PRESENCE

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Executive summary

This deliverable provides a midterm update on PRESENCE's progress toward its impact goals, with a focus on market insights, exploitation readiness, communication strategy, and standardisation alignment. PRESENCE is committed to reshaping how people interact in virtual environments by enhancing the sense of presence across training, professional collaboration, cultural heritage experiences, and health. Through its three technological pillars of Haptics, Holoportation, and Intelligent Virtual Humans the project combines technical innovation with stakeholder co-creation to address real-world challenges in the XR ecosystem and the broader application domains.

The market and exploitation chapters document PRESENCE's shift from early planning to strategic positioning. A refined Decision-Making Unit now structures key user types, linking technology development to business relevance. The project has introduced its MVP Canvas and prototype canvasses to identify, test, and refine commercial hypotheses, especially around modular licensing and subscription models. Joint Business Clinic (JBC) #1 engaged 43 participants and generated validated insights into sector-specific value propositions. The updated Component Exploitation Matrix tracks technical maturity, IP ownership, and reuse potential. Looking ahead, the third cycle of Human-Centred Design (M20 to M30) will consolidate real-world validation through JBC#2, partner engagements, and early adopter feedback, preparing the groundwork for results consolidation with human-centred approach.

Our communication and dissemination activities have progressed from foundational setup to targeted engagement. The project's online presence has matured to becoming primary outreach tools to connect with business developers and user decision-makers. Capacity building efforts have exceeded expectations, with 14 workshops and training sessions involving over 530 participants. These sessions serve both awareness and exploitation goals. Offline visibility was reinforced through new factsheets, brochures, and participation in events. The strategic emphasis in the second half of the project will be on deepening engagement, streamlining content, and supporting adoption pathways through tailored materials and campaigns.

PRESENCE is also advancing its contributions to European standardisation. Partners are actively involved in working groups on haptics, light field formats, and AI standards. These efforts ensure alignment with emerging technical guidelines while extending PRESENCE's influence into shaping future regulatory and interoperability frameworks.

Together, these strands of work form a coherent strategy for transforming PRESENCE's research outputs into real-world pathways that extend the project's impact beyond its formal conclusion

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1. Introduction to D6.2

PRESENCE is a Horizon Europe project committed to reshaping human interaction in eXtended Reality (XR) through three core technological pillars: Holoportation, Haptics, and Intelligent Virtual Humans. Building on interdisciplinary research and partner-driven innovation, PRESENCE provides a modular toolkit of SDK's that allow developers, solution providers, and adopters to create emotionally rich, realistic, and immersive virtual experiences.

This second deliverable within Work Package 6 (WP6) Impact Maximisation presents the midterm update on PRESENCE's dissemination, communication, and exploitation efforts. Where D6.1 focused on planning and framework-building, D6.2 offers concrete progress, new strategic insights, and validated user-facing results across all impact dimensions.

While PRESENCE contributes meaningfully to the XR ecosystem, its ambitions go further. The project aims to transform key verticals through the targeted application of its technologies. In training, PRESENCE enables hands-on learning in low-risk virtual environments. In collaboration, it enhances remote interaction through spatial and emotional realism. In cultural heritage, it offers new ways to experience and preserve shared history. And in healthcare, it supports innovative interventions for stress, pain, and cognitive therapy. PRESENCE is not simply advancing XR, it is using XR to reshape how people learn, communicate, explore, and heal.

D6.2 is structured around four thematic chapters: Market Update, Exploitation, Dissemination and communication, and Standardization. Each section documents progress, outlines lessons learned and sets priorities for the second half of the project. Together, they provide a comprehensive picture of PRESENCE's growing maturity.

1.1. WP6 KPI Tracking

The main objective of 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. These objectives are managed in four different Tasks:

- T6.1 - Dissemination & Communication (M1-M36) [Lead:SOUND]
- T6.2 - Exploitation & Business planning (M1-M36) [Lead: SOUND]
- T6.3 - Communication, Community & Capacity-Building (M1-M36) [Lead: SOUND]
- T6.4 - Standardisation (M4-M36) [Lead: INTER]

In a Horizon Europe project, tracking Key Performance Indicators (KPIs) for the Exploitation, Dissemination, and Communication work package is essential. It ensures that project results and knowledge are effectively shared with stakeholders, thereby maximizing impact and visibility. Moreover, it provides a structured approach to evaluate the effectiveness of exploitation efforts, highlighting opportunities for improvement.

The benefits of robust KPI tracking in WP6 include:

- **Strategic Alignment**: Confirms that activities support the project's overarching goals and objectives.

- **Stakeholder Engagement**: Enables targeted outreach and fosters strategic partnerships.
- **Impact Assessment**: Delivers measurable insights into the societal, economic, and environmental value of the project.
- **Adaptability**: Supports timely adjustments to strategies in response to changing project dynamics or external conditions.
- **Resource Optimization**: Guides efficient resource allocation by identifying the most effective channels and actions, enhancing cost-efficiency.

Within the Presence-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 Annex I: KPI tracker):

- Due to the volume of KPIs, we have separated all the T6.1 Communication KPIs.
- 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 PRSENCE.

2. Market Update

This part provides an updated market analysis for the Extended Reality (XR) industry while distinguishing between the European XR market and the global XR market. It looks at recent market size and investment trends, sectoral adoption, user/consumer behaviour, and device and hardware developments (notably wearables and haptics) from 2024 onward.

2.1. Global XR market

2.1.1. Market size projections and recent performance

Globally, the XR industry reached an inflection point as it entered 2025. After several years of mixed performance, the worldwide XR market began to rebound in late 2024. According to the International Data Corporation (IDC), global shipments of AR/VR headsets grew by 10% in 2024, reversing a two-year decline This growth was driven by the launch of new devices from major players like Apple and Meta, as well as increased commercial demand and adoption in sectors such as education. Meta remained the dominant distributor at 74.6% marketshare, followed by Apple with 5.2% (IDC, 2025). IDC (2025) expects a compound annual growth of the XR sector 38.6% between 2025 and 2029[1].

In terms of market value, estimates (pre-dating 2024) pegged the global XR market at roughly €62–63 billion by 2025 (PRESENCE_D6.1). Longer-term outlooks remain bullish: one analysis anticipates the XR market could grow to around €160 billion globally by 2030 (PRESENCE_D6.1), reflecting compounded growth as technology matures. However, recent experience has introduced some caution into these projections.

The XR industry experienced a reality check during 2022–2023, as the initial “metaverse” hype subsided and several early consumer XR initiatives underperformed. This period was marked by a decline in global VR headset shipments over two consecutive years. However, 2024 marked a turning point, with the market showing renewed growth in shipments, signaling a potential rebound for the industry. This resurgence was likely driven by hardware advances and adjacent technology trends, such as AI, which have significantly enhanced XR’s value proposition (IDC, 2025; Fink, 2025).

2.1.2. Investment trends and shifts

Investment patterns worldwide reflect this tempered optimism. Over the past decade, billions have been poured into XR startups, content studios, and R&D (often under the banner of AR/VR and, more recently, “metaverse” development). However, a recent 2024 insider survey confirms a persistent sentiment that XR is still *underinvested* relative to its potential. 83% of industry insiders believe XR lacks sufficient funding and support (Perkins Coie LLP, 2024). Contributing factors include market immaturity, the long horizon to profitability for XR ventures, and competition for capital with emerging tech like artificial intelligence (AI). Indeed, there has been a notable shift in investment focus: funding that once chased VR/AR exclusivity or Web3 integration has partly pivoted toward incorporating AI in XR experiences. Only 18% of XR insiders in 2024 reported current investment in

[1] This is consistent with multiple report that all expect a compound annual growth of between 25 and 40 procent (GlobeNewswire, 2025; Grand View Research, n.d.; Mordor Intelligence, n.d.).

Web3/NFT/crypto aspects (a sharp drop from 54% a year prior), whereas 59% are now actively investing in AI-related XR projects (Perkins Coie LLP, 2024). This suggests that the industry sees more immediate value in AI (for content generation, intelligent avatars, computer vision, etc.) than in speculative metaverse economies. The concept of the "metaverse" itself has evolved; rather than a purely blockchain-based vision, it is now more commonly seen as synonymous with immersive XR technologies enriched by AI (Perkins Coie LLP, 2024). Despite recent economic headwinds, the outlook for XR investment is largely positive: 63% (59% slightly higher, and 4% significantly higher) of respondents expect overall XR spending to increase in the coming year (Perkins Coie LLP, 2024).

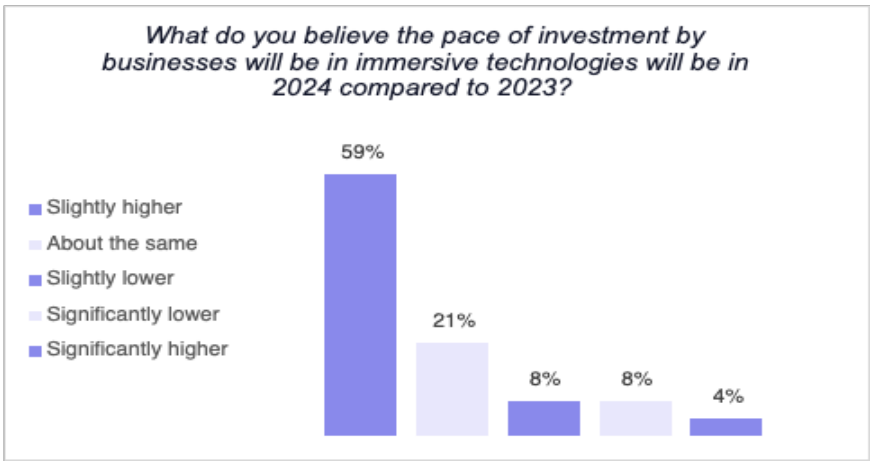


Figure 1: Expected change in business investment in immersive technologies, 2023–2024

Big tech companies (Apple, Meta, Microsoft, Google, ByteDance) are committing substantial resources to XR, and many smaller companies continue to raise capital for specialised XR solutions in enterprise, gaming, and media. Additionally, consulting firms like PwC highlight enormous economic potential unlocked by XR at scale, on the order of $1.5 trillion in global GDP impact by 2030, through productivity and efficiency gains across industries (PWC, 2024). This kind of projection underscores why many stakeholders remain eager to invest in XR's long-term growth, even if short-term returns have been slower than hoped.

