).

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[12] https://digitalzentrum-tourismus.de/events/xr-day-tourismus/

Table 14: XReco Contributions to Standardisation

Date	Standards body	Reference (e.g. document number)	Type (Meeting input, comments, ...)	Title	Partner
2024-04	ISO/IEC JTC1 SC29 WG4	m65753	Meeting input	[NNC] Proposed DoC on ISO/IEC DIS 15938-18 (2nd ed.)	JRS
2024-06	ISO/IEC JTC1 SC42	A.S.I AG001.42 N0575	Comments (AT)	Comments on ISO/IEC NP42112 Guidance on machine learning model training efficiency optimisation	JRS
2024-06	ISO/IEC JTC1 SC42	A.S.I AG001.42 N0576	Comments (AT)	Comments on ISO/IEC NP42111.2 Guidance on lightweight AI systems	JRS
2024-07	ISO/IEC JTC1 SC29 WG4	m68271	Meeting input	[NNC] Proposal for Bit-Depth and Data Type Levels in NNC	JRS
2024-07	VQEG/ITU-T (Q10/SG12)	VQEG_IMG_2024_216	Meeting document and presentation	Status of the Rec. P.IXC	UPM
2024-09	ISO/IEC JTC1 SC42 WG3	A.S.I AG001.42 N0645	Comments (AT)	Comments on ISO/IEC DTS 12791 Information technology, Artificial intelligence, Treatment of unwanted bias in classification and regression machine learning tasks	JRS
2024-11	ISO/IEC JTC1 SC29 WG2	m69967	Meeting input	[NNC] Input to NNC use cases for tensorial data	JRS, i2CAT
2025-01	ISO/IEC JTC1 SC29 WG2	m70706	Meeting input	[Market Needs] Proposed additions to Draft white paper on Metaverse	JRS
2025-01	ITU-T (Q10/SG12)	T25-SG12-C-0017	Meeting input	UIBCpdated draft of P.IXC "Interactive test methods for subjective assessment of extended reality communications"	UPM
2025-05	VQEG/ITU-T (Q10/SG12)	VQEG_IMG_2025_123	Meeting document and presentation	Status of the Rec. P.IXC	UPM
2025-07	ISO/IEC JTC1 SC42 WG3	A.S.I AG001.42 N0895	Comments (AT)	Comments on ISO/IEC FDIS 12792 Transparency taxonomy of AI systems	JRS

Date	Standards body	Reference (e.g. document number)	Type (Meeting input, comments, ...)	Title	Partner
2025-07	ISO/IEC JTC1 SC42 WG5	A.S.I AG001.42 N0894	Comments (AT)	Comments on ISO/IEC CD 4213 Performance measurement for AI classification, regression, clustering and recommendation tasks	JRS
2025-08	ISO/IEC JTC1 SC42 WG5	A.S.I AG001.42 N0910	Comments (AT)	Comments on ISO/IEC CD 24029-3 Methodology for the use of statistical methods	JRS
2025-09	ITU-T (Q10/SG12)	T25-SG12-C-0067	Meeting input	Updated draft of P.IXC "Interactive test methods for subjective assessment of extended reality communications" (for consent)	UPM
2025-09	ITU-T (Q10/SG12)	ITU-T P.1321	Meeting output (recommendation consented)	ITU-T P.1321 - "Interactive test methods for subjective assessment of extended reality communications"	UPM
2025-10	ISO/IEC JTC1 SC29 WG4	m74002	Meeting input	[MPEG-AI] A review of existing standardization activities on AI reproducibility	JRS
2025-6	IEC TC100/TA1/WG1	IEC TR 63610 ED1	Comments (AT)	Comments on doc. 100/4217/CD , IEC TA 21 : VIRTUAL (VR), AUGMENTED (AR) AND MIXED (MR) REALITY SYSTEMS AND EQUIPMENT	RAI
2025-1	5G MAG, WI_011_XR_3D_Assets	CDT.0144.5G-MAG-Explainer-XR-v0.1.0	Meeting input	Contribution to the document: 5G-MAG Explainer; XR and 3D Experiences via 5G	RAI
2024-3	5G MAG, WI_009 AdvancedMedia5G	Use case on connected digital twins of humans	Meeting document and presentation	6G Workshop #1 - Media applications & services towards the next G	RAI
2024-5	5G MAG	UC0053r5.5G-MAG_Input_3GPP_SA1_6G WS	Meeting input	3GPP Stage 1 workshop on IMT 2030 Use Cases	RAI

7   Reflection on outcomes by target groups

In Section 2 of the XReco proposal, **22 distinct target groups** were defined to represent the full spectrum of stakeholders across the project's research, industry, and societal impact domains. These groups span from **scientific and academic communities** engaged in AI, data governance, and visual computing, to **industrial actors** in media production, cultural heritage, and mobility, as well as **end users, policy makers, and standardization bodies** shaping the broader XR ecosystem

Among the 22 identified target groups, the **research communities in AI, interactive technologies, and visual computing** (TG1.1–TG1.3) have experienced some of the clearest and most verifiable outcomes from XReco's activities (see Table 15: Outcomes per identified Target Group). The project generated extensive scientific outputs focused on neural media repositories, AI-driven media retrieval, and blockchain-based rights management. Research teams from CERTH, UPM, and RAI validated XReco's technical achievements through collaborative experimentation on volumetric rendering and 3D reconstruction using NeRF and Gaussian Splatting techniques. Moreover, the project's open access deliverables and its contributions to ISO/IEC SC42 (AI) standardization have provided the academic community with concrete technical references that extend beyond the life of the project.

