D6.2

Dissemination, communication, and exploitation report 1

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Abstract	D6.2 outlines the first dissemination, communication, and exploitation results of XReco spanning M0-M18 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

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Glossary

ABBREVIATION	MEANING
AI	Artificial Intelligence
AR	Augmented Reality
B2B	Business to Business
B2C	Business to Consumer
2CB	Consumer to Business
DNNs	Deep Neural Networks
DoA	Description of Action
EAB	External Advisory Board
EBU	European Broadcasting Union
FVV	Free Viewpoint Video system
HCD	Human-Centered 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)
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
WP	Work Package
VFX	Visual Effects
VPC	Value Proposition Canvas
VQEG	Video Quality Experts Group
TRL	Technical Readiness Level
UCF	Unified Compute Framework
VR	Virtual Reality
XR	Extended Reality

Table of Contents

Index of Figures

Index of Tables

Executive summary

XReco (Extended Reality Media Ecosystem) is a project co-funded by the European Union under the Horizon Europe program. It began in 2022 with the aim of integrating XR Media content into various industries. We're creating a seamless and permissioned data-driven XR ecosystem that enhances content access for media creators through state-of-the-art XR services, innovative data monetization and rights management policies.

XReco's mission is to redefine the utilization and integration of XR media content within the media, tourism, and mobility sectors. Our vision focuses on simplifying XR content creation and integration, making advanced technologies accessible to all. By empowering users with innovative tools for immersive storytelling and fostering a collaborative ecosystem, we aim to promote a data-driven industry evolution. XReco embodies a commitment to enhancing human creativity and connection, marking a significant leap towards a future where XR technology seamlessly enriches our professional and personal landscapes.

Therefore, XReco aims to create a new data driven ecosystem among different organizations - speaking in technical terms, to develop a platform that facilitates data sharing, search, and discovery. The data in question will be 2D and 3D content, respectively XR experiences. Providers of content will benefit from distributing their content and data (e.g., via monetization) and other users will benefit from increased access to it, with, as added benefit, the ability to offer and sell their content within the ecosystem. Naturally, providers of content can also be these creators themselves.

The current deliverable D6.2 presents the first results of the Dissemination, Communication, and Exploitation strategy and activities. D6.2 will present the reader with an overview of the steps and results XReco took during the project months between D6.1 and now (M7-M18) which add up to the (in)validation of exploitation pathways and guarantee successful dissemination and communication of the project.

As such, D6.2 covers all activities related to market analysis, exploitation, communication and dissemination, and standardization. These four topics cover the four core sections of the deliverable you are currently reading:

The **section on Market analysis** provides the reader with an overview of the XR market forecast by leveraging proxy indicators in the absence of available updated market reports. By examining technological advancements, AR/VR headset sales, AI integration, and the rise of no-code/low-code development platforms as proxy indicators, the findings indicate a market scenario characterized by gradual growth and technological evolution. However, the potential of AI integration and the democratization of XR content creation signal a potential future shift towards a scenario with accelerated market growth. For XReco, which is still in its developmental phase, the current (less dynamic) market presents a strategic advantage. It allows for more deliberate positioning and refinement of our platform within a gradually evolving market. As XReco is still being developed, it is important to monitor these proxy indicators to ensure timely adaptation and leveraging upcoming market opportunities, preparing XReco to thrive as the market begins to expand more dynamically.

The **section on Exploitation** presents the results of the XReco project concerning the creation and iteration of validated value propositions and the steps taken to design, research, co-create, and (in)validate potential exploitation pathways on a joint and individual level. On the basis of XReco's six core components (market and customer analysis, creation of exploitation strategies, Joint Business Clinics, value proposition and commercial strategy, IP management, and results consolidation with a user-centered approach) for successful exploitation and user validation we show how our human-centered approach has led to the co-creation of 5 vertical user types that are

present in the horizontal markets of media, mobility, and tourism and how we identified their place within the XReco platform and ecosystem in such a manner that solves their needs and pains. This led to new insights on value propositions, how (and which) to develop the technical aspects of XReco and has implications for our business- and monetization-models for successful scaling of the XReco solutions and market uptake.

The **section on Communication and Dissemination** activities shows that XReco's project dissemination and communication strategy has made steady progress towards meeting its Key Performance Indicators (KPIs). The LinkedIn campaign effectively reached its initial targets, reflecting a solid start in our digital engagement efforts. Collaborative efforts within the Horizon program have helped to modestly boost visibility in the extended reality domain. The repeated visible use of a roll-up banner at industry events has also contributed to maintaining the project's presence, facilitating engagement within the XR community. As the XReco project moves forward, it continues to leverage both online and offline channels to engage with its target audience, aiming to build on these foundations to fully achieve and, where possible, exceed its set objectives within the extended reality sector.

The **section on Standardization** shows an overview of standardization activities, where XReco consortium partners were involved mainly in MPEG activities and presents an outlook towards future activities that may be extended once the project provides more technical and scientific results that can actually.

1   Introduction

XReco creates a new data-driven B2B ecosystem for the media industry, focusing on facilitating data sharing, search and discovery and supporting creation of news and entertainment content. The focus will be on the creation and (re-)use of location-related 2D and 3D assets and the creation of XR experiences. While media organizations increasingly support non-linear experiences for the consumer, those are still limited to single channels and media domains. Although several media organizations have recently succeeded in breaking data silos, data sharing is mostly limited to within the organization.

XReco is building enabling technology for lifting the use of XR media content from being occasionally involved in media production to being regularly integrated in the media industry. For the time being, the project focuses on use case from media and tourism, including use of XR in cars. The foreseen market of the B2B platform the consortium partners are building, however, is potentially broader and will be explored in the future.

The ecosystem's core, represented by the following tech stack:

- **Neural Media Repository (NMR):** AI-powered platform for advanced search and retrieval, enabling the creation and marketplace offering of novel XR content.
- **Rights and Monetization Management:** Utilizes Blockchain to manage IP rights and monetization, ensuring fair content use and clear ownership.
- **3D Reconstruction:** Neural Radiance Fields (NeRF) enables 3D scene creation from 2D images for novel XR content, facilitating immersive experiences.
- **Holoportation:** Offers real-time volumetric capturing for immersive remote experiences, providing a sense of presence in XR environments.
- **Free Viewpoint Video (FVV):** Allows immersive scene navigation and real-time rendering from any virtual camera angle, enriching XR storytelling.
- **Authoring Tools:** Simplifies XR content creation for media broadcasting and tourism with intuitive interfaces for content manipulation and generation.

Our tech stack, outlined above, forms the building blocks of the XReco platform and as such form the core components for exploitation. These components leverage inter-organization content sharing and provide increased access to content for media creators, considering novel data monetization and rights management policies. A set of AI-based media transformation services are built around the NMR to produce novel media- and XR experiences, including 3D neural reconstructions, neural-based device localization, image stitching, de-/re-lighting and holoportation. The XReco tech stack will offer our users the following benefits and unique selling points:

- **Data organization made simple:** XReco's Neural Media Descriptors streamline your data organization for efficient searching.
- **Transparent asset use:** Enjoy easy rights management without the need for extensive rights holder searches.
- **Intuitive creation:** XReco's tools simplify your creative process, enhancing content creation.
- **Flexible content sharing:** Share your creations effortlessly on or off the platform, enhancing accessibility for all users.
- **Effortless monetization:** With XReco, rights and monetization management is streamlined, freeing you from additional concerns.

In the current deliverable we will present the reader with the results achieved in exploitation, dissemination & communication, and standardization so far. The aim is to illustrate the steps we are

undertaking to create market uptake of XReco based on a human-centered two-way engagement with the potential market and our stakeholders.

1.1   WP6 overview and KPI tracking

The main objective of Work Package 6 (WP6) is to maximize the impact of the project through dissemination, communication, and exploitation. Stakeholders' identification, together with target audience and communities is addressed within WP6. More in-depth, the WP6 objectives entail: These objectives are managed in four different Tasks:

- T6.1 - Dissemination & Communication (M1-M36) [Lead: XRBB]
- 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]

In a Horizon Europe project, Key Performance Indicator (KPI) tracking for the Exploitation, Dissemination, and Communication work package is crucial for several reasons. Firstly, it ensures that project outcomes and knowledge generated are effectively communicated and disseminated to relevant stakeholders, maximizing the project's impact and visibility. Additionally, KPI tracking allows for the systematic evaluation of the success and efficiency of exploitation strategies, helping to identify areas for improvement and optimization. The benefits of rigorous KPI tracking in WP6 include:

- **Strategic Alignment:** Ensures alignment with project goals and objectives, enhancing overall project success.
- **Stakeholder Engagement:** Facilitates targeted engagement with key stakeholders, fostering collaboration and partnerships.
- **Impact Assessment:** Provides a quantitative basis for assessing the societal, economic, and environmental impact of project outputs.
- **Adaptability:** Enables timely adjustments to dissemination strategies, ensuring adaptability to evolving project needs and external contexts.
- **Resource Optimization:** Helps in efficiently allocating resources by identifying high-performing channels and activities, ultimately enhancing the cost-effectiveness of the project's communication and dissemination efforts.
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Within the XReco-project, we have adopted KPI-tracking with the use of PowerBI, a dedicated tool developed by Microsoft for visualizing data. We do our tracking on three levels (see 7.1 Annex I: KPI Tracker WP6):

- Due to the volume of KPIs, we have separated all the T6.1 Communication KPIs (both as a table and as a visualization),
- The KPIs for Tasks 6.2, 6.3 and 6.4 together comprise a second slide in the KPI reporting,
- Finally, we track certain progress markers by partners, considering that each partner committed to publishing 2 web-articles/blog posts and attending 2 events to represent XReco.
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2   Market analysis

The year 2023 has seen a few notable developments in the Extended Reality (XR) sector, characterized by a slowly maturing market and the entrance of new players to the sector. This chapter builds on the market analysis presented in the D6.1 Dissemination, Communication, and Exploitation Plan which was submitted at the end of M6 (28-02-2023) of the project. It captures the dynamic shifts and developments in the XR market over the past year. Furthermore, it provides updates on the current market outlook and delves into last year's trends of enabling forces and industry barriers. The analysis in this chapter aims to offer an insightful view of the XR market's current state, reflecting both continuity and change since the initial findings of D6.1 report.

2.1   XR overview

The D6.1 report highlighted the XR market's structure, growth potential, and the challenges and opportunities experienced by the sector. Key takeaways included the market's continuous expansion, driven by advancements in hardware and software, and a consumer acceptance that was initially hesitant but steadily increasing.[1] A notable observation mentioned by the report is the dual impact of the Covid-19 pandemic on the industry. While the pandemic temporarily hindered investments and dampened market expansion, it simultaneously accelerated the adoption of XR technologies. This was driven by the demand for extended reality events and virtual solutions across sectors like media, tourism, and ecommerce during lockdowns. According to market research on XR by Ecorys mentioned in D6.1, this will result in a baseline scenario where the European market value is expected to reach approximately 35 billion EUR by 2030. However, beside the baseline scenario, Ecorys outlines another scenario: the optimistic scenario. In the optimistic scenario, the European XR market value could soar to approximately 65 billion EUR by 2030, if the sector achieves significant milestones and advancements ahead of expectations.[2] The 2022 analysis projected a market growth of around 30% annually until at least 2030.

Based on this analysis, the D6.1 report concluded that the XR market is an emerging sector in the EU with high potential for growth. Nevertheless, the D6.1 report also sheds light on the main barriers to overcome in the XR sector, identifying high costs and technical challenges as significant obstacles in the development of XR technologies. Another barrier that was mentioned is the lack of adoption of XR technologies. The adoption of XR is hindered by a lack of practical use cases, as well as challenges in integrating XR into existing workflows and systems. D6.1 stated that overcoming these barriers can unlock further opportunities for XR in various sectors, such as automotive and tourism. Overall, the report emphasized the diverse applications of XR technologies in enhancing experiences and solving modern challenges, underlining the sector's potential for continuous growth and innovation.

2.1.1   Absence of Updated Market Reports

In the lead-up to D6.2, the absence of (accessible) updated European market reports on XR became evident. Especially, the in D6.1 widely referenced Ecorys report on the XR market outlook for Europe has not released an update.[3] The lack of newly available quantitative market reports may suggest a period of stabilization in the market outlook, where the fundamental dynamics and projections

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[1] Sound (2022). D6.1 Dissemination, communication, and exploitation plan

[2] Ecorys (2021). XR and its potential for Europe. page 19. Retrieved from: https://xreuropepotential.com/assets/pdf/ecorys-xr-2021-report.pdf (last visited on February 22, 2023)

[3] Vikki Copland, "Ecorys And The XR Association Explore The Potential Of XR Technologies in Europe", Ecorys, 6 June 2023, https://www.ecorys.com/ecorys-and-the-xr-association-explore-the-potential-of-xr-technologies-in-europe/.

outlined in earlier analyses, such as those in the Ecorys report, have not undergone significant changes necessitating an annual update.[4] In light of this, the analysis in this chapter will pivot to alternative data points to evaluate the current state of the XR market. These alternative data points will be used as proxy indicators (as detailed in section 2.1.2) to assess whether these data points align with, contradict, or add new dimensions to the baseline and optimistic scenarios established by deliverable D6.1. By examining these qualitative data points, this chapter aims to provide a comprehensive and nuanced understanding of the XR market's evolution in the absence of updated formal market reports.

2.1.2   Proxy Indicators for XR Market Analysis

In the absence of updated European market reports on Extended Reality (XR), our analysis for D6.2 pivots towards using proxy indicators to assess the current state of the XR market and its alignment with the baseline or optimistic growth scenarios outlined in the Ecorys report. These proxy indicators are critical in providing an understanding of market dynamics, especially when quantitative market analyses are not available.

The chosen proxy indicators include:

- **Technological Advancement**: The advancements in XR technology, encompassing hardware and software developments, are pivotal in driving market growth.[5] Announced or released new products and developments by companies in XR provide insight into the pace of innovation within the industry. For the baseline scenario, steady and incremental advancements indicate a market growing at a sustainable pace. Rapid advancements in technology, especially in hardware and user interfaces, suggest progression towards the optimistic scenario, as they indicate a market ready for broader adoption and more sophisticated applications.[6] Technological advancement is a strong proxy for market health because it can stimulate demand through improved user experiences and expanded capabilities. However, it is important to note that without corresponding adoption rates, even significant technological strides might not translate into market growth.

- **Global AR/VR Headset Sales**: This indicator reflects consumer and business adoption of XR technology. High sales numbers indicate a growing market, suggesting alignment with the Ecorys report's optimistic scenario. Conversely, stagnant (or declining) sales could imply a trend closer to the baseline scenario. Headset sales are directly indicative of market activity and consumer interest, making them a reliable indicator, but they don't account for the length and depth of user engagement and should therefore be analyzed alongside other data points to provide a comprehensive view of market development.[7]

- **Integration of AI into XR:** The integration of Artificial Intelligence in XR technologies can considerably stimulate market growth.[8] If the integration of AI improves existing XR functionalities and user interfaces gradually, it suggests alignment with the baseline scenario

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[4] Sarah Schmidt, "How To Identify Bad Data When Conducting Market Research", *Market Research Blog* (blog), 20 April 2023, https://blog.marketresearch.com/how-to-identify-bad-data-when-conducting-market-research.

[5] Pedro J. Sáez Martínez, "Extended Reality: The Future Of Immersive Technologies", *Onirix* (blog), 30 November 2023, https://www.onirix.com/extended-reality/.

[6] Ecorys (2021). XR and its potential for Europe. page 18. Retrieved from: https://xreuropepotential.com/assets/pdf/ecorys-xr-2021-report.pdf (last visited on February 22, 2023)

[7] Kenton, Will. "Retail Sales: Definition, Measurement, And Use As An Economic Indicator". Investopedia, 15 februari 2024. https://www.investopedia.com/terms/r/retail-sales.asp.

[8] Petkov, Martin. "AI – The Catalyst Of The Metaverse's Expansion", 24 June 2023. https://www.linkedin.com/pulse/ai-catalyst-metaverses-expansion-martin-petkov/.

of steady market growth. If AI is being used to streamline content curation or provide more accurate analytics for user behavior, it is an indicator of subtle enhancements that keep pace with a growing but not explosive market. Conversely, transformative AI applications leading to new XR innovations and personalized immersive experiences or opening new market segments and use cases, would indicate alignment with the optimistic scenario: characterized by rapid advancements and market expansion. The actual impact of AI in XR on its market growth depends on the relevance and appeal of the applications it enables. AI-driven features must address real user needs to translate into market growth. If AI advancements in the XR sector are not matched with market demand, or if they fail to significantly improve user experiences, their impact on the market might be muted. Therefore, while AI's role in XR development is a strong proxy for market innovation and serves as an indicative data point of forward momentum that can catalyze market growth, the actual impact depends on how AI-integrated XR applications are received by users and whether they solve real-world problems or create substantial new opportunities.

- **No code development/low code development:** The rationale behind including no-code/low-code development platforms as a strong proxy for market growth lies in their potential to democratize technology and innovation. By reducing the need for specialized programming skills, these platforms can significantly broaden the pool of XR content creators, leading to a more vibrant and diverse ecosystem of applications. This democratization is crucial for developing new use cases and stimulating adoption of XR technologies. The rise of no-code/low-code platforms have the potential to be a game-changer. In the optimistic scenario, they could trigger a rapid surge in XR application development and diversity, revolutionizing the market. Under the baseline scenario, these platforms gradually increase market accessibility. The rise of these development platforms can significantly lower the barrier to entry, potentially expanding the market.[9] However, the quality and market relevance of the applications created can vary, and a proliferation of low-quality content could dilute the market's value proposition. The true impact on market growth may depend not just on the ability to create XR content but on the creation of meaningful, useful, and engaging experiences that meet users' needs and expectations.[10]

Each of these indicators will be analyzed in the context of current market developments, as detailed in Section 2.2 Technological advancements in 2023, Section 2.3 Global AR/VR sales, Section 2.4 Integration of AI into XR and Section 2.5 Low to No-Code Content development XR. By assessing these proxy indicators, we aim to determine whether the current market trends align more closely with the baseline or optimistic scenarios projected by the last Ecorys report. This approach will enable us to provide a comprehensive analysis of the XR market's trajectory in 2023, leveraging qualitative data points to compensate for the absence of updated formal market reports.

The proxy indicators mentioned above will provide valuable insights into the XR market's trajectory. They can be considered proxies, because they relate to essential aspects of market growth: technological capability, user adoption, innovation, and content creation. Nevertheless, they must be critically assessed, as they do not provide a direct measure of market value, consumer spending,

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[9] Das, Sejuti. "Low-Code Development Lowers The Barrier To Entry". Analytics India Magazine, 4 August 2020. https://analyticsindiamag.com/low-code-development-lowers-the-barrier-to-entry-the-need-of-the-hour-says-venkatesh-ramarathinam-ceo-vuram/.

[10] Hollingsworth, Tom. "Low Code And No Code Aren't The Magic Solution - Gestalt IT". Gestalt IT, 7 August 2023. https://gestaltit.com/all/tom/low-code-and-no-code-arent-the-magic-solution/.

or profitability.[11] It is possible for a market to have high technological advancement and sales but low profitability if the cost of innovation exceeds revenue, or for a market to have high user numbers but low engagement if the experiences do not retain users. Therefore, while these proxies offer valuable insights to determine whether the XR market aligns more closely with the baseline or optimistic scenarios, they should be interpreted with caution and complemented with additional metrics such as profitability, user retention, and engagement levels to gain a full picture of the market outlook on the XR sector.

2.2   Technological advancements in 2023

The year 2023 has been marked by notable developments for the Extended Reality (XR) market, with several hardware developments advancing the industry.[12] These developments, when analyzed in the context of the baseline and optimistic scenarios outlined in the Ecorys report, provide insights into the current and future state of the XR industry. Among these, one key development of the XR market in 2023 is Apple's step into the XR field. In June 2023, Apple announced its first venture into XR (or, as Apple calls it, 'spatial computing') with the introduction of the Apple Vision Pro, slated for release in early 2024. This move by Apple is particularly significant for several reasons:

- **Apple's Market Strategy**: Apple is renowned for its 'fast follower' approach.[13] The company's strategy involves waiting for new technologies to mature and prove their market viability before introducing their own refined versions. The launch of the Apple Vision Pro is a clear indication that Apple perceives the XR market as having reached a level of maturity ripe for their entry.

- **Impact on the XR Market**: Apple's entry into any market is a signal of that market's potential and readiness for mainstream adoption.[14] The introduction of the Apple Vision Pro suggests an endorsement of the XR technology's viability and growth potential. It serves as a validation of the market's maturity and a likely catalyst for further expansion and innovation within the XR ecosystem.[15] However, the price of the Apple Vision Pro of $3,499 indicates that the device is not aimed at the general consumer market but rather at developers and a select group of enthusiasts. Apple's strategy seems to focus on refining the product first through development and innovation, rather than immediate widespread adoption. The company is unlikely to expect a large volume of sales at this price point.[16]

- **Strategic Partnerships and Ecosystem Development**: Alongside the device launch, Apple's partnerships, such as its XR partnership with Unity, hint at a broader strategy to foster an

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[11] Benjamin, Migolo. "Understanding Proxy Indicators", 3 April 2023. https://www.linkedin.com/pulse/understanding-proxy-indicators-migolo-benjamin/.

[12] Alan Truly, "XR in 2023: The Year's Best AR/VR Hardware And Apps", *MIXED Reality News*, 29 December 2023, https://mixed-news.com/en/xr-in-2023-the-years-best-ar-vr-hardware-and-apps/.

[13] Novak. "How Apple's Fast Follower Approach Can Revolutionize The AI Landscape". Medium, 17 April 2023. https://medium.com/the-generator/how-apples-fast-follower-approach-can-revolutionize-the-ai-landscape-fb4764bab8d8.

[14] Horn, Stefan. "Apple Is Entering The Markets Of The Metaverse – What Are The Legal Challenges From A Competition Law Perspective?" TW, 3 July 2023. https://www.taylorwessing.com/en/insights-and-events/insights/2023/07/apple-is-entering-the-markets-of-the-metaverse.

[15] Hackl, Cathy. "How Early-Adopter Companies Are Thinking About Apple Vision Pro". Harvard Business Review, 16 February 2024. https://hbr.org/2024/02/how-early-adopter-companies-are-thinking-about-the-apple-vision-pro.

[16] Gans, Joshua. "What Is Apple's Vision Pro Really For?" Harvard Business Review, 14 June 2023. https://hbr.org/2023/06/what-is-apples-vision-pro-really-for.

accessible and vibrant XR content ecosystem. This initiative is likely to up the standards in user experience and content creation within the XR market.

Apple's announcement of its XR product, the Vision Pro, marks a noteworthy venture. Given Apple's reputation for entering markets only when a certain level of maturity and viability is established, this move could be seen as an affirmation of the XR market's growth and potential and could be a proxy indicator for the optimistic scenario presented by Ecorys. However, the high price point of $3,499 and the focus on a niche audience of developers and enthusiasts suggest a cautious approach not aimed on broader consumer adoption. This aligns more closely with the baseline scenario, where growth is steady and sustainable, rather than the exponential market expansion anticipated in the optimistic scenario.

Apple Vision Pro was, however, not the only significant product launch in 2023. Throughout the year, there were multiple product launches that had impact on the XR sector. According to Ben Lang, an analyst solely dedicated to the XR industry, HTC's Vive XR Elite, Sony's PlayStation VR2 and Meta's Quest 3 were the most notable headsets that contributed to the sector's evolution.[17]

- **HTC Vive XR Elite**: The launch of HTC's Vive XR Elite represented a step forward in compact and high-quality XR devices. This innovation was most notable for its compact design, while maintaining a high quality. It has a retail price of €1049.
- **PlayStation VR2**: Sony's PlayStation VR2 was released with advanced gaming features. This not only enhanced the gaming experience but also showcased the potential of VR in other sectors, including healthcare. With an attractive retail price of €599, Sony's launch could expand the VR gaming market, contributing to XR's growth in the entertainment sector.[18]
- **Meta Quest 3**: Meta's Quest 3 emerged as a significant development, especially in terms of business applications. Its improved features and competitive pricing of only €499 positioned it as a vital tool for integrating XR into daily business operations and consumer use. This release will likely accelerate the overall adoption of XR technologies and further reimburses the leading position of Meta in the XR industry.[19]

In conclusion, the XR product launches of 2023 signify an evolutionary phase in the maturing XR sector. The different product launches indicate significant technological advancements and consumer interest. Each of these products brings improvements in terms of performance, user experience, and application diversity. However, these are more reflective of iterative advancements rather than industry-transforming innovations. As such, they align more with the baseline scenario, emphasizing gradual improvement and market penetration rather than the rapid, disruptive growth of the optimistic scenario.