2.1.3. Sectoral adoption trends

The use of XR is expanding across multiple sectors worldwide, with enterprise and training applications leading the way. To date, one of the clearest success stories for XR has been workforce training and skill development. Companies around the globe are using VR simulations to train employees in everything from factory equipment operation to safety procedures, often with measurable improvements in retention and reduced costs versus traditional training. Industry experts identified workforce development and training as the sector most transformed by XR so far, ahead of others (Perkins Coie LLP, 2024). Following training, education and healthcare stand out as high-impact domains. Educators increasingly leverage XR to create immersive learning experiences, for example, virtual field trips, 3D visualisation of complex concepts, or AR-assisted instruction, which can boost student engagement. In healthcare, XR is used for surgical training (allowing medical residents to practice procedures in VR), patient therapy (treating phobias or PTSD with controlled virtual environments), and even diagnostics and surgery with AR overlays. These applications have demonstrated tangible benefits, which are accelerating adoption in hospitals and medical schools worldwide. Another sector gaining momentum is military defence: Defence organisations in the U.S.,

Europe, and Asia are investing heavily in XR for combat training, mission rehearsal, and maintenance operations. Although defence applications fall outside the current scope of Presence's use-case portfolio, the sector is nevertheless poised for the fastest growth in XR adoption. An industry survey shows that 63 % of respondents expect defence to post the largest year-on-year expansion (Perkins Coie LLP, 2024). High-profile programmes, such as the U.S. Army's Integrated Visual Augmentation System (IVAS) and parallel trials in allied forces, underscore this momentum. So our market outlook explicitly recognises defence as a high-potential vertical, even though our demonstrators concentrate on other use cases.

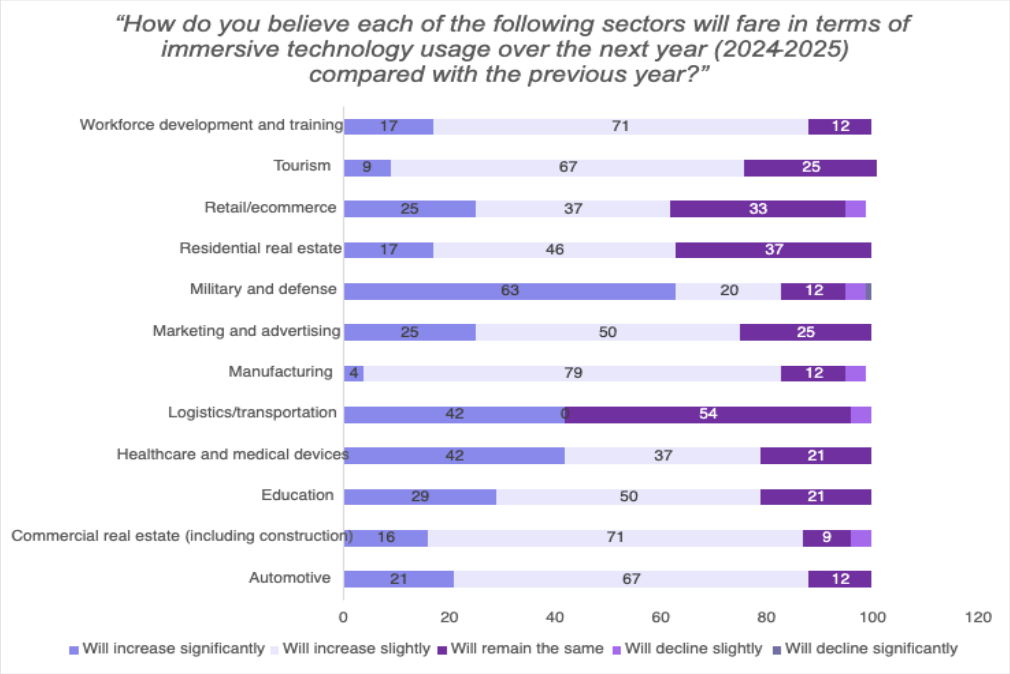


Figure 2: Projected change in immersive technology usage by sector (2024–2025). Rounded percentages

Beyond these frontrunners, XR is making inroads in manufacturing and engineering (for prototyping, design reviews, and QA with AR), retail (virtual product showrooms and AR try-on for e-commerce), entertainment and media (immersive games, virtual concerts, cinematic VR experiences), and tourism and cultural heritage. In tourism and culture globally, there is a drive to create "virtual tourism" content, for instance, 360° VR tours of landmarks or AR apps that animate historical sites. However, a noted challenge here is content creation: the 2024 XR Industry Survey found that 57% of experts feel current content offerings are insufficient (Perkins Coie LLP, 2024), with sectors like *tourism, real estate, and logistics* cited as particularly under-served in XR content (Perkins Coie LLP, 2024).Many organizations are hesitant to invest in XR content without a critical mass of users, creating a classic chicken-and-egg scenario. As a result, the XR market remains primarily developer-focused, which is the target group that Presence aims to support. Nonetheless, as tools improve (e.g. easier content authoring via no-code XR platforms) and as success stories emerge (such as museums reporting higher visitor engagement through VR exhibits), adoption in these experience-driven sectors is expected to climb. It is also worth noting the role of geography in sectoral adoption: for example, Asia (especially China and South Korea) has seen strong government-backed adoption of XR in education and public venues; North America leads in enterprise training and defence XR spending; Europe excels in cultural XR projects. Overall, the global XR market in 2025 is marked by an expanding array of use cases, with enterprise value-driving applications currently outpacing mass

consumer entertainment in adoption. This trend may evolve as consumer devices improve and more content becomes available. In Europe, rising defense budgets are also accelerating XR adoption, particularly in military training and the integration of mixed reality displays into military vehicles. For example, Finnish startup Distance Technologies has partnered with defense firm Patria to equip 6×6 armored vehicles with MR windshields that display real-time tactical data and AI-driven insights directly on the glass, enhancing situational awareness in low-visibility environments (Geschwindt, 2025).

2.1.4. Consumer behaviour and barriers

From a consumer perspective, 2024 might be remembered as the year XR remained on the cusp of mainstream, with broad awareness but still limited everyday use. Global consumer surveys show a mix of enthusiasm and frustration. On the one hand, interest in immersive experiences is high, and users want to play immersive games, explore virtual worlds, and use AR for practical tasks (navigation, information). On the other hand, many who have tried XR come away with significant pain points. The top global barriers to mass consumer adoption crystallised clearly: *user experience, content, and cost*. A large majority of industry stakeholders (almost three-quarters) agree that the user experience in XR is still too often sub-par, citing issues like device bulk, discomfort, short battery life, and suboptimal user interfaces (Perkins Coie LLP, 2024). The launch of Apple's ultra-premium Vision Pro headset in 2024, while a milestone, exemplified these challenges. Early reviewers praised its technical expertise but also highlighted its bulkiness and fatigue from extended use (Perkins Coie LLP, 2024). Its very high price and the requirement for an external battery pack reinforced the notion that truly consumer-friendly XR hardware had yet to arrive (Perkins Coie LLP, 2024). However, Apple is allegedly working on a lighter, more affordable version of the Vision Pro, potentially priced around $2,000, which would reduce weight and complexity while making spatial computing more accessible to everyday users (Richardson, 2025). Indeed, hardware cost remains a significant deterrent: 33% of XR professionals in 2024 said expensive devices are a major barrier to adoption (up from 26% previously) (Perkins Coie LLP, 2024), and many consumers are unwilling to spend the price of a high-end laptop on a first-generation XR device. As a result, it seems currently VR/AR headsets are largely confined to enthusiasts and institutional buyers.

Another major consumer-side factor is the content ecosystem. Consumers note that compelling content is lacking beyond a handful of games or novelty apps. This was reflected in the industry survey, where over half of the respondents (57%) said the available XR content is not sufficient to attract mass users (Perkins Coie LLP, 2024). The perceived content drought is partly due to the earlier slowdown in investment for content development (for example, fewer VR games were funded after an initial boom). However, the outlook here is improving: the integration of generative AI into content creation is viewed as a potential game-changer, with 83% of XR insiders believing AI will benefit the industry by enabling richer content and experiences (Perkins Coie LLP, 2024) AI can help automate environment generation, behaviours of agents built with The Intelligent Virtual Agent SDK, and cross-platform content conversion, potentially addressing the content gap over time. behaviours.

In terms of consumer behaviour trends, one noticeable shift is the desire for mobility and the blending of devices. Consumers are looking to use XR in the home and *on the go*. Ericsson's (2024) ConsumerLab study notes that users who combine smartphone AR with dedicated AR/VR devices report higher satisfaction, and the share of such mixed usage is expected to double in the next five years (Yao et al., 2024). The same study found that 75% of consumers globally anticipate portable

AR/MR glasses for use outside the home and are willing to pay ~20% extra for the convenience of wearable, go-anywhere XR (Yao et al., 2024). This indicates a potential future where, much like smartphones today, lightweight AR glasses could become everyday personal devices for information and entertainment. A glimpse of this future is already visible in products like the Ray-Ban Meta Smart Glasses.. These glasses offer features such as hands-free photo and video capture, spatial audio, voice-activated Meta AI, and upcoming real-time video analysis and live translation, making them increasingly viable as daily-use devices (Meta, n.d.). However, this vision is contingent on overcoming wearable XR's social and privacy hurdles. Privacy concerns are *especially pronounced*: an overwhelming 93% of industry respondents are concerned about privacy issues in XR (Perkins Coie LLP, 2024). Users worry about how their data (and their surroundings' data) is collected and used; for instance, cameras in AR glasses scanning faces or homes raise red flags about surveillance and consent. The ConsumerLab study highlighted that *bystander privacy*, people's discomfort with others wearing AR devices, could significantly impede adoption (Yao et al., 2024). These concerns are global, though attitudes vary by culture (with some countries more accustomed to public surveillance than others). In response, companies like Apple have emphasised privacy features (the Vision Pro's LED indicator to show when cameras are active, for example), and industry groups are developing privacy standards. Consumers also exhibit caution due to concerns about physical safety (e.g. bumping into real objects while in VR) and cyber safety (harassment in virtual environments). To win over mainstream consumers, the XR industry recognises it must *earn trust* by improving user safety and privacy protections.

In summary, consumer behaviour around XR in late 2024 is characterised by keen interest, restrained by practical barriers. People imagine integrating XR into daily life and are excited by specific possibilities (gaming, fitness, creative expression, remote socialising). However, many are waiting until devices become more user-friendly, content offerings grow, and privacy/security issues are addressed.