Similarly, **professional user groups within the media and creative industries**, notably **News Media Professionals (TG2.1)**, **Tourism Industry Professionals (TG2.2)**, and **Artists & Designers (TG2.6)**, clearly benefited from XReco's co-creation and pilot activities. Deutsche Welle's newsroom pilot, for instance, directly validated AI-assisted content retrieval and automated 3D infographic generation for journalism. In the tourism and cultural heritage sectors, ZAUBAR and VISYON implemented XReco's storytelling and reconstruction tools to produce immersive visitor experiences, publicly demonstrated at Immersive Tech Week and Stereopsia. These pilots served as real-world proofs of concept for the platform's potential to bridge traditional 2D archives and interactive XR experiences.

Finally, **Standardisation Bodies (TG3.5)** and **Policy Makers & Regulators (TG3.4)** have benefited from XReco's sustained contribution to international interoperability and trustworthy AI frameworks. The project's architecture, orchestrator, and media metadata framework were referenced in discussions and plug-tests within MPEG-I, OpenXR, and ISO/IEC working groups. By feeding concrete results into ongoing European data governance and media standardization dialogues, XReco helped shape policy-relevant practices around transparency and interoperability in immersive technologies. These achievements demonstrate that the project not only delivered high-impact technical innovation but also influenced structural developments in how Europe approaches cross-sector XR data ecosystems, ensuring that its outcomes continue to inform both research and policy beyond the consortium's immediate lifetime.

While XReco delivered strong results for several groups, some **partially served target groups** followed a different pattern, features were **successfully designed and validated** but **not yet adopted**.

For example, **Media Producers (TG2.4)** and **Content & Data Providers (TG2.5)** benefitted from the Marketplace prototype, orchestration tools, and improved metadata and licensing displays, all confirmed as usable through MVP testing and HCD feedback. However, with the Marketplace not

activated during the project, these groups could not apply the tools in real operations, leaving XReco's content reuse and rights management potential proven in design but untested commercially. Similarly, **SMEs (TG2.9)** and **Startups & Entrepreneurs (TG2.10)** engaged through workshops and capacity-building sessions, yet uptake remained limited without an operational platform.

Table 15: Outcomes per identified Target Group

Target Group	How XReco Served This Group (Outcomes and Benefits)
TG1.1 – Research Community in AI, Distributed Ledger, and Data	XReco delivered clear benefits for this group through scientific outputs and practical tools. The consortium published numerous AI and data governance papers and made available APIs for the Neural Media Repository and blockchain-based rights management experiments. These were used by researchers to explore data provenance and trust in distributed systems.
TG1.2 – Research Community in Interactive Technologies	This community was actively engaged through tutorials and demonstrations on XR interaction methods and human-centered design. Examples include live sessions at ACM Multimedia and EURASIP 2025, where researchers could experience how XReco enables user-adaptive and multimodal interaction within immersive environments.
TG1.3 – Research Community in Vision and Video Processing	The project provided tangible outcomes, such as AI-driven 3D reconstruction and volumetric rendering techniques (NeRF and Gaussian Splatting). These were showcased at conferences and integrated into collaborative research with CERTH and UPM, advancing visual computing methods for media and XR applications.
TG1.4 – Broader Scientific and Technical Community	The scientific community benefited indirectly through open access to deliverables and technical reports. All public deliverables were made available online, allowing researchers outside the consortium to review results and potentially reuse architectural components, even though direct collaboration remained limited.
TG1.5 – Academic Community (Education)	Educational engagement was achieved through tutorials, webinars, and five online learning modules addressing AI and XR. These were used in postgraduate training sessions, although there is no evidence yet of formal integration into academic curricula.
TG2.1 – News Media Professionals	Deutsche Welle's co-creation activities provided a strong demonstration of value for this group. XReco's AI-assisted search and retrieval tools streamlined newsroom workflows and supported new 3D infographic formats, which were demonstrated at industry events and shared through press campaigns.
TG2.2 – Tourism Industry Professionals	Tourism and heritage professionals benefited directly from pilot activities with ZAUBAR and VISYON, where XReco was used to connect 2D archival material with immersive storytelling experiences. These pilots confirmed the system's potential for location-based tourism content.

Target Group	How XReco Served This Group (Outcomes and Benefits)
TG2.3 – Mobility and Automotive Industry	Continental validated XReco's technical potential in its pilot on AI-supported 3D visualisation for infotainment and simulation. Although these applications remain pre-commercial, they demonstrated cross-sector relevance and technical feasibility for XR in the automotive domain.
TG2.4 – Media Producers	Media producers were partially served through demonstrations of the XReco Marketplace prototype and orchestration environment. These tools showed how assets could be reused across productions, though activation of the Marketplace was postponed, limiting real-world testing.
TG2.5 – Content and Data Providers	This group was supported through improvements in metadata clarity and licensing transparency. For example, the MVP was updated to display Creative Commons and attribution information, allowing providers to share content more confidently even though external adoption was still in preparation.
TG2.6 – Artists and Designers	Artists and creative professionals benefited from the integration of low-code authoring tools and XR Capsules. During live demonstrations, such as at Immersive Tech Week, creators tested how to combine visual assets and narrative elements without extensive technical knowledge.
TG2.7 – Game Developers	While the architecture supports Unity-based integration, engagement with the game development community remained exploratory. The modular and API-driven design offers potential for future adaptation, but no documented partnerships were recorded during the project.
TG2.8 – Programmers and Developers	Developers were supported through documented APIs for orchestration and media retrieval. Clear onboarding materials and guidance layers were introduced to help technical users connect and test services with reduced integration complexity.
TG2.9 – SMEs	SMEs participated in XReco's workshops and co-creation sessions, with more than 200 organizations across Europe reached through community-building activities. While many small companies expressed interest, concrete integrations into SME workflows are expected post-project.
TG2.10 – Startups and Entrepreneurs	Startups benefited indirectly from the platform's modular business logic and monetization templates. The financial case study demonstrated potential profitability after two years of operation, but dedicated incubation or startup pilots were not yet established.
TG2.11 – Investors and Business Angels	The project provided analytical material for investors, such as the monetization and break-even scenario. Although investor discussions were not formalized, the model offers a concrete base for future funding dialogues.