2.3 Global AR/VR Headset Sales

In 2023, the global AR and VR headset market presented a mixed picture, that did not manage to meet the expectations of the optimistic market forecast for 2023 by Ecorys. This suggests a trend that aligns more closely with the baseline scenario projected in the report. The year saw a notable decrease in VR headset shipments, descending to 6.97 million units from the 8.30 million recorded in

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[17] Lang, Ben. "Most Important XR Stories Of 2023 And What They Mean For 2024". Road To VR, 22 January 2024. https://www.roadtovr.com/xr-year-in-review-most-important-vr-stories-2023-2024/.

[18] Lang, Ben. "Most Important XR Stories Of 2023 And What They Mean For 2024", Road To VR, 22 January 2024, https://www.roadtovr.com/xr-year-in-review-most-important-vr-stories-2023-2024/.

[19] Counterpoint Technology Market Research. "Quest 3 To Help Maintain Meta's XR Dominance". Counterpoint Market Research, 2 November 2023. https://www.counterpointresearch.com/insights/quest-3-help-maintain-metas-xr-dominance-even-apple-entry-looms/.

2022.[20] This decline, after the substantial growth observed from 2020 to 2021 (rising from 4.43 million in 2020 to 9.06 million in 2021), could be indicative of a market in anticipation of forthcoming innovations or reaching a point of stabilization, which more closely aligns with the baseline scenario.
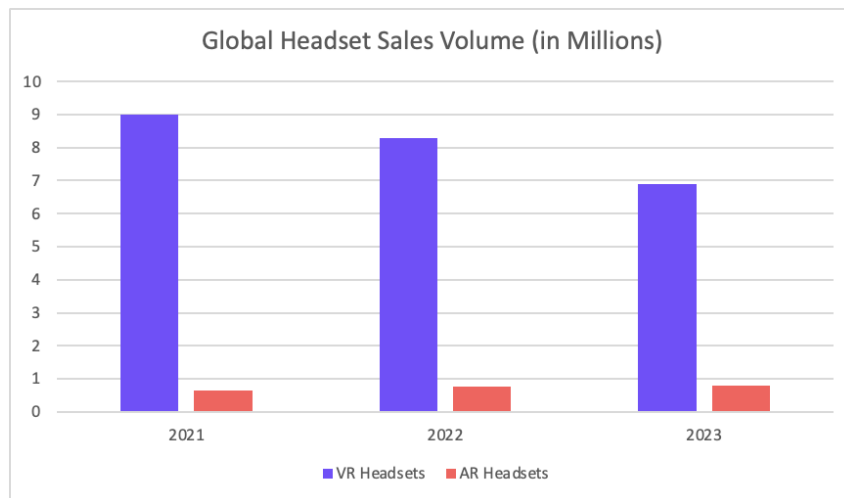
Figure 1: Global headset sales volume (in millions)

The AR headset market, while maintaining stability with 0.78 million units shipped consistently over the past two years, did not exhibit the exponential growth characteristic of displayed in the optimistic scenario. Instead, this steadiness points towards a gradual and steady adoption of AR technologies, aligning with the more conservative growth estimates of the baseline scenario.
The reduction in VR headset sales might reflect several factors, including market saturation after an initial surge of interest and economic uncertainties, like the inflation of 2023, influencing consumer spending.[21] According to Scalerr, a tech consultancy firm, this showcases a deceleration in growth, rather than a decline in the technology's relevance.[22] It suggests a market adjusting to its natural growth rhythm after a period of rapid expansion. Furthermore, the VR market's slower growth pace, contrasted with the steep increase seen in previous years, supports the notion of a maturing market.[23] This maturation process, where growth rates normalize after initial excitement, is a characteristic of the baseline scenario as opposed to the exponential growth predicted in the optimistic scenario.[24]
In conclusion, the 2023 AR and VR headset sales data reveal a market that is evolving towards stability and sustainable growth, rather than maintaining the rapid expansion pace that would

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[20] TrendForce. Augmented reality (AR) and virtual reality (VR) headset shipments worldwide from 2020 to 2023 (in millions) [Graph]. August 22, 2023. In Statista. Retrieved February 19, 2024, from https://www.statista.com/statistics/653390/worldwide-virtual-and-augmented-reality-headset-shipments/

[21] ReportLinker. "Extended Reality Market: Growth Analysis 2023", 1 February 2024. https://www.reportlinker.com/p06484014/Extended-Reality-Market-Size-Share-Analysis-Growth-Trends-Forecasts.html?utm_source=GNW.

[22] Joseph, V. "Interview With The CSO Of Tech-consultancy Firm Scalerr". Inspiring Business News Stories From Asia, 22 November 2023. https://www.asiabiztoday.com/2023/11/21/its-not-the-technology-that-is-the-problem-but-the-mindset/.

[23] Lucid Reality Labs. "Maturing Of XR: Meta's Revenue Milestone, Apple's Market Excitement, And New Industries Expansion", 12 February 2024. https://www.linkedin.com/pulse/maturing-xr-metas-revenue-milestone-apples-market-excitement-rdr8f/?trk=public_post_main-feed-card_feed-article-content.

[24]Ecorys (2021). XR and its potential for Europe. page 19. Retrieved from: https://xreuropepotential.com/assets/pdf/ecorys-xr-2021-report.pdf (last visited on February 22, 2023)

indicate alignment with the optimistic scenario. The alignment with the baseline scenario of the Ecorys report still underscores the market's potential for growth and innovation, while also highlighting the importance of adaptive market strategies in response to evolving consumer behaviors and economic contexts.

2.4   Integration of AI into XR

The integration of Artificial Intelligence (AI) into Extended Reality (XR) points to a future where XR devices can be more intuitive and integrated into daily life. In 2023, products like the Meta AI and Ray-Ban smart glasses have showcased this potential, where XR devices can be embedded in everyday experiences with the integration of AI. This development is significant as it opens new possibilities for XR applications. However, the full impact of AI integration on the XR market growth is yet to be seen.[25] The steady evolution and integration of AI into XR reflects a market trend towards gradual sophistication rather than immediate, market-transforming innovation, aligning with the baseline scenario of the Ecorys report.

Figure 2: Detail of Ray-Ban's Smart Glasses

The fusion of AI and XR holds immense potential to shift XR's market trajectory towards the optimistic scenario. AI's capabilities in personalization, contextual understanding, and interactive environments can revolutionize XR applications, extending their use beyond current limitations.[26] The potential for AI to transform XR lies in its ability to create deeply immersive and personalized experiences that are currently unattainable. For instance, AI-driven XR can lead to breakthroughs in fields like education, where personalized learning environments adapt in real-time to each user's needs, or in healthcare, where AI-enhanced XR can provide revolutionary diagnostic and therapeutic tools through biofeedback.[27,28] If these developments are realized, it could propel the XR market into the rapid growth and innovation characteristic of the optimistic scenario.

In short, the current integration of AI into XR aligns with the baseline scenario due to its incremental impact up to date. However, its potential to redefine the boundaries of XR technology and its applications, positions it as a key driver that could eventually steer the market towards the ambitious growth and transformative change of the projected optimistic scenario by Ecorys.

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[25] Reiners, Dirk, Mohammad Reza Davahli, Waldemar Karwowski, en Carolina Cruz-Neira. "The Combination Of Artificial Intelligence And Extended Reality: A Systematic Review". Frontiers in Virtual Reality 2 (7 September 2021). https://doi.org/10.3389/frvir.2021.721933.

[26] Carter, Rebekah. "Metaverse AI: The Rise Of AI in The Metaverse". XR Today, 7 September 2023. https://www.xrtoday.com/virtual-reality/metaverse-ai-the-rise-of-ai-in-the-metaverse/.

[27] Arés, Monica. "How AI and XR can transform education and create a new dimension of learning", Imperial College Business School, 15 January 2024. https://www.imperial.ac.uk/business-school/ib-knowledge/technology/how-ai-and-xr-can-transform-education-and-create-new-dimension-learning

,[28] Nicoll, Mark. "How AI Combined With XR Can Transform Healthcare". Simulation Magazine, 8 August 2023. https://www.simulationmagazine.com/how-ai-combined-with-xr-can-transform-healthcare/.

2.5   Low- to No-Code Content Development XR

In 2023, there have emerged several no-code or low-code developments in the XR sector, simplifying the creation process of immersive experiences. Traditionally, building XR applications required deep technical expertise in areas like 3D graphics and physics simulation, creating a high barrier to entry for non-technical creators.[29]

Platforms like CoSpaces, Glitch, and Unity's XR Interaction Toolkit have simplified XR creation, allowing users with low to no traditional coding skills to assemble diverse elements into virtual spaces. This development is beneficial in industries such as healthcare, education, and media, where its applications range from training simulations to interactive learning and immersive media experiences. These sectors, facing a shortage of skilled XR developers, stand to benefit significantly from the lowered technical barriers.[30]

The rise of no-code platforms represents a particularly noteworthy development, as they democratize XR creation by enabling educators, marketers, designers, and other non-technical professionals to design and publish XR experiences without the need for coding.[31] This trend is a key data point for the D6.2 market research, as it signals a broadening of the XR market's reach and accessibility. It is likely that this democratization will lead to a surge in new applications and use cases, potentially accelerating the market's diversity and growth.

The support for hand and eye tracking, advanced animation and physics engines, integration with AI and IoT, and enhanced collaboration and sharing features in no-code platforms signify a slowly maturing creators' side of the market, where developing XR software is becoming increasingly accessible. These enhancements not only improve the realism and interactivity of XR experiences but also expand the creative possibilities and accessibility for a broader range of creators. The emergence of these platforms addresses the previously noted lack of practical use cases in XR, opening up new avenues for application. The impact of no-code platforms in reducing technical barriers and fostering a wave of creativity from various industries aligns with the baseline scenario's emphasis on gradual market expansion.

The transformative potential of these platforms in unlocking new segments and applications also hints at a possible future shift towards the optimistic scenario, characterized by rapid market evolution and diverse creation of XR software. This anticipated shift is based on the similar increase in market growth and -diversity for apps when no-code trends started to take shape in app developments. Much like in app development, the introduction of no-code tools in XR is predicted to lower barriers to entry, attracting a broader range of creators.[32] The lowered barrier to create XR experiences will also likely lead to a surge in available XR content.[33] While there are similarities between the complexity and specialized skills required for XR development and those in early app development, it's possible that the XR field might benefit from the simplification and accessibility offered by no-code platforms, though the extent of this similarity and benefit is yet to be fully determined.

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[29] Holo Pundits. "Barriers To AR Adoption And What Is Being Done To Overcome Them", 15 March 2023. https://www.holopundits.com/blog/2023/03/what-are-the-current-business-barriers-to-ar-adoption-and-what-is-being-done-to-overcome-them.html.

[30] OWNverse. "Empowering Creators With A No-Code XR Platform - OWNverse - Medium". Medium, 22 June 2023. https://ownverse.medium.com/empowering-creators-with-a-no-code-xr-platform-633037295c8c.

[31] CTRUH. "Trends in No-Code XR Development For The Next Decade", 2023. https://www.ctruh.com/blogs/exciting-trends-in-no-code-xr-development-for-the-next-decade.

[32] Brisk, G. "10 No-code And Low-code Trends To Look Out For". Baserow, 18 January 2024. https://baserow.io/blog/low-code-no-code-trends.

[33] Fernandes, J. "Low-Code/No-Code Application Development – Putting Users in Control". DevOps.com, 16 October 2023. https://devops.com/low-code-no-code-application-development-putting-users-in-control/.

Furthermore, the convergence of XR technologies with no-code development is exemplified in use cases like the Connected Worker and Remote Support. For instance, in the Connected Worker concept, employees equipped with XR devices access real-time information and guidance, enhancing productivity and reducing errors through applications that were made by low-code platforms. Equally impactful is the integration of XR data with analytical low-code platforms like Power BI and BIM. This advancement facilitates immersive data visualization, making complex information more accessible, understandable and actionable for decision-making. The ability to explore interactive 3D models and analyze trends through low-code applications has proven to drive operational efficiency and strategic planning.[34]

In conclusion, while the current state of no-code XR development aligns with a baseline scenario of incremental market growth, its underlying capabilities and the emergence of new use cases indicate a starting shift towards the optimistic scenario. The expansion of XR development access to a broader audience is not just democratizing technology but potentially shifting current market dynamics, like it did in the app development industry. This accessibility invites diverse perspectives and new applications, potentially fueling a surge in both market size and the rate of innovation in the XR field.

As no-code tools evolve, they may introduce unique solutions that could significantly expand the user base and application spectrum of XR. However, this transition is not without challenges. The market must navigate potential barriers such as technology adoption hesitancy, the need for widespread digital literacy, and ensuring that no-code platforms can meet the diverse and complex demands of various industries.

Ultimately, the shift towards the optimistic scenario hinges on the ability of no-code XR development to not only simplify technology creation, but also facilitate multiple use cases for XR. By doing so, it could potentially lead to rapid growth and diversification in the XR market. However, the current state of no-code XR development aligns with a baseline scenario of incremental market growth.

2.6   Bringing it all together: Market Analysis based on Proxy Indicators

The Ecorys report projected two scenarios for the XR market: a baseline scenario with steady, incremental growth, and an optimistic scenario characterized by rapid expansion and diversification. Given the lack of direct, updated market reports, the analysis in this report has focused on several proxy indicators to assess the market's current trajectory.

The following table summarizes the alignment of each proxy indicator with the baseline or optimistic scenario:

PROXY INDICATOR	BASELINE SCENARIO	OPTIMISTIC SCENARIO
Technological advancements & product launches in 2023	✓	
Global AR/VR Headset Sales	✓	
Integration of AI into XR	✓	✓
Low-code Content Development and Ecosystem Expansion	✓	✓

Table 1: Proxy indicators for market analysis

The analysis of the proxy indicators suggests that the current state of the XR market is more closely aligned with the baseline scenario projected in the Ecorys report. The gradual technological advancements and relative stability of AR/VR headset sales support a trend of incremental market

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[34] Federica.Prunotto. "Meta BI: The Evolution Of BI Towards The Metaverse". BIP xTech, 3 August 2023. https://bipxtech.com/en/meta-bi-evolution-of-bi-towards-metaverse/.

growth, mirroring the baseline scenario's market outlook of Ecorys. Similarly, the integration of AI into immersive technologies and the emergence of low-code XR development platforms currently align with this trend, indicating a steady evolution of the market. However, the integration of AI into XR and the rise of low-code development platforms also present the potential for a future shift towards the optimistic scenario. This potential shift, while not immediately apparent, should be monitored closely in future market analyses. These aspects reveal a market that is slowly maturing and becoming more accessible, setting the stage for broader adoption and more diverse applications.

The potential for a future transition towards the optimistic scenario is grounded in the democratization of XR content creation, the personalization of immersive experiences facilitated by AI, and the expanding range of creators and industries engaging with XR. This shift could mirror the diversified impact observed in the app development industry following the emergence of no-code trends. Nevertheless, the XR market faces challenges, such as technology adoption hesitancy and the need for platforms to meet diverse industry demands, which could influence the pace and direction of its growth. Therefore, in the absence of available updated market reports and based on the evaluated data points, it can be concluded that the European XR market predominantly aligns with the baseline scenario as projected by Ecorys.

For XReco, alignment with the baseline scenario is beneficial. Since XReco is not yet ready to be released to the market and will be launched in two years, a market environment characterized by steady growth and stable dynamics is preferable. Exponential growth and rapidly shifting market dynamics, as envisaged in the optimistic scenario, might pose challenges for an ecosystem like XReco that is still in development. The current market conditions allow more time for XReco to align its offerings with market needs and to enter a more mature and stable market.

In the baseline scenario, the total market value of the European VR and AR industry is expected to increase to around €35 billion by 2030, and directly create employment for some 440,000 people. The wider supply chain impacts are also expected to indirectly increase production value, generating an additional 780,000 jobs. This forecast still presents an opportunity for growth and employment, offering a stable and growing market for new entrants like XReco.

In summary, while the XR market currently exhibits characteristics of the baseline scenario, emerging trends in AI integration and no-code development hold the potential to propel it towards the rapid growth and innovation envisaged in the optimistic scenario. These dynamics underscore the evolving nature of the XR market and highlight the importance of monitoring these indicators to anticipate future trends.

2.7   Concluding remarks on market analysis

Even though no updated quantitative market analysis has been released by the major research institutions in the sector, we have been able to estimate that state of the market through the use of proxy indicators. In aggregate these proxy indicators signal a market full of hope, which has nonetheless not yet entered exponential growth territory. In D6.1 we presented both a baseline and an optimistic scenario, and based on the trends and indicators at the moment we concluded that we are closer to the baseline scenario than to the optimistic scenario. At the same time, several trends are also indicative that at any moment we can "make the jump" and start approaching the optimistic scenario.

For the moment we believe these are quite fortunate circumstances for the project, considering that we are currently around the half-way point, and we would probably prefer the market to start growing exponentially around the time of the wrap up of the project and not necessarily right now. Seeing the virtue in being ready for that moment, we have deepened our understanding of the XR value chain and ecosystem theory, by analyzing contact points for possible users with the XReco platform. We showed the process by which we arrived at 5 user types, which would all interact (and

transact) with XReco in unique ways. We also demonstrated how XReco can facilitate the interconnection of multiple value chains and is therefore well positioned to derive value from the creation of an entire ecosystem based around the different user types.

As an ecosystem, XReco would need to provide certain keystone contributions and a tollgate mechanism, for each user type. This will be the central task of the development work for the coming months, to be validated during the third Joint Business Clinic and incorporated into a working prototype by month 30.

In this section we have established that a positive macro-level outlook exists for XReco to be developed. Furthermore, as will be explained in Section 3 about exploitation, we have identified a number of value propositions depending on user type, which all have to do with the creation of XR content.

At this point of time, additional analysis will be required to gain a deeper understanding of the ways demand for XR content will grow. This is a question that can divided into two parts for XReco:

      a. We need to investigate in which industries demand for XR content will grow fastest and/or emerge first. For example, an industry like Virtual Reality Training might show strong demand for XR content to populate their virtual training environments with photorealistic objects.

      b. Additionally, we need to understand what will be the nature of demand for XR content specifically in those industries that are the focal point for XReco: automotive/mobility, media and tourism. In this context we might see that the mobility industry is currently primarily focused on creating digital twins, whereas the tourism industry is focused on creating end user experiences.

Understanding both trends and analyzing the type of demand arising from each of these industries will inform decisions about the design of XReco's MVP and will also be essential in establishing a longlist of potential launch customers, ranked on their potential interest in a XR content creation platform like XReco.

3   Exploitation

Exploitation of research outcomes stands as a pivotal bridge between innovation and societal impact. As such this section delves into the methodology, strategic framework, and activities designed to maximize the utilization of project results, ensuring their seamless integration into markets, policies, and communities. In D6.1 we set up an exploitation plan based on 6 exploitation components for which we will now show the first results. Our aim was to provide a clear and effective plan for realizing the project's results and maximizing their benefits for customers and markets through Human-Centered Design.

We promised to develop the XReco exploitation strategy by starting with defining current needs, how we can deliver benefits to customers and markets in the future, and how it could be jointly commercialized and monetized. In addition, we started to design a Minimum Viable Product (MVP) canvas that meets the needs of our target users and addresses the current challenges in the XR ecosystem. Other important steps included; the organization of our first two Joint Business clinics and use results to (in)validate current insights on value proposition, co-create with users to brainstorm potential concepts to understand how XReco can solve their current or upcoming problems within the next three years, the creation of individual exploitation plans for each consortium member and map joint exploitation opportunities based on this data, and as WP6 we will design a standardized capacity building framework for learning modules.

In the coming section you will read the results, until now, of our exploitation plan and activities and what we will do in the coming 18 months to further validate and substantiate the XReco exploitation strategies.

3.1   Methodology

The challenge with any design project is to ensure the design process remains flexible and responsive, and centered on users and their needs. By revisiting and revising the product based on user feedback and real-world testing, the process will lead to products that resonate deeply with the intended users, ensuring they remain human-centric and adaptable to evolving needs and preferences.
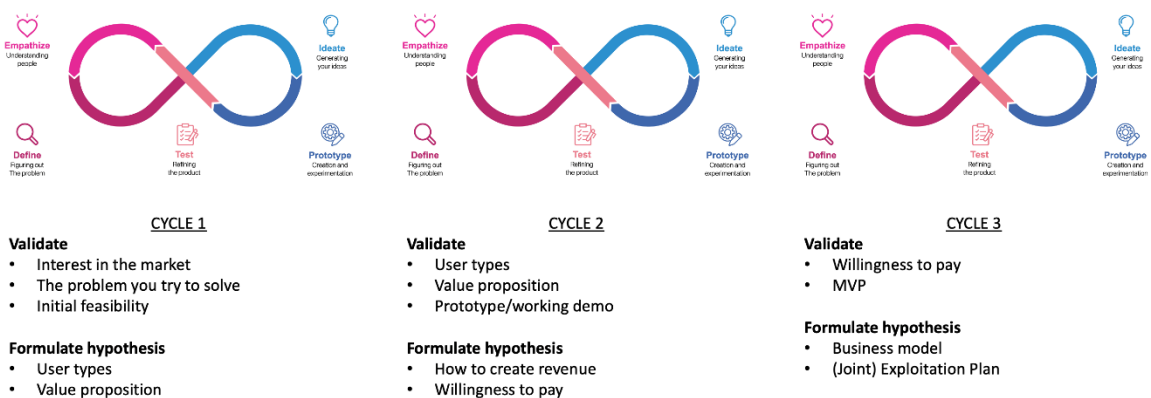
Figure 3: XReco's methodology for user validation and exploitation

To achieve this objective, Design Thinking proposes to work in loops that include five key steps: empathize, define, ideate, prototype, and test. These steps form a dynamic and iterative cycle that consistently leads to Human-Centered products, because it challenges the designer to think both internally and externally. One should try to empathize with users (externally), define the problem to be solved, ideate a solution, and create a prototype (internally), which will then be tested with the users to obtain feedback (externally). This feedback in turn serves to deepen the understanding of

the user (empathize), improve on the prototype, which can be tested again, and so on, and so on. This loop can be done an infinite number of times, on each occasion leading to new incremental improvements to the product or the service. Hence, the infinite loop.

XReco's methodology for user validation and exploitation consists of 3 consecutive 10-month cycles or loops (see Figure 3: XReco's methodology for user validation and exploitation above), with an additional 6-month period for results consolidation (see Section 3.8 Results consolidation with Human-Centered approach (component 6)), contacting & contracting launching customers and strategic partners, the creation of a use & business case per potential launching customer, and the establishment of further strategic alliances & partnerships.

Each cycle concludes with a user co-creation event, the 3 Joint Business Clinics. Each Joint Business Clinic serves a dual purpose: to validate our existing assumptions and based on new insights formulate further hypotheses to be analyzed and validated. This iterative approach ensures that XReco outcomes have traction in our focus markets and among our identified user types.

We are currently in the finalization of the second cycle and in the process of analyzing the results of the second Joint Business Clinic and formulating hypothesis on revenue creation and willingness to pay that are set to be validated in the coming cycle.

3.2   Exploitation components

This section briefly describes the exploitation components specifically defined and implemented by the XReco WP6 team to maximize the exploitation of the outcomes to be generated during the project lifetime.

The implementation of the steps described in this section will be accompanied by communication activities undertaken by the dissemination team (described in Section 4 Dissemination & Communication) as well as one-to-one demos with prospects.

The following components, influenced by Human-Centered Design (HCD), and most of the time implemented, analyzed, and processed in parallel, have been put in place starting from September 2022 onwards, with the challenging objective to develop an integrated strategy for the exploitation of the project results at individual and collaborative level.

These components are often intertwined in practice and influence each other, the results per component described in this deliverable often cross into the territories of other components and as such the following sections should be read as all influencing the creation of overall (joint) exploitation strategies and not as rigid boundaries between components.

3.2.1   Component 1: market and customer analysis

In line with the HCD methodology, the first step in the exploitation strategy involves conducting a comprehensive analysis of the current XR market and identifying the gaps and needs of the customers. This step prioritizes the (end) users, and customers, by taking into consideration their needs and preferences to inform the strategy. The objective of this step is to lay the foundation for defining a sound exploitation strategy by analyzing the current market and identifying potential opportunities for exploiting the results of the XReco project. Section 2 Market analysis provides the framework for XReco's growth scenario and ensuring that we are aware of current and future developments that (might) impact XReco, like the expected impact of no code / low code and AI on content creation.

3.2.2   Component 2: creation of exploitation strategies

The exploitation strategies offer a project overview consisting of items relevant for exploitation, including ways in which stakeholders can be identified and engaged, and ultimately for technology transfer. To understand the expectations and plans of each consortium member for using the project

outcomes in their businesses or further research activities, specific individual exploitation plans have been created. This step takes a co-design approach, involving the consortium members in the strategy development process and ensuring that their perspectives and expectations are taken into consideration.