2.1.5. Device and hardware developments

The end of 2024 has brought a storm of activity in XR hardware, setting the stage for a new generation of devices. The most high-profile development was Apple's entry into the XR market. Apple's Vision Pro, announced in June 2023 and released in early 2024, is a sophisticated mixed-reality headset that garnered worldwide attention. Its impact on the industry has been twofold. First, it served as a strong validation of XR's importance, as noted in PRESENCE D6.1, Apple's entry was seen as a signal that XR is ready for mainstream consideration, lending credibility and spurring competitors to up their game (PRESENCE_D6.1). Second, the device set new benchmarks in capability (high-resolution pass-through, powerful M2/M3 chips enabling advanced graphics) but also highlighted existing limitations (bulk, short battery life, extremely high cost) (Perkins Coie LLP, 2024). Sales of the Vision Pro in 2024 were reportedly below Apple's initial targets; roughly *370,000 units* were sold through Q3 2024, and Apple allegedly curtailed production plans due to the lukewarm uptake (Riley, 2025). This illustrates that while cutting-edge XR hardware can be made, market readiness remains a challenge in terms of price tolerance and available use cases. By contrast, Meta (Facebook) pursued a more incremental and cost-conscious hardware strategy that paid off in sustaining the VR market. The Meta Quest 3 headset launched in late 2023 at a consumer-friendly $500 price point, bringing improvements like higher resolution and mixed reality features while remaining standalone (no PC required). Together with the cheaper Quest 2 (which saw price cuts), Meta has sold millions of units globally, making Quest the most common VR platform in 2024. Meta

also introduced the Ray-Ban Stories smart glasses (2nd generation in 2023) with built-in cameras and audio, hinting at AR capabilities. While far from true AR glasses, they indicate tech giants' interest in normalising wearable tech, although these record numbers, the XR enterprise of Meta still lost a lot of money. (Hayden, 2024). Other hardware players contributed to a rich device ecosystem in 2024: Sony's PlayStation VR2 catered to console gamers with high-end VR experiences (its reception was mixed due to the limited game library, but it demonstrated excellent visuals for VR gaming). HTC released the Vive XR Elite, a compact headset targeting both consumers and businesses, and Pico (owned by ByteDance) pushed its Pico 4 and new models, especially in Asian and European markets, as an alternative to Quest. These developments kept competition healthy. Notably, mixed reality (MR) features, blending AR and VR, became standard in new devices, indicating a convergence toward devices that can do both VR and AR.

In terms of wearables and haptic technology, globally, we saw major strides to enhance immersion. Haptic vests and gloves are becoming more sophisticated: companies like HaptX and SenseGlove (U.S. and Europe) are improving force-feedback gloves, while bHaptics (Korea) offers consumer haptic vests for VR gaming. As highlighted, Europe's SenseGlove launched a pro-grade haptic glove with active contact feedback, force feedback, and vibrotactile feedback in XR (SenseGlove, n.d.). Such peripherals, while currently niche, are critical for certain professional applications (e.g. virtual prototyping of products, where feeling the object is important). In the wearable AR segment, several startups demoed lightweight AR glasses or smart glasses in 2024: e.g. Nreal (now Xreal) continued to refine its AR eyewear, and Lenovo launched ThinkReality glasses (now discontinued) for enterprise. These resemble regular glasses more than bulky headsets, though most still must tether to a phone or pack for processing. We also see early XR wearables beyond headsets, like tracking suits and sensor bands that capture full-body motion or facial expressions to drive avatars, which is important for social VR and enterprise training.

These advancements are not just enhancing gaming or prototyping; they are foundational for emerging use cases like holoportation and intelligent virtual agents (IVAs). Haptic gloves and tracking suits enable users to physically interact with remote participants or AI-driven avatars in shared virtual spaces, adding a tactile dimension to presence. As holoportation evolves, such wearables will be essential for conveying not just visuals and audio, but also touch and motion, making remote collaboration and training more immersive and human-like. Similarly, sensor bands and facial tracking enhance the realism of IVAs by enabling more expressive, emotionally responsive interactions, while haptic feedback allows users to feel virtual contact, further blurring the line between digital and physical.

2.1.6. Regulatory and privacy landscape

As XR technologies become more prevalent, there is a mounting global conversation about how to govern them responsibly. In the United States, there isn't a comprehensive XR regulatory law yet, but the industry is self-organising to influence future policy. The XR Association (XRA), a consortium of leading XR companies, has been actively engaging with U.S. lawmakers. In 2024, XRA applauded the introduction of a "United for Privacy Act" in Congress and joined a coalition letter urging federal privacy protections that would also cover XR data (Lake et al.). XRA's 2024 legislative priorities focus on positioning the U.S. as a leader in XR innovation while calling for guidelines on privacy, safety, and accessibility in immersive experiences (XR Association, 2024). We can expect more concrete policy proposals in the U.S. around issues like biometric data in XR, content moderation in virtual

spaces (to address harassment or misinformation), and product safety standards (to cover concerns like physical injuries or neurological effects of prolonged XR use). In Asia, China has been proactive in setting tech rules and will likely extend oversight to XR as it grows (e.g. ensuring content aligns with censorship laws and mandating user identification in online VR communities). South Korea and Japan, with strong gaming and tech industries, are funding XR development and considering frameworks for things like virtual asset transactions in the metaverse.

Globally, a few common regulatory themes are emerging: privacy, safety, accessibility, and interoperability. Privacy concerns the need to protect users and bystanders from unauthorised data collection. Safety encompasses both physical safety (preventing seizures from VR or ensuring users stay aware of their surroundings) and psychological safety (mitigating harassment or extreme content exposure). Accessibility is about making XR usable for people with disabilities (for example, providing captioning for audio in VR or adjustable interfaces for those with limited mobility) so that the technology inclusively benefits all. The upcoming European Accessibility Act, coming into effect on June 28th, 2025, is expected to positively influence this by encouraging more accessible design in XR experiences. Interoperability and open standards are being championed by groups like the Metaverse Standards Forum to avoid walled-garden virtual worlds. The European Union remains a trendsetter in tech regulation, with GDPR and upcoming AI rules influencing global companies. The EU's work on virtual world governance will likely produce guidelines that other countries look to. Meanwhile, international organisations and multi-stakeholder forums (such as the World Economic Forum) have begun issuing reports on XR governance, ethics, and security (Kuenzler & Reim, 2024). A World Economic Forum report in 2024 on metaverse governance, for example, stressed the importance of *interoperable standards and respect for user rights in virtual spaces*. All these efforts underscore a strong "pro-regulation" sentiment: according to the XR Industry Survey, 58% support government regulation in XR to ensure things like privacy and ethical use (Perkins Coie LLP, 2024). However, there is a balance to strike; overregulation could stifle innovation in this still-evolving field. Thus, regulators are working closely with industry and civil society to craft rules that address the risks without derailing the development of valuable XR applications.

2.1.7. Global outlook and emerging trends

Looking at the global XR market at the end of 2024, we see a field that has matured in understanding its challenges and is coalescing around solutions. The narrative has shifted from unbridled hype to a more pragmatic optimism. The coming 1–2 years are pivotal. If hardware makers deliver the next wave of devices that are more affordable and ergonomic, and if content creators (empowered by AI tools and growing user bases) build the experiences that truly demonstrate XR's unique value, the industry could hit an inflexion point of mass adoption. Consumers could move from sporadic use to daily reliance on XR for communication, productivity, and entertainment, much like how smartphones evolved. This "slow burn" route to the next computing platform seems more likely than an overnight revolution. XR's progress depends not only on user adoption and content development but also on the steady improvement of foundational technologies such as bandwidth, latency, and computational power. These technical prerequisites are essential for delivering seamless and high-quality XR experiences, and they are expected to evolve gradually alongside the industry. At the same time, XR is becoming increasingly connected with other technological domains. One prominent example is the integration of AI. According to Perkins Coie LLP (2024), 83 percent of industry insiders believe generative AI will benefit XR's future. AI can enhance virtual environments by populating them with intelligent characters, generating immersive training scenarios, and personalising experiences for

users, making XR more engaging and practical. Another trend is the blending of digital ownership and economies within XR. While pure crypto-metaverse ideas have receded for now, concepts like digital twins of real-world assets, virtual goods, and creator monetisation in XR remain relevant (game platforms like Roblox, Fortnite and CSGO demonstrate thriving virtual economies, which could extend into more AR/VR contexts). Collaboration and remote presence are another domain to watch. With hybrid work now a lasting norm, XR's potential to enable lifelike remote meetings and virtual coworking spaces is drawing significant investment, as seen in platforms like Meta's Horizon Workrooms and Microsoft Mesh. If XR can move beyond the limitations of traditional video conferencing and reduce "Zoom fatigue" by offering more natural, spatial interactions, it could become a staple business tool. Looking ahead, the integration of AI adds a new dimension to this vision. Intelligent AI agents could participate in virtual meetings alongside human users, acting as facilitators, note-takers, or even collaborators. This blend of physical and virtual presence could redefine how teams interact, making remote work more dynamic, efficient, and inclusive.

Finally, it's important to note the contingency of XR's trajectory on public perception and societal readiness. XR will transform how people interact with information and with each other; essentially, it's the next interface for the Internet (often termed the *"Future Internet"* or *Web 4.0*) (European Commission, 2024). As such, achieving the full market potential requires not just technical progress but also building public trust and enthusiasm. The XR industry recognises this and is making efforts to highlight positive use cases (education, healthcare, inclusivity) and address concerns proactively. In conclusion, the global XR market as of Q1 2025 can be described as cautiously optimistic and gearing up for its next phase of growth. The pieces (improving hardware, richer content, converging technologies, and clearer governance) are slowly falling into place. Should these trends continue, the coming years will likely see XR transition from a niche "early adopter" technology to a mainstream platform that is integrated into many aspects of business and daily life.

2.2. European XR market landscape

2.2.1. Market size and growth

The European XR market is experiencing a steady increase, although it is conservative. Recent analyses show the total XR market in Europe (across hardware, software, and services) was valued at around €8 billion in 2021 (PRESENCE_D6.1). Forecasts for 2030 have outlined a baseline growth scenario reaching roughly €35 billion by 2030 and an optimistic scenario of up to ~€65 billion if breakthrough advances accelerate adoption (PRESENCE_D6.1). As of the beginning of 2025, the market trends in Europe suggest that the European market remains closer to the baseline scenario described in D6.1; this scenario is characterised by gradual expansion rather than explosive growth (PRESENCE_D6.1). Contributing to this moderated growth, XR revenue in Europe is still dominated by enterprise and B2B applications, and a significant portion of XR products used in Europe are supplied by U.S. or Asian companies (PRESENCE_D6.1). Even so, Europe's XR industry is expanding year-over-year, driven by improving technology infrastructure (widespread 5G, cloud services) and increasing awareness of XR's potential in various sectors.

2.2.2. Investment and funding climate

Investments in the European XR market have been steady but nothing spectacular. Industry insiders continue to perceive an investment gap in XR. A global survey in 2024 found that 83% of XR professionals feel the sector remains underfunded relative to its potential (Perkins Coie LLP, 2024).

In Europe, this funding is being partly supplemented by public programs and innovation grants (e.g. Horizon Europe projects like PRESENCE itself), which are supplements for private investments. European startups in XR still face challenges raising late-stage capital as investors watch for proven use cases, which are not a lot in the young market. However, investor optimism is growing going into 2025: 63% of XR insiders (global) expect XR spending and investment to increase in the coming year (Perkins Coie LLP, 2024). Europe's share of this investment uptick is likely, especially with big tech companies establishing XR research hubs in Europe and governments prioritising digital innovation. Additionally, reports indicate that there is an optimistic view in terms of revenue growth in 2025, essentially from companies that have global clients and are active in multiple sectors. (XR4EUROPE, 2025). Notably, Europe also leads in XR research output. A recent study observed that many of the top countries publishing XR research are in Europe (Marín-Vega et al., 2023), which bodes well for long-term innovation and spin-offs in the European XR ecosystem.