Target Group	How XReco Served This Group (Outcomes and Benefits)
TG3.1 – News Consumers and General Public	News consumers were indirectly engaged through partner pilots that showcased XR storytelling formats in broadcasting. The project also ran press campaigns around milestones to build awareness of immersive journalism.
TG3.2 – Tourists and Cultural Visitors	The tourism audience was directly reached through public heritage demonstrations with ZAUBAR and VISYON. Visitors experienced immersive re-creations of historical sites, validating XReco's role in cultural accessibility and engagement.
TG3.3 – Drivers and Automotive Users	This group was addressed in early internal demonstrations by Continental, testing interactive XR visualisations for infotainment and driver assistance, though results remain experimental and not yet public.
TG3.4 – Policy Makers and Regulators	XReco partners contributed to European and international standardization processes, such as ISO/IEC and CEN/CLC committees on AI and immersive media. Policy makers were engaged through workshops and presentations demonstrating trustworthy and transparent AI applications.
TG3.5 – Standardization Bodies	The project contributed directly to working groups on MPEG-I, OpenXR, and AI trustworthiness. XReco's architecture and media orchestration concepts were used as examples in interoperability plug-tests organized by SMPTE and ISO.
TG3.6 – Open-Source and Technical Communities	Open-source engagement was fostered through the release of architectural documentation and partial code components. Developer communities were invited to review and test features, although sustained community governance has yet to be established.

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9 Annex

9.1 Annex I: KPI Tracker WP6

Category	KPI	M36 Som van Value	ProgressF
Banner/Rollup	No. of events where banner is used: 4	5,00	125%
Brochure	Brochures distributed: 800	2.632,00	329%
	No. of events where brochure is used: 10	10,00	100%
	No.of Brochures: 2	5,00	250%
Factsheet	No. events where factsheet is used: 10	10,00	100%
LinkedIn	LinkedIn Group of 150 People	588,00	392%
Newsletter	Number of e-Newsletters published: 12	12,00	100%
	Size of dissemination list > 300	222,00	74%
Poster	No. of events where poster is used: 10	10,00	100%
Publication	At least 2 publications per project partner (articles)	20,00	100%
	Publishing, presenting, and teaching XRECO's progress in science journals (>10)	4,00	40%
Twitter	Number of Tweets > 200	189,00	95%
	Number of Twitter Followers > 100	112,00	112%
Video	No. of videos = 2	34,00	1700%
	Video views > 700	1.631,00	233%
Website	Average duration of website visits: 2:00 (per month)	1,30	65%
	number of posts published on website > 50	52,00	104%
	Number of website visitors by M12 > 800 (from M1)	6.606,00	826%
Workshop	Organizing a minimum of 5 workshops and 2 tutorials	11,00	157%
	participating in at least 8 (virtual) exhibitions in total	15,00	188%

Figure 21: Communication KPIs for M38 (T6.1)

Task		Alles selecteren	T6.2	T6.3	T6.4

Task	KPI	Actual	Target	Progress
T6.2	Contact & contracts X lauching customers	4	3	133%
T6.2	Establishment of agreements and collaboration with external initiatives	3	2	150%
T6.2	Identify X launching customers	4	3	133%
T6.2	Joint Business Clincs >3	3	3	100%
T6.2	Offered free trial versions >3	4	3	133%
T6.2	Present XRECO at relevant international conferences like VRDays	26	10	260%
T6.2	Quarterly permanent market-screening >8 (from M12 onwards)	8	8	100%
T6.2	Reporting exploitation of intellectual property rights by M18 and M36	2	2	100%
T6.3	(Virtual) meetings, workshops and e-learning modules ≥5	26	5	520%
T6.3	Attending minimum of 2 networking events per partner (# of partners reached)	17	20	85%
T6.3	Blog (2x) on business methodology based on D6.1	2	2	100%
T6.3	Creating a vivid community of >200 companies and organisations across Europe	209	200	105%
T6.3	Meetings with policy makers >4	3	4	75%
T6.3	Trade show and conference proceedings >30	36	30	120%
T6.4	10 input documents to international standardisation activities	20	10	200%
T6.4	Contribution to standardisation of new media formats by M18 and M36 >3	3	3	100%
T6.4	Open source software license >1	7	1	700%
T6.4	Software licenses > 6	7	6	117%

Figure 22: Monitoring KPIs for T6.2, T6.3 and T6.4

Partner	Som van # Articles	Min 2 articles	Som van # Events	Min 2 Events
Atos	2	Yes	0	No
Cap Gemini	2	Yes	2	Yes
CAR (Continental)	3	Yes	6	Yes
CERTH	3	Yes	4	Yes
DW	4	Yes	12	Yes
FFP	2	Yes	3	Yes
FINCONS	3	Yes	4	Yes
i2CAT	3	Yes	22	Yes
IP-RIGHTS	2	Yes	4	Yes
JRS	2	Yes	13	Yes
KUL	3	Yes	1	On track
MOG	2	Yes	7	Yes
NVIDIA	2	Yes	0	No
RAI	2	Yes	3	Yes
Sound	3	Yes	11	Yes
UNIBAS	2	Yes	10	Yes
UPM	2	Yes	11	Yes
Visyon	2	Yes	4	Yes
XRBB	2	Yes	19	Yes
ZAUBAR	10	Yes	3	Yes