3.2.3   Component 3: Joint Business Clinics

To define an integrated strategy for exploiting the XReco results, three Joint Business Clinics (JBC) will be organized. These workshops aim to present and demonstrate XReco's key assets to business experts from different markets, discuss their needs and gaps, and assess how XReco could potentially deliver value to specific customer segments. The workshops also aim to initiate further discussions with potential early adopters and explore partnerships with external companies to invest in technological developments for future market uptake. The JBCs adopt a co-creation approach, involving business experts in the strategy development process and ensuring that their perspectives and needs are taken into consideration.

3.2.4   Component 4: XReco value proposition & commercial strategy

Based on the inputs that will be collected during the JBCs and the extended market analysis, a Minimum Viable Product (MVP) and a high-level business model will be defined. This step takes a user-centered approach, taking into consideration the inputs collected from the workshops and the market analysis to inform the development of the MVP and the business model. The workshops will allow for (1) the assessment of how XReco's solution can be applied in specific markets; (2) the identification of key features customers are looking for in specific use cases; and (3) the development of unique value propositions for different customer segments. Business models for multiple selected use cases will be developed, ensuring that the HCD methodology and concepts are integrated into the commercial strategy.

3.2.5   Component 5: IP management

Before exploiting the results of an EU-funded collaborative project, it is essential to have a clear understanding of the potential inputs brought into the project by each participant, of the common goals and expected outcomes, and to come to a joint agreement on the terms and conditions for the use of and access to intellectual property (IP) generated in the project. This step helps to avoid conflicts and supports individual and joint exploitation of results, during interviews and the creation of individual exploitation plans consortium members will be asked to list and describe their IP. The IP management step takes a collaboration-focused approach, ensuring that all participants have a clear understanding of the IP generated in the project and the terms and conditions for its use and access.[35]

3.2.6   Component 6: results consolidation with human-centered approach

This component integrates the key project outcomes and lessons learned from the other components to provide a comprehensive overview of the available exploitation options for the XReco project. Taking the HCD approach, we will be putting 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 includes a thorough evaluation of the potential impact of the XReco project on various user groups, as well as a

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

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 commercialization of the XReco solution.

3.3   Market and customer analysis (component 1)

3.3.1   Market analysis

For our market analysis see Section 2 Market analysis.

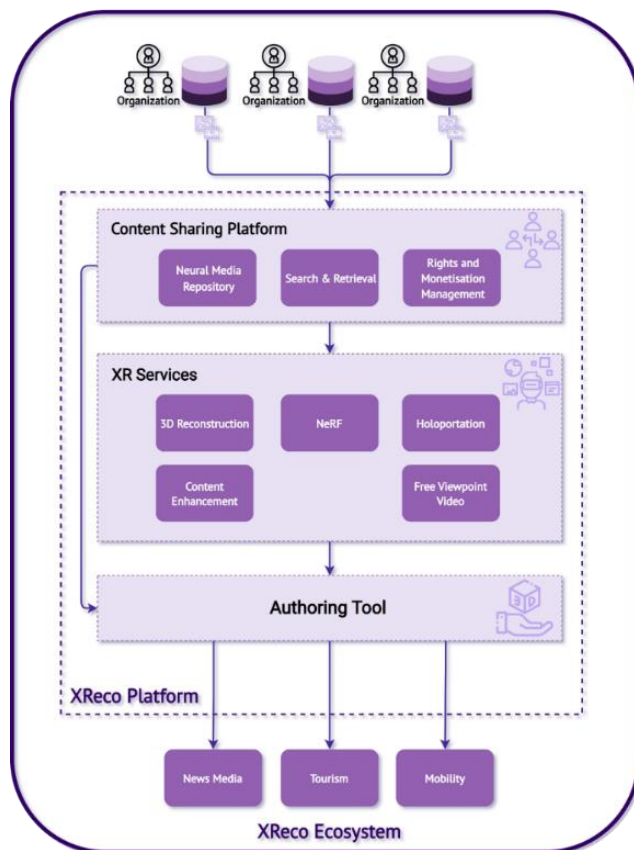### 3.3.2   Customer analysis

3.3.2.1   XReco value chain

Figure 4: Schematic overview of XReco ecosystem

In D6.1 we aimed to demonstrate that multiple value chains exist within XReco's conceptual design through an analysis of the XR value chain and a mapping of XReco's core functionalities. The theory of ecosystems specifically addresses situations of these types of multi-sided platforms whereby multiple value chains intersect. In our development work since D6.1 we took this approach further and we tried to identify exactly where value chains were interacting. We realized that one natural input point and two natural exit points exist based on the diagram shown (**Fehler! Verweisquelle konnte nicht gefunden werden.**): The Content Sharing Platform provides a natural entry point for users that might be interested in sharing material. This could source images in 2D or assets in 3D. Similarly, the Content Sharing Platform also provides an interaction point for users interested in the search functionality to obtain images or 3D assets for further processing outside of XReco. Finally, a third interaction point exists for users that do not merely want to use the search engine. For these users the search functionality is a means to an end. They are looking for advanced XR Services and an Authoring Tool to manipulate images into 3D assets or combine 3D assets into experiences. They would use XReco as a processing tool as part of their workflow, thereby possibly substituting other tools that they are currently using. We tried to imagine possible customer journeys through the schematic overview and we settled on the following conceptual descriptions:

- A user is the rights holder of a collection of images or 3D models and would like to share these assets (2D or 3D) with the XReco ecosystem. Users of this type are not themselves interested in 'taking out' assets from XReco, however they are willing to provide source material, and might be interested in being offered some sort of financial compensation.

- A user is the rights holder of a collection of images or 3D models and would like to reuse some of these assets as part of their workflow, however their database as currently composed does not allow for any search or meta-search functionality. Their base is unstructured. This type of user would benefit from a service that would attach neural descriptors to their material so that after processing and classification their collection would be searchable and therefore reusable (either by themselves or the XReco ecosystem at large).
- A user is set up with their own tools and workflow for creating 3D experiences but lacks access to a diverse base of images to create 3D models or a diverse set of 3D models to incorporate in their workflow. Even if they would be able to gain access to the right input material, they frequently struggle with quality and licensing restrictions. This user would be interested in using XReco's search functionality to find the assets that they need and obtain these assets with minimal friction.
- A user has creative ideas about 3D experiences they would like to develop but lacks access to the right tools for creating 3D assets and authoring 3D experiences. This user is looking for an accessible point of entry in the sector, combining search functions and authoring capabilities, integrated into a seamless workflow. This eliminates the need for operating several tools and needing access to many sources of input materials. What was once a tiresome, multistep workflow will now become a single, integrated authoring environment.

3.3.2.2   XReco user types

Based on insights from the first Joint Business Clinic (see Section 3.5.1 The First Joint Business Clinic (JBC#1)), talks with experts from within and outside of the consortium, the individual exploitation plans, and market analysis we created a set of 4 personas, to which a fifth was added during the XReco consortium meeting in Amsterdam on October 3-5, 2023, on the basis of feedback and discussion with the whole consortium.

During the first XReco Joint Business Clinic we co-created 3 Value Proposition Canvasses (VPCs) with breakout groups corresponding to the sectors on which XReco focuses (media, mobility, and tourism) across the following demonstrators:

- News media, XR-based broadcasting and automatic and customized multitarget news publishing,
- Location-based information and entertainment content, with applications that work in both tourism and the automotive industry.

In our analyses of these VPCs we saw those similar types of jobs-to-be-done, needs, and pains are present across all 3 sector-based breakout groups. Meaning, our users are not (only) categorized by sector but by roles that transcend sector boundaries as well. This insight was strengthened by the 3 co-created Lean Canvasses made during the breakout sessions of the first Joint Business Clinic. Here we see customer segments that are not limited to our market focus, signaling a need to further substantiate who the users of XReco would be.

This insight showed us that to effectively focus on and categorize XReco users we had to identify their placement within the XReco platform and ecosystem. To do this, we created a Mural board with the schematic overview of XReco and the VPCs created in the first Joint Business Clinic and started going over the responses the participants gave during that session. We mapped these responses and virtual post-its to sections of the schematic overview and from this, 4 user types started to emerge. We then further analyzed these 4 user types and started tracing their respective place within the XReco platform and ecosystem and mapping out which components, facets, and services they would likely use.

Through this method we came up with 4 rough user types which we further substantiated in persona canvases and wrote descriptions. During internal validation of these 4 user types at the third consortium meeting a 5th user type was identified: The *Creator*. This was brought up as a concern about the *Transformer* really embodying two user types:

- A user lacks access to the right tools and processing power for creating 3D assets. This user is looking for an accessible point of entry in the sector, combining search functions and 3D processing capabilities like NeRF, holoportation and free viewpoint video. Processing power is expensive and furthermore this user typically needs to operate several tools, while having to access source materials from many different databases and in many different formats. This is a more precise description of a Transformer.
- A user has creative ideas about 3D experiences they would like to develop but lack access to the right tools for authoring 3D experiences. This user is looking for authoring capabilities, integrated into a seamless workflow. This would allow the user to combine several 3D assets into one, overall experience.

Unlike the earlier 4 identified user types, the C*reator* focuses heavily on XReco's authoring tools and what can be achieved with them. For here it may suffice to give an overview of the 5 user types:

- **Searchers**: Seek efficient organization of their content through content search and retrieval and quality control to avoid content disorganization and save time, ultimately accelerating the workflow.
- **Takers**: Rely on XReco for simplified rights and monetization management. They seek quick access to quality 3D and XR content, appreciating the platform's efficient rights identification to save time and mitigate legal concerns during content sourcing.
- **Transformers**: Passionate about pushing the boundaries of XR content and relying on XReco's advanced transformation tools like NeRF to captivate their audience. They need user-friendly techniques for immersive XR content creation, aiming to captivate and engage their audience in innovative ways.
- **Givers**: Use XReco to upload visual material for others to access. They rely on XReco's rights and monetization management system to supplement their income, providing a valuable resource for content seekers while ensuring their content is protected and fairly compensated.
- **Creators**: Want to leverage the integrated workflow offered by XReco's Authoring Tool, allowing them to focus more on the creative aspects of their projects by allowing them to effortlessly blend 3D assets into these projects.

These 5 user types have been externally validated during XReco's second Joint Business Clinic based on co-created Persona Canvases made by stakeholders present and through discussion. For an in-depth understanding of these 5 users see 7.2 Annex II: User types & personas.
Furthermore, we created persona canvases and updated descriptions for these 5 user types in which we also indicated their place within XReco (Figure 5: Place of users within XReco):

Figure 5: Place of users within XReco

Through this process we added an extra vertical layer to the horizontal sector view we used until then. Giving us a better understanding of the users of XReco, the ways in which the XReco platform can be used, and how to reach them and meet their needs.
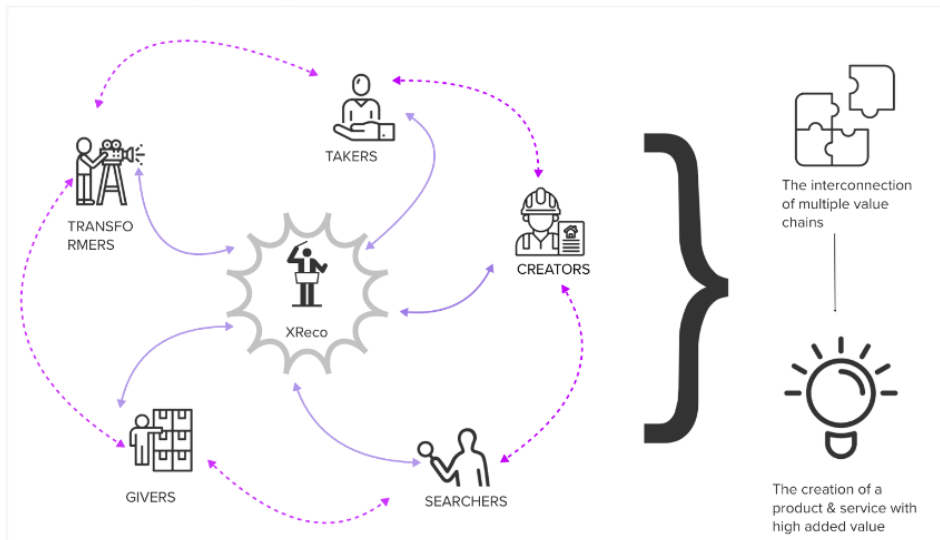
3.3.2.3   Interconnection of user types

Figure 6: XReco's interconnection of value chains

These 5 user types all interact with XReco in different ways, and by doing so they start to interact with each other on the XReco platform and ecosystem as well. They take each other's inputs, share, transform, and interact to make new XR assets and experiences. Precisely this interconnection of multiple value chains makes XReco a platform with high added value for these users (see Figure 6: XReco's interconnection of value chains).

Through user surveys (held during the second Joint Business Clinic) it became clear that this interconnection is even further strengthened than we expected and there is potential for expanded use and scaling; respondents are open to using XReco in ways beyond their initial expectations, suggesting that once users engage with the platform, they discover additional functionalities that are

beneficial to their workflows. This indicates a potential for user evolution or transition between user types as they explore more features of XReco. Based on the analysis of survey outcomes it becomes clear that there is a high correlation (0.86) between Searchers and Takers indicating similar platform utilization. And furthermore, that correlation between Transformers and both Searchers (0.76) and Takers (0.81) suggests a unified need for content management and creation tools across user types. Whereas these are conceptually distinct user types, we do not believe that in practice the lines dividing these user types will be very strong. For example, a Transformer who used XReco to create a set of 3D models out of famous buildings, might then opt to make these models available for both Takers and Creators, thereby becoming a Giver in the process (in the sense that they might be incentivized by the same opportunity to gain some profit of their work). Alternatively, a Taker might come across a limitation of their current tools and discover some XR transformation functionality within XReco typically used by Transformers. A Searcher might be primarily interested in the classification of their database for use within their own organization, only to realize that other users within the ecosystem search for and request access to their materials, which would put them in the role of Givers.

Ultimately the true added value of XReco lies in the creation of an ecosystem around the platform itself. This ecosystem includes suppliers, lead producers, competitors, and other stakeholders, who co-evolve their capabilities and roles over time. The function of an ecosystem leader is valued because it enables members to move toward shared visions, align their investments, and find mutually supportive roles. We have demonstrated in D6.1 that several types of ecosystems exist. We also showed that regardless of the exact form an ecosystem takes, one would need to provide a keystone contribution[36] (some element or activity it can uniquely own and control that is essential for the ecosystem to create value for users) and a tollgate mechanism (a tailor-made mechanism to collect revenue). In D6.1 we reviewed the theory about value chains and their application in the XR sector. By imagining user interaction with XReco in a transactional way, we arrived at 5 different keystone contributions according to 5 unique user types. The next step will be to identify a tollgate mechanism, i.e. a revenue generating mechanism, for each user type. This will be the subject of the 3rd cycle (see Section 3.1 Methodology), to be validated during the third Joint Business Clinic. This interconnection will potentially ensure that users start using XReco more and more, even for tasks that they initially didn't envision themselves doing. Further research and validation is needed before any results can be reported on this. In the coming months we will have in-depth user interviews to further substantiate these insights and identify ways in which to bolster the ecosystem.

3.4   Creation of exploitation strategies (component 2)

As XReco, we are building towards (joint) exploitation strategies that are currently taking more and more shape. By combining results and insights from all 6 exploitation components validated exploitation strategies (in the third Joint business Clinic for example) will be developed that take into account the needs of our users, how we can deliver benefits to customers and markets, and how we can jointly commercialize and monetize XReco. This will be addressed in the third cycle of XReco user validation and exploitation activities.

3.4.1   Individual Exploitation plans

Between May and June 2023 we had the consortium partners fill out the individual exploitation survey showcased in D6.1. This survey had a two aims:

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[36] Williamson, P. and Meyer, A. de (2019). How to monetize an ecosystem. *Harvard Business Review*. Retrieved from: https://hbr.org/2019/09/how-to-monetize-a-business-ecosystem (last visited on February 22, 2023)

- **Exploitation**: Description of an individual commercial exploitation plan, which includes market focus, business plan, and commercialization strategy questions as well as a table to describe non-commercial project results.
- **Validation:** By incorporating feedback and insights gathered through validation questionnaires and other methods, we are able to iterate and improve upon our value propositions to create an ecosystem that will truly resonate with and serve the needs of our target audience. The questionnaire includes questions on products and services, markets and customers, commercial and community value, and IPR protection.

We analyzed all the individual exploitation surveys committed to us by the consortium partners and created an individual exploitation overview spreadsheet. This overview can be seen in [7.3 Annex III – Individual Exploitation Plan overview](). In this overview the essential information each consortium partner gave in their individual exploitation surveys is given. For here a summary of the key goals and outcomes for XReco partners may suffice:

- **Development and Expansion of Immersive Technologies:** The consortium is advancing immersive technologies through new research lines, gaining insights into the XR production market. They aim to integrate technologies for diverse environments, strengthening research, copyrights, and patents.
- **Intellectual Property and Use Case Generation:** Consortium partners focus on filing patents related to XR technologies, generating new use cases, and enhancing expertise in AR/VR and copyright. The consortium also sees opportunities for the provision of specialized legal support for XReco solutions.
- **Strategic Positioning and Market Exploitation:** There is interest to explore spin-off opportunities post-project and targeting the XR market and cultural sector for exploitation possibilities. Partners aim to enhance strategic positioning and strengthen their market position through XReco and its outcomes.
- **Collaboration and Knowledge Transfer:** XReco partners aim to expand their network through knowledge transfer, sharing results, and demonstrations, sharing results and demonstrations with contacts, acquiring new partners for future innovation projects, and contributing to the future of XR technologies.
- **Revenue Generation and Commercialization:** Partners anticipate positive responses and demand for XReco services. As such they aim at incorporating project outcomes for new products/services and future research. The focus is on potential revenue generation in various XR scenarios, including broadcasting, media production, VFX, and post-production.

These insights from the individual exploitation plans highlight the importance of technological advancements, intellectual property, strategic positioning, collaboration, and revenue generation for XReco and its partners. The project aims to develop and integrate immersive technologies, create new use cases, strengthen market position, and explore commercial opportunities in the media, tourism, and mobility sectors, while looking for opportunities in various other sectors. Furthermore, the central insights on the individual exploitation focus are:

- **Licensing, spin-off, and commercialization:** Licensing and spin-off as main points of general exploitation plan, consideration of contribution to standardization, there is a focus on volumetric video compression pipeline, and plans include founding a spin-off company to focus on commercializing NeRF and volumetric video technologies.
- **Market focus and partnerships:** Targeting ICT companies and researchers specializing in computer vision, deep learning, and 3D modeling, offering user-friendly tools for individuals with

limited programming skills, providing add-on options for existing software in the market, and partners aim for scientific publications and sharing outcomes with the research community.

- **Markets and customer relationships**: The target market for commercialization is media broadcasters and media companies, mentioned as well is a market focus on film and entertainment, gaming, virtual reality, teleconferencing, advertising, tourism, and for partners the commercialization strategy involves direct relationships with customers through consultancy services.

Partners see potential for exploitation of XReco as a platform and aim to validate and iterate XReco for better service offerings. As such we can conclude there is potential for joint exploitation with partners, form to be defined.

3.5   Joint Business Clinics (component 3)

The Joint Business Clinics (JBCs) represent an essential component of XReco's integrated exploitation strategy, as exemplified by their central role in our methodology consisting of 3 user-validation cycles. To find XReco's 'sweet spot' for durable exploitation and innovation we employ a process consisting of 3 consecutive iterative cycles spearheaded by JBCs in each to validate our assumptions and insights (see Section 3.1 Methodology). By utilizing a human-centered design approach, the JBCs aim to gain a deep understanding of the needs and challenges faced by potential customers and explore how XReco can deliver value to specific customer segments.

Table 2: XReco JBC Objectives

THE OBJECTIVES OF THE XRECO JOINT BUSINESS CLINICS ARE TO:
• Demonstrate (expected) key results identified for exploitation.
• Market & problem validation by identifying and verifying market and end-user needs.
• Explore possible business models for the exploitation of XReco.
• Investigate external partnerships that may have the potential to accelerate the exploitation of XReco results for future market uptake.

The three consecutive JBCs are a crucial part of the process for defining XReco's integrated exploitation strategy and offer a unique opportunity for XReco to gain hands-on experience, gather fresh perspectives and innovative ideas, and validate its value proposition with potential customers. The JBCs bring together business experts from various markets, sectors, and fields of expertise. These sessions provide an opportunity for XReco to showcase its key assets and demonstrate its potential to possible users and other stakeholders. The JBCs also provide a platform for engagement with business experts, allowing XReco to gain further insights into customer needs and assess how it can potentially solve existing problems.
Another crucial objective of the exploitation workshops is to explore potential partnerships with external companies who are interested in the technological developments for future market uptake.

3.5.1   The First Joint Business Clinic (JBC#1)

Figure 7: Patrick at JBC#1

JBC#1 took place online on May 30th, 2023, with an attendance of 40 participants (of which 10 where internal). During this JBC we researched and validated interest in the (media, mobility, and tourism) market, we validated if the problem XReco is solving is a problem the market actually faces, and we asked participants how we can make XReco healthier and stronger – the feasibility. Furthermore, we demonstrated and showcased XReco to participants and held 3 breakout sessions on market level (media, mobility, and tourism) to co-create market-specific Lean Canvasses and Value Proposition Canvasses. The insights from these canvasses helped us formulate hypotheses about personas and user types that were then validated during consortium meetings and JBC#2, the results of which can be seen in Section 3.5.2 The Second Joint Business Clinic (JBC#2).

During the breakout sessions, participants brainstormed potential concepts to understand how XReco can solve their current or upcoming problems, for a co-created VPC overview see 7.4 Annex IV: Co-created VPC overview (3 JBC#1 breakout groups combined). The key results from these breakout sessions are as follows:

Table 3: Key results of breakout sessions in JBC #1

	MEDIA	TOURISM	MOBILITY
Common gains between use cases	Option to monetize Tools for asset creation / optimized workflow Tagging of the (meta)data		
Common pains between use cases	Lack of quality and diversity of assets Rights management Cost (of equipment/production) Decision-maker aversion User-friendliness		
Specific gains for each use case	Quick turnaround for asset creation	Integration with existing platforms (Airbnb, Booking.com, TripAdvisor)	Ability to maintain assets up-to-date, especially if they are used to create a virtual environment (e.g. city digital twin)

These insights helped us to create the personas and user types discussed above, but not only that. These insights also helped us validate that the focus of XReco on a fair and easy-to-use monetization and rights management system is wanted by the market, that XReco's focus on tools and workflow optimization is seen as a gain, and that the market is in desperate need of better search functionality. So yes, XReco is solving problems the market faces. Which is further substantiated through common pains the JBC participants experience. XReco will focus on these as well and they have been adopted in our user type profiles.

Some of the inputs that stakeholders contributed in JBC#1 are not only related to viability but have impact on the technical work in the project, in particular concerning the deployment models of components. Those inputs that concern the core of the XReco platform have been addressed as far as possible, while some others are to be addressed in a productization phase (e.g., those that concern use case specific integrations beyond the scope of the DoA). The key adjustments made based on JBC#1 concern the following points:

- **Platform as a service**: The architecture has foreseen a service-oriented approach from the beginning, but the assumption was that at least larger organizations would run a dedicated instance of the platform, meaning that content and services would be run in their domain (even if this involves cloud infrastructure). It turned out that this is likely to be an exceptional case and the hosted model would be the default case. This is well supported by the original architecture, but it will require a more involved authentication approach to manage user groups from different organizations. The authentication approach developed in T3.5 for connectors has been adopted platform wide and management of groups will be introduced in the second phase of the project.

- **Pick, choose and integrate**: There is interest in using only specific XReco services, and in using them outside the XReco platform but integrating them with other tools and workflows. This means that service implementations will minimize the dependencies between components of the platforms and rely on generic interfaces where possible. For example, min.io has been chosen as a solution for content storage, that complies to widely adopted standards, instead of requiring interfaces with specific APIs of the NMR backend.

- **Interoperability with the cultural heritage sector**: Cultural heritage-related use cases have been mentioned, and content from cultural heritage repositories is already being used as test and demo content for 3D assets. In the second phase of the project, connectors to cultural heritage data sources will be added.

3.5.2   The Second Joint Business Clinic (JBC#2)

Figure 8: Opening of JBC#2

JBC#2 was held on January 24th, 2024, and a total of 34 participants engaged in the morning program, where we demonstrated XReco and had a discussion with the participants present on the basis of this demonstration. The outcome of this discussion was positive with participants identifying several ways in which they could use XReco. A user survey was then conducted in which we asked participants about their current responsibilities, the main challenges they face in their role that XReco could help address or make easier, and how they see themselves using XReco in their work tasks. During the afternoon breakout groups we focused on validating user types and the value proposition for each user type. These afternoon breakout groups consisted of 9 *Searchers*, 5 *Takers*, 5 *Transformers*, and 3 *Creators*. As you can see no *Giver* breakout group was present as finding, selecting, and inviting participants of this group proved difficult. We currently have set interviews with 2 respondents that do fit the *Giver* profile and will be having in-depth discussions with them to research, co-create, and validate our user type, value proposition, and service with and for them.