2.2.3. Adoption by sector in Europe

XR technologies are setting foot in a diverse range of European industries and cultural contexts. In terms of cultural heritage, European museums, heritage sites, and cultural institutions are using XR to create immersive experiences for visitors. For example, augmented reality (AR) museum guides and virtual reconstructions of archaeological sites allow the public to deepen their knowledge and engagement with cultural sites (Innocente et al., 2023). These XR cultural heritage applications enhance visual and structural experiences and can evoke emotional connections with history (Anwar et al., 2025), aligning well with Europe's strong heritage preservation character. In education, schools and universities in Europe are experimenting with VR/AR for interactive learning, from virtual science labs to historical VR field trips, supplementing traditional modules with immersive content. In the healthcare sector, European hospitals and medical training centres use XR for surgical simulations, anatomy visualisation, mental health therapy, and rehabilitation. This sector has seen some of the fastest uptake; XR is viewed as a valuable tool for safe training and patient treatment, echoing global trends where healthcare and education were among the most transformed sectors by XR (Perkins Coie LLP, 2024). The defence and security sector in Europe is likewise investing in XR for training and simulation. Several European armed forces (for example, NATO allies) have been testing VR battlefield simulations and AR heads-up displays for soldiers (Phil, 2024). Industry surveys expect military and defence to be one of the fastest-growing XR user segments, with 63% of respondents predicting substantial growth in XR use for defence in the next year (Perkins Coie LLP, 2024). Overall, Europe's XR adoption is broad-based, though often in pilot or early deployment stages within each sector.

2.2.4. User and consumer behaviour

European consumers mirror global attitudes toward XR in many respects. Interest in XR experiences is high, but actual usage remains moderate due to barriers in the user experience. Many Europeans have encountered AR through smartphone apps (e.g. AR filters, navigation) or tried VR at gaming arcades or events. European consumers mirror the global picture: XR is still a niche pastime because today's head-mounted displays are bulky, uncomfortable in long sessions, prone to motion sickness, and supported by a limited range of compelling content (Perkins Coie LLP 2024; Yao et al. 2024). Satisfaction with smartphone-based AR is therefore modest, and many users say they are waiting for lightweight, stylish AR or mixed-reality glasses that can slip seamlessly into everyday life. Most expect such glasses to become a standard companion to the smartphone within the next five years and indicate they would pay a premium for that convenience (Yao et al. 2024). Where Europe

diverges from other regions is its heightened sensitivity to privacy. Strict data-protection rules and high public awareness make wearable cameras and sensors in public spaces socially delicate. Concerns about “bystander privacy” can cut Europeans’ willingness to adopt AR devices by almost one-fifth, underscoring the need for privacy-by-design hardware and transparent safeguards if XR is to move from the living room into the street (Yao et al. 2024). So, European users are enthusiastic about the promise of XR (for entertainment, learning, and socialising), but widespread uptake awaits improvements in comfort, content, and privacy assurances.

2.2.5. Device and hardware developments

Europe’s XR hardware market is influenced heavily by global product releases, yet European companies and researchers contribute niche innovations, especially in wearables and haptics.In 2023–2024, major XR hardware developments, such as Apple’s Vision Pro and Meta’s Quest 3, drew significant attention in Europe, though European user adoption patterns reflected some key differences from global trends. Apple’s Vision Pro, announced in mid-2023, was widely seen as a milestone for spatial computing and a signal of mainstream tech’s commitment to XR (PRESENCE_D6.1). However, its high price point (~€3300) and limited European availability meant that its impact on European consumers remained minimal through late 2024. While global sales were modest, European uptake was even more constrained, reinforcing the perception that mass-market XR adoption in Europe remains cautious and price-sensitive. In contrast, more affordable and accessible devices like Meta’s Quest 3 (launched Q4 2023) and Sony’s PlayStation VR2 (early 2023) have seen greater traction among European users, particularly in gaming and entertainment contexts. These trends suggest that European consumers broadly align with global preferences for mid-range, user-friendly XR hardware, but with a stronger emphasis on value and accessibility. Moreover, European users tend to be more privacy-conscious, which may influence their adoption of devices that collect sensitive biometric data. Wearable AR glasses have also advanced: Meta partnered with Ray-Ban on camera-equipped smart glasses with early AR features, and several startups (including European firms) are developing lightweight AR eyewear. These devices remain early in functionality but point toward the anticipated shift to everyday AR wearables. In the realm of haptics and immersion, Europe is at the forefront of innovation. A notable example is Netherlands-based company *SenseGlove*, which has been developing a set of haptic gloves called the Nova–2 tailored for professional XR applications (SenseGlove, n.d.). These advanced gloves provide active contact feedback, force feedback, and vibrotactile feedback (SenseGlove, n.d.). Such technology enables users to *feel* virtual objects with unprecedented realism, vastly deepening immersion for training, design prototyping, and remote operation scenarios. The introduction of Senseglove’s Nova–2 haptic gloves demonstrates Europe’s strength in the XR peripherals space and addresses the “realism gap” often cited in XR experiences. Additionally, there has also been some real progress in the development of depth cameras. An example of such a camera is *Raytrix, with* its Lightflield 4D vision, which can do Inline Computational Imaging, 3D Video and shoot in VR/AR/MR (Raytrix GmbH, 2025). Overall, the European hardware landscape in late 2024 is characterised by the steady adoption of the latest VR/MR headsets and growing capabilities in wearables/haptics, but also a recognition that device costs need to come down. Indeed, device affordability remains a concern; the high cost of cutting-edge headsets is consistently cited as a barrier (one-third of industry experts say device cost is a significant challenge to adoption) (Perkins Coie LLP, 2024). The European market, with its mix of cost-sensitive consumers and enterprise buyers, is pushing for a range of device options from affordable, entry-level VR kits to high-end professional rigs.

2.2.6. Regulatory and privacy landscape in Europe

Europe's approach to XR governance stands out globally for its proactive, rights-based regulatory framework, rooted in broader digital legislation like the General Data Protection Regulation (GDPR). Unlike the U.S., where XR regulation is more fragmented and industry-led, or Asia, where state-driven innovation often prioritizes rapid deployment over privacy, Europe emphasizes user rights, data protection, and ethical standards. This is particularly significant given XR's capacity to collect sensitive biometric and environmental data (e.g., eye tracking, facial expressions, spatial mapping). European experts have flagged current safeguards as insufficient, warning of risks like identity theft or emotional manipulation (Maddern, 2024). In response, European regulators and scholars have called for XR-specific frameworks that go beyond GDPR. For example, a 2024 University of Exeter study urged a combination of legal, policy, and ethical best practices tailored to immersive tech. Novel issues like bystander privacy and emotional profiling are now under scrutiny, reflecting Europe's commitment to anticipatory governance. This regulatory rigor presents both opportunities and threats. On one hand, it positions Europe as a global leader in "responsible XR", fostering trust, safety, and innovation aligned with democratic values. Initiatives like the European Commission's 2023 strategy for "Virtual Worlds fit for people" and the upcoming AI Act reinforce this vision. On the other hand, strict compliance requirements may pose barriers for smaller developers or non-EU companies, potentially slowing market entry or innovation. Nevertheless, industry sentiment in Europe is largely supportive: 58% of XR professionals favor government oversight to ensure ethical standards (Perkins Coie LLP, 2024). Frameworks like PwC's Responsible XR initiative exemplify this collaborative push toward transparent, fair, and user-centric immersive technologies (Likens et al., 2023).

2.2.7. Outlook for Europe

The European XR market is poised to continue on its steady growth path, with the potential to accelerate if key hurdles are overcome. In the near term, it is expected that European XR adoption will rise in enterprise and public sector domains, training, education, and cultural projects, where clear ROI and public benefits are demonstrated. Consumer XR in Europe will likely inflect upward when lighter, cheaper AR/MR devices become available (several such products are anticipated in 2025–2026). Europe's strong research and innovation base in XR (spanning academia, design, and engineering) provides a foundation for home-grown XR solutions that address local needs (for example, multilingual education content or XR for heritage preservation). Importantly, the alignment of European XR development with societal values (privacy, inclusion, accessibility) could become a differentiator. By proactively tackling issues like data protection and content accessibility, the European XR industry can build trust with users, a factor identified as critical for growth (Perkins Coie LLP, 2024). In conclusion, Europe's XR market at end-2024 and at the beginning of 2025 can be characterised as one of *cautious optimism*: significant opportunities across sectors and a gradual uptick in adoption, tempered by challenges that are being addressed through technical progress and regulatory guidance. If the baseline scenario holds, Europe will see solid, linear growth in XR over this decade; if emerging trends (like seamless AR wearables and AI-driven content) materialise faster and policies foster innovation, the region could yet shift to a more accelerated growth curve approaching the high-end forecasts by 2030 (PRESENCE_D6.1).

2.3. "New" governance requirements

XR technologies in Europe operate under a comprehensive EU-wide regulatory framework. Current laws such as the GDPR, the Digital Services Act (DSA), and the Digital Markets Act (DMA) already govern many aspects of XR, with new rules like the Artificial Intelligence Act (AI Act) on the horizon (XR Association, 2024).

2.3.1. GDPR and XR

The General Data Protection Regulation (GDPR) (Regulation (EU) 2016/679) applies fully to XR applications, which often process extensive personal data. XR devices (e.g. VR headsets and AR glasses) collect a wide range of biometric and behavioural information, from eye movements and facial expressions to voice and body-motion data, that can uniquely identify individuals and reveal sensitive attributes like age, health or even emotional state (Official Journal of the European Union, 2024). This raises significant privacy concerns, so XR providers must ensure compliance with GDPR's core principles, including lawfulness, fairness and transparency in processing, purpose limitation, data minimisation, accuracy, storage limitation, and integrity/confidentiality (Maddern, 2024). In practice, regulators stress "privacy by design" and obtaining informed user consent for each distinct use of personal data in immersive environments (rather than one blanket consent), which is in line with GDPR requirements (Official Journal of the European Union, 2024). These measures are crucial as VR/AR services increasingly handle data as sensitive as "a fingerprint" in terms of personal identifiability (Official Journal of the European Union, 2024).

2.3.2. Digital Services Act and Digital Markets Act

The Digital Services Act (DSA) (Regulation (EU) 2022/2065) and Digital Markets Act (DMA) (Regulation (EU) 2022/1925) form part of the EU's recent digital regulation package (Grady, 2024). The DSA establishes obligations for online intermediaries and platforms, which include XR platforms and metaverse worlds that host user-generated content. It implements the principle that *"what is illegal offline should be illegal online,"* requiring platforms to swiftly remove illegal content and take measures against risks like hate speech or disinformation (Grady, 2024). XR service providers must also ensure transparency under the DSA, for instance, by disclosing how algorithms rank content or how advertising is targeted and providing users with avenues to report issues. The DMA, on the other hand, addresses competition in digital markets by imposing rules on large "gatekeeper" platforms. If major XR ecosystem operators (for example, a dominant app store or XR device OS provider) are designated as gatekeepers, they will be required to avoid self-preferencing their services and to ensure interoperability and fair access for third-party developers and businesses (Grady, 2024). While these regulations introduce compliance challenges (the DSA's content moderation and data obligations can be complex, and the DMA may require changes to platform business models), in the long run, they are expected to foster a healthier XR market. Improved competition, greater transparency, and interoperability under the DSA/DMA should increase user trust and innovation in the XR industry, even if smaller XR firms face some short-term compliance costs (Mahr et al., 2025).