Figure 23: Partner Commitments KPI-tracking

9.2 Annex II: Component/IP Tracker

Key feature	Attribute	Owner	Component	Description	Dependencies	Opportunities for exploitation
Orchestrator-as-a-Service						
Multi Modal search & retrieval						
ATOS, JRS, CERTH, UNIBAS, MOG, FINCONS	*Data adapters*	ATOS, I2CAT	Connectors to DW Feed, RAI Archive, Wikimedia, Sketchfab, Europeana	Interface components to connect search to external data sources	None	Apply in the context of data spaces
	Neural cross-modal descriptors	JRS	Landmark classification and few-shot object detection	Classification of landmark images and object detection, both trainable to new classes	none, optionally Metasearch for content mining	Automatic metadata creation in media archiving, content management in cultural heritage, object detection in building information management
		JRS	Shot-boundary detection	Detection of edits and transitions in video	None	JRS background IPR, already in use in commercial solutions (e.g. video quality control)
		CERTH	Cross-model content descriptors	Descriptors for matching 2D and 3D assets	None	-
		I2CAT	Object detection and tracking	Descriptors for image and video sequences	None	Automatic metadata creation in media archiving, content management in cultural heritage
		UNIBAS	Temporal video segmentation and keyframe embedding	Segmentation of videos into shots and keyframes and embedding of keyframes with vision-language models	None	-

Key feature	*Attribute*	Owner	Component	Description	Dependencies	Opportunities for exploitation
	Content sourcing & filtering	JRS	Multimodal relevance and novelty detection	Determine whether a particular text/image/video item is relevant wrt a story and contains novel information	None	Video to text + translation service used separately without the fact comparison for indexing and search, novelty detection for media production and monitoring
		RAI	News Tagger	Extracting tags from textual content	None	Standalone service for text processing
	Neural Media repository	UNIBAS	vitrivr Multimedia retrieval framework	Multimedia retrieval stack including database, content ingest, query processing and ranking	None	Open-source software, already used in cultural heritage applications
		I2CAT	Metasearch	Component for federated content search and result integration/reranking	one or more connectors	Connector-as-a-Service, SaaS Platform,Actionable Search Analytics
		MOG	Retrieval frontend	UI for content search and result management	vitrivr or Metasearch	Enables seamless search, visualisation, and access to XR assets across federated repositories, offering opportunities for integration into MAM systems, licensing as a user interface module, and adoption in research or standardization contexts.
Marketplace interface						
FINC, MOG	*Rights & monetization management*	FINCONS	License definition and notarisation	Tools for defining content licenses and notarising them using a private blockchain	marketplace	Service to support license management in any kind of marketplace where some kind of licensing and monetization is needed
		FINCONS	Monetization manager	Tool to monetize assets	marketplace, license manager	Related to Licence manager

Key feature	*Attribute*	Owner	Component	Description	Dependencies	Opportunities for exploitation
		MOG	Marketplace	Front end for content purchase and offering	vitrivr for content search and monetization API	Provides a decentralized, blockchain-based platform for trading and licensing XR assets, exploitable through PaaS or embedded models to support interoperable, cross-sector XR content exchange and monetization.
Partner-owned service modules						
3D Reconstruction Services						
CERTH, i2CAT, UPM	*Neural radiance Fields (NeRF)*	CERTH	Octree-NeRF-in-the-wild	NeRF algorithm for reconstructing Radiance Fields from real-world data (accounting for occlusions and changes in apperance between different samples)	None	Standalone service for content creation.
		I2CAT	GDNeRF: Human-centred sparse view NeRF	NeRF algorithm for reconstructing Radiance Fields with human subjects from sparse views	None	Standalone service for content creation. Plugin for usually employed 3D engines (Unreal, Maya, etc)
	Gaussian Splatting	I2CAT	GDGS: human-centric Genaralizabe depth Gaussian Splatting	Synthesizes novel views from sparse images in real-time using 3D Gaussian Splatting. It accepts a ZIP archive of images as input and outputs RGB and depth videos, along with trained model weights. It is able to reconstruct dynamic sequences.	None	Standalone service for content creation. Plugin for usually employed 3D engines (Unreal, Maya, etc)

Key feature	Attribute	Owner	Component	Description	Dependencies	Opportunities for exploitation
		I2CAT	3DGS	Uses 3D Gaussian Splatting to generate dense neural renderings from input media. It accepts images, a video, or a ZIP archive as input and outputs a PLY model.	None	Standalone service for content creation. Plugin for usually employed 3D engines (Unreal, Maya, etc)
	Structure from Motion (SfM) 3D reconstruction	UPM	occlusion-aware Structure from Motion	Structure from Motion algorithm for reconstructing scenes and outputing standard mesh objects (able to be consumed in all the emploued 3D engines), accounting for occlusions betweem the input data	None	Standalone service for content creation. Plugin for usually employed 3D engines (Unreal, Maya, etc)
3D Optimization Services						
CERTH, i2CAT, RAI	*Neural Reconstruction in the wild*	CERTH	Octree-NeUS-in-the-wild	Neural Signed Distance Function based reconstruction, able to reconstruct surfaces from real world data (accounting for occlusions and different appearance between the training samples)	None	Standalone service for content creation. Output (textured mesh) is interoperable with all 3D engines
	Human-centric 3D data enhancement	I2CAT	3D Data Enhancement	Improves the resolution and geometry of existing 2D and 3D data. It accepts 2D, and 3D data as input and outputs an enhanced 3D data.	None	Standalone service for content creation. Plugin for usually employed 3D engines (Unreal, Maya, etc)
	Blind face restoration	RAI	Blind face restoration	Automatic face restoration using a state of the art deep model	None	Standalone service for face enhancement.