All in all, JBC#2 was a success, it helped us validate and adapt our user types and value proposition, helped us validate our initial insights into how XReco can generate revenue and into users' willingness to pay with breakout groups revealing preferred business models per user type (See Section 3.6.2 Business- and monetization- models).

Some key take-aways include:

- Participants showed us that there is an overlap in different user types, highlighting the importance of a multifaceted approach to platform development.
- Participants found XReco's *economies of scale* potential interesting: XReco can help streamline workflow and production of its users leading to efficient production and thereby reducing costs for users. These users, and the XReco platform as a whole, can achieve economies of scale by increasing production and lowering costs.
- How can we open XReco to become an organic ecosystem? Questions from participants focused on what the possibilities would be to potentially connect XReco with existing platforms.
- A participant sees the most potential in the blockchain concept relating to IP/monetization.
- We have to look into creating a platform "*...where licensees and licensors are, so to speak, verified."* This could ensure that the content on the platform respects copyrights and would in part solve a trust issue - a decent, transparent, and clear copyright model will make the platform more attractive.

We currently are still in the middle of analyzing the discussion, results, and artefacts of JBC#2 and as such it is too early to share any further in-depth insights and impact other than those discussed above. The combined VPCs that were co-created during JBC#2 (see 7.5 Annex V: 4 combined VPCs on user type level) will help us validate and identify mismatches between our offerings and the needs of those specific user types. This will help us to further substantiate our value proposition, how we can create revenue with XReco, and to come closer to the 'sweet spot' of desirability, viability, and feasibility.

Key take-aways from the user survey results (see 7.6 Annex VI: JBC#2 user survey outcomes on XReco use) include that 80% of the respondents are interested in XReco for its capabilities in XR content management and efficiently organizing, uploading and searching for XR content, allowing quick access to quality 3D and XR content and mitigating legal concerns during content sourcing, meaning they would be interested in becoming a *Taker*.

73% of the participants that filled out the user survey were interested in being a *Transformer* by using XReco for advanced XR content creation techniques, such as NeRF. Only 40% would be willing to take on the *Giver* role by uploading visual material for others to access, so as to create new streams of income - with the sidenote that 46% of respondents are neutral about this, indicating a need for us to sharpen our value proposition for *Givers* and illustrate why the XReco platform, ecosystem, and all users would benefit from taking on this role. Finally, 73% of the respondents could imagine themselves in the *Creator* role, using XReco for an integrated workflow that allows effortless blending of 3D assets into projects.

These results indicate that, indeed, users are interested in taking on multiple roles and user types in parallel in XReco, showing the high added value of XReco through the interconnection of multiple value chains and XReco's power to solve multiple needs and wants of users within a single platform. Our goal is to further analyze these results and build stronger value propositions based on these.

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.

3.6   XReco value proposition & commercial strategy (component 4)

The components outlined in Section 3.2 Exploitation components have led to a significant amount of information and data that is fundamental in determining the XReco exploitation strategy and value proposition. The results over the past 18 months have led to a more in-depth understanding of the XR market, the needs of users, the pains they face in their work, what gains we could offer them, and ultimately how XReco can deliver added value to them. We are continuously in the process of updating and validating our value propositions based on our 3-cycle model (see Section 3.1 Methodology).
In the subsequent sections, the focus will be on the first results XReco collected for creating a validated and aligned value proposition, business- and monetization-models, and what the first Minimum Valuable Product (MVP) will be.

3.6.1   Value Propositions

To define and really understand our customers, including their jobs-to-be-done, pains, and gains, as well as our unique offer to them, XReco has been employing the Value Proposition Canvas and step-by-step guide supplied by Design a Better Business[37]. By creating, validating, and iterating multiple versions of the VPCs XReco has been able to better create outcomes that are tailored to the needs of our target clusters, users, and customers.
Over the past 18 months multiple VPCs have been created:
- During JBC#1 we co-created 4 VPCs for the media, mobility, and tourism sector, and one with overall insights, that helped lay the foundation for our current user types (see 7.4 Annex IV: Co-created VPC overview (3 JBC#1 breakout groups combined)).
- During our third consortium meeting we created 5 VPCs for our 5 current user types in which we focused on the services we could offer them, the gain creators XReco offers them, and how we could relieve their pains. These insights were adopted to tell our 5 user types a story of the benefits XReco offers them (e.g. during JBC#2).
- During JBC#2, in 5 breakout groups on the basis of our defined user types, we co-created 5 VPCs with stakeholders and potential users to focus on the jobs-to-be-done, pains, and gains these 5 user types have (see 7.5 Annex V: 4 combined VPCs on user type level from the third consortium meeting and JBC#2 results).

The comprehensive validation of XReco's value proposition, as depicted in the Value Proposition Canvasses for each user type, reveals a strong alignment between XReco's offerings and the articulated needs of potential users. This alignment is critical as it confirms that the services provided by XReco are not only desired but are also essential to fulfilling the specific jobs, gains, and pains identified by stakeholders during the Joint Business Clinic.

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[37] Design a Better Business (n.d.) Value Proposition Canvas. Retrieved from: https://www.designabetterbusiness.tools/tools/value-proposition-canvas (last visited on February 22, 2023)

3.6.1.1   Defining the target audiences

The first step in creating a value proposition is to understand our target audience. This means researching and identifying their needs, pain points, and desires. Through our iterative process and our JBCs we have realized that not only there are horizontal sectors (media, mobility, and tourism), but that these sectors consist of diverse vertical users that all have specific and intertwined needs that need to be addressed.

3.6.1.2   Identifying unique selling points

The next step was to analyze XReco and identify what sets it apart from the competition. What are the unique features, benefits, and values that XReco offers that others do not? During the JBCs it became clear that our rights- and monetization-system, ease to license and find license-holders, our search and tagging of (meta)data, tools for asset creation, optimized workflow, interoperability, ability to use only part of XReco, and potential for economies of scale where what resonated with potential users. These are the pains XReco addresses and are what sets us apart from other XR services. The following benefits and unique selling point are currently identified and will be included in the first XReco leaflet (see Section 4.3.2 XReco leaflet):

- **Data organization made simple:** XReco's Neural Media Descriptors streamline your data organization for efficient searching.
- **Transparent asset use:** Enjoy easy rights management without the need for extensive rights holder searches.
- **Intuitive creation:** XReco's tools simplify your creative process, enhancing content creation.
- **Flexible content sharing:** Share your creations effortlessly on or off the platform, enhancing accessibility for all users.
- **Effortless monetization:** With XReco, rights and monetization management is streamlined, freeing you from additional concerns.

3.6.1.3   Understanding customer benefits

Once we identified our unique selling points, we needed to determine how these will benefit the target audiences. What are the outcomes that the XReco target audience will experience because of using our product or service? These can be read within our user-type overviews in 7.2 Annex II: User types & personas.

3.6.1.4   Creating a clear and concise message

The next step was to craft value proposition statements that clearly communicate the unique selling points and benefits to the XReco target audience. These statements are to be concise, easy to understand, and memorable. For this we use *ad libs*. *Ad libs* are easy to read value statements and we've co-created many of them for each user type. For a selection made during, e.g., consortium meetings see 7.7 Annex VII: Ad libs, the current overall Ad lib for XReco as a whole read as follows:

> Our ***XR platform*** helps ***users within multiple XR-related value chains who want to share, create, monetize, transform, and manage 2D & 3D content*** by ***streamlining* content creation & management** and simplifying workflow unlike **existing partial XR solutions**.

3.6.1.5   Testing and refining

The final step is to test and refine the XReco value proposition. This means gathering feedback from target audiences, analyzing customer behavior, and continuously refining it to ensure it effectively

resonates with the target audience. This will be done Month 25 onward, for example, through our MVP testing, which can be read about in Section 3.6.3 The Minimum Viable Product (MVP).

3.6.2 Business- and monetization- models

Based on comments made during the XReco Informal Review in Graz on 21 June 2023, we turned our eyes to business- and monetization-models and the willingness to pay by potential XReco users. To do this we first had to further identify who our potential users are, which led to the 5 user types described above. We then took these 5 user types and started matching them with the schematic XReco overview shown above and the services XReco can offer. This led to a long list of business- and monetization-models selected from Business Model Navigator[38] that we mapped on the user types and their position within the XReco platform and ecosystem.

Figure 9: Selection of Business models from https://businessmodelnavigator.com/
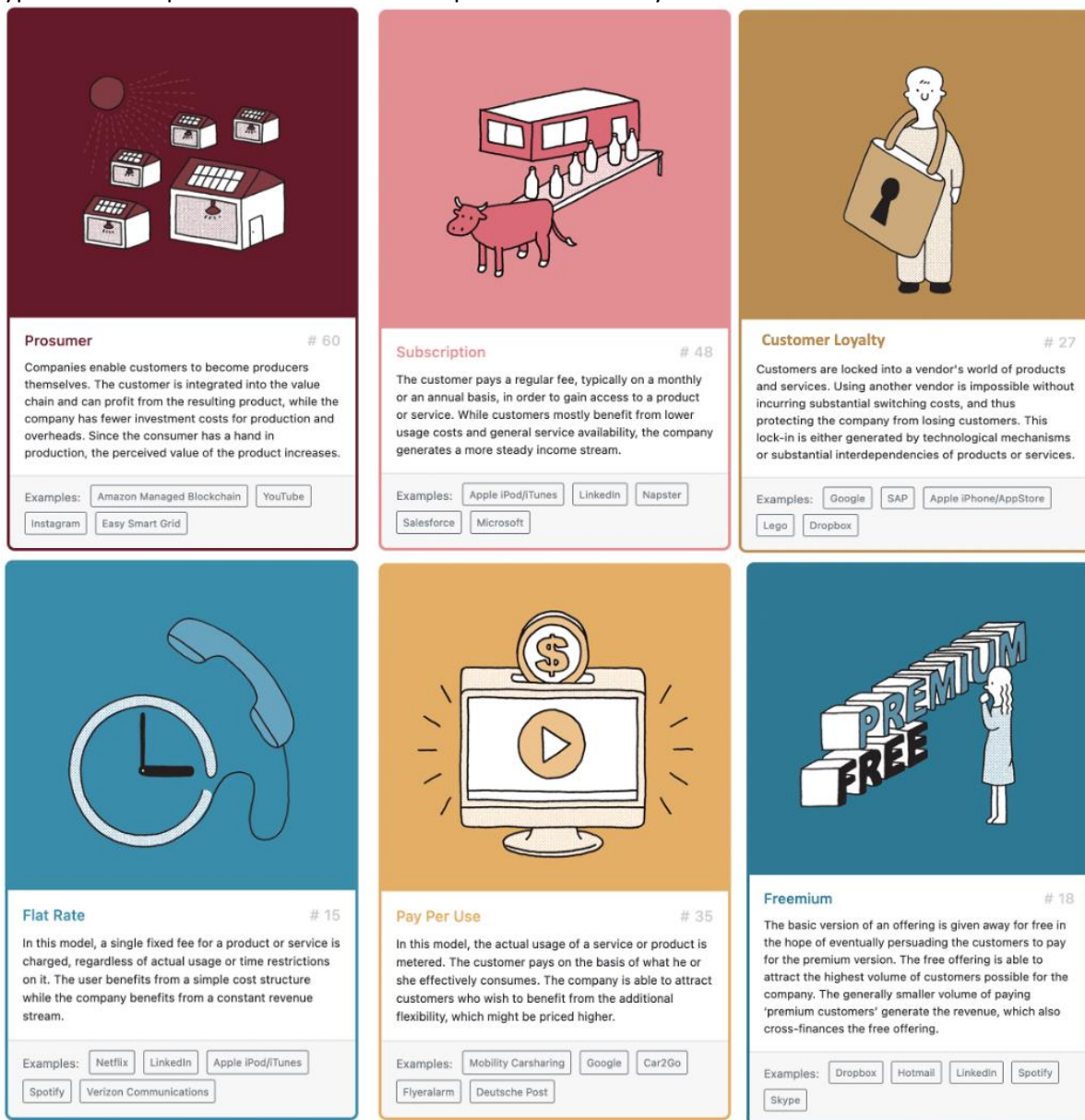
From this longlist we then selected the models that kept returning multiple times for each user type to create the shortlist seen in Figure 9: Selection of Business models from https://businessmodelnavigator.com/. This is the list we set out to (in)validate with potential users:

- **Prosumer**: Prosumer business models involve customers who both consume and produce goods or services. These customers may contribute content, ideas, or labor to a platform or community. Example organizations that employ prosumer models include Wikipedia, where users contribute and edit content, and Airbnb, where individuals rent out their properties to other users.

- **Subscription**: Subscription-based business models offer goods or services in exchange for recurring payments, often on a monthly or yearly basis. Customers have ongoing access as long as they maintain their subscriptions. Examples of organizations with subscription models include Netflix, which provides streaming video content, and Spotify, which offers music streaming.

- **Customer Loyalty**: Lock-in business models aim to make it difficult for customers to switch to competing products or services. They often create dependencies or barriers that keep customers loyal. An example is Adobe Creative Cloud, which offers software tools on a subscription basis and stores user work in a proprietary format, making it challenging to switch to alternatives.

- **Flat Rate**: Flat rate business models charge customers a fixed fee for unlimited access or usage of a product or service. This pricing structure is straightforward and can encourage increased use without incremental costs. An example is Amazon Prime, which offers free shipping and various other benefits for a fixed annual fee.

- **Pay Per Use**: Pay-per-use business models charge customers based on their actual consumption or usage of a product or service. Customers pay for what they use, which can be cost-effective for sporadic or variable needs. An example is ride-sharing services like Uber, where passengers pay for each ride based on distance and time.

- **Freemium:** Freemium is a business model that provides basic services or products for free to users, with the option to access enhanced or premium features at an additional cost. This approach is commonly employed in the digital industry, particularly in software, mobile applications, and online services. The goal is to attract a large user base by offering a functional free version while generating revenue from a subset of users who opt for the premium offerings. An example includes Spotify where user can pay for an uninterrupted add-free experience.

3.6.2.1   *Formulation of hypothesis and further validation*

We set out to gather information on our initial assumptions concerning the business- and monetization-models through user surveys and discussion during JBC#2. We wanted to see how, and in what order, the 5 models on our shortlist resonated with the JBC#2 participants. Across the 4 user types present at the JBC#2 (all except *Givers*) the following business models where most popular:

1. Freemium
2. Subscription
3. Pay Per Use

This is in line with what we expected, as they are low-cost business models for the user. Some context and feedback given per business model was:

- **Freemium**:
  - *"Pay for selected parts or services on the platform while we can invite our collaborators and client to access it for free without the fear of having to pay for a license."*
  - *"Having the possibility to try a service and then "grow" as you advance is very attractive to me."*
  - *"First try out free and then pay €20/month."*
- **Subscription**:
  - *"It is common and easily countable (€19,99)"*
  - *"If I like the output and will use it a lot I'm happy to pay for a subscription."*
  - *"XR technologies often require constant updates and improvements to keep up with technological advances and new functionality, a subscription model could be beneficial for both users and the continued development of the XReco. [I would be willing to pay] €25 p.m."*
- **Pay Per Use:**
  - *"Most of the time it will need to be writing of a project budget (single payment works for this), also getting in to subscriptions can be difficult for some companies."*
  - *"Maybe create an XR asset you need and not use it for more at a time."*

These insights underscore the significance of diverse pricing models for XReco. The freemium model is seen as enticing, allowing users to pay for specific services while extending free access to collaborators and clients, fostering a trial-and-growth experience without the concern of obligatory licensing fees. The subscription model is seen as a common and easily quantifiable option, with users expressing a willingness to pay monthly fees based on the perceived value of the service. Notably, this model is deemed beneficial for both users and the continuous development of XR technologies, which often require updates to stay technologically relevant. Meanwhile, the pay-per-use model is acknowledged as suitable for scenarios where project budgets or intermittent usage make subscription commitments challenging for some companies. Collectively, these insights highlight the importance of providing flexible and appealing pricing structures to cater to the varied needs of users.

Our current hypothesis is that *Searchers*, *Transformers*, *Creators*, and *Takers* **are most interested in XReco when it is based on a freemium or subscription model at a price point of €20-€25 a month**. We are currently setting up in-depth interviews with JBC#2 participants to validate this hypothesis and find additional potential users to interview through our newsletter and LinkedIn channel to validate this hypothesis within cycle 3 of user validation and exploitation. All in all, our first results on this topic are promising and show a potential need for multiple business- and monetization-models co-existing within XReco.

A hypothesis that still needs to be tested is the ways in which we need to entice *Givers* to join the platform and have others access their content. For these givers we are in the process of setting up 2 in-depth interviews, as mentioned above.

Furthermore, we will start with the first tentative calculations on platform costs, how this would be feasible, and the critical mass of users to sustain the platform at these costs at a price the users deem appropriate.

3.6.3   The Minimum Viable Product (MVP)

The Minimum Viable Product (MVP) is a product with the bare minimum, yet essential, features that provide value to customers. The first MVP experiment of XReco is focused on giving *Transformers* and *Takers* the tools to create assets from XReco's libraries and neural media repository, by having them test and experience the search, retrieval, XR services, and authoring tools. To facilitate this process the consortium will use the MVP canvas and method designed by Bram Kanstein.[39] The MVP Experiment Canvas is a practical framework that offers us a structured approach for designing and launching the XReco MVP to validate our exploitation options and business ideas.

Based on the current technical status of XReco and what we can demonstrate and validate in the coming months, the following MVP is to be tested and validated on business and exploitation level. The current WP6 MVP, described below, focusses on Transformers and Takers. For an overview of our MVP canvas see 7.8 Annex VIII: MVP Canvas. We will develop additional MVPs to be tested on a business and exploitation level before Month 30 focusing on the other user types and where needed on additional MVP testing for the same or multiple user types.

The MVP testing will help us gain insights on how *real* users experience XReco and if the pain relievers and gain creators we've identified through co-creation, and user validation hold true in real-world scenarios that have users willing to pay for them. The MVP experiment that will be tested and (in)validated in Month 25 onward of the project consists of the following elements and information:

3.6.3.1   Customer segment

The first XReco MVP testing will be focused on T*ransformers* and T*akers*:

- **Transformers**: Passionate about pushing the boundaries of XR content and relies on XReco's advanced transformation tools like NeRF to captivate their audience. They need user-friendly techniques for immersive XR content creation, aiming to captivate and engage their audience in innovative ways.
- **Takers**: Relies on XReco for simplified rights and monetization management. They seek quick access to quality 3D and XR content, appreciating the platform's efficient rights identification to save time and mitigate legal concerns during content sourcing.

3.6.3.2   Value proposition

In addition to our value proposition outlined at the start of this chapter we have multiple value propositions focused on our multiple user types:

- **Transformers**: XReco is developing a platform to help media, tourism, automotive users to enhance and modify content items and create 3D assets from images and videos.
- **Takers**: XReco is developing a platform to help media, tourism, automotive users to have easier access to 2D and 3D assets for XR experience creation.

3.6.3.3   Channels

The way in which we will reach our customer segments and deliver our value propositions to them is through consortium partners, our LinkedIn network, our newsletter, events we will be present at, and JBC participants.

3.6.3.4   Customer engagement

We will engage with users who've experienced our MVP, learn from them, and gather feedback through the MVP experiments themselves, like demo's, our third Joint Business Clinic, focus groups, and in-depth interviews.

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[39] Kanstein, B. (n.d.). The MVP Experiment Canvas. Retrieved from: https://themvpcanvas.com/ (last visited on February 22, 2023)

3.6.3.5   Riskiest assumptions

In the MVP experiment, we are setting out to test the following assumptions that can make or break XReco:

- XReco supplies users with cost efficient and streamlined creation of XR content.
- Rights and license information is managed with sufficient clarity.
- Professionals, without XR knowledge are able to use XReco to create XR content.
- Users are willing to pay for the XReco platform.

3.6.3.6   Experiment format

The experiment format we will use is that of user testing, followed up by an interview or post-experiment questionnaire.

3.6.3.7   Experiment scenario and workflow

The user testing will take the following format:

1. Live demonstration of XReco and what it can do.
2. User testing with outcome specified beforehand (e.g. Eiffel tower XR asset).
3. Have the user create the predefined asset without predefining the workflow tasks.

As we need to make sure the relevant content exists within XReco for the user testing the to-be-created asset is defined beforehand. This will make comparison between users and outcomes easier as well.

3.6.3.8   Metrics

During the user tests we will measure the following metrics:

- Effectiveness: successfully completed task.
- Efficiency: time spent generating expected outcome.
- Satisfaction: what do users feel? time, quality, process, etc.
- Viability: users are open to paying for XReco.
- Time difference: XReco vs current way of doing it.

3.6.3.9   Success criteria

The following criteria will indicate a successful MVP test based on which we can further substantiate our exploitation strategies and value propositions:

- 70% of users moderately or extremely positive.
- 50% users interested in XReco for XR asset creation instead of current way of working.
- 50% of user willing to pay for XReco services.

3.7   IP Management (component 5)

Before exploiting the results of an EU-funded collaborative project, it is essential to have a clear understanding of the potential inputs brought into the project by each participant and how these components of XReco are intertwined and work together. In order to identify, assess and report all project exploitable results we've created a component tracker (see 7.9 Annex IV: Component tracker / Component-Exploitation-Matrix) that shows all XReco attributes, the components that make up these attributes, the owners of these components, a description of the component, dependencies, and our current ideas concerning opportunities for exploitation of the component.
The component tracker is a living spreadsheet in the sense that it will be continuously validated and updated based on the latest opportunities and dependencies. The current version is to be validated in XReco's respective Work Package meetings in the coming months, in 1-on-1 talks with consortium partners, and during all consortium meetings to come. Based on the component tracker, we hope to further identify options for (joint) exploitation and the strategies we need to do so. We have

included our unvalidated, initial and preliminary ideas on opportunities for exploitation with the aim is to have validated opportunities for exploitation for each respective component by M36.

In the coming months an additional tab will be created in the component tracker in which we match, based on outcomes described in this deliverable and further analysis of JBC#2 results, the user needs, pains, and jobs-to-be-done with the identified components as to create an overview of what component is interesting to which user type. Substantiating our insights in how to reach these user types with service offerings and value propositions that match their wants and needs.

3.8   Results consolidation with Human-Centered approach (component 6)
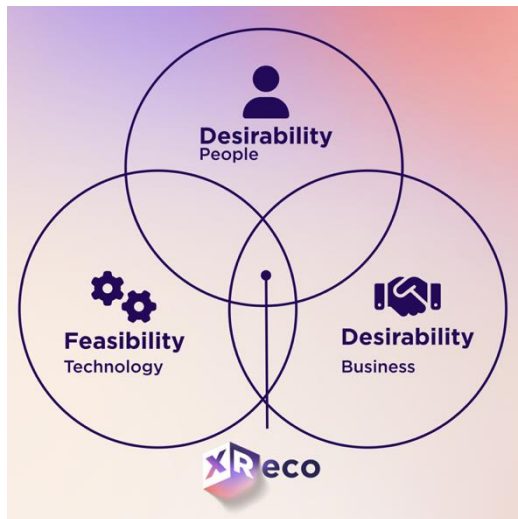
Figure 10: The 'sweet spot'

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 commercialization 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 10: 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?

XReco's methodology, as described in Section 3.1 Methodology, is a process of working with users to co-design solutions, rather than designing for them. This approach allows XReco to tap into the knowledge and creativity of our target segments and to create solutions and services that are more likely to be adopted and used. Our HCD method, already exemplified in the other 5 components, has provided an overview of the current available exploitation options for the XReco project with these first results in D6.2 and D6.3 will offer a comprehensive overview based on all results.

3.9   Capacity Building and workshops

The consortium's capacity-building strategy is strategically designed to address the need for enhanced digital skills across Europe. Central to this strategy is the objective of contributing to the uptake of digital skills through the provision of comprehensive training and courses aligned with the outcomes of XReco. By focusing on XReco outcomes, the consortium aims to equip individuals with the necessary expertise to navigate and excel in the evolving digital landscape. The consortium seeks to empower a diverse range of participants, including young researchers, students, and professionals, with future-ready skills. This emphasis on skill development not only fosters individual

growth but also bolsters European technological and data sovereignty by ensuring a proficient workforce capable of driving innovation and competitiveness on a global scale.

Moreover, the consortium is committed to fostering knowledge dissemination and accessibility through the creation of multiple e-learning modules. These modules serve as educational resources that showcase the future of extended reality (XR) content creation and underscore the pivotal role of XReco within this domain. The consortium endeavors to engage learners and cultivate a deeper understanding of XR technologies and their applications. Furthermore, recognizing the importance of practical guidance, the consortium is developing a series of tutorials tailored to assist users, content creators, and customers in effectively utilizing XReco authoring tools. Through these tutorials, individuals can harness the full potential of XReco, facilitating seamless integration into their workflows and promoting the widespread adoption of XR solutions across various industries.