2.3.3. Artificial Intelligence Act (AI Act)

The EU Artificial Intelligence Act, officially adopted in 2024 and entered into force later that year, established a comprehensive, risk-based regulatory framework for AI systems across the European Union. This landmark legislation is particularly significant for XR technologies, which increasingly

integrate AI for applications such as virtual assistants, adaptive environments, biometric analysis, and emotion recognition.

The Act classifies AI systems into four risk categories: unacceptable, high-risk, limited-risk, and minimal-risk. XR applications that involve biometric identification, emotion detection, healthcare diagnostics, educational assessments, or workplace training are likely to be categorised as high-risk, especially when they can significantly impact users' safety, rights, or well-being (Corrales, 2024)

For high-risk AI systems in XR, the Act imposes strict obligations, including:

- Transparency: Users must be clearly informed when they are interacting with AI.
- Human oversight: Systems must allow for meaningful human intervention and control.
- Accuracy and robustness: AI must meet high standards for reliability and performance.
- Cybersecurity: Systems must be resilient against manipulation and data breaches.
- Conformity assessments: Before deployment, high-risk systems must undergo rigorous evaluation and certification processes.

The immersive and potentially persuasive nature of XR has led EU regulators to pay special attention to how AI in these environments might manipulate perception or behaviour. As a result, AI-driven XR practices that distort reality, infringe on autonomy, or exploit psychological vulnerabilities may be restricted or banned under the Act (Corrales, 2024).

Ultimately, the AI Act aims to ensure that AI in XR aligns with EU values such as privacy, non-discrimination, transparency, and user safety. It has become a foundational regulation for XR developers and companies operating in or targeting the EU market, shaping how immersive technologies are designed, deployed, and governed. (European Commission, 2025).

2.3.4. Product safety and CE marking

Product safety regulations in the EU apply to XR hardware to ensure devices are safe for users. The recently updated General Product Safety Regulation (GPSR) (Regulation (EU) 2023/988, effective Dec 2024) extends the EU's consumer safety regime to new technologies, explicitly covering risks from software, artificial intelligence, and connected devices (which includes XR equipment) throughout their lifecycle. This means XR manufacturers must design products that remain safe under normal use and foreseeable misuse and address potential hazards like optical radiation, motion-induced sickness, or cybersecurity vulnerabilities that could affect user safety. All XR hardware sold in the European Economic Area must carry the CE marking, indicating conformity with applicable EU health, safety, and environmental protection standards (European Commission, 2021). To use the CE mark, XR device manufacturers must comply with a host of EU directives/regulations, for example, the Radio Equipment Directive for wireless communication, the Low Voltage and Electromagnetic Compatibility directives for electrical safety and emissions, and others as relevant. They must assess and document product compliance (via internal tests or third-party certification notified bodies) and issue an EU Declaration of Conformity. The CE mark thus assures consumers and regulators that an XR headset or AR smart glasses meet all required safety standards and can be freely circulated in the EU market (European Commission, 2021). EU market surveillance authorities, empowered by the new GPSR, can also take action (like recalls or sales bans) if XR products are found unsafe or not in compliance. Overall, robust product safety and compliance processes are mandatory in the XR sector to maintain user safety and confidence.

2.3.5. Accessibility and inclusion requirements

The EU places a strong emphasis on accessibility to ensure digital technologies, including XR, are inclusive of persons with disabilities. The European Accessibility Act (EAA) (Directive (EU) 2019/882) is a key piece of legislation in this area. Adopted in 2019 and coming into effect on 28 June 2025, the EAA requires that a range of products and services meet common accessibility requirements across the EU (European Commission, 2025). This covers many ICT products relevant to XR; for example, consumer electronics like computers, gaming consoles and smartphones are explicitly listed, which by extension suggests that VR/AR devices (often considered gaming or computer peripherals) should also be made accessible. XR software and content may also fall under services like e-commerce, e-books, or banking services, which the Act covers, mandating features like text-to-speech, alternative controls, and adaptable interfaces so that users with visual, hearing, motor or cognitive impairments can use them. In addition to the EAA, the Web Accessibility Directive (EU) 2016/2102) already requires public-sector websites and mobile apps in the EU to be accessible, which could extend to XR applications developed by public bodies or used in public services. Furthermore, broader EU non-discrimination laws and guidelines (such as the EU's European Disability Strategy) reinforce the need for inclusive design in emerging technologies. In practice, XR companies operating in Europe will need to incorporate accessibility in hardware (e.g. adjustable straps, support for assistive input devices) and software (e.g. closed captions in VR experiences, high-contrast display modes, scalable interfaces) to comply with these requirements and not exclude disabled users. As of 2025, with the EAA's implementation, accessibility is not just a social responsibility but a legal requirement in the EU's XR market (Official Journal of the European Union, 2024a).

2.3.6. Intellectual property in virtual environments

XR and "virtual world" platforms must navigate the EU's existing intellectual property (IP) framework, which fully applies to digital content and assets. The European Parliament has affirmed that the body of EU law on IP, including copyright, trademark, patent, design, and trade secret laws, "fully applies to virtual worlds" and immersive environments (Official Journal of the European Union, 2024b). This means that creations in XR (such as 3D models, artwork, music, or software code) are protected by copyright just as in the physical world, and brand names or logos used in virtual spaces are protected by trademark law, etc. All XR stakeholders (platform operators, developers, and end-users) are obliged to respect IP owners' rights (Official Journal of the European Union, 2024b). For example, using or selling a copyrighted film or a designer's 3D object inside a virtual reality experience *without permission* would infringe copyright, and creating a virtual item bearing someone else's registered trademark (e.g. a famous brand logo on a digital avatar's clothing) without authorisation could violate trademark rights. Even new concepts like NFTs (non-fungible tokens) do not alter IP fundamentals; an NFT representing a piece of virtual art still requires that the art itself not infringe copyright (Official Journal of the European Union, 2024). However, the rise of virtual economies does pose novel enforcement challenges: It can be difficult to identify infringers or apply national jurisdiction when content is shared globally in VR spaces (Official Journal of the European Union, 2024b). EU institutions are studying these issues. For instance, the European Parliament called for guidance on how rules like the DSA's liability exemptions and the Copyright Directive's platform responsibilities (Article 17) should concretely apply to user-generated content in virtual worlds (Official Journal of the European Union, 2024b).

2.4. XR Case studies in Europe

XR has seen numerous implementations across Europe in recent years. Key sectors embracing XR include tourism, health tech, training & manufacturing, and professional collaboration. Below is a brief sector-by-sector overview of notable 2024–2025 European XR case studies, highlighting the technologies used, outcomes achieved, and whether initiatives were led by public or private entities (including government-backed projects and commercial ventures).

2.4.1. Tourism

In spring 2024, the Musée d'Orsay in Paris launched an ambitious virtual reality experience titled "An Evening with the Impressionists, Paris 1874." This project was co-produced by the museum in collaboration with French media studio Gédéon Programmes and VR developers Emissive, timed to celebrate the 150th anniversary of the first Impressionist art exhibition (Sortiraparis, 2024). The initiative reflects a broader European trend of using XR to bring cultural heritage to life, offering new ways to experience art and history (European Commission, n.d). It represents a public–private partnership model: a national museum teamed with creative tech firms to merge art curation with VR technology.

Using high-end VR headsets, visitors are literally transported back to April 15, 1874, the opening night of the Impressionists' breakaway exhibition in photographer Nadar's studio (Sortiraparis, 2024). In a richly detailed virtual recreation of 19th-century Paris, participants stroll down Boulevard des Capucines and enter Nadar's atelier, encountering famed artists like Claude Monet, Auguste Renoir, Berthe Morisot, Paul Cézanne, Camille Pissarro, and Edgar Degas (Sortiraparis, 2024). Over a 45-minute free-roaming group VR session, visitors witness these artists discussing and arranging their works, immersing themselves in the sights and sounds of the era (Willsher, 2024). This collective time-travel experience is designed to complement the museum's physical exhibition "Paris 1874. Inventing Impressionism," either as a prelude or a post-visit highlight. By virtually reconstructing a pivotal moment in art history, the Orsay's VR tour lets audiences "take a virtual voyage back 150 years to the very moment that marked the birth of Impressionism" (Willsher, 2024), enhancing understanding of the artworks' original context.

2.4.2. Health tech

In the healthcare arena, XR technologies have been deployed in Europe for medical training, therapy, and surgical support. One notable government-backed initiative is the UK's Mindset programme, launched in 2024 by Innovate UK to fund immersive digital therapeutics for mental health. Under this programme, £3.2 million was invested in 24 XR health projects developing treatments for conditions like anxiety, PTSD, and developmental disorders (UKRI, 2024). The funded solutions include VR-based therapy for young people with depression and phobias, an XR application for adults with ADHD, an immersive hypnotherapy tool for neurological disorders, and a mixed reality (MR) system to aid patients with bipolar disorder and psychosis (UKRI, 2024). These projects (led by private startups and healthcare providers with public funding support) aim to deliver faster, more cost-effective mental health care by immersing patients in simulated environments under clinician guidance. Early findings indicate that such XR therapies can improve patient engagement and potentially clinical outcomes by providing safe, controlled exposure and interactive coaching (UKRI, 2024).

At the European level, collaborative R&D efforts are also advancing XR in health. The EU-funded VR Health Champions project (launched in October 2024) brings together academic institutions, health providers, and five innovative SMEs from across Europe (Antino, 2025). This consortium (publicly co-funded by an EU regional development program) is developing XR solutions in three key areas: medical training simulations, intra-operative support, and digital therapeutic applications (Antino, 2025). For example, VR is used to create immersive clinical training scenarios for doctors and nurses, allowing them to practice procedures in realistic virtual environments. In surgical settings, augmented reality is being tested to provide surgeons with enhanced visual guidance and 3D overlays during operations (Antino, 2025). Another focus is therapeutic VR for patients with neurodegenerative and neurodevelopmental conditions, e.g. VR modules to improve cognitive and motor skills in Parkinson's or Alzheimer's patients, as well as in autistic youth (Antino, 2025). By mid-2025, the VR Health Champions consortium reported progress in user-centred design and pilot deployments of these solutions in clinical contexts (Antino, 2025). This project demonstrates a public-private partnership approach: a publicly led initiative (EU-funded) supporting private sector SMEs to bring XR health innovations to market, with an emphasis on usability and evidence-based impact in European healthcare systems.