Key feature	Attribute	Owner	Component	Description	Dependencies	Opportunities for exploitation
	Video based Super Resolution	RAI	2D video upscale	Algorithm for enhancing the resolution of standard 2D RGB videos	None	Standalone service for content enhancement.
Volumetric video services						
UPM, i2CAT	*Holoportation*	i2CAT	Holoportation	RGB-D based system comprising hardware and software for multi view point cloud reconstruction of human subjects. The whole pipeline is implemented, consisting of capturing, compression, transmission, and reconstruction.	None	Standalone service for content creation. Plugin for usually employed 3D engines (Unreal, Maya, etc)
	Free Viewpoint Video	UPM	RGB-D based FVV	RGB-D based system comprising hardware and software for free viewpoint interpolation between sparse RGB-D viewpoints. The whole pipeline is implemented, consisting of capturing, transmission, and reconstruction	None	Standalone service for content creation. Plugin for usually employed 3D engines (Unreal, Maya, etc)
AR CMS						
ZAUBAR	*XR mobile based experience*	ZAUBAR	CMS	Software for uploading and placing (remotely and onsite) of contents (photos, videos, audio, 3D assets) in Augmented Reality	None	Web-Standalone-End-to-End-Solution for any 3D media to bring to its real world location, potential to add any API and serve as SDKs for popular 3D engines such as Unity
Virtual production capsules						
Unity, MOG, Visyon	*Authoring tool*	Unity / Capgemini	Authoring Tool	Unity Editor extensions for easy creation of XR applications	None	Opensourcing the AT might be an option to bring more visibility to XReco

Key feature	Attribute	Owner	Component	Description	Dependencies	Opportunities for exploitation
		MOG	Orchestrator	Web-based tool for communicating with the Search and retrieval components and the services	Vitrivr, Metasearch, WP4 services	Standalone web-service tool for searching the repositories, and using the services
	XR Capsules	Visyon	Authoring Tool	XR-Capsule is a lightweight, open-source solution for creating, sharing, and interacting with XR experiences. XR-Capsule uses JSON scene descriptors to define and exchange immersive environments	None	Open source, XRcapsule enables the visualisation of 3D models and integrates into third-party solutions.
Demonstrators						
ZAUBAR CAR, ATOS, RAI, DW	Mobile Tourist Experience	ZAUBAR	ZAUBAR's CMS	Software for uploading and placing (remotely and onsite) of contents (photos, videos, audio, 3D assets) in Augmented Reality	None	Web-Standalone-End-to-End-Solution for any 3D media to bring to its real-world location, potential to add any API and serve as SDKs for popular 3D engines such as Unity
	In-cabin experience (self-driving cars)	CAR	Hardware: Car, computer in car, camera	-	ZAUBAR's CMS and ATOS' App	-
		ATOS	ATOS automotive VR app	Multi-device compatible app for placing virtual rooms on a map to facilitate audio and video sessions centered around a synchronized, high-quality 3D models.	ATOS cluster based, on demand gameserver deployer	Can be exploited as a standalone solution for placing rooms on a map
	XR-based broadcasting productions	RAI				
		DW				

9.3 Annex III: Visualisation of Dissemination Results
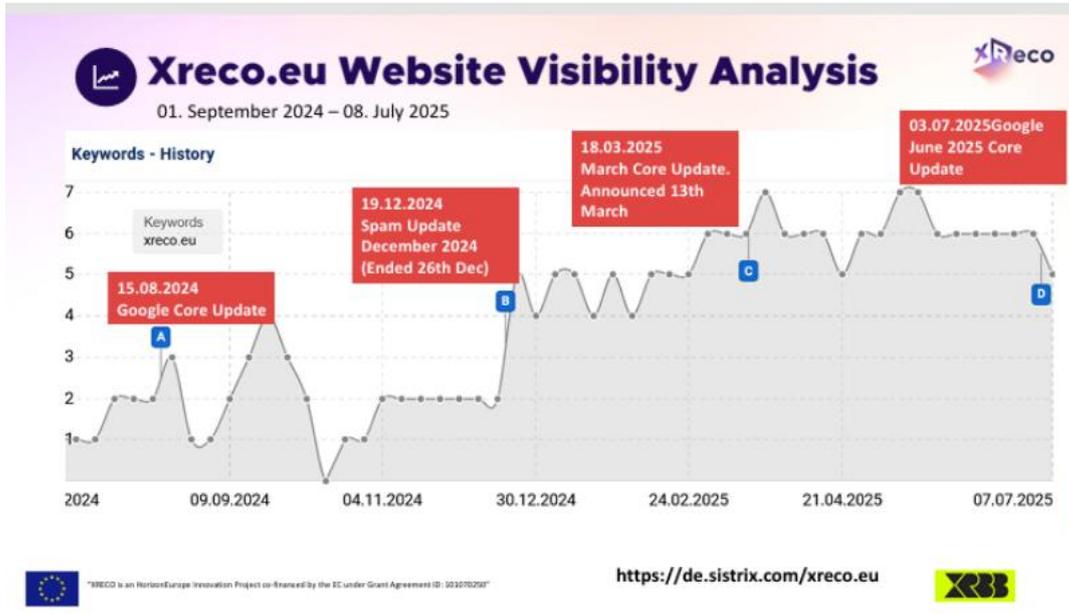
Figure 24: Development of page rankings XReco website

Figure 25: Screenshots of AI search results (22.09.2025)