YEAR 2 upskilling and co-creation activities	YEAR 3 upskilling and co-creation activities
Development	
Seminar – Search and Retrieval	Seminar – IP Rights and smart contracts
Seminar – FVV	Workshop – What can your organisation do with XR(eco)?
Workshop – Human-Centered Design	Workshop – Human-Centered Design
Workshop – Human-Centered Design	Co-creation – Joint Business Clinic 3
Co-creation – Joint Business Clinic 2	Co-creation – Focus group
Use of XReco	
Co-creation – Ambassador network first hands on	Tutorial – Authoring tool for media
	Tutorial – Authoring tool for tourism and mobility
	Tutorial – How to set up monetization with XReco

Figure 11: Capacity building framework

To guide our efforts, we have developed a framework (see Figure 11: Capacity building framework). In the framework we separate two dimensions. First of all, we distinguish whether our efforts concern general capacity development or specific skill development related to the use of XReco as a platform. The second dimension is a planning dimension: whether we plan to run the activity during year 2 of the project or during year 3. Using these two dimensions, we have created a 2x2 matrix, with 4 quadrants.

Figure 12: UPM/i2Cat Summer School in Madrid 2023

Figure 13: UPM/i2Cat Summer School attendants

Naturally, the efforts connected to use of XReco will be concentrated in Year 3 and will take the form of Tutorials (lower-right quadrant). In Year 2 we will focus on Workshops and Seminars related to general skill development in our field. (upper left quadrant), as well as setting up a community of

XReco Ambassadors (lower left quadrant). Finally, in the upper right quadrant we have planned a diverse set of activities, both Seminar/Workshop style and Co-creation events.

At present we can report that we have concluded 3 events:

- A Summer school organized by UPM and i2Cat in Madrid.
- A Human-Centered Design workshop for 15 participants at Stereopsia 2023 in Brussels
- A Human-Centered Design workshop for 50 participants at Immersive Tech Week 2023 in Rotterdam.

Figure 14: HCD workshop at Immersive Tech Week 2023   *Figure 15: HCD workshop at Stereopsia 2023*

3.10 Concluding remarks on exploitation

This section has given an overview of our first exploitation and capacity-building results for XReco. Our aim was to provide a clear and effective overview of the results and the process we followed in the past 12 months to achieve them. As always, our aim is maximizing the benefits of XReco for users, customers, and markets through Human-Centered Design. To achieve this, we have outlined six core components that are essential for identifying the appropriate value proposition(s) and exploitation strategies. As shown in this section these components help us position ourselves for future growth and success, by laying the foundation for successful exploitation and user validation. Over the past 12 months we've defined current needs of users, how to deliver benefits to customers and markets, started identifying ways in which individual exploitation and joint exploitation align, and what components - and in which manner - are essential for joint commercialization and monetization. Through XReco's methodology for user validation and exploitation - consisting of 3 consecutive 10-month cycles, with an additional 6-month period for results consolidation - we've laid the foundation for future market opportunities over the past 12 months. In the first and second cycle, and the accompanying Joint Business Clinics we've seen a growing demand for solutions that enable seamless and permissioned collaboration and interaction across different stakeholders, such as distributors and consumers.

In the first cycle (M0-M10) we've validated interest in the market for XReco and its services and if the problem we're solving with XReco is a problem that needs to be solved according to the market. Our analysis of the data here showed that it's not markets per se that are the focus of XReco. Within our 3 focus markets of media, mobility, and tourism we saw that the same type of users were active vertically. This led to the creation of new insights on user types focusing on their place within XReco in the second cycle (M11-M20), the ecosystem, and the XR landscape as a whole. These 5 user types have different, all important, roles and functions in the creation, transformation, sharing, licensing, and monetization of XReco outcomes. Their value chains are intertwined and interconnected in such

a way that it creates high added value for XReco and can lead to economies of scale from which we all benefit.

Furthermore, the insights on feasibility from the First Joint Business Clinic led to changes in the technical architecture of the project. While the assumption was that at least larger organizations would run a dedicated instance of the platform, the architecture had foreseen a service-oriented approach from the beginning. It turned out that this is likely to be an exceptional case, and the hosted model would be the default case. This is well supported by the original architecture, but it will require a more involved authentication approach to manage user groups from different organizations. It became clear that there is interest in using only specific XReco services, and to use them outside the XReco platform, but integrate them with other tools and workflow. Furthermore, there is interest in interoperability with the cultural heritage sector, for which connectors to cultural heritage data sources will be added.

The insights on user types and the accompanying value propositions led to the creation of personas and value proposition statements that placed certain users within certain aspects of the platform according to their specific needs and wants. These hypotheses where researched and validated in cycle 2 (M11-M20) during consortium meetings and the second Joint Business Clinic. Minimal adjustments were made based on this. Furthermore, we started our capacity-building track with multiple HCD workshops and a summer school. We are disseminating methodological and technical knowledge to the European network of XR professionals, academics, and students.

We are looking forward to the third cycle (M21-M30) and the 6-month results consolidation with a focus on contacting and contracting launching customers and strategic partners, the creation of a use and business case per potential launching customer, and the establishment of further strategic alliances and partnerships. In the coming cycle we will focus on researching, analyzing, and validating the willingness to pay by users and in what manner, doing MVP testing and validating our assumptions about the current challenges in the XR ecosystem for our users. The MVP will be designed to demonstrate the full potential of our solution and generate interest from potential customers and partners. All this will lead to insights on what business- and monetization-models should support the growth of XReco in combination with a (joint) exploitation plan.

In addition, the important next steps leading up to D6.3 will be:

- Latest insights on user types based on JBC#2 analysis will lead to updated VPCs for the 5 user types and the creation of 5 clear, concise, and updated value proposition statements to reach these users.
- The component tracker and exploitation opportunities will be continuously validated and updated, with user type-mapping on component level being added.
- Cycle 3 of XReco exploitation and user validation will see MVP- and user testing from Month 22 onward first focusing on the *Transformer* and *Taker* user types.
- We will set up meetings with policymakers to discuss the importance of XR and XReco for strengthening Europe's digital transition, skills uptake, and innovative qualities.

4   Dissemination and communication

Building on the solid groundwork established in our first report (D6.1), the XReco project has made thoughtful improvements and adjustments to its communication and dissemination strategy. We've sharpened our understanding of our target audiences, thanks to ongoing dialogue with our community and the insights from WP6. Additionally, we've established partnerships with other projects within the EU Horizon program, enhancing our strategy in a meaningful way. These collaborations have subtly extended our influence in the XR ecosystem. Our communication now more accurately reflects the interests and needs of our audience, ensuring our outreach is not just effective but also resonates more deeply with those we aim to engage.

Dissemination and Communication is used not only for general publicity of the project, but also for focused dissemination to target groups yet to be defined. An important component of these efforts is to develop a coherent narrative that provides a good and, above all, comprehensible basis for the explanation and communication strategy.
In the ongoing development of the XReco project, we've transitioned from metaphorical storytelling to a precise technical visualization that resonates with our stakeholders. The collaborative effort between WP6 and our technical partners has resulted in a simplified diagram that encapsulates the XReco ecosystem, effectively communicating the infrastructure and functionality of the platform. This visualization, created by the collective expertise within our consortium, highlights the various layers of the XReco platform, from content sharing to the authoring tools. It also indicates how the news media, tourism, and mobility sector are connected to the platform. It serves as a high-level guide to the project, bringing clarity to our ambitious objectives and the intricate web of our services.
As a communication tool, this lean representation has become essential, aligning our consortium's understanding, and already served at multiple opportunities.

4.1   The XReco dissemination & communication strategy

The XReco communication strategy has been marked by significant milestones, particularly the LinkedIn campaign's rapid achievement of its KPIs. Continual engagement efforts are underway across various platforms, steered by a Content Calendar expressly developed to orchestrate the consortium partners' content production and contributions. This calendar serves as a proactive tool, guiding the partners in creating and sharing timely content that reflects the unfolding narrative of XReco.
Complementing this, a monthly email initiative collects updates from all partners, documenting their event participations, publications, and independent communication efforts related to XReco. This approach not only fosters a cohesive communication effort but also ensures that all project-related activities are aligned and amplified.
Furthermore, strategic collaborations with other projects within the Horizon program have bolstered the project's visibility and awareness. These alliances are a testament to XReco's commitment to expanding its reach and impact within the extended reality domain. Managed through Trello, the strategy's success is regularly evaluated against the defined KPIs, maintaining a keen alignment with the project's goals and the audience's evolving interests.

4.1.1   XReco target audience

In advancing the XReco project, our engagement with the target audience has dynamically evolved. Initially, we had developed personas for the news media, tourism, and automotive industries to

guide our marketing strategies effectively. These personas were foundational in tailoring our communication to meet specific sector needs.

As the project progressed, insights from the Joint Business Clinics led us to broaden our audience targeting, introducing new user types alongside our initial personas. This expansion enriched our communication strategy, making it more inclusive and responsive to the changing landscape of our target industries.

With the Minimum Viable Product (MVP) on the horizon, we are now beginning to shift our communication focus towards this upcoming milestone. This transition marks a strategic emphasis on ensuring our messaging resonates with the new user types identified. By doing so, we aim to engage more directly with stakeholders who will benefit from the MVP.

This approach underscores our commitment to a flexible and evolving communication strategy, aimed at effectively engaging with a diverse and expanding audience, ensuring the XReco project's relevance and impact.

4.2   Specific objectives for communication tools (online and offline)

4.2.1   Online

The XReco project has successfully established and maintained a uniform presentation across all platforms. The branding, with its distinct logo and color scheme, has been fully integrated into all communication materials, ensuring a consistent and professional representation of the project.

The XReco website has become a cornerstone of our online presence, demonstrating strong performance in visitor numbers. It serves as a comprehensive hub, providing not just an overview of the project but also timely updates on recent activities and events. The site thoroughly details the project's key features, the innovative services, and the technical functions offered by our partners, becoming an invaluable resource for anyone interested in the project's scope and progress.

By emphasizing these elements and streamlining our online focus, XReco's web presence effectively supports our broader communication and dissemination goals.

4.2.1.1   *Navigating traffic differentiation: Distinguishing between internal and external engagement across channels*

Responding to feedback and inquiries regarding our ability to differentiate between traffic originating from consortium partners (internal) and that from external sources, we undertook a comprehensive evaluation across our communication channels. This analysis aimed not only to address the question of differentiation but also to refine our engagement strategies to optimize outreach and maximize impact efficiently. Further, our strategy aims to adjust the balance between internal and external traffic, making the presence of internal traffic proportionally minimal and thus less relevant for our overall engagement analysis.

Website traffic analysis

In direct response to concerns about traffic differentiation and in adherence to the GDPR's principles of data minimization and privacy by design (Articles 5 and 25), we have prioritized the privacy and data protection rights of our users. This approach has guided our decision to not track individuals by IP address to explicitly differentiate between internal and external website traffic, ensuring compliance with GDPR and demonstrating our commitment to ethical data handling.

Detailed analysis on X (formerly Twitter)

Our engagement analysis on X, where 30 of 122 followers are consortium partners (approximately 24.6% internal traffic), illustrates our commitment to adjusting our focus based on platform dynamics. This strategic realignment, driven by external developments, highlights our adaptability and dedication to optimizing platform engagement.
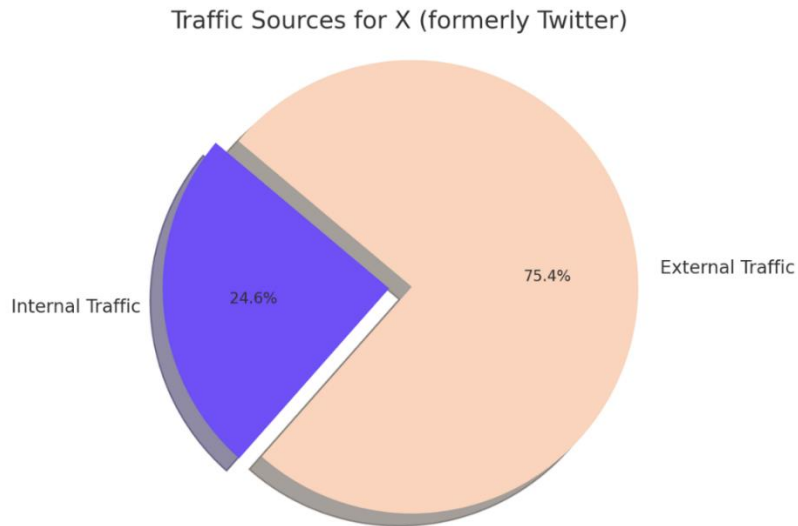
Figure 16: Traffic sources for X (formerly Twitter)

LinkedIn engagement metrics

The success of our strategy is exemplified on LinkedIn, where a significant majority of our followers are external, with only 68 of 398 being consortium partners (17.1% internal traffic). This outcome supports our goal to minimize the relevance of internal traffic through audience growth, affirming LinkedIn's role as a key channel for project dissemination.
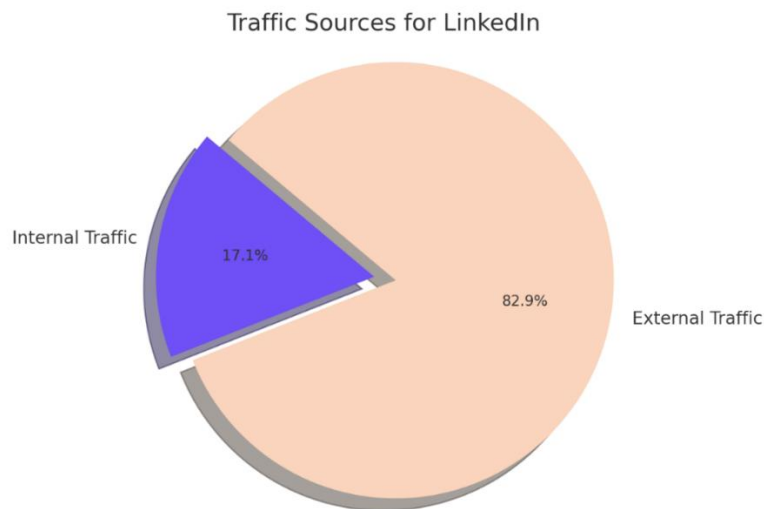
Figure 17: Traffic sources for LinkedIn

Newsletter Insights
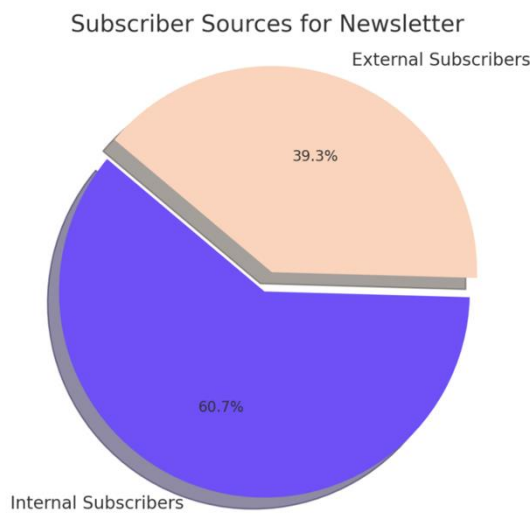
Figure 18: Subscriber sources for Newsletter

Addressing the composition of our newsletter subscribers, we acknowledge the current predominance of consortium members. With 91 of 150 subscribers being internal, the focus now shifts towards enhancing external engagement. The leaflet's distribution and reiterated invitations are strategic moves to attract a wider external audience, aiming to diversify and expand our newsletter's reach.

4.2.2   Offline

XReco's offline strategy, adapted to the project's current phase, prioritizes event participation. With the roll-up banner as the current primary promotional tool. The roll-up banner, shared across consortium partners, ensures consistent branding and effective communication at various industry events.

Events form the backbone of our offline efforts, facilitating networking and project showcase. Coordinated through a central event calendar, our consortium partners actively partake in and organize events, amplifying XReco's reach within the XR community. This strategic focus on event participation and selective use of promotional materials aligns with our goal of an impactful offline presence.

4.3   Online actions report

The following numbers represent a time frame from 01.01.2023 until 23.02.2024.

4.3.1   Website XReco.eu
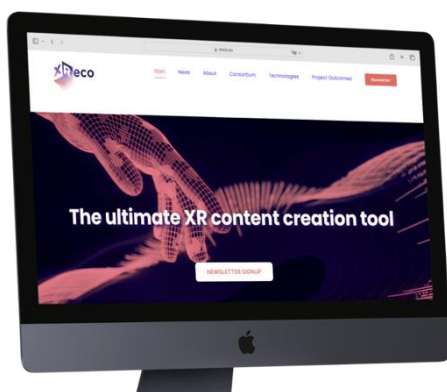
Figure 19: Landing page of XReco's website

Over the course of 2023, the XReco website has demonstrated substantial growth compared to its launch year. With pageviews exceeding 7,700, there has been an impressive increase from the previous year's 780. The overall number of visitors exceeds 2.500 (01.10.22-23.02.24), so that the KPI of reaching more than 800 by M12 was successfully reached. The average monthly session's duration successfully exceeded the KPI of 2 minutes per session multiple times. However, it ranges from 01:40 to 02:40.

Our bounce rate, now at 39.9%, has improved by 16.2% since the initial launch phase, signaling that users are finding the content more relevant and engaging. These metrics reflect the strategic improvements in content delivery and user experience on the website, resulting in heightened interest and interaction with the XReco project. See 7.10 Annex X: XReco website monthly dwell time.

4.3.2   Social media

4.3.2.1   LinkedIn

From January 10, 2023, to February 23, 2024, the XReco LinkedIn account showed significant progress. Page views hit 1,651, with 605 unique visitors, and the follower count reached 398, exceeding our initial KPI of 150. The platform proved crucial for engagement, with 65 custom button clicks, solidifying LinkedIn as a key channel for connecting with professionals and stakeholders in the XR ecosystem.

4.3.2.2   X (formerly Twitter)

On X, formerly known as Twitter, the XReco account achieved an important milestone with 122 followers, contributing to our goal of a strong online presence. Despite challenges in monitoring due to platform changes, our team's efforts ensured continued engagement and strategic content delivery, affirming X as a resilient communication channel for the project. Following the challenges encountered with Twitter after Elon Musk's takeover, we're redirecting our focus towards LinkedIn, which offers better performance and a more favorable environment for our project. While we'll maintain our Twitter presence, our efforts there will be minimal, prioritizing LinkedIn for effective outreach.

Figure 20: XReco's social media

4.3.2.3   Instagram

The XReco has demonstrated a commendable increase in engagement, with a number of followers of 106. This platform has enabled us to reach 336 accounts, suggesting a growing interest in our content, especially through reels. As the Instagram account was established voluntarily by the XRBB and not outlined in the proposal, it functions without specific KPIs, illustrating our commitment to organic growth and enhancing XReco's community involvement.

4.3.3   Newsletter

The XReco project has released two newsletters, with 150 subscribers so far. The timing aligns with the phase of substantial project developments, promising more informative newsletters ahead. The use of the XReco leaflet at events aims to significantly increase our subscriber base, complemented by reminders to partners to subscribe, addressing insights from our subscriber analysis.

Figure:21 Mockup showing XReco's second newsletter

4.4   Offline actions report

XReco's approach to offline engagement has been discerning and focused, with an emphasis on event participation to maximize visibility and impact within the extended reality sector.

4.4.1   Roll-up banner

Part of our offline promotional materials is the XReco roll-up banner (see Figure 17), which has been deliberately designed for simplicity and functionality. It features a QR code that currently directs to our website, providing an interactive element for deeper engagement. This banner's design file is shared with all consortium partners, enabling them to produce and utilize their own banners for local events. This decentralized approach ensures XReco's presence is both prominent and consistent at various industry events across different regions.

4.4.2   XReco Leaflet

The development of the XReco project leaflet represents a crucial milestone in the project's communication plan. This leaflet serves primarily as an invitation, designed to provide stakeholders with a comprehensive overview of the project's aims and innovations. It distills the project's complex information into an accessible and visually appealing format that resonates with the intended audience.
In line with our sustainable and efficient approach, the file for the leaflet is made available to partners, enabling them to locally produce the leaflet at their chosen print service providers. This method ensures a demand-driven production and distribution while minimizing the environmental impact of our dissemination activities.

Figure 22: XReco roll-up banner

The leaflet's distribution is set to cover 10 different events, with a goal of disseminating 800 copies. We are confident that this quantity will suffice to achieve significant reach, making the leaflet an effective tool for introducing and increasing awareness of the XReco project. A QR code on the backpage refers to our XReco linktr.ee, promoting all communication channels at once for readers to pick according to individual preferences.
Please refer to 7.11 Annex XI: XReco leaflet for a detailed view of the content and design.

4.4.3   Event participation

The XReco project has been dynamically disseminating its presence across the global stage, with consortium partners actively participating in more than 19 distinct events and more to come (see 7.12 Annex XII: XReco events table for a complete overview). In 2022, XReco had a pronounced presence, with partners delivering presentations at premier industry events such as Stereopsia and Immersive Tech Week.
In 2023, the momentum continued with significant contributions, including expert-led workshops at Stereopsia and Immersive Tech Week, where the Human-Centered Design approach was introduced to curious minds.

Figure 23: Human-Centered Design workshop at Immersive Tech Week 2023

Moreover, the consortium's commitment to building a strong professional network was evident through strategic participation at events like Laval Virtual and more, where partners engaged in meaningful dialogues, forming alliances that could propel the project to new heights. Noteworthy is the consortium's initiative in hosting its own events, such as a spring school in 2023 by UNIBAS, further extending the project's educational outreach and impact.

Each event was a chance to showcase the project's progress, exchange knowledge, and lay the groundwork for innovation. The collective efforts of the partners have not only amplified XReco's visibility within the industry but have also solidified its stance as a forward-thinking leader in its domain.

Figure 24: Presentation of the XReco project at the 3IT summit at Fraunhofer HHI in Berlin

Figure 25: Summer school at UNIBAS

4.5　Collaboration with other initiatives

As part of T6.4 Orchestration with other initiatives, DW and XRBB have established a collaboration with 1) the three sibling projects from the same call , 2) a number of XR-related initiatives, and 3) a group of individual experts, all of which have been or will be featured in a dedicated section in the XReco newsletter, based on a mutual agreement between the parties to promote each other in this and similar ways.

4.5.1　Sibling projects

As early as October 2022, month 2 of the XReco project, XReco have established a contact with the TRANSMIXR project, starting with individual talks, inviting each other to the projects' Advisory Boards and establishing a monthly video call where we share project outcomes and develop common communication strategies. Later, Max-R and EMIL XR joined these calls, contributing further ideas for collaboration and exchange.

All participants agreed to share each other's major news, such as, e.g., new publications, or invitations to XReco's Joint Business Clinics, user evaluation activities, etc., and to organise a common workshop where all four projects can share the outcomes of their first periods with each other. Beyond this online event in early March 2024, there will be a panel discussion at FMX - Film & Media Exchange, in Stuttgart, Germany, on 23 April 2024, where representatives of all four sibling projects will present the projects and discuss the future of XR in the media.[40]

Furthermore, partners from TRANSMIXR and XReco have started co-organising a so-called Special Session at the 21st International Conference on Content-based Multimedia Indexing, CBMI 2024 in Reykjavik, Iceland, on 18-20 September 2024, (https://cbmi2024.org/).

4.5.2　XR-related initiatives

Beyond the research and innovation community, XReco reached out to XR-related networks like
- Women in Immersive Tech,[41] "*an inclusive network of talented women who are driving Europe's virtual, augmented and mixed reality sectors*" with whom we agreed to organise a hackathon to test and evaluate the MVP before its launch to the public;

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[40] The programme will be published in due time at https://fmx.de/en/program/program.
[41] https://www.wiiteurope.org/

- The S+T+ARTS Initiative,[42] an initiative of the European Commission, launched under the Horizon 2020 research and innovation programme to support collaborations between artists, scientists, engineers and researchers, who actually reached out to XReco to join in common arts demonstrators using S+T+ARTS content with XReco technologies;
- XR4Europe,[43] has created an international network of XR experts with territorial clusters and organises the Stereopsia[44] event every year. XR4Europe's President and Head of IMPULSE Programme, Laetitia Bochud, and supports XReco's approach as part of the project's External Advisory Board.
- The TEMS project[45] – Trusted European Media Dataspace – "the flagship European initiative to build a resilient data-driven ecosystem in the media sector". With XReco partner FINCONS being a TEMS partner from the start, recently also Sound joined the initiative after TEMS reaching out to the coordinator, asking for support in developing appropriate business models for the XR sector. The responsible persons had participated in the second JBC and were impressed by the XReco approach, so that it was easily agreed that Sound would be the perfect partner to also support the TEMS project.