2.4.3. Training and manufacturing (industry)

XR has proven especially valuable in industrial training, manufacturing, and maintenance across Europe. Analyst reports show that manufacturing is the top sector for AR adoption in Europe, with augmented maintenance and worker training identified as high-value use cases driving productivity and safety gains (IDC, 2024). In practice, many European firms now use augmented reality headsets to guide employees through complex assembly or maintenance tasks on the factory floor. A compelling example is Portugal's national energy grid operator REN, which in 2024 implemented an AR solution for high-voltage substation maintenance (Alliance4xr, 2024a). Workers wearing AR devices (tablets or smart glasses) can see interactive 3D overlays of technical instructions and safety boundaries superimposed on the live equipment view (Alliance4xr, 2024a). This system, developed as part of REN's "Digital Substation Protection" project, provides step-by-step guidance and real-time schematics in the worker's field of view, reducing human error and improving safety in a high-risk environment (Alliance4xr, 2024a). Preliminary results from the pilot in Portugal indicate the AR solution helped prevent accidents by visually delineating hazard zones and triggered instant alerts if personnel approached unsafe areas (REN, 2023). The initiative was led by REN (private industry) with an innovation strategy aligned to public safety and regulatory standards, illustrating how a commercial operator can leverage XR to meet critical operational needs. Moreover, REN reported ancillary benefits such as reduced downtime and more efficient training of new technicians, thanks to hands-free access to expert knowledge on-site (Alliance4xr, 2024a).

Another case comes from Eastern Europe's energy sector: DTEK, Ukraine's largest energy company, partnered with XR firm Sensorama Lab to revamp power plant training using virtual reality and haptics (Alliance4xr, 2024b). In this 2024 project, a photorealistic 3D model of a thermal power plant was created in VR, allowing electrical engineers to practice procedures in a risk-free virtual environment that closely mimics real operations (Alliance4xr, 2024b). Trainees wear VR headsets and even a haptic feedback suit, which provides tactile sensations (e.g. vibration or resistance) corresponding to virtual interactions (Alliance4xr, 2024b). This added realism heightens immersion and skill retention, as participants can *feel* equipment and hazards in the simulation. An instructor station and performance analytics database complement the system, enabling supervisors to

monitor progress and evaluate competencies gained in VR(Alliance4xr, 2024b). The outcome has been a safer, more effective training regimen for DTEK's electricians: they can repeatedly practice responding to emergencies or operating complex machinery virtually, with zero risk to themselves or plant infrastructure. This project, while conducted outside the EU, was showcased by European XR networks as a success story in industrial VR training, demonstrating the impact of private-sector innovation (Sensorama is a tech SME) supported by an industry leader to improve workforce skills (Alliance4xr, 2024b). Its use of wearable haptic technology also underlines how XR hardware advancements are being applied in European industries to enhance learning outcomes.

Beyond individual company efforts, Europe's public sector is also investing in XR platforms for industry-wide use. For example, the EU's XR2Industry project (Horizon Europe, 2025) is developing next-generation XR solutions for manufacturing and maintenance, with a focus on interoperability and data security (xr2industry, 2025). This consortium is piloting XR training simulations for various factories and AR remote assistance tools to reduce downtime in equipment servicing (XR2Industry, 2025). The project is led by a coalition of European tech providers and industrial firms, with EU funding ensuring alignment to European standards and values (privacy, safety). Such government-backed initiatives complement the commercial case studies by creating shared XR frameworks and validating best practices (through pilot programs) that can be adopted across the manufacturing sector (XR2Industry, 2025).

2.4.4. Professional collaboration (industry)

XR is also transforming how professionals collaborate in industrial and enterprise settings, especially in an era of distributed teams and hybrid work. Virtual reality and mixed reality platforms are enabling remote co-working, design reviews, and knowledge sharing in ways that traditional video conferencing cannot. According to IDC, enterprise spending on VR in Europe reflects this trend, with immersive training currently one of the largest use cases and VR-based collaboration and one of the fastest-growing use cases, as firms seek new ways to connect employees across locations (IDC, 2024). This is driven by the shift towards more flexible and remote work models, creating demand for virtual collaborative environments that mimic in-person interactions (IDC, 2024).

In 2025, Siemens Digital Industries Software (in partnership with Sony) launched an "Immersive Engineering" XR toolset for product design collaboration (Siemens, 2025). The solution integrates Siemens' NX CAD software with Sony's new mixed reality hardware, enabling engineers and designers to co-create on 3D digital twins in real time. British supercar manufacturer Briggs Automotive Company (BAC), an early adopter, reported that this XR system lets their teams visualise and edit car parts at full scale and collaborate more easily between design and production (Siemens, 2025). Stakeholders can join design review sessions either in VR or via desktop, supporting both co-located and remote participants in a shared virtual workspace (Siemens, 2025). The technology was introduced via a Siemens press release at CES 2025, with BAC's founder praising how the mixed-reality design reviews help them validate components with stakeholders before manufacturing (Siemens, 2025). By providing a secure, cloud-enabled 3D collaboration platform, Siemens and Sony's initiative exemplifies XR's growing role in enterprise engineering workflows, reducing errors, speeding up iterations, and connecting distributed teams in the industrial design process (Siemens, 2025).

Another example is Belgian food products group Vandemoortele, which deployed an AR vision picking solution in 2024 to boost its warehouse productivity (TeamViewer, 2024). Using

TeamViewer's Frontline platform with smart glasses, warehouse staff receive visual pick lists and navigation cues in their field of view, allowing them to assemble orders hands-free and with voice commands (TeamViewer, 2024). The system was rolled out in multiple distribution centres and fully integrated with Vandemoortele's SAP inventory software (TeamViewer, 2024). According to the company's announcement, key outcomes include:

- Significantly faster picking processes, handling roughly *200,000 boxes per month* with the AR system (TeamViewer, 2024).
- Near-zero error rates in order picking, improving accuracy and customer satisfaction (TeamViewer, 2024).
- Better ergonomics and training, new workers onboard faster with guided picking, and voice control frees their hands, reducing strain (TeamViewer, 2024).

2.5. Concluding remarks on market update

In conclusion, the XR industry at the start of 2025 finds itself at a pivotal juncture. Globally, a recalibrated optimism has replaced earlier metaverse-driven hype, as hardware advances, AI integration, and a clearer focus on practical use cases rekindle growth. Enterprise and training applications, in areas such as workforce development, healthcare, and defence, are leading adoption, while consumer uptake remains tempered by device affordability, comfort, and content availability. With headset shipments set to surge and AI-enhanced XR experiences on the rise, the industry is preparing for a gradual but meaningful expansion as hardware becomes lighter, more cost-effective, and more intuitive, and as content ecosystems mature.

Europe, meanwhile, exemplifies a steady-growth trajectory underpinned by a strong research base, targeted public funding, and a cluster of innovative start-ups in wearables and haptics. While enterprise and B2B applications continue to dominate current revenues, particularly in manufacturing, healthcare, cultural heritage, and training, the gradual introduction of mid-priced consumer devices and the promise of stylish AR glasses suggest that European consumer adoption could accelerate once comfort, privacy, and regulatory confidence align. The EU's rigorous regulatory frameworks (GDPR, DSA/DMA, AI Act, EAA, and GPSR/CE requirements) create a demanding environment, but they also foster trust, safety, and interoperability, key elements for broader acceptance.

Looking ahead, XR's near-term trajectory will depend on three interrelated developments: (1) hardware convergence toward lighter, more affordable head-mounted systems or glasses, (2) an expanding catalog of AI-driven, sector-specific content that demonstrably improves productivity or learning outcomes, and (3) a balanced regulatory landscape that ensures user safety and privacy without stifling innovation. At present, XR remains largely a developer-driven market, with much of the momentum coming from enterprise pilots, institutional use cases, and innovation labs rather than widespread consumer adoption. However, should these foundational elements align, XR could transition from niche deployments to a more mainstream role in both business and everyday life. Ultimately, the coming years will determine whether XR takes the "slow burn" road to ubiquity, integrating into standard workflows, education, and entertainment, or whether unforeseen breakthroughs accelerate its evolution into a truly ubiquitous spatial computing platform. In either case, the groundwork being laid through pragmatic, use-driven implementations and responsible governance suggests that XR's most transformative chapter is still unfolding.

3. Exploitation

Exploitation within PRESENCE serves as the strategic engine that transforms technological research into real-world value. It ensures that project results are not only technically sound but also aligned with the needs, expectations, and realities of future users, adopters, and stakeholders. This chapter presents the midterm update of our exploitation activities and results, demonstrating how we have begun to shape viable exploitation pathways and validate market potential.

In D6.1, we introduced a six-component exploitation framework rooted in Human-Centred Design and driven by iterative validation cycles. The approach focuses on understanding user needs, co-creating value propositions, testing assumptions, and formulating both individual and joint exploitation strategies across the consortium. The Joint Business Clinics (JBCs) form the backbone of this methodology, acting as co-creation milestones to align PRESENCE with market dynamics and stakeholder feedback.

This deliverable (D6.2) provides an overview of what has been achieved so far, highlights early findings, and outlines how we will continue to validate and refine our approach in the coming 18 months. Key midterm outcomes include the first Joint Business Clinic with validation of market interest and use-case relevance, the identification of a new strategic user type (the business developer), early hypotheses for user value creation, and the refinement of the PRESENCE Decision Making Unit and value chain. In the following sections, we present the first tangible results for each exploitation component and explain how they will evolve toward finalization in Month 36, as presented in D6.3.

3.1. Methodology

The methodology underpinning PRESENCE's exploitation strategy remains as outlined in Deliverable 6.1. It is based on a Design Thinking approach, characterized by five iterative steps: empathize, define, ideate, prototype, and test. These steps are organised into three validation cycles of ten months each, supported by a final six-month consolidation phase (see *Figure 3: PRESENCE methodology for user validation and exploitation*). The process is deliberately dynamic and user-focused, ensuring that PRESENCE remains responsive to real-world needs while reducing the risk of product-market misalignment.