Figure 26: Newsletter growth
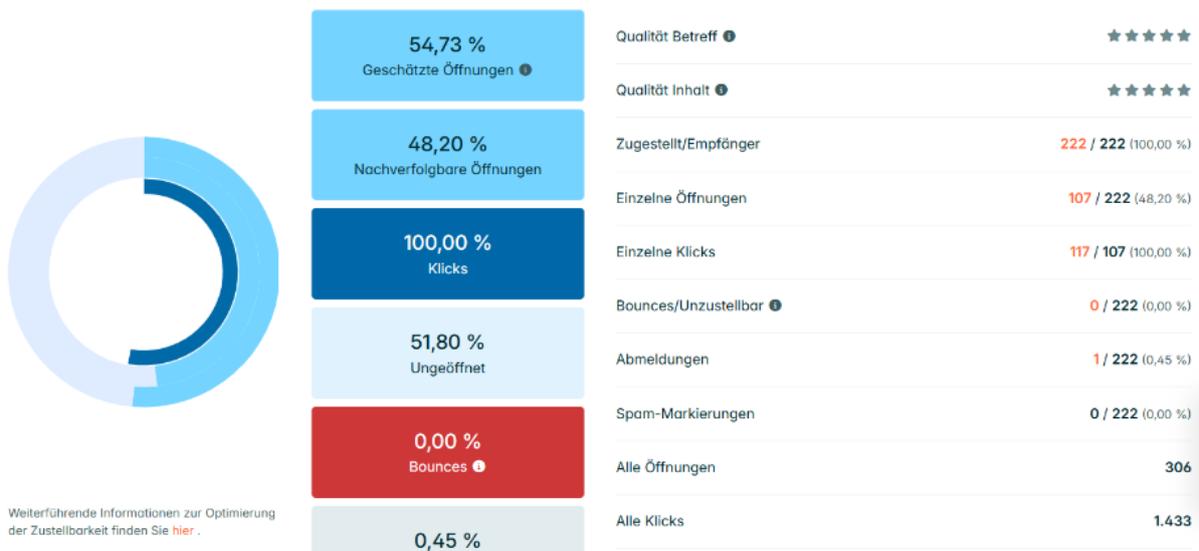
Figure 27: Analytics Newsletter #12

Translation for newsletter statistic above: "Geschätzte Öffnungen" = estimated openings; "Nachverfolgbare Öffnungen" = traceable openings, „Klicks" = clicks, „ungeöffnet" = unopened.

Highlights

Daten für 1.10.2024 bis 31.10.2024

3.696	128	4	1
Impressions	Reaktionen	Kommentare	Direkt geteilte Beiträge
▲78,7 %	▲3,2 %	▲300 %	▼66,7 %

Figure 28: LinkedIn Analytics – Highlights from Oct 2024

October 2024 was a particularly successful month regarding impressions.

Highlights

Data for 10/27/2024 - 10/26/2025

22,423	827	55	17
Impressions	Reactions	Comments	Reposts

Figure 29: LinkedIn Analytics – Highlights from October 2024–October 2025

9.4 Annex IV: Full Event List (M19-M38)

Table 16: Overview of events in which XReco participated

DATE	EVENT	PARTNER(S)	ACTIVITIES
10.-12.04. 2024	Laval Virtual	Sound	Booth, Networking
13.-17.04. 2024	NAB	MOG	Networking, booth/ exhibition (roll-up & poster of XReco)
16.-21.04. 2024	Athens Science Festival 2024	CERTH, IPR	Presentation
22.-23.04. 2024	fmx 2024	DW	Booth, Panel discussion
16.05.2024	KI Park e.V. Sommerfest	XRBB	Networking
24.05.2024	Xarxa RDI-IA (2024)	i2Cat	Presentation, Networking
30.05.2024	Animation Rendezvous	XRBB	Networking
05.-07.06. 2024	IEEE GEM 2024	RAI	Presentation and demo of XReco project results
12.06. 2024	Interaction and Storytelling with(in) Immersive Media Workshop (2024)	i2Cat	Organisation, Presentation
12.06. 2024	Video4IMX (2024)	i2Cat, JRS	Presentation of XReco project as keynote speaker, presentation of paper on incremental landmark classification
02.07.2024	Future Narratives Smart City	XRBB	
07.-10.07. 2024	EURASIP International Summer School on eXtended Reality Technology and eXperience (2024)	i2Cat, UPM	Organisation
11.-13.09. 2024	EPIP 2024	KUL, IPR	Presentation, Networking
13.-16.09. 2024	IBC (2024)	DW, i2Cat, Visyon, MOG, Sound, UPM, FINC, XRBB, CAP	Presentation on AI Stage, Demos at Booth in AI Village, Presentation at Accelerator Pod, Networking

DATE	EVENT	PARTNER(S)	ACTIVITIES
18.09.2024	Meet the Nerds (DW internal event)	DW	Demo booth for Virtual Production
23.10.2024	NEM Summit	DW, i2Cat, JRS, UNIBAS	Presentation and expert panel
28.10.-01.11. 2024	ACM Multimedia	JRS, UNIBAS	Presentation and tutorial
13.-14.11. 2024	NextReality	DW	Networking
28.-29.11. 2024	Numix Lab Berlin	DW, XRBB	Presentation, Networking
04.-06.12. 2024	Immersive Tech Week (2024)	i2Cat, Sound	Booth
12.01.2025	Plug-In	MOG	XReco Presentation
07.-10.01. 2025	MMM (2025)	JRS, UNIBAS	Co-organisation and participation in Video Browser Showdown (interactive video retrieval benchmark)
23.01.2025	Future Narratives w/ Lufthansa Innovation Hub	XRBB	XReco Presentation
28.-30.01. 2025	Production Technology Seminar at EBU	UPM	Demo on FVV in Virtual Studio productions
04.02.2025	ISE Integrates Systems Europe	Visyon	Presentation
11.02.2025	XR/Virtual Worlds Meeting of DG CNCT and VRAR Coalition	DW, CERTH	Networking and presentation
20.02.2025	ADRA Brokerage Event 2025	i2Cat	Presentation, networking
08.05.2025	XRBB	XRBB	Presentation
17.03.2025	Future Narratives Health	XRBB	Networking
31.03.-04.04. 2025	ACM MMSys 2025	i2Cat	Keynote
05.-09.04. 2025	NAB	FINC	Networking
08.-09.05. 2025	XR Expo	Zaubar	Presentation