4.5.3   Individual Experts

Communicating with expert networks, in fact, means communicating with expert individuals. Building on a growing network of such experts, XReco invited a number of individuals to join the Expert Advisory Board (EAB) to support the project by sharing ideas but also by criticizing the project's approach and results wherever this might help avoiding pitfalls.

Table 4: Members of XReco's Expert Advisory Board

Name	Organisation	Field(s) of Expertise	Relevant WP(s)
Prof. Pablo Cesar (M)	Centrum Wiskunde & Informatica, CWI and TU Delft	Distributed and Interactive Systems; Human-Centered Multimedia Systems	WPs 2, 3, 4, 5
Lisa Maria Wurzinger (F)	GO! Pictures KG and GO!insideVR	Immersive Storytelling & Experiences; Immersive media Production; Business	WPs 3, 4, 5, 6
Alexandre Rouxel (M)	EBU	AI; Innovation; Broadcasting/Media	WPs 4, 5, 6
Laetitia Bochud (F)	XR4Europe	Immersive Technologies; Business	WPs 5, 6
Marloes Pomp (F)	Dutch DAO	Human Centric AI; Blockchain; Metaverse; Web 3.0; Digital Economy	WPs 3, 4, 5, 6
Laura Hirvi (F)	Meta	Immersive Technologies; Metaverse; Business	WPs 5, 6

As of now, the EAB members have not come together for a meeting with all members at once, but individual experts have provided invaluable feedback in individual talks at XR events and in dedicated individual video calls.

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[42] https://starts.eu/

[43] https://xr4europe.eu/

[44] https://www.stereopsia.com/

[45] https://tems-dataspace.eu/

4.6   Concluding remarks on dissemination & communication

As the XReco project progresses, we have refined our communication strategy to better reflect the changing dynamics of our target audience, alongside a more pronounced emphasis on AI due to its pivotal role in our technology stack and its significance in the current market. This strategic adjustment not only keeps us at the forefront of AI and XR developments but also ensures that our communications are highly relevant to our target groups through the project's journey.
The introduction of technical visualizations has significantly enhanced the clarity of the XReco ecosystem's representation, simplifying complex concepts for our audience. This shift has been crucial in making our objectives and infrastructure more comprehensible and engaging.
Digitally, the marked increase in website traffic and the effective use of a Content Calendar highlights the strength of our online strategy. These initiatives have been key in promoting a consistent and engaging narrative across the consortium, ensuring all partners are synchronized and the project's milestones, such as the upcoming Minimum Viable Product (MVP), are communicated effectively.
Offline, our strategic deployment of roll-up banners at industry events continues to bolster XReco's visibility, complementing our digital efforts with tangible, impactful presence in key industry gatherings.
In sum, our communication and dissemination efforts have dynamically adapted to the project's evolving requirements and the expanding understanding of our target audience. This approach ensures that XReco not only meets but is positioned to surpass the T6.1 KPIs. Moving forward, we remain committed to leveraging these refined strategies to effectively engage our community and showcase XReco's innovative contributions to the AI and XR domains.

5   Standardization

JRA, Rai and UPM are active partners in several standardisation bodies, primarily MPEG-related. Beyond these "traditional" contributions by technical partners to established standardisation bodies, XRBB presented XReco to Germany's man standards body, the DIN Institute,[46] and Visyon participated in a number of meetings of the Volumetric Format Association which claims to be "driving the development of volumetric video as the next revolution for content creation, editing 3D content, distribution of 3D content and creating entirely new ways to tell stories and communicate with each other." As the latter two activities have only started recently, their outcome will be elaborated in the final report.

The tables below focus on the contributions to Standardisation Bodies.

Table 5: XReco participation in standardisation-related meetings

DATE	STANDARDS BODY	STANDARDISATION PROJECT	EVENT (EG. MEETING)	ACTIVITY	PARTNER
2022-11	ISO/IEC JTC1 SC42	Artificial intelligence - Data quality for analytics and machine learning (ML) (ISO/IEC 5259)	CD ballot	Provided comments on pt. 2, data quality metrics	JRS
2022-12	VQEG	VQEG Immersive Media Group (IMG)	Meeting, input document	Co-chairing the IMG session, kick-off of the test plan for interactive test methods for subjective assessment of extended reality communications	UPM
2023-03	ISO/IEC JTC1 SC42	Artificial intelligence Reference architecture of knowledge engineering (ISO/IEC 5392)	DIS ballot	Provided comments on draft	JRS
2023-04	MPEG	Neural Network Compression (ISO/IEC 15938-17,-18)	Meeting, input document	Co-chairing break-out group, finalisation of draft of pt. 17 ed 2.	JRS
2023-04	MPEG	MPEG-AI	Meeting, input document	Input to tech report on MPEG-AI vision	JRS
2023-06	VQEG/ITU	VQEG Immersive Media Group (IMG)	Meeting, input document	Co-chairing the IMG session, continuation of the test plan for interactive test methods for subjective assessment of extended reality communications, creation of the ITU-T P.IXC (Q10/SG12) related to it	UPM

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[46] https://www.din.de/en

DATE	STANDARDS BODY	STANDARDISATION PROJECT	EVENT (EG. MEETING)	ACTIVITY	PARTNER
2023-07	MPEG	Neural Network Compression (ISO/IEC 15938-17,-18)	Meeting, input documents	Co-chairing break-out group, inputs to document on applications of NN compression and white paper	JRS
2023-07	MPEG	Neural Network Compression (ISO/IEC 15938-17,-18)	Meeting, input documents	Co-chairing break-out group, inputs to document on applications of NN compression and white paper	JRS
2023-07	MPEG	Neural Network Compression (ISO/IEC 15938-17,-18)	Meeting, input documents	Co-chairing break-out group, inputs to document on applications of NN compression and white paper	JRS
2023-07	MPEG	MPEG-AI	Meeting, input document	Input to tech report on MPEG-AI vision (vision statement and terminology)	JRS
2023-08	ISO/IEC JTC1 SC42	Artificial intelligence - Data quality for analytics and machine learning (ML) (ISO/IEC 5259)	DIS ballot	Provided comments on DIS of parts 1,2,4	JRS
2023-08	ISO/IEC JTC1 SC42	Transparency taxonomy of AI systems (ISO/IEC 12792)	CD ballot	Provided comments and proposed improved text and graphics	JRS
2023-10	MPEG	Neural Network Compression (ISO/IEC 15938-17,-18)	Meeting, input document	Co-chairing break-out group, inputs on comment resolution for conformance and reference SW (resulting in issueing of DIS ed. 2)	JRS
2023-10	MPEG	MPEG-AI	Meeting, input document	Input to tech report on MPEG-AI vision	JRS
2023-10	ISO/IEC JTC1 SC42	Artificial intelligence - Data quality for analytics and machine learning (ML) (ISO/IEC 5259)	Meeting	Participation in comment resolution for pt. 2	JRS
2023-10	ISO/IEC JTC1 SC42	Human-AI teaming	Meeting	Participation in discussion on establishing new work item	JRS
2023-12	VQEG/ITU	VQEG Immersive Media Group (IMG)	Meeting, input document	Co-chairing the IMG session, report on the progress of the test plan for interactive test methods for subjective assessment of extended reality communications (collaboration with ITU-T P.IXC Q10/SG12)	UPM

DATE	STANDARDS BODY	STANDARDISATION PROJECT	EVENT (EG. MEETING)	ACTIVITY	PARTNER
2024-01	ISO/IEC JTC1 SC42	Comments on ISO/IEC TS 12791 Treatment of unwanted bias in classification and regression machine learning tasks	DIS ballot	Provided comments	JRS

Table 6: XReco contributions to standards

DATE	STANDARDS BODY	REFERENCE (E.G. DOCUMENT NUMBER)	EVENT (EG. MEETING)	TITLE	PARTNER
2022-12	VQEG	VQEG_IMG_2022_229	Meeting document and presentation	IMG Work Plan	UPM
2023-04	ISO/IEC JTC1 SC29 WG5	A.S.I AG001.42 N0362	Comments (AT)	Comments on ISO DIS 5392 Reference architecture of knowledge engineering	JRS
2023-04	ISO/IEC JTC1 SC29 WG2	m62548	Meeting input	[NNC] Proposed DoC on ISO/IEC 15938-17 ed2	JRS
2023-04	ISO/IEC JTC1 SC29 WG2	m62510	Meeting input	[MPEG-AI] Input on NNC to MPEG-AI Technical Report	JRS
2023-06	VQEG/ ITU-T (Q10/SG12)	VQEG_IMG_2023_125	Meeting document and presentation	IMG Test plan on Immersive communication systems	UPM
2023-07	ISO/IEC JTC1 SC29 WG2	m64009	Meeting input	[MPEG-AI] Inputs to TR on vision and terms	JRS
2023-08	ISO/IEC JTC1 SC42 WG3	A.S.I AG001.42 N0425	Comments (AT)	Comments on ISO/IEC 12792 Transparency taxonomy of AI systems	JRS
2023-08	ISO/IEC JTC1 SC42 WG2	A.S.I AG001.42 N0432	Comments (AT)	Comments on ISO/IEC DIS 5259-1, -2, -4	JRS
2024-01	ISO/IEC JTC1 SC42 WG3	A.S.I AG001.42 N0487	Comments (AT)	Comments on ISO/IEC TS 12791 Treatment of unwanted bias in classification and regression machine learning tasks	JRS

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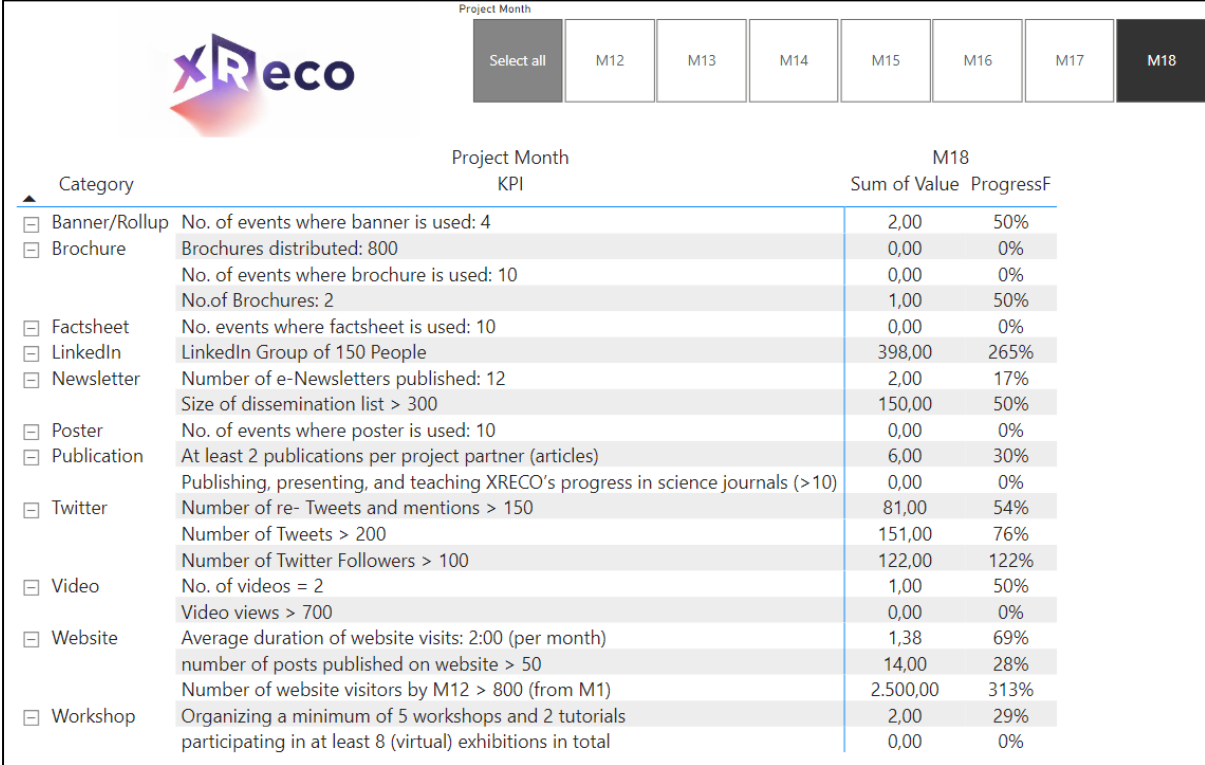
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7   Annex

7.1   Annex I: KPI Tracker WP6

7.1.1   KPI Tracking T6.1 - Table format

Category	KPI	Sum of Value	ProgressF
Banner/Rollup	No. of events where banner is used: 4	2,00	50%
Brochure	Brochures distributed: 800	0,00	0%
	No. of events where brochure is used: 10	0,00	0%
	No.of Brochures: 2	1,00	50%
Factsheet	No. events where factsheet is used: 10	0,00	0%
LinkedIn	LinkedIn Group of 150 People	398,00	265%
Newsletter	Number of e-Newsletters published: 12	2,00	17%
	Size of dissemination list > 300	150,00	50%
Poster	No. of events where poster is used: 10	0,00	0%
Publication	At least 2 publications per project partner (articles)	6,00	30%
	Publishing, presenting, and teaching XRECO's progress in science journals (>10)	0,00	0%
Twitter	Number of re- Tweets and mentions > 150	81,00	54%
	Number of Tweets > 200	151,00	76%
	Number of Twitter Followers > 100	122,00	122%
Video	No. of videos = 2	1,00	50%
	Video views > 700	0,00	0%
Website	Average duration of website visits: 2:00 (per month)	1,38	69%
	number of posts published on website > 50	14,00	28%
	Number of website visitors by M12 > 800 (from M1)	2.500,00	313%
Workshop	Organizing a minimum of 5 workshops and 2 tutorials	2,00	29%
	participating in at least 8 (virtual) exhibitions in total	0,00	0%

Figure 26: KPI Tracking T6.1 - Table format

7.1.2   KPI Tracking T6.1 - Visual format
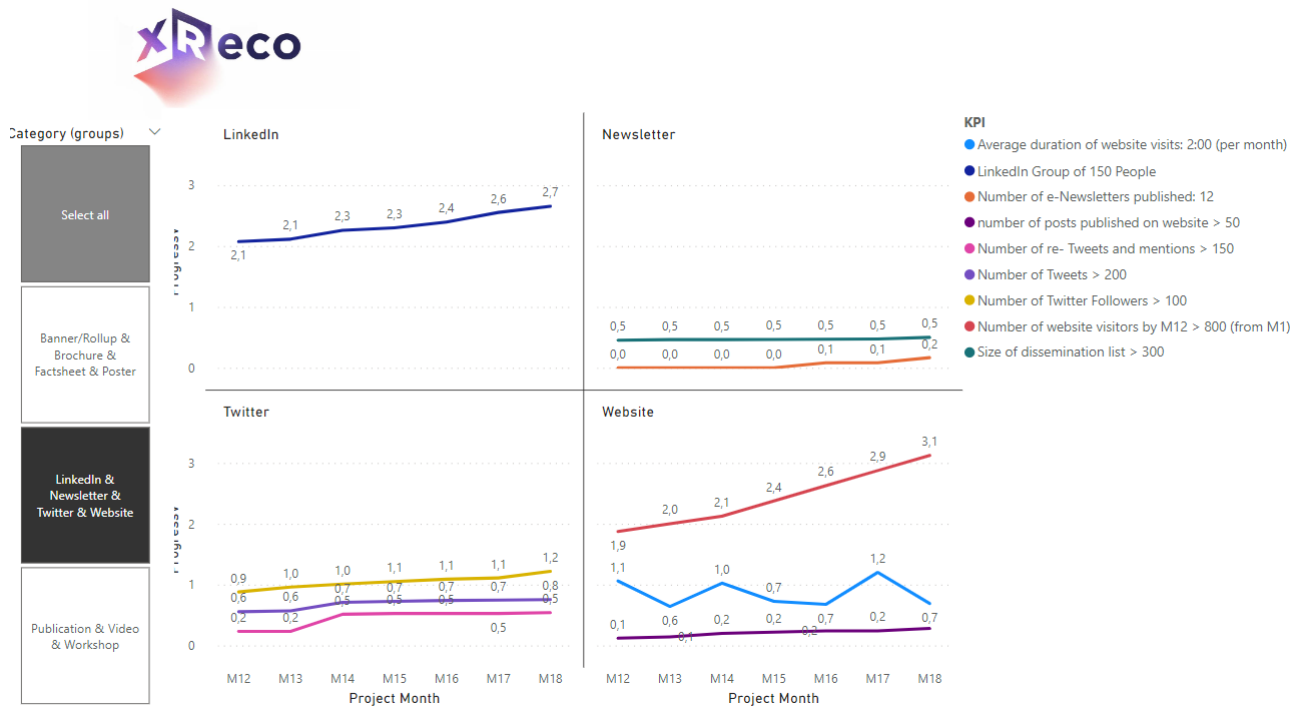
Figure 27: KPI Tracking T6.1 - visual format

7.1.3   KPI Tracking T6.2, T6.3 & T6.4

Task	Select all	T6.2	T6.3	T6.4

Task	KPI	Actual	Target	Progress
T6.2	Contact & contracts X lauching customers	0	3	0%
T6.2	Establishment of agreements and collaboration with external initiatives	1	2	50%
T6.2	Identify X launching customers	0	3	0%
T6.2	Joint Business Clincs >3	2	3	67%
T6.2	Offered free trial versions >3	0	3	0%
T6.2	Present XRECO at relevant international conferences like VRDays	2	10	20%
T6.2	Quarterly permanent market-screening >9 (from M12 onwards)	3	9	33%
T6.2	Reporting exploitation of intellectual property rights by M18 and M36	0	2	0%
T6.3	(Virtual) meetings, workshops and e-learning modules ≥5	3	5	60%
T6.3	Attending minimum of 2 networking events per partner (# of partners reached)	11	20	55%
T6.3	Blog (2x) on business methodology based on D6.1	1	2	50%
T6.3	Creating a vivid community of >200 companies and organisations across Europe	38	200	19%
T6.3	Meetings with policy makers >4	0	4	0%
T6.3	Trade show and conference proceedings >30	8	30	27%
T6.4	10 input documents to international standardisation activities	0	10	0%
T6.4	Contribution to standardisation of new media formats by M18 and M36 >3	0	3	0%
T6.4	Open source software license >1	0	1	0%
T6.4	Software licenses > 6	0	6	0%

Figure 28: KPI Tracking T6.2, T6.3 & T.64

7.1.4   KPI Tracking partner commitments

Partner	Sum of # Articles	Min 2 articles	Sum of # Events	Min 2 Events
Atos	0	No	0	No
CAR (Continental)	0	No	0	No
CERTH	0	No	1	No
DW	1	No	3	Yes
FFP	1	No	1	No
FINCONS	0	No	0	No
i2CAT	1	No	3	Yes
IP-RIGHTS	1	No	3	Yes
JRS	0	No	4	Yes
KUL	1	No	0	No
MOG	0	No	3	Yes
NVIDIA	0	No	0	No
RAI	0	No	2	Yes
Sound	2	Yes	6	Yes
UNIBAS	1	No	5	Yes
Unity 3D	0	No	1	No
UPM	0	No	2	Yes
Visyon	0	No	1	No
XRBB	6	Yes	7	Yes
ZAUBAR	0	No	5	Yes

Figure 29: KPI Tracking partner commitments

7.2   Annex II: User types & personas

7.2.1   User type: *Taker*

Figure 30: The Taker user type

7.2.2   User type: *Searcher*

Figure 31: The Searcher user type

7.2.3 User type: *Giver*

Figure 32: The Giver user type

7.2.4   User type: *Transformer*

Figure 33: the Transformer user type

7.2.5   User type: *Creator*

Figure 34: the Creator user type

7.3   Annex III: Individual Exploitation Plan overview

Table 7: Individual Exploitation Plan overview

PARTNER	Disruptive Technological Developments	XReco's Goals	Exploitation Focus	Relevant Highlights
i2CAT	- i2CAT considering impact of disruptive technological developments - Focus on volumetric video compression pipeline: quality, speed, and further development - Decision on standardization based on research results	- Development of new research lines on immersive technologies - Filing new patents - Generation of new use cases - Further knowledge about XR production market	- Licensing and spinoff as main points of general exploitation plan - Consideration of contribution to standardization - Focus on volumetric video compression pipeline	- Discussions with Qualcomm on challenges and potential collaborations - Periodic presentations/demos to potential customers - Preliminary patent study and copyright analysis for pipeline usage - 2-3 years timeline to bring use case to market - Project results contributing to new products, services, and future research - Continuing research lines and creating new ones - Identifying potential customers and partners for market exploitation - Protection of outcomes through patents and collaboration agreements

PARTNER	Disruptive Technological Developments	XReco's Goals	Exploitation Focus	Relevant Highlights
DW	- DW acknowledges the rapid development of NeRF and 3D reconstruction technologies. - They see it as an opportunity to track and utilize these advancements in their plans rather than a reason to change them.	- Archiving and easy retrieval of XR experiences. - Affordable and efficient creation of 3D assets and complete sceneries without programming skills. - Creation and distribution of interactive journalistic XR experiences to engage new generations.	- DW plans to use the XReco results to create new products and services, including virtual camera paths in 2D videos, images, and fully interactive XR experiences. - They intend to publish interactive XR experiences based on the market demand in different regions. - The use of XReco tools for virtual studio productions is not restricted by market considerations.	- DW will share results among their media production network, such as ARD and/or EBU, once the platform is functional and provides promotable results. - Their goal is to make documentaries more understandable and engaging for viewers through 2D videos with virtual camera paths and XR experiences. - DW will involve journalists and media producers to explore the potential and limitations of XReco outcomes as soon as the technologies are available. They anticipate continuous research and development in the field of 3D/VR production, driven by ethical, legal, and creative aspects. DW plans to share their gained knowledge and expertise with the external community and exploit outcomes and standardization works through various means, such as patents, collaboration agreements, and open source initiatives.
XRBB	- Prompting to 3D technology, which may impact XRBB's exploitation plans.	- Interest in a spinoff after the final stage of the project. - Targeting the XR market and cultural sector for exploitation. - Expanding network and enriching it through knowledge transfer. - Contributing to the future of XR technologies. - Strategic positioning and increasing awareness for VRBB. - Positive responses and demand for XReco services. - Sharing results and demonstrations with contacts. - Reusing project outcomes for new products/services and future research.	- Market focus on the XR industry and cultural institutions. - Emphasis on data sharing within the network for increased access to XR content. - Growing partnerships by exchanging knowledge and expertise.	- Positive responses and demand for XReco services from contacts. - Sharing knowledge and expertise through network and events. - Rights management system for enhanced data sharing. - Possible standardization results for XR productions. - Increasing visibility and growth for VRBB. - Leveraging individual results for maximum impact. - Reusing project outcomes for new products/services and future research.

PARTNER	Disruptive Technological Developments	XReco's Goals	Exploitation Focus	Relevant Highlights
CERTH (Unimodal / Crossmodal)	- Utilizing advanced Deep Neural Networks (DNNs) for 3D model retrieval and cross-modal content retrieval. - Novel query paradigms for expressing search criteria in conventional user interfaces or virtual reality. - Leveraging state-of-the-art techniques in 3D retrieval and cross-modal embedding.	- Develop novel retrieval methods based on deep learning for multi-modal content. - Produce novel research on popular fields such as multi-modal retrieval. - Strengthen CERTH's position in research and innovation.	- Targeting ICT companies and researchers specializing in computer vision, deep learning, and 3D modeling. - Offering user-friendly tools for individuals with limited programming skills. - Providing add-on options for existing software in the market. - Aim for scientific publications and sharing outcomes with the research community.	- Ownership of the 3D model retrieval service and cross-modal content retrieval service by CERTH. - Focus on research purposes, with permissive licenses for sharing and modification. - Exclusion from direct competition by offering add-on options. - Potential for future research and development using the developed methods and datasets. - Sharing knowledge and expertise through scientific publications and licensing outcomes.
CERTH (Volumetric Video / NERF)	- The advancements in NeRF and image-based 3D reconstruction technologies have enhanced CERTH's plans for exploitation. - These developments enable more accurate and realistic volumetric video creation, opening up new opportunities for immersive content experiences.	- CERTH aims to build on existing knowledge and expertise in 3D reconstruction and master novel image-based reconstruction technologies like NeRF. - They hope to stay relevant in research, acquire research grants, and commercialize the research technologies through the foundation of a spin-off company.	- CERTH's exploitation plan includes founding a spin-off company to focus on commercializing NeRF and volumetric video technologies. - Market focus includes film and entertainment, gaming, virtual reality, teleconferencing, advertising, tourism, and education. - IP protection measures, prospect approach, and timelines for going to the market are mentioned. - Non-commercial project results will be made available for future exploitation by project partners and stakeholders.	- CERTH's business model revolves around collaboration, grants, and knowledge transfer programs. - IP protection measures such as patent applications and copyright registrations will be undertaken. - Demonstrations, workshops, and research publications will be used to approach prospects and engage with industry partners. - The timelines for going to the market depend on technology maturity and ongoing research efforts. - Specific markets for exploitation include entertainment, advertising, education, and tourism. - Ideas for exploitation include commercial licensing, custom development, consulting and training, partnerships, collaborations, and seeking grants and funding.