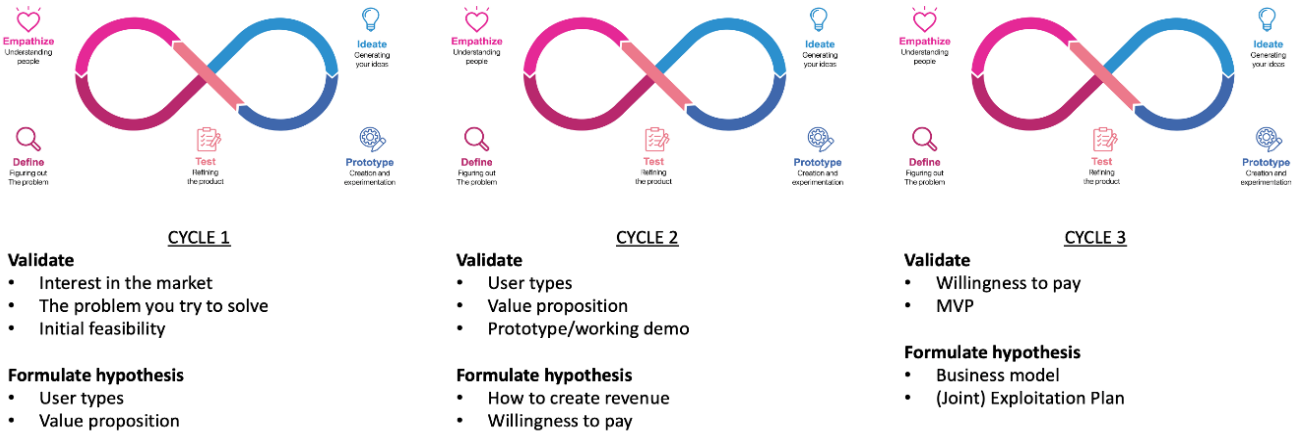


Figure 3: PRESENCE methodology for user validation and exploitation

At the end of each cycle, a Joint Business Clinic is held. These clinics are co-creative workshops that validate assumptions made during development and support the formulation of new hypotheses. Through this structured and repeatable methodology, we ensure that exploitation remains rooted in human-centred insight, market relevance, and iterative learning.

For a full description of the methodology, we refer to Section 2.1 Global XR market of D6.1.[2]

3.2. Exploitation components

This section introduces the six exploitation components developed and implemented by the PRESENCE consortium to maximise the utilisation of project outcomes throughout the project lifecycle. In D6.1, we outlined our intention to create an integrated, human-centred exploitation strategy that balances individual partner goals with collaborative, cross-sector opportunities. Now, in this midterm report, we provide a reflection on what has been achieved, what insights have emerged, and how each component will evolve in the second half of the project.

The implementation of these components has been supported by targeted dissemination activities (see Section 4 Dissemination and communication), one-on-one engagements with stakeholders, and the organisation of the first Joint Business Clinic. These activities are designed not only to validate key assumptions but also to co-create viable exploitation directions with real-world actors.

Each component contributes to PRESENCE's overarching ambition: to develop results that are usable, adoptable, and sustainable. Importantly, these components are not discrete or sequential. Rather, they are interlinked and mutually reinforcing, with many activities and outcomes intersecting across components. As such, the sections that follow should be viewed as collectively contributing to the development of an integrated (joint) exploitation strategy.

3.2.1. Component 1: market and customer analysis

In line with our Human-Centred Design methodology, this component analyses the most promising market domains and clarify how and where PRESENCE can deliver meaningful value. This involves analysing market trends, customer pain points, and sector-specific conditions across domains such as health, cultural heritage, manufacturing & training, and professional collaboration. Findings from this component informed the structure of our first Joint Business Clinic and the refinement of our Decision Making Unit and value chain, particularly in identifying gaps between PRESENCE's technical offering and market realities.

3.2.2. Component 2: creation of exploitation strategies

This component defines how project outcomes can be translated into exploitation actions, both at the level of individual partners and the consortium as a whole. We have developed individual exploitation plans, based on partner surveys and co-creation formats. The strategy framework incorporates lessons from the Joint Business Clinics, especially the role of new user types like the business developer, and how exploitation can be staged in a way that matches technical maturity

[2] PRESENCE D6.1 Dissemination, communication, and exploitation strategy plan can be accessed through Zenodo: https://doi.org/10.5281/zenodo.12551125

with market readiness. This process employs a co-design approach, incorporating consortium members to ensure their perspectives and expectations are duly considered.

3.2.3. Component 3: Joint Business Clinics

Three Joint Business Clinics serve as the cornerstones of our exploitation process, each corresponding to one of our three design validation cycles. The first JBC was successfully conducted in September 2024 and focused on validating market needs and use-case relevance. It also surfaced key insights, such as the need to better articulate the PRESENCE Decision Making Unit and value chain and the identification of the business developer as a strategic intermediary user type. JBC#2 and JBC#3 will build on these results by validating user types, value propositions, willingness to pay, and ultimately supporting the formulation of a joint exploitation plan.

3.2.4. Component 4: PRESENCE value proposition & commercial strategy

Grounded in data gathered from market analysis and the JBCs, this component involves the definition of value propositions for different customer segments and the design of Minimum Viable Product (MVP) concepts. We are currently in the process of validating these propositions with user groups and refining our assumptions about how PRESENCE can generate value across domains. The commercial strategy will take into account both the product's desirability and feasibility, and the viability of potential business models.

3.2.5. Component 5: component & IP management

To enable both joint and individual exploitation, we are tracking technical contributions, ownership, and access rights related to PRESENCE components. This includes aligning expectations around Intellectual Property (IP) and resolving dependencies across work packages. Interviews and internal partner discussions are feeding into this IP mapping process, laying the groundwork for downstream decisions around licensing, technology transfer, and partner-specific uptake.

3.2.6. Component 6: results consolidation with human-centred approach

The final component synthesises lessons learned and strategic directions from all other components into a coherent roadmap for adoption and scale-up. While this phase will formally begin at Month 30, early planning is already underway. We are identifying potential launching customers and strategic partners, exploring societal and ethical implications, and ensuring that PRESENCE remains anchored in a human-centred design ethos. This component will culminate in a consolidated exploitation roadmap that reflects not only technical outcomes, but also user realities, market conditions, and future growth opportunities.

3.3. Market and customer analysis (component 1)

3.3.1. Market analysis

For our market analysis see Section 2 Market Update.

3.3.2. Customer analysis

To effectively bridge PRESENCE's research and technical outputs with its intended real-world applications, a coherent customer analysis is essential. As PRESENCE moves from foundational research toward applied impact, it becomes increasingly important to understand how the technologies being developed will reach users, generate value, and support adoption.

Effective exploitation begins with a clear understanding of who the customer is, how they make decisions, and how value is created and delivered across their ecosystem. In PRESENCE, this work began with an early value chain and persona analysis in D6.1. Since then, WP6 has expanded and refined this foundation through Joint Business Clinics, prototype canvasses, and iterative co-creation with partners and stakeholders. The result is a more structured and actionable customer analysis that informs both strategic positioning and day-to-day exploitation decisions.

This section integrates three core perspectives:

- **The Decision-Making Unit (DMU):** An analysis of who the key roles are in the adoption process, particularly within organisations where PRESENCE-enabled solutions may be deployed. This includes those who influence, decide, or gatekeep purchasing and implementation decisions.
- **The Value Chain:** A systems-level view of how PRESENCE technologies generate value as they move through development, packaging, decision-making, and end use. This lens helps identify friction points, integration challenges, and where PRESENCE offers unique differentiation.
- **Validated User Types:** Building on early persona work, PRESENCE now anchors its customer analysis in four user types aligned with the value chain. These include Software Developers, Business Developers, User Decision-Makers, and Operational Users, each of whom interacts with PRESENCE in a distinct way.

Together, these three views offer a holistic map of PRESENCE's exploitation landscape. The DMU clarifies who must be convinced, the value chain reveals how PRESENCE creates and captures value, and the user types inform how communication, validation, and product development should be tailored. This integrated approach will continue to guide MVP testing, use-case piloting, and business model development in the second half of the project.

PRESENCE Decision Making Unit (DMU)

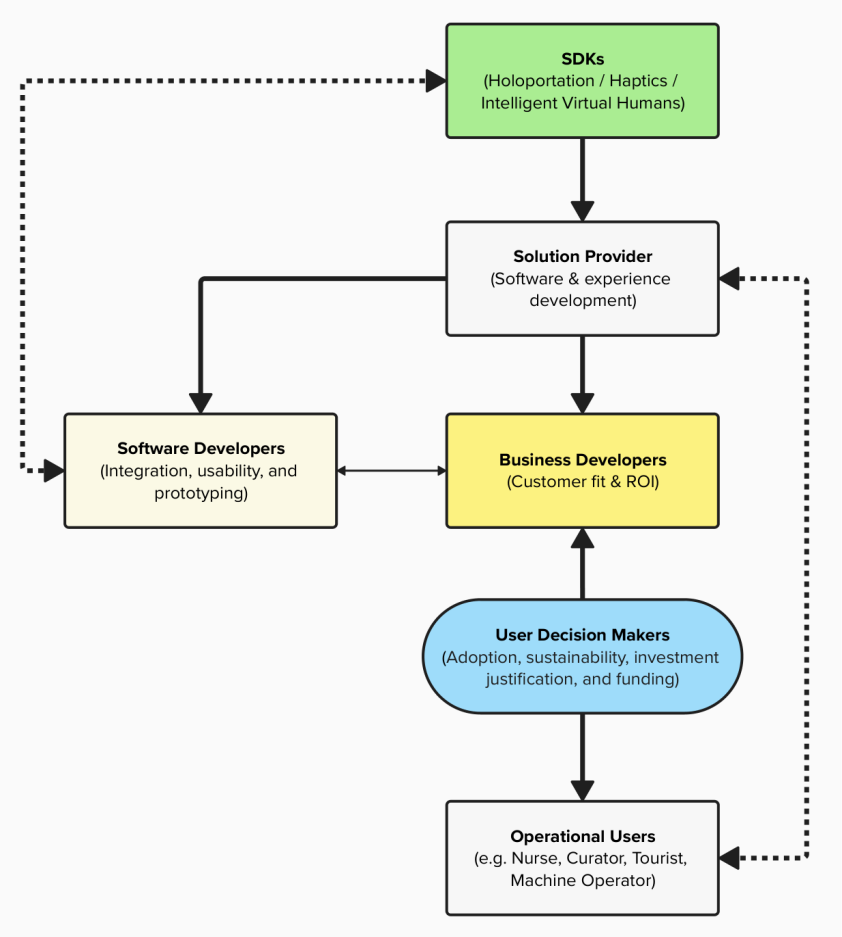


Figure 4: PRESENCE Decision Making Unit

This DMU (see *Figure 4: PRESENCE Decision Making Unit*) presents a structured overview of the actors, transformations, and relationships that enable PRESENCE to move from core SDKs to meaningful, real-world applications. It reflects the layered and interdependent nature of PRESENCE's ecosystem and provides a shared language to align technical development, business modelling, and stakeholder engagement.

The DMU begins with PRESENCE's three modular SDKs in holoportation, haptics, and intelligent virtual humans. These constitute the technical input stage: enabling real-time volumetric capture, tactile feedback, and virtual behavioural logic. While they offer powerful standalone capabilities, their value emerges only when embedded into usable and meaningful applications.

That embedding is the role of **software developers**, who serve as the first key intermediaries. They take PRESENCE's modular components and integrate them into application environments, often using Unity or other XR development frameworks. Their work involves testing usability, adapting to hardware constraints, and preparing functional prototypes. Importantly, developers must translate technology into developer-facing tools that others can adopt and build on.

Alongside developers, the **solution provider** (either an internal team or third-party service provider) begins crafting market-ready use cases. These actors focus on user workflows, storytelling design,

and cross-domain alignment. Their role is especially relevant in verticals like healthcare, training, cultural heritage, and collaborative design, where sector-specific requirements define how PRESENCE is deployed and scaled.