DATE	EVENT	PARTNER(S)	ACTIVITIES
23.-25.06. 2025	MindXR	XRBB	Networking
03.06.2025	Interaction and Storytelling with(in) Immersive Media Workshop (2025)	UPM	Organisation, Presentation
11.-13.06. 2025	IEEE BMSB 2025	i2Cat	Keynote
30.06.-04.07. 2025	ICME 2025 - IEEE International Conference on Multimedia & Expo 2025	i2Cat	XReco Presentation
07.-10.07. 2025	EURASIP International Summer School on eXtended Reality Technology and eXperience (2025)	i2Cat, UPM	Organisation
12.-15.09.2025	IBC 2025	DW, JRS, Visyon, FINC, Rai, CAP	Project booth at EBU Village, Networking
22.-25.09. 2025	CAIP 2025	CERTH	Paper and poster presentation at Research conference
29.-30.09. 2025	QoMEX 2025	i2Cat	Networking
30.09.2025	AI Austria: GenAI Revolution	JRS	Presentation of some XReco outcomes
10.10.2025	REBOOT CONFERENCE	JRS, IPR	Presentation of some XReco outcomes
20.10.2025	ICCV 2025	CERTH	Paper and poster presentation at Research conference
22.-24.10. 2025	CBMI 2025	JRS	Co-organisation of special sessions (MmIXR, VR4B)
27.-31.10. 2025	ACM International Conference on Multimedia (ACM MM 2025)	JRS, Rai, CAR, UNIBAS	Presentations, demo and networking
12.-14.11. 2025	JITEL 2025	i2Cat	Presentation (planned)

DATE	EVENT	PARTNER(S)	ACTIVITIES
08.-09.05. 2025	XR-Expo 2025	ZAUBAR	Booth, demo of AR-CMS, QR-code for website and newsletter was displayed
16.-20.10. 2024	ITS World Congress 2024	CAR	Presentation, networking
19.-21.05. 2025	ITS World Congress 2025	CAR	Presentation, networking
09.-11.09. 2024	ICCCI 2024	CAR	Presentation, networking
23.-25.04. 2025	ACIIDS 2025	CAR	Presentation, networking

9.5   Annex V: Full List of Publications (M19-M38)

DATE OF PUBLICA-TION	AUTHOR(S)	TITLE	TYPE OF PUBLICATION	STATUS
03/2024	Konstantin Schall and Werner Bailer et al.	Interactive Multimodal Video Search: An Extended Post-Evaluation for the VBS 2022 Competition	Article in journal	Published
04/2024	Javier Usón, Carlos Cortés, Victoria Muñoz, Teresa Hernando, et al.	Untethered Real-Time Immersive Free Viewpoint Video	Publication in conference proceeding/ workshop	Published
04/2024	Javier Usón, Julián Cabrera	Analysis and Development of Deep Learning Depth Estimation Techniques for Volumetric Capture and Free Viewpoint Video	Publication in conference proceeding/ workshop	Published
05/2024	Lucia Vadicamo, Rahel Arnold, Werner Bailer, et al.	Evaluating Performance and Trends in Interactive Video Retrieval: Insights from the 12th VBS Competition	Article in journal	Published
05/2024	M. Pegia, B. Þ. Jónsson, A. Moumtzidou, S. Dimplaris, et al.	Descriptor Impact on Multimodal 3D Retrieval	Publication in conference proceeding/ workshop	Published

Date of publication	Author(s)	Title	Type of Publication	Status
06/2024	Maria Pegia, Dimitris Georgalis, et al.	3DMSE: An Interactive 3D Media Search Engine	Publication in conference proceeding/ workshop	Published
06/2024	Maria Pegia	Multimodality in Media Retrieval	Publication in conference proceeding/ workshop	Published
06/2024	Maria Pegia, Sotiris Diplaris, Stefanos Vrochidis, Heiko Schuldt, et al.	Multimedia Retrieval in and for XR	Publication in conference proceeding/ workshop	Published
06/2024	Helmut Neuschmied and Werner Bailer	Efficient Few-shot Incremental Training for Landmark Recognition	Publication in conference proceeding/ workshop	Published
07/2024	Martini, Miriana and Valentini, Valeria and Ciprian, Alberto et al.	Semi-Automated Digital Human Production for Enhanced Media Broadcasting	Publication in conference proceeding/ workshop	Published
09/2024	Helmut Neuschmied and Werner Bailer	Enabling Domain Experts to Train Efficient Few-Shot Incremental Landmark Recognition	Publication in conference proceeding/ workshop	Published
09/2024	Ivan Huerta, Leonel Toledo, Sergio Montoya, Marc Martos, Sergi Fernandez, Mario Montagud	Volumetric Video Reconstruction and Communications: Toward a New Era of Interactive and Immersive Social Virtual Reality (VR) Experiences	Publication in conference proceeding/ workshop	Published
09/2024	Valcan, S; Gaianu, M.	Complete Convolutional Neural Networks Environment For Computer Vision Problems With Nvidia Drive AGX Xavier	Chapter in book	Published