PARTNER	Disruptive Technological Developments	XReco's Goals	Exploitation Focus	Relevant Highlights
NVIDIA	- The company is driving disruptive technologies in artificial intelligence and accelerated computing. - They have solid plans for transferring enabling technologies to the market, including NERF, UCF, Rivermax, and other suites for video and image broadcasting and editing. - Plans for exploitation may change if technology matures faster than expected.	- Develop new technologies enabling remote direct memory access (RDMA) and showcase the unified compute framework (UCF) platform. - Benefit the organization by strengthening its position in the market and learning the needs of large broadcasting enterprises. - No existing revenue scenarios mentioned.	- Market focus includes the filming industry, broadcast and media industry, content providers, marketing and advertising industry. - Integration of developments into existing libraries and solutions. - Prototype validation, integration, backtesting, and general availability. - Partnerships will develop through ad-hoc discussions. - Commercial value includes UCF development, co-integration with NERF solutions, and strengthening market position.	- IP protection is important as their software solutions are made available through open-source or soft licenses platforms. - A business developer engages with end users in the broadcasting and media industry to showcase and commercialize solutions. - They are already in the market with general solutions, incorporating their development work in new releases. - Communication and dissemination channels will be used to share knowledge and expertise with the external community. - Outcomes and standardization works will be integrated into existing software libraries. - Market outcomes will be protected through IP measures before open-source release.
Fincons	- The focus is on the exploration, development, and evaluation of key technologies, particularly Blockchain, for Rights Management within the XRECO project. - The latest developments around Blockchain are crucial and require careful consideration for exploitation plans.	- Develop Rights Management functionality based on Blockchain. - Gain specific know-how in Rights Management and related technologies like Blockchain and XR-specific technologies. - Strengthen position in the market by offering consultancy services and acquiring new contacts for collaboration.	- The target market for commercialization is media broadcasters and media companies. - The commercialization strategy involves direct relationships with customers through consultancy services. - IP protection measures will be considered for the prototypes developed during the project. - Timelines for going to the market are estimated within a 3-year range.	- Valuable project outcomes, beyond core components, will contribute to positive impacts in the research community and standardization organizations, benefiting society as a whole. - The Business Model Canvas highlights Rights Management functionality based on Blockchain. - Partnerships will be developed during and after the project, with potential for further research and development. - Future funding from national/regional sources, such as EU Horizon projects and research grants, is identified to support additional research and development initiatives. - The organization plans to share knowledge and expertise through social media posts and communication/dissemination events. - IP protection measures and collaboration agreements will be used to market the outcomes generated by XRECO.

PARTNER	Disruptive Technological Developments	XReco's Goals	Exploitation Focus	Relevant Highlights
KUL	- the knowledge produced will be protected by copyright. - the outcomes will be published under open access policies. - the knowledge gained will be shared via open access sources.	- Expectations include the development of Rights Management functionalities and gaining specific know-how in rights management, Blockchain, and XR-specific technologies. - Benefits for the organization involve offering consultancy services and strengthening their position in the market. - Existing scenarios for generating revenue with future XRECO solutions are not yet formalized.	-Market focus is on media broadcasters and media companies. - Commercialization strategy involves direct relationships with customers through consultancy services. - IP protection measures, including copyright, will be considered for the project's outcomes.	- Valuable project outcomes, beyond core components, will contribute to positive impacts in the research community and standardization organizations. - The outcomes will be reused by project partners or other stakeholders for the development of new products, services, and future research initiatives. - The knowledge gained and outcomes will be published in line with open access stipulations and shared with the external community. - The organization intends to use copyright as a means to protect the outcomes generated by XRECO.
Sound	- No change in plans for exploitation due to disruptive technologies. - Discussions about developments in generative AI, metaverse, and other tech developments.	- Develop a platform that can be jointly exploited. - Strengthen the organization's position in the market. - Provide consultancy services for customers and partners focusing on human-centered design (HCD) business development.	- Exploitation of XReco as a platform. - Validate and iterate XReco for better service offerings. - Develop HCD methodology for R&D centers in the EU. - Joint exploitation with partners, form to be defined.	- No specific IP protection measures mentioned. - Approach potential customers through organic contact and involving them in the development cycle. - Timelines for going to the market start from M30 onward. - Results from the project will strengthen the organization's current service offering. - Sharing knowledge and expertise through consultancy services and coaching student groups.
UNIBAS	- UNIBAS acknowledges the presence of disruptive technological developments. - These developments may have an impact on the exploitation of project results. - They need to consider the sustainability of technical results.	- UNIBAS aims to showcase their technical contributions through a demonstrator system. - the demonstrator will be used for PR events and tailored to the general public. - Visibility for the project is a key objective.	- UNIBAS plans to release all their results under an open-source license. - They aim to create a developer community beyond the project. - Scientific publications will be used for scholarly communication and Visibility in the Scientific community.	- UNIBAS will showcase technical contributions through a demonstrator system. - open-source release of results and creation of a developer community are emphasized. - Scientific publications will be used to communicate results and Gain visibility. - UNIBAS seeks Visibility for the project and its technical contributions. - sustainability of technical results is also a consideration.

PARTNER	Disruptive Technological Developments	XReco's Goals	Exploitation Focus	Relevant Highlights
MOG	- Disruptive technological developments have not changed MOG's plans for exploitation.	- With XReco, MOG hopes to achieve the creation of new cutting-edge products and services, increase R&D collaboration, gain relevant know-how in innovative technologies such as XR asset management and decentralised marketplaces. - Revenue generation opportunities include licensing the federated asset management for XR ecosystems, offering holoportation as a service, and exploiting the XR marketplace in B2B, C2B, and B2C scenarios. - The main markets targeted for exploitation are broadcasting, media production, VFX, and post-production. MOG will focus its promotion efforts on companies willing to incorporate innovations in their workflows.	- The exploitation focus is on targeting broadcasters, media groups, media production companies, and media integrators as potential customers for the XR marketplace and other XR-based solutions. - MOG plans to approach potential customers through direct contact, participation in sectorial trade fairs and networking events, and social and media campaigns. - They also plan to run pilots in well-known media clients to demonstrate the technology's potential.	- MOG expects an additional year of technical development before launching the product to the market. IP protection measures include using secret know-how and the design of the marketplace technology. - MOG expects to benefit from the inclusion of XR products in their portfolio, attracting new types of clients and consolidating their brand in the broadcasting and professional media production markets. - MOG plans to exploit XReco outcomes through decentralized marketplace licensing, collaboration with partners in EC concertation meetings, and integrating XReco know-how in future developments. - To turn ideas into actual opportunities, MOG will leverage existing client relationships, assess client interest, develop customized features, secure licensing deals, and promote the products based on reference cases.

PARTNER	Disruptive Technological Developments	XReco's Goals	Exploitation Focus	Relevant Highlights
JRS	- Recent developments in deep learning, such as more powerful vision-language models, may provide alternative technologies. - These developments do not change exploitation plans. - Tailored solutions that operate with customer-controlled data and environments are preferred. - Competition with large-scale models trained on datasets with unclear origin and legal status is a concern.	- Develop more effective content description methods for content understanding and search. - Research methods for assessing novelty and relevance of incoming content. - Benefit the organization by providing technology to existing customers in the media and mobility domains. - Attract new partners for future innovation projects. - Extend knowledge for future industry research projects.	- Media: Services for content understanding, description, search, and relevance assessment. - Licensing containerized services or building custom solutions for media organizations. - Relevance for media production, archiving, monitoring, and media monitoring. - Mobility: Integration of XReco results into solutions for traffic monitoring and infrastructure documentation.	- JRS aims to provide tailored solutions, considering customer needs and control over data and environments. - XReco results expected to be deployable within 12 months after the project's end. - Code of analysis algorithms made available as open source for further research. - Contributions to AI-related standards, particularly in multimedia and media industry applications. - XReco outcomes may be integrated into existing products/services, strengthening the organization's position in the market. - Knowledge and expertise shared through publications, presentations, and events. - IPR protection includes open source components and collaboration agreements.

PARTNER	Disruptive Technological Developments	XReco's Goals	Exploitation Focus	Relevant Highlights
IPR	- disruptive technological developments do not affect legal approaches and nature of legal services. - technological advancements have not changed the exploitation plans.	- XReco aims to enhance expertise in the intersection of XR/VR and copyright. - The project seeks to acquire knowledge about monetization of works as data for creating new media output. - Strengthening the organization's position in the legal market of copyright and new technologies. - Generating new assignments for legal support in the XR/VR and copyright field. - Exploring opportunities for future participation in EU-funded projects. - Provision of specialized legal support for XReco solutions.	- the individual exploitation plan targets the media sector and innovative tourism product developers. - the plan includes marketing legal specialization connected with XReco to the identified sectors.	- The individual plan does not include specific IP protection measures other than copyright protection. - The participation in the XReco consortium will be highlighted as experience and specialization in XR/VR&IP and AI&Copyright fields. - Legal research results are planned to be published in legal journals for scientific public dialogue and policymaker consideration. - The plan includes online advertisements through IPrightsGR, EU Commission funding website, and scientific publications for customer acquisition. - The organization expects to benefit from enhanced expertise, new products/services, strengthened market position, and potential partnerships. - The outcomes from XReco can be exploited directly in academia and indirectly through legal services. - The organization plans to share newly gained knowledge through scientific publications and blog posts for a broader audience.

PARTNER	Disruptive Technological Developments	XReco's Goals	Exploitation Focus	Relevant Highlights
RAI	- Adoption of immersive, ultra-high-definition, high dynamic range, and 360-degree content. - Integration of XR technologies, AI, and emerging delivery technologies like 5G. - Impact on traditional media usage, augmented and virtual reality, and new interactive use cases. - Creation of new applications and business models.	- Combine technologies like NeRF, image-based 3D reconstruction, and generative AI for content production. - Enable immersive content experiences for end users. - Provide novel solutions for media producers, editorial teams, and journalists. - Adapt to changing communication patterns and reach new audiences.	- Media industry, including broadcasters, news organizations, and journalists. - Tools and concepts for finding new audiences and communication patterns. - IP protection measures for prototypes, including patent application and copyright registration. - Demonstrations, workshops, and research publications to engage production centers and build credibility.	- Reuse of project outcomes for future exploitation, new products, and services. - Support for production centers' specific needs and non-skilled users. - Integration of virtual production solutions and technical support. - Potential revenue generation from sharing 2D content and selling 3D content. - Scalability of 3D content creation services and effective search and retrieval. - Automation of content monetization, transactions, and non-linear event plotting. - Improvement of business developments, collaboration, and new TV formats. - Sharing knowledge and expertise through international events and conferences. - Protection of outcomes through patents and collaboration agreements.

PARTNER	Disruptive Technological Developments	XReco's Goals	Exploitation Focus	Relevant Highlights
ATOS	Promising market identified: manufacturing companies seeking virtual reality applications.	- Provide tools to support commercialization strategy. - Benefit organization with new products/services and strengthen market position. - Potential revenue generation with future XRECO solutions.	- Two main assets being developed within XRECO: MetaSearch for 3D repositories and a virtual reality application integrated with car sensors and screens. - Minimum requirement of achieving TRL 7 and TRL 4 for considering developments as potential commercial assets. - Market focus on manufacturing companies within the product service line. - Roadmap for go-to-market strategy: agreement, mapping, development, integration, and new market-ready product. - No plans for filing patents at the moment. - Emphasizing the importance of leveraging individual results for maximum impact.	a- No specific non-commercial project results mentioned. - Organization expects enhanced business offerings from XRECO results. - Sharing of knowledge depends on the selected licensing scheme. - Standardization activities are not planned. - Marketing outcomes as commercial products.
UPM	-Disruptive technological developments have not changed the original exploitation plan. - Focus on extending the technologies portfolio UPM and Standardization activities. - Contributions to MPEG and VQEG.	- Upgrade, develop, and integrate technologies for new environments and markets. - Reach new users. - Strengthen research activities, copyright, and patent issues. -Contribute to standardization and dissemination.	- Markets for FVV Live: Immersive broadcast, video conference, cultural shows, digital content. - Markets for 3D reconstruction: Gaming industry, 3D design, cultural heritage, tourism, digital content. - No specific plans for exploitation outcomes yet.	- No IP protection measures taken yet. - Technologies showcased at various events. - Timelines for going to market: 3-5 years. - Research and development opportunities identified. - Expectation to extend UPM's technologies portfolio and commercialize XReco results. - Dissemination through scientific publications, standardization plan, website, social media, and videos. - Intention to use patents and collaboration agreements for marketing outcomes.

PARTNER	Disruptive Technological Developments	XReco's Goals	Exploitation Focus	Relevant Highlights
Visyon	- They are integrating generative systems using Disruptive technologies like Stable Diffusion for real use cases.	- Visyon collaborates with XReco partners to reinforce their efforts in innovation and development. - They provide their expertise in XR and have developed XRcapsule to enable users without XR knowledge to access XReco's assets.	- Visyon's market focus is on integrating new technologies, improving usability, and enhancing user experience for their clients. - They aim to create meta-tools like XRcapsule to share with customers. - Their commercialization strategy involves leveraging their track record of projects and supporting customers in adopting new technologies. - They have a fast time-to-market approach, innovating quickly.	- Visyon's market is diverse, catering to art exhibitions and clients like VW, Mercedes, Fiat, WSJ, Google, Adidas, and Red Bull. - They expect to create new products and applications of new technologies through networking and development with consortium partners. - XReco partnership offers opportunities for research, development of new products, and services. - They plan to share knowledge and expertise through conferences, showcasing use cases, and social networks. - IP protection strategy and specific commercialization plans are still being developed.
FFP		- Provide a new production pipeline for seamless content generation and higher fidelity experiences. - Enable the use of simple mobile cameras for venue scanning and reconstruction. - Create virtual broadcasters and personalities using NeRF-based human modeling and generative AI tools. - Revolutionize the search and retrieval process for visual and 3D assets using Neural Search and generative AI tools.	- FFP's primary market is advertising and broadcast, with a focus on leveraging the latest technologies. - The exploitation plan includes addressing pre-selected markets, such as broadcast, for joint exploitation. - Commercialization strategy involves creating a portfolio to showcase the technology, offering free tests, and adapting to rapidly changing business models.	- No IP protection measures have been undertaken recently. - Timelines for going to the market are very short, aiming for within 1 year. - Valuable non-commercial project results will be made available for future exploitation. - XReco's Business Model Canvas emphasizes individual partner exploitation for maximizing impact. - FFP expects to offer new visual services to clients using NeRFs, Neural Search, generative AI, and Virtual Humans. - FFP plans to exploit XReco outcomes through in-house testing, proof-of-concept productions, and free demos to clients. - FFP aims to implement and exploit results in commercial products such as NeRF-As-a-Service, multi-camera human capture and modeling, neural search as a service, and asset creation 3D/2D marketplace.

PARTNER	Disruptive Technological Developments	XReco's Goals	Exploitation Focus	Relevant Highlights
Zaubar		- Unlock unparalleled augmented reality experiences at physical locations. - Introduce novel AR services and build strategic partnerships. - Strengthen market position through XReco.	- Potential expansion into retail, tourism, real estate, and event management sectors. - Key partners include AR device manufacturers, content creators, software developers, and physical hosts. - Main activities revolve around AR software development, strategic partnerships, and customer acquisition and support. - Value proposition centered on unique AR solutions for physical locations, user-generated experiences, and interactive content. - Commercialization strategy includes IP protection, targeted marketing campaigns, partnerships, and product demonstrations.	- ZAUBAR's exploitation strategy involves partnering with AR device manufacturers, content creators, software developers, and physical hosts. - Their focus is on developing AR software, establishing strategic partnerships, and acquiring and supporting customers. - The value proposition revolves around providing unique AR experiences for physical locations, including user-generated and interactive content. - They plan to penetrate the market by Q4 of 2023 and protect their IP through patent applications and NDAs. - XReco aims to introduce novel AR services, expand into various sectors, and share findings with the wider community while safeguarding innovations through IP protection.

7.4   Annex IV: Co-created VPC overview (3 JBC#1 breakout groups combined)
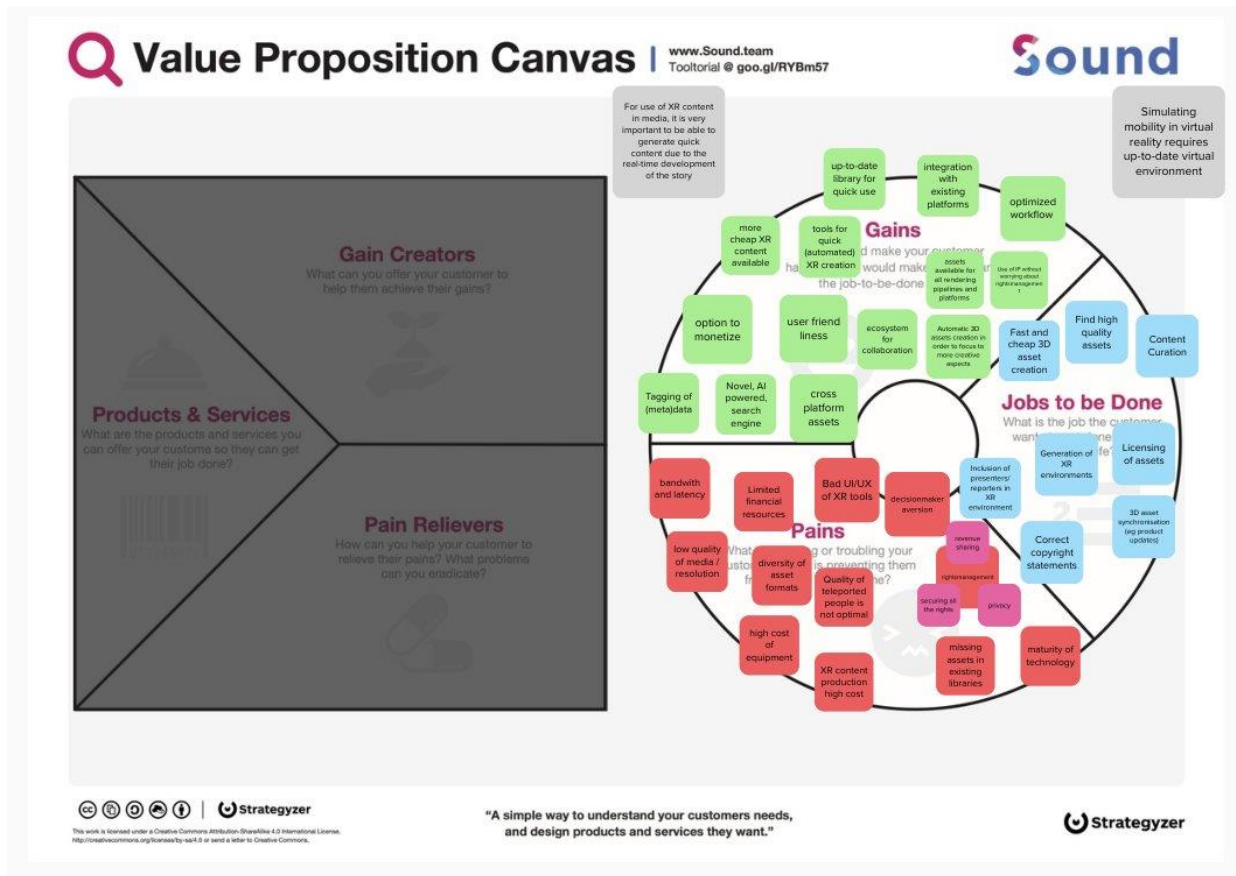
Figure 35: MVP Canvas (status February 2024)

7.5   Annex V: 4 combined VPCs on user type level

The combined VPCs that were co-created during JBC#2, the right side focusing on the jobs-to-be-done, pains, and gains of users, in combination with the left side of the VPCs filled out by the consortium on user type level during the third consortium meeting.

7.5.1   VPC: *Taker*
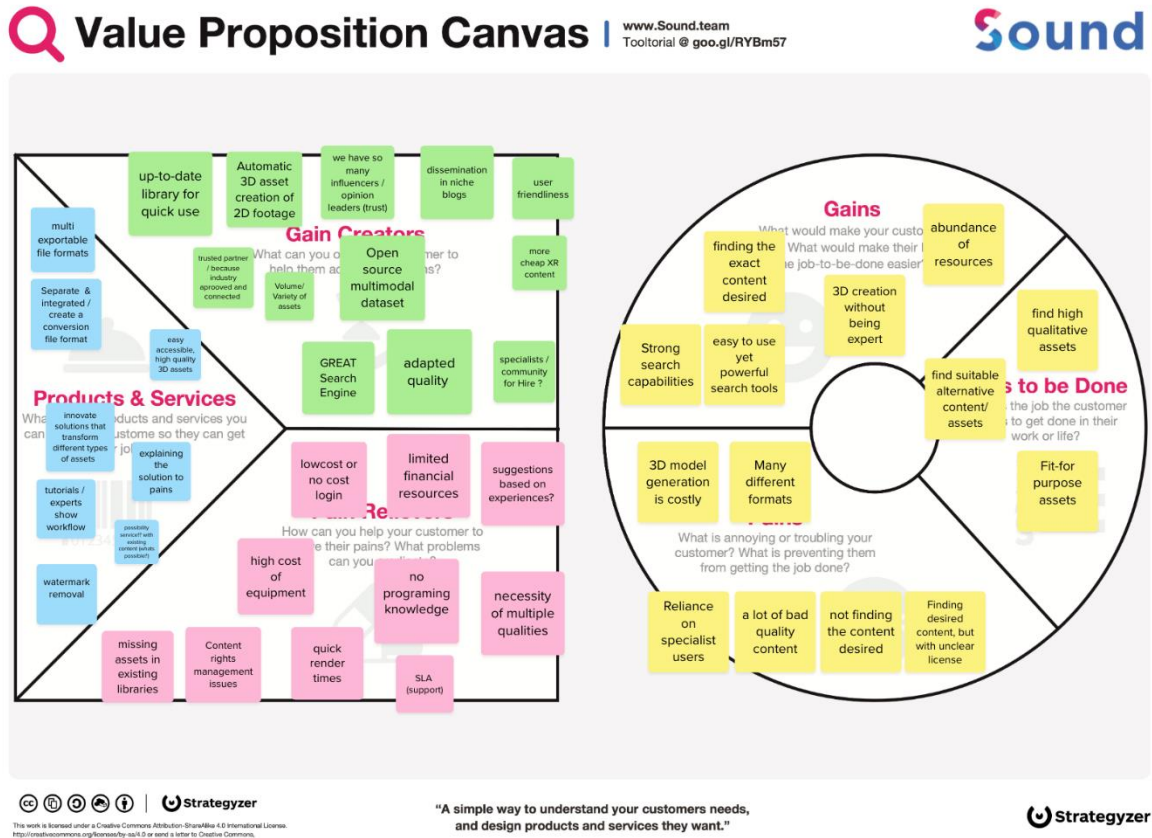
Figure 36: VPC Taker

7.5.2   VPC: *Searcher*
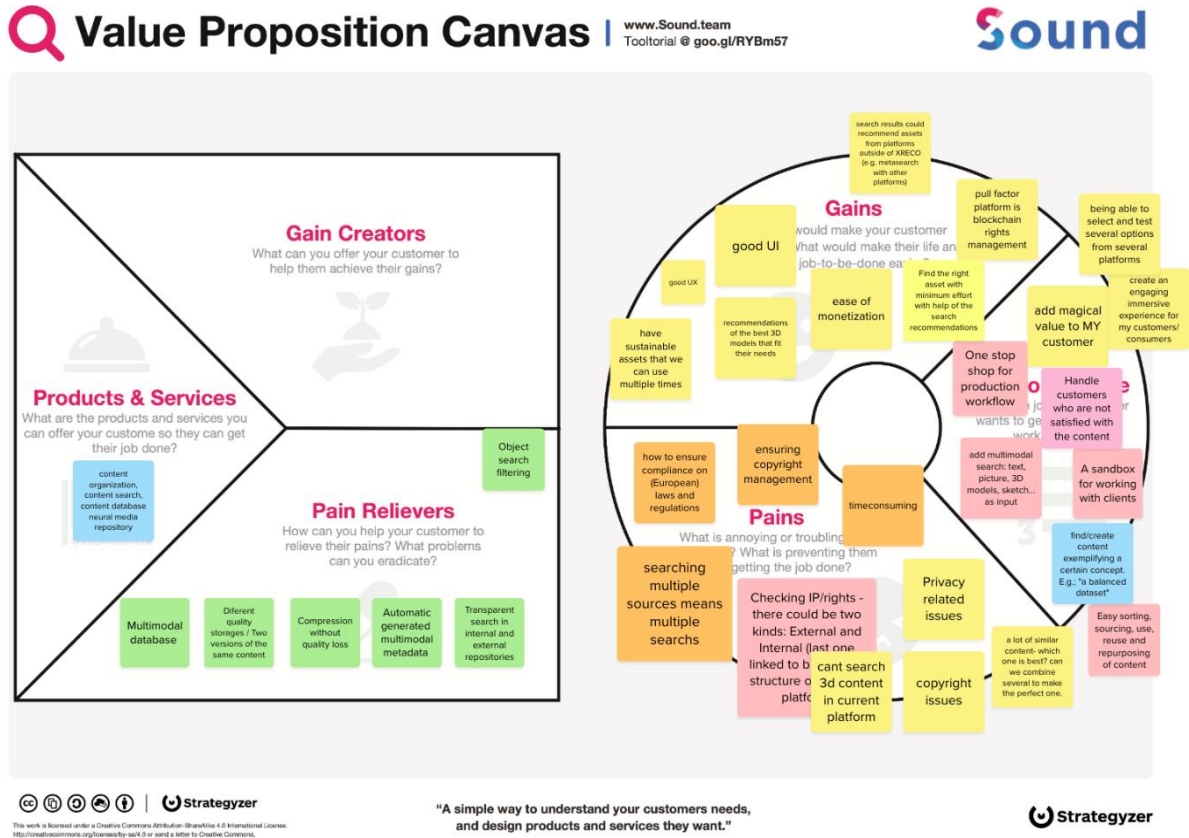
Figure 37: VPC Searcher

7.5.3   VPC: *Transformer*

Figure 38: VPC Transformer

7.5.4 VPC: *Creator*

Figure 39: VPC Creator

7.6   Annex VI: JBC#2 user survey outcomes on XReco use

7.6.1   Survey question *Searcher*
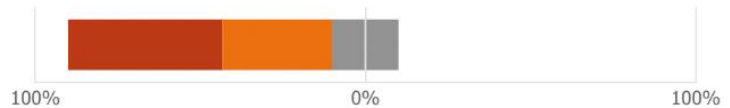
Figure 40: Survey question Searcher

7.6.2   Survey question Taker

Figure 41: Survey question Taker

7.6.3   Survey question Transformer

Figure 42: Survey question Transformer

7.6.4   Survey question *Giver*

8. I would use XReco to upload visual material for others to access, as to create new streams of income:

Meer details

■ Strongly agree   ■ Agree   ■ Neutral   ■ Disagree   ■ Strongly disagree
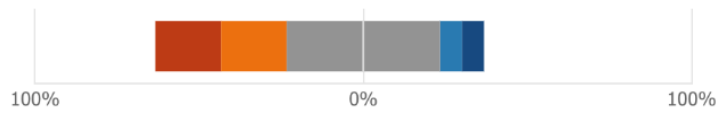
Figure 43: Survey question Giver