Date of publication	Author(s)	Title	Type of Publication	Status
10/2024	Rahel Arnold, Werner Bailer, Ralph Gasser, et al.	Multimedia Information Retrieval in XR	Publication in conference proceeding/ workshop	Published
10/2024	Rahel Arnold, Heiko Schuldt	Multimodal Understanding: Investigating the Capabilities of Large Multimodal Models for Object Detection in XR Applications	Publication in conference proceeding/ workshop	Published
02/2025	Leo Toledo, Ivan Huerta, Sergi Fernandez et al.	Cooperative Perception for Digital Twin Reconstruction	Publication in conference proceeding/ workshop	Published
04/2025	David Nevezi-Strango, Gaianu Mihail	Ubervvald: Advanced Object Detection Library for Optimizing Complex Convolutional Neural Networks (CNNs)	Publication in conference proceeding/ workshop	Published
04/2025	Javier Usón, Julián Cabrera	Is Real-time Deep Learning-based Monocular Depth Estimation accurate for Multi-Camera Setups?	Publication in conference proceeding/ workshop	Published
06/2025	Hermann Fürntratt, Werner Bailer, et al.	Exploring Image Search on Quantum Computing Systems	Publication in conference proceeding/ workshop	Published
09/2025	Cheimariotis, G.A., Karakottas, A., Chatzis, V., Kanlis, A., Zarpalas, D.	Image Valuation in NeRF-Based 3D Reconstruction	Chapter in book	Published
09/2025	Javier Usón, Victoria Muñoz, Carlos Cortés, Daniel Berjón, Francisco Morán et al.	Real-Time Free Viewpoint Video for Immersive Videoconferencing	Publication in conference proceeding/ workshop	Published

DATE OF PUBLICA-TION	AUTHOR(S)	TITLE	TYPE OF PUBLICATION	STATUS
10/2025	Ignasi Mas, Josep Brugues, Sergi Mercade, Leonel Toledo, Ivan Huerta et al.	Urban scene removal and completion	Publication in conference proceeding/ workshop	Published
10/2025	Roberto Iacoviello; Alberto Ciprian; Alberto Messina; Maurizio Montagnuolo; Davide Zappia	XReco Platform and RAI News Media Demonstrator	Publication in conference proceeding/ workshop	Published
10/2025	Stefan J. Arzberger, Paul Raith, Werner Bailer and Marion Jaks	A Dataset and Metric for Textual Video Content Description	Publication in conference proceeding/ workshop	Published
Forth-coming	Theodoros Chiou	Data as Remuneration in Digital Copyright Licensing: Some Reflections on the Concept of 'Appropriate and Proportionate Remuneration' Under Art. 18 EU Directive 2019/790 in the Data Era	Publication in conference proceeding/ workshop	Accepted
Forthcoming	Sergio Montoya, Ivan Huerta, Josep Escrig	GDNeRF: Generalizable Depth-based NeRF for sparse view synthesis	Publication in conference proceeding/ workshop	Accepted
Forthcoming	Anna Ferrarotti, Isabel Rodríguez, Javier Usón, Sara Baldoni, Jesús Gutiérrez et al.	Analysis and Comparison of Objective Metrics for Quality Assessment of 3D Meshes in Cultural Heritage Applications	Publication in conference proceeding/ workshop	Accepted
Forthcoming	Ralph Gasser, Rahel Arnold, Laura Rettig, Heiko Schuldt, Raphael Waltenspül, Luca Rossetto	Open-Source Multimedia Retrieval with vitrivr-engine	Publication in conference proceeding/ workshop	Published

DATE OF PUBLICATION	AUTHOR(S)	TITLE	TYPE OF PUBLICATION	STATUS
Forthcoming	Luca Rossetto, Heiko Schuldt, Ralph Gasser	Towards a Universal Query Representation for Multimodal Information Retrieval	Publication in conference proceeding/ workshop	Accepted
Forthcoming	Florian Spiess, Heiko Schuldt	Novice-Friendly Video Retrieval in Mixed Reality with vitrivr-VR	Publication in conference proceeding/ workshop	Accepted
Forthcoming	Mihail Găianu, Victoria-Larisa Ivaşcu	Progressive Learning: Boosting CNN Accuracy via Incremental Area-of-Interest Expansion for Automotive Eye Detection	Publication in conference proceeding/ workshop	Accepted
Forthcoming	Mihail Găianu, Victoria-Larisa Ivaşcu, Vlad-Florin Vinătu	Automating Hand Gesture Recognition for Cars	Publication in conference proceeding/ workshop	Accepted
Forthcoming	Andrina Geller, Rahel Arnold, Heiko Schuldt	Emotion-Aware Retrieval with Retriever	Publication in conference proceeding/ workshop	Submitted
Forthcoming	Andrina Geller, Rahel Arnold, Raphael Waltenspül, Heiko Schuldt	Extending vitrivr-engine with Emotion-Based Retrieval and a Modular User Interface	Publication in conference proceeding/ workshop	Submitted
Forthcoming	Rahel Arnold, Anna Pietzak, Heiko Schuldt	MediaMix: Multimedia Retrieval with Dual Backend Support and Result Exploration in MR	Publication in conference proceeding/ workshop	Submitted
Forthcoming	Theodoros Chiou, Leander Staehler	EU Copyright Law, Artificial Intelligence and 'Transformative Use' of Works: The Case of 3D Reconstruction	Article in journal	Accepted