7.6.5   Survey question C*reator*

9. I would use XReco for an integrated workflow that allows effortless blending of 3D assets into projects:

Meer details

■ Strongly agree   ■ Agree   ■ Neutral   ■ Disagree   ■ Strongly disagree
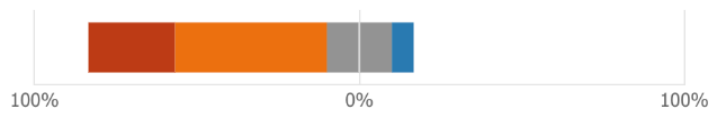
Figure 44: Survey question Creator

7.7   Annex VII: Ad libs

7.7.1   Ad lib: *Taker*

Figure 45: Ad lib Taker

7.7.2   Ad lib: *Searcher*

Figure 46: Ad lib Searcher

7.7.3   Ad lib: *Transformer*

Figure 47: Ad lib Transformer

7.7.4   Ad lib: *Creator*

Figure 48: Ad lib Creator

7.7.5   Ad lib: *Giver*

Figure 49: Ad lib Giver

7.8   Annex VIII: MVP Canvas
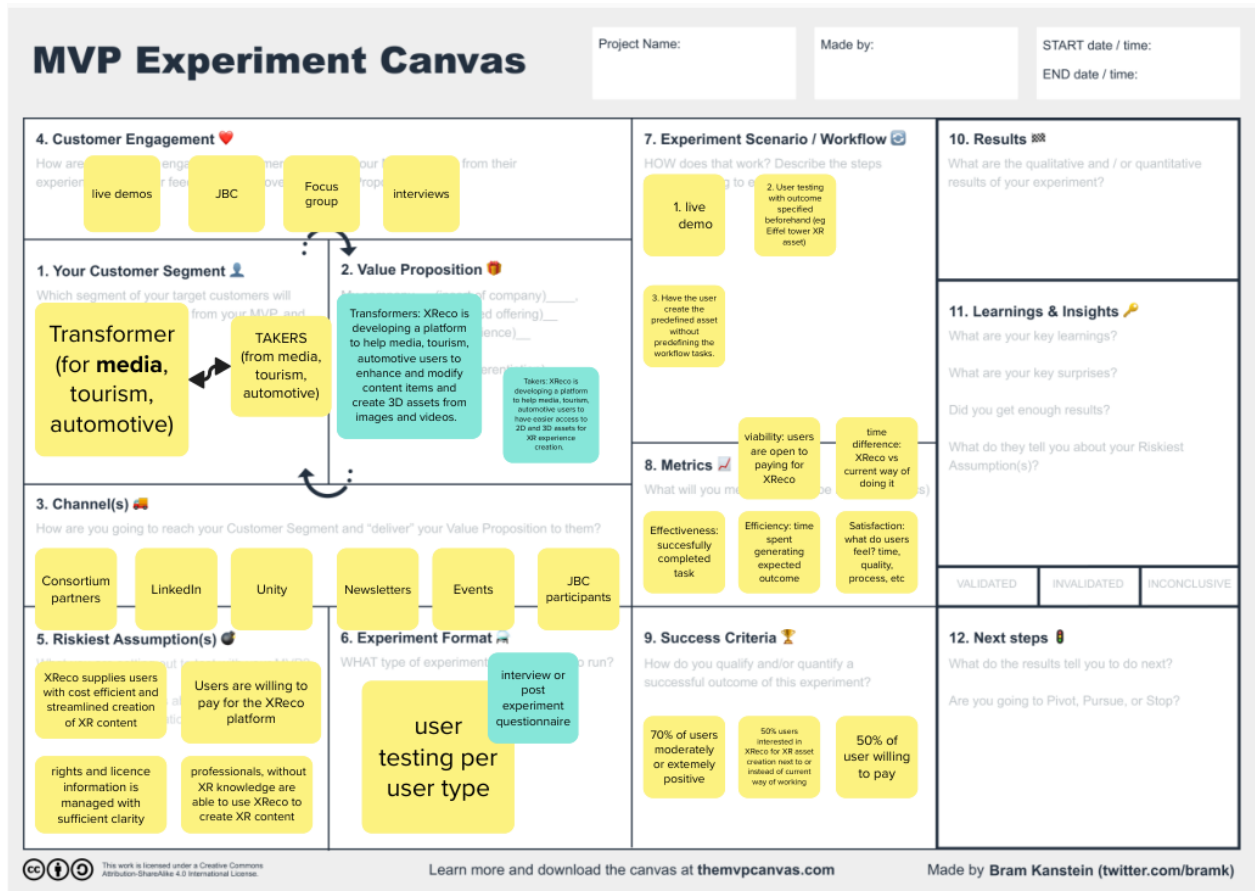
Figure 50: MVP canvas for Transformer & Taker user types

7.9   Annex IX: Component tracker / Component-Exploitation-Matrix

Table 8: XReco component tracker

Key feature	Attribute	Owner	Component	Description	Dependencies	Opportunities for exploitation
Multi Modal search & retrieval						
ATOS, JRS, CERTH, UNIBAS, MOG, FINCONS	*Data adapters*	ATOS, RAI	Connectors to DW Feed, RAI Archive, Wikimedia, Sketchfab	Inferface components to connect search to external data sources	none	Apply in the context of data spaces
	Neural cross-modal descriptors	JRS	Landmark classification	Classification of landmark images, trainable to new classes	none, optionally Metasearch for content mining	Automatic metadata creation in media archiving, content management in cultural heritage
		CERTH	Cross-model content descriptors	Descriptors for matching 2D and 3D assets	none	
		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	Service to be integrated into news gathering tools, monitoring of news feeds, etc.
	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
		ATOS	Metasearch	Component for federated content search and result integration/reranking	one or more connectors	
		MOG	Retrieval frontend	UI for content search and result management	vitrivr or Metasearch	
	Rights & monetization management	FINCONS	License definition and notarisation	Tools for defining content licenses and notarising them using a private blockchain		
		MOG	Marketplace	Front end for content purchase and offering	vitrivr for content search	

Key feature	Attribute	Owner	Component	Description	Dependencies	Opportunities for exploitation
3D Reconstruction Services						
CERTH, I2CAT, UPM	*Neural radiance Fields (NeRF)*	CERTH	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. Plugin for usually employed 3D engines (Unreal, Maya, etc)
		I2CAT	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)
	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	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
				engines), accounting for occlusions betweem the input data		
3D Optimization Services						
I2CAT, CERTH, RAI	*Point Cloud Super Resolution*	I2CAT	Super resolution for 2D encoded point-clouds	Algorithm for enhancing the resolution of 3D point-clouds encoded in PNCC format (Projected Normalized Coordinates Code)	None	Standalone service for content creation. Plugin for usually employed 3D engines (Unreal, Maya, etc)
	Neural Reconstruction in the wild	CERTH	Neuralangelo in-the-wild	Neural Signed Distance Function based reconstruction, able to reconstruct surfaces from real world data (accounting for occlusions and	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
				different appearance between the training samples)		
	Video based Super Resolution	RAI	Super resolution for standard RGB video sequences	Algorithm for enhancing the resolution of standard 2D RGB videos	None	Standalone service for content creation. Plugin for usually employed 3D engines (Unreal, Maya, etc)
Volumetric video services						
UPM, i2CAT	Holoportation	i2CAT	Horloportation	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,	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
				transmission, and reconstruction.		
	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						

Key feature	Attribute	Owner	Component	Description	Dependencies	Opportunities for exploitation
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			
		MOG	Orchestrator	Web-based tool for communicating with the Search and retrieval components and the services	Vitrivr, Metasearch, Content sourcing and filtering	Standalone web-service tool for searching the repositories, and using the services
	XR Capsules	Visyon				
Demonstrators						
	Mobile Tourist Experience	ZAUBAR	ZAUBAR's CMS	Software for uploading and placing (remotely and onsite) of contents (photos,		Web-Standalone-End-to-End-Solution for any 3D media to bring to its real world

Key feature	Attribute	Owner	Component	Description	Dependencies	Opportunities for exploitation
				videos, audio, 3D assets) in Augmented Reality		location, potential to add any API and serve as SDKs for popular 3D engines such as Unity
	In-cabin experience (self-driving cars)	CONTINENTAL	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	
	XR-based broadcasting productions	RAI				
		DW				

7.10 Annex X: XReco website monthly dwell time

Figure 51: Website statistic showing the monthly dwell time of December 2023
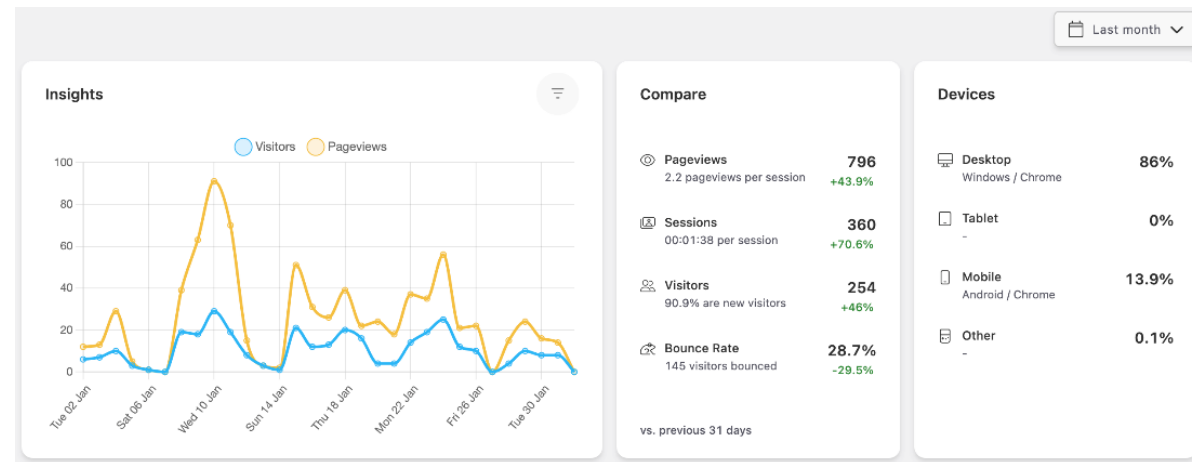
Figure 52: Website statistics showing the monthly dwell time of January 2024

7.11 Annex XI: XReco leaflet
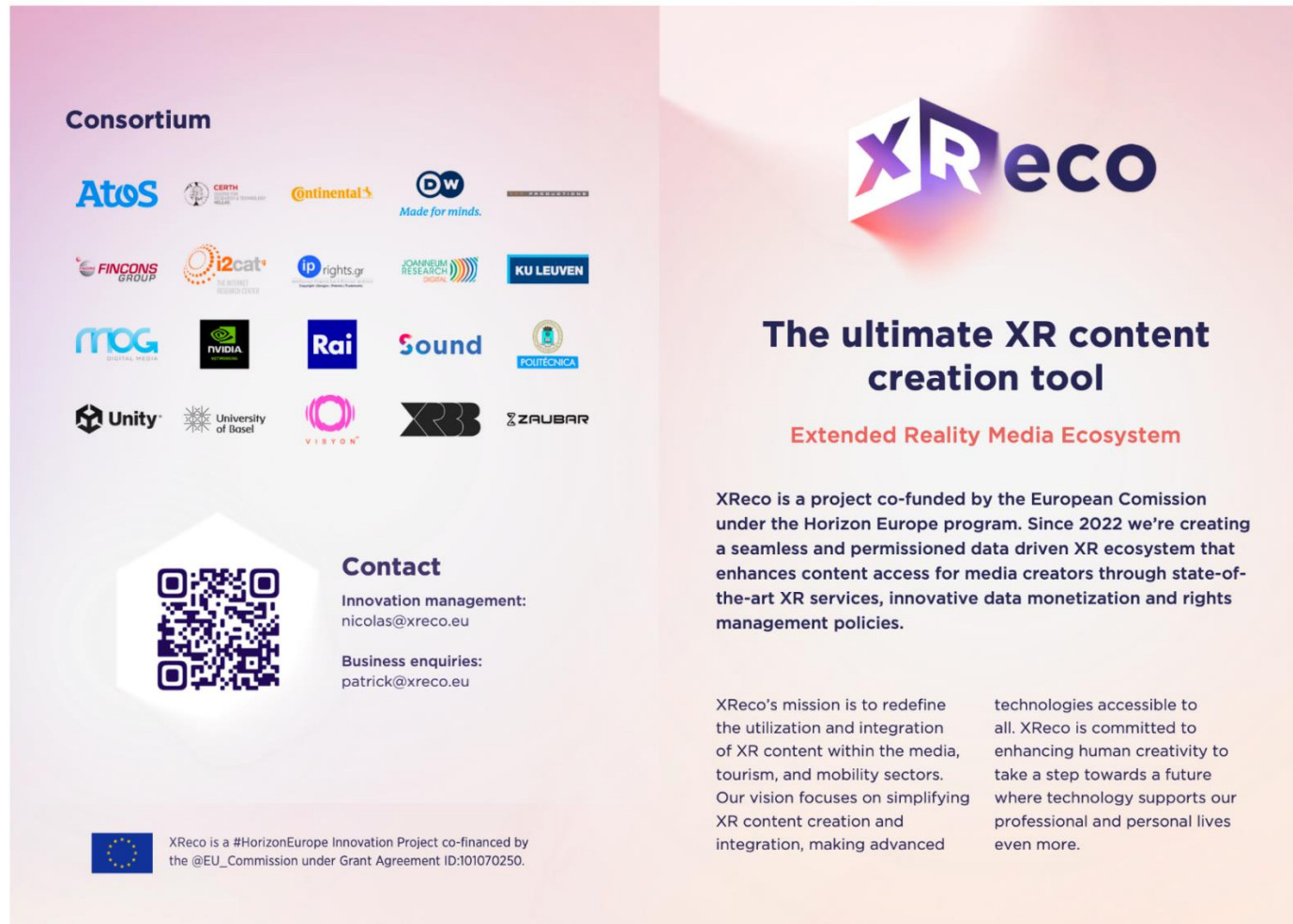
Figure 53: XReco leaflet page 1&2
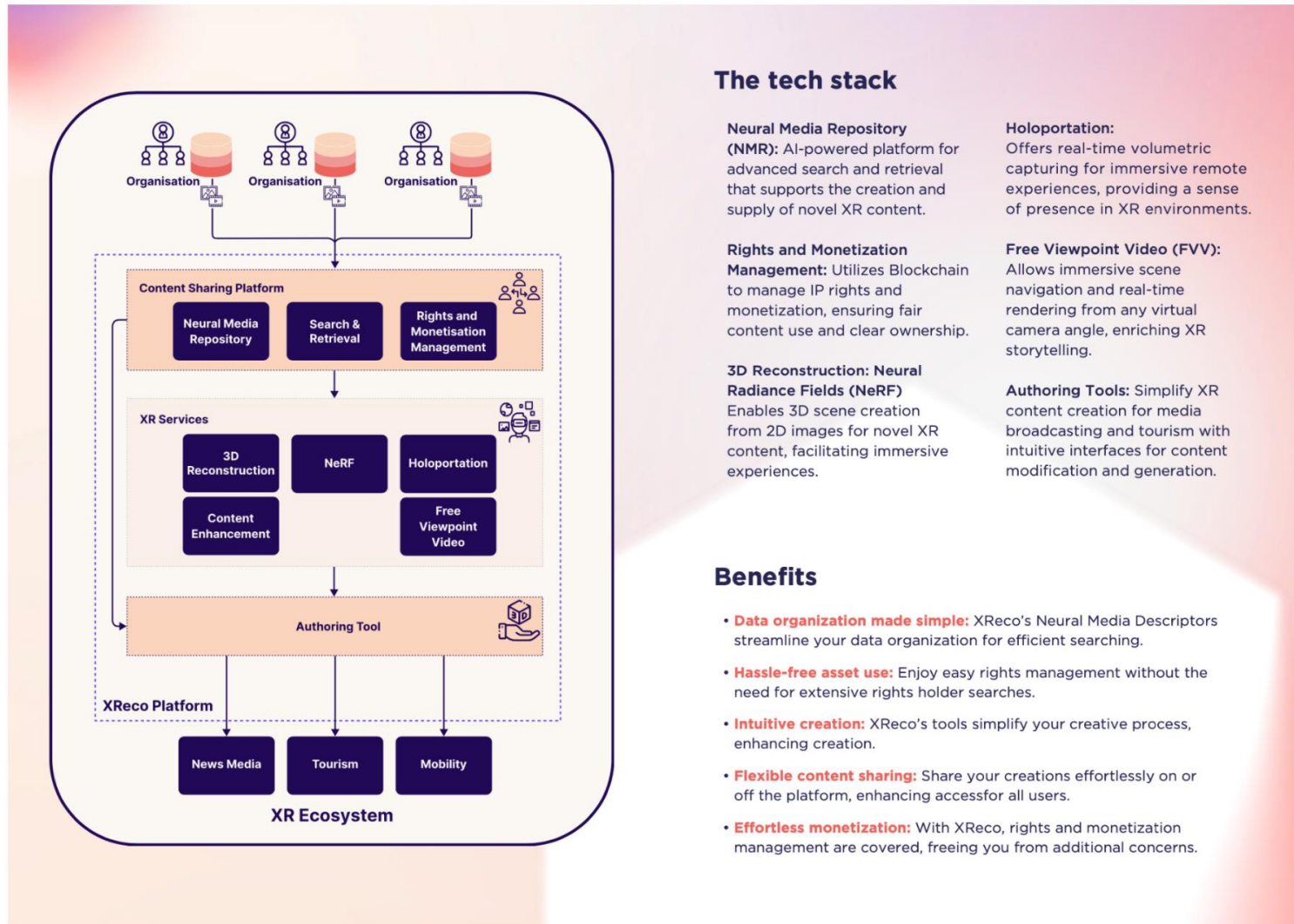
The tech stack

Neural Media Repository (NMR): AI-powered platform for advanced search and retrieval that supports the creation and supply of novel XR content.

Rights and Monetization Management: Utilizes Blockchain to manage IP rights and monetization, ensuring fair content use and clear ownership.

3D Reconstruction: Neural Radiance Fields (NeRF) Enables 3D scene creation from 2D images for novel XR content, facilitating immersive experiences.

Holoportation: Offers real-time volumetric capturing for immersive remote experiences, providing a sense of presence in XR environments.

Free Viewpoint Video (FVV): Allows immersive scene navigation and real-time rendering from any virtual camera angle, enriching XR storytelling.

Authoring Tools: Simplify XR content creation for media broadcasting and tourism with intuitive interfaces for content modification and generation.

Benefits

- **Data organization made simple:** XReco's Neural Media Descriptors streamline your data organization for efficient searching.
- **Hassle-free asset use:** Enjoy easy rights management without the need for extensive rights holder searches.
- **Intuitive creation:** XReco's tools simplify your creative process, enhancing creation.
- **Flexible content sharing:** Share your creations effortlessly on or off the platform, enhancing access for all users.
- **Effortless monetization:** With XReco, rights and monetization management are covered, freeing you from additional concerns.

Figure 54: XReco leaflet page 3&4

7.12 Annex XII: XReco events table

Table 9: XReco events table M1-M18

DATE	EVENT	PARTNER(S)	ACTIVITIES
2022/10/16-21	View Conference	Rai	Networking
2022/10/17-18	Stereopsia	DW, Sound, XRBB	Project presentation
2022/11/28-12/02	Immersive Tech Week	Sound, XRBB	Networking
2023/01/09-12	MMM - International Conference on Multimedia Modeling	JRS	Networking
2023/01/31-02/03	ISE (2023)	Visyon	Networking
2023/03/10-19	SXSW	Zaubar	Networking
2023/04/12-16	Laval Virtual	Sound, XRBB, Zaubar	Networking
2023/04/13-17	NAB	MOG	Networking
2023/04/17-21	Hannover Messe	Sound	Networking
2023/06/10	International Workshop on IMmersive Mixed and Virtual Environment Systems (MMVE)	UPM	Networking
2023/06/12-15	ICMR	JRS	Networking
2023/06/26	3IT Summit	XRBB	Networking
2023/08/30-08/09	Venice Biennale Immersive	XRBB	Networking
2023/09/04-08	EUSIPCO	UPM	Networking
2023/09/15-18	IBC	MOG, Rai	Networking
2023/09/26-27	AI & BIG DATA	I2Cat	Networking

Date	Event	Partner(s)	Activities
2023/09/27-28	Mediatech Hub Conference	XRBB	Networking
2023/10/17-18	Stereopsia	DW, Sound, Unity	Project presentation; Workshop on Human-Centererd design
2023/11/07-09	Smart City Convention	Zaubar	Networking
2023/11/13-16	Web Summit	Zaubar	
2023/11/16	Unite	i2Cat	Networking
2023/11/29-12/01	Immersive Tech Week	DW, Sound	Workshop on Human-Centererd design
2023/	Aveiro University Presentation	MOG	Presentation
2024/01/29-02/02	MMM - International Conference on Multimedia Modeling	JRS	Networking
2024/01/29-02/04	AI Week in the City of Science Katowice	JRS	Networking
2024/02/26-29	Mobile World Congress	Sound	Networking

Table 10: XReco events table already confirmed for after M18 (more to be added)

DATE	EVENT	PARTNER(S)	ACTIVITIES
2024/03/13	Ninth session of WIPO conversation "Training the machines…"	IPR	tbd
2024/04/10-12	Laval Virtual	Sound	tbd
2024/04/16-21	Athens Science festival	CERTH, IPR	tbd
2024/04/23	fmx	DW	Project presentation, Panel
2024/06/10-14	ICMR 2024	JRS	tbd
2024/06/12-14	ACM International Conference on Interactive Media Experiences (IMX)	JRS	tbd
2024/09/13-16	IBC	tbd	tbd
2024/12/9-11	Stereopsia	tbd	tbd
2024/12/04-06	Immersive Tech Week	tbd	tbd
2024	Guest Lecture on AI and copyright, MA in Art Law and Arts Management	IPR	Lecture
2025	MMM - International Conference on Multimedia Modeling	tbd	tbd