At the centre of the chain sits the **business developer**. Identified as a critical missing link during JBC#1, this actor ensures that technical capabilities are matched with organisational needs, feasibility constraints, and economic rationale. Business developers translate functional potential into business cases, build internal advocacy, and assess alignment with client or market pain points. Their inclusion reflects PRESENCE's growing focus on viability as a core dimension of design.

Downstream, **user decision-makers** assess adoption from an organisational standpoint. These are budget holders, procurement leads, or strategy officers who evaluate sustainability, compliance, and investment return. Their willingness to support adoption is shaped not only by the technology's functionality but also by the clarity of its value proposition and the credibility of its implementation path.

Finally, the chain reaches **operational users**: the nurses, trainers, curators, and other front-line professionals who interact directly with PRESENCE-enhanced systems. These users ultimately define whether PRESENCE is practical, effective, and desirable. Their feedback informs upstream design, influencing future iterations of the SDKs and the applications built around them.

These insights on the DMU set the foundation for PRESENCE's exploitation model. It makes clear that value is not created at a single point, but rather through coordinated transitions between actors who each bring distinct skills, insights, and constraints. Three insights stand out:

- First, PRESENCE must invest in reducing friction across transitions. This means better onboarding tools for developers, clearer frameworks for business modelling, and effective communication materials for decision-makers.
- Second, the business developer emerges as a key persona who ensures that innovation is not only technically feasible and user desirable, but also economically viable. Recognising and designing for this role significantly strengthens PRESENCE's exploitation approach.
- Third, the DMU reaffirms the project's human-centred ethos. Technology alone cannot drive adoption. What matters is how people experience, understand, and operationalise that technology in context.

PRESENCE Value Chain

The PRESENCE value chain provides a strategic lens on how value is created, enhanced, and delivered through the integration of PRESENCE's three core technology pillars of Holoportation, Haptics, and Intelligent Virtual Humans. While Section 2.6. XR value chain & business models for PRESENCE in D6.1 Dissemination, communication, and exploitation strategy plan[3] introduced a value chain analysis based on a generalised XR pipeline, this updated version reflects insights gained through co-creation activities, Joint Business Clinics, prototype canvasses, and the MVP

[3] PRESENCE D6.1 Dissemination, communication, and exploitation strategy plan can be accessed through Zenodo: https://doi.org/10.5281/zenodo.12551125

validation planning and work undertaken. It is grounded in how PRESENCE components actually generate value across the stakeholder landscape.

The structure of the value chain mirrors the logic developed in Section 3.6 PRESENCE value proposition & commercial strategy (component 4) and in Section 3.8 Results consolidation with human-centred approach (component 6) of this deliverable. It connects technical assets to real-world impact by tracing how the SDKs are integrated into workflows, packaged by solution providers, validated by business developers, adopted by user decision-makers, and ultimately used by operational end-users in context-rich environments.

At the start of the chain, PRESENCE delivers modular SDKs for volumetric video, multisensory interaction, and intelligent agents. These are adopted and customised by software developers, either working independently or within XR studios, integration firms, or research labs. The developer's role is crucial: they translate PRESENCE technologies into features, interactions, and proof-of-concept applications.

The next link involves business developers. These individuals operate within solution providers and determine whether PRESENCE-enabled technologies can support their organisation's commercial objectives. They are the ones who shape offerings, conduct client discussions, and define how PRESENCE will be integrated into deployable products or services. Their role was consistently emphasised during JBC#1 as critical to both internal buy-in and external market alignment.

User decision-makers, such as innovation managers, clinical leads, or museum directors, then assess the viability of deploying these solutions within their own environments. Their concerns include cost, ROI, interoperability, and strategic alignment. Validation at this level is essential for moving beyond pilot status into actual procurement and deployment.

Finally, operational users engage with the deployed solution. These may include medical staff, trainees, factory workers, or museum visitors. Their experience is vital, not only as a measure of effectiveness but also because their feedback informs ongoing design, improvement, and value articulation. Feedback loops are especially important here, reinforcing PRESENCE's commitment to iterative design and stakeholder alignment.

The value chain also highlights critical friction points that PRESENCE is addressing through exploitation tools such as the MVP Canvas (see Section 3.6.3 Towards a Commercial Strategy):

- The transition from software developer to business developer depends on clarity of value proposition, bundling options, and SDK usability. If documentation is poor or market fit is unclear, opportunities may be lost.
- The transition from business developer to user decision-maker requires business cases, ROI models, and evidence of efficacy. PRESENCE's MVP strategy is designed to generate these validation elements in close coordination with JBC#2 and partner pilots.

In many cases, business developers and decision-makers need tailored messaging and support. As a result, exploitation efforts are focused on aligning technical outputs with procurement logic, domain-specific use cases, and integration services.

This updated value chain model not only informs the continued refinement of user types and personas but also strengthens the project's ability to define viable business models. It supports the

hypothesis, outlined in Section 3.6 PRESENCE value proposition & commercial strategy (component 4), that either a subscription-based model or modular licensing structure will most effectively map onto real-world procurement practices.

Together with the Decision Making Unit, the value chain provides a complete view of PRESENCE's customer architecture. While the DMU shows who makes adoption decisions, the value chain shows how PRESENCE creates and delivers value. This dual framing allows PRESENCE to systematically shape its exploitation strategy in the second half of the project, focusing not just on visibility or technology maturity but on ensuring that value is perceived, activated, and sustained by the right stakeholders at the right stage.

PRESENCE User Types

As outlined in D6.1[4] PRESENCE began with a set of twelve detailed user personas structured along the four main use cases: health, cultural heritage, manufacturing and training, and professional collaboration. Each use case included a combination of producer (developer) and consumer (end-user) personas. This framing was appropriate for early-stage design work, allowing the consortium to understand domain-specific opportunities, user needs, and potential barriers to adoption.

However, as the project progressed, our methodological commitment to Human-Centred Design (HCD) prompted us to iterate on this model. Through whiteboard sessions, internal co-creation workshops, and most importantly stakeholder engagement during the first Joint Business Clinic (JBC#1), we recognised limitations in the initial persona framework. While rich in detail, the twelve-persona model obscured structural commonalities between use cases and failed to represent certain critical roles in the exploitation and adoption journey.

In particular, JBC#1 made visible a gap between technical capability and organisational deployment. While we had previously hypothesised in D6.1 the existence of more business-oriented personas, it became clear during validation that exploitation success hinged on a specific type of intermediary: the actor who translates technical solutions into value propositions that resonate with organisational buyers. This prompted us to formally define the business developer as a distinct user type. The business developer works within or adjacent to the solution provider and connects user decision-makers with the development process, the business developer can also take the form of strategic product owner or strategic product manager. They play a pivotal role in filtering market demand, prioritising features, and defining business logic. Their inclusion helps move PRESENCE from theoretical relevance to market fit, acting as a key viability validator in the exploitation chain.

This refinement reflects not a pivot but a progression. It demonstrates how PRESENCE's HCD approach is iterative by design, accumulating insights across phases and adapting its strategy in response to real stakeholder input. Just as we sharpened our definition of the user decision-maker based on recurring patterns during the first clinic, we also acknowledged the absence of a commercial interpreter who could bridge client needs with technological offerings. The business developer does not champion PRESENCE as such, but advocates for whatever tool, PRESENCE-based or otherwise, helps close the gap between market needs and technical feasibility.

[4] PRESENCE D6.1 Dissemination, communication, and exploitation strategy plan can be accessed through Zenodo: https://doi.org/10.5281/zenodo.12551125

The business developer user type is important because they operate at the tipping point between technology and adoption. Positioned inside or adjacent to the solution provider, the business developer listens to decision-makers, understands organisational constraints, and translates both into actionable feedback for product teams. They play a pivotal role in prioritising features, validating market fit, and deciding whether PRESENCE-based components are worth integrating. They are not motivated by the PRESENCE project itself, but by whether it enables them to deliver better solutions, faster and at lower cost. Their perspective introduces an essential viability lens into the exploitation framework, without which PRESENCE risks building tools that solve no buyer's problem. As such, this persona does not just enrich our user model, it directly strengthens the credibility and realism of our exploitation strategy.

We now propose a streamlined set of four user types, mapped directly to the PRESENCE DMU chain (see Figure 4: PRESENCE Decision Making Unit). Our customer analysis not only captures the diversity of roles across domains, but also aligns with exploitation and commercialisation logic. The user types are:

- **Software Developer**: Integrates PRESENCE SDKs into functional XR applications
- **Business Developer**: Aligns solution capabilities with market needs and organisational priorities
- **User Decision-Maker**: Evaluates and authorises investment into PRESENCE-based deployments
- **Operational User**: Engages with PRESENCE-enhanced tools in real-world environments

These user types work with or around PRESENCE technologies and services. Each plays a distinct role in moving PRESENCE from technical enablement to tangible value. Their activities, decisions, and constraints are critical to exploitation outcomes.

Descriptions of each user type are provided below. Full visual representations can be found in Annex II: PRESENCE User Types): **Software Developer**: ***The software developer is the technical actor responsible for integrating PRESENCE SDKs into usable XR applications.*** Working in software teams, creative studios, or internal innovation units, they bridge the gap between raw technical capability and real-world usability. Developers make key decisions about how holoportation, haptics, and virtual human modules are implemented and combined. They are not the end-user but create the tools and platforms that operational users will eventually interact with. Their needs include accessible documentation, well-maintained APIs, and modular design. If PRESENCE is to be usable, scalable, and robust, developers must find it not only powerful, but practical.

- **Business Developer:** ***The business developer is a strategic intermediary situated within the solution provider, responsible for connecting technical integration with market relevance***. They act as the commercial link between what is possible and what is desirable. Their focus is not on promoting PRESENCE for its own sake, but on identifying and selling solutions that meet real client needs. If PRESENCE-based components offer a competitive advantage, the business developer will seek to incorporate them. Working closely with user decision-makers, this persona gathers insights into pain points, organisational constraints, and procurement priorities. They then bring these insights back to their technical and product teams to refine or reprioritise development. Their value lies in

understanding what can be sold, what needs to be demonstrated, and which features influence adoption. The Business Developer is often a Product Owner and/or Product Manager related role.

- **User Decision-Maker:** ***The user decision-maker is responsible for making final go or no-go choices on adopting PRESENCE-enabled solutions.*** These are typically senior figures such as directors of innovation, department heads, or procurement leads who manage budgets, assess risk, and evaluate strategic alignment. While they may not directly use PRESENCE, their decisions determine whether a solution reaches implementation. PRESENCE must offer clear pathways to measurable benefits, including operational efficiency, cost savings, patient outcomes, or visitor engagement. This user type was already indicated in D6.1 but has since been sharpened into a formal persona through our customer analysis. Their buy-in is critical for PRESENCE to move beyond pilots into sustained use.

- **Operational User:** ***The operational user is the frontline actor who interacts directly with PRESENCE-enhanced applications in their day-to-day work.*** This includes nurses delivering stress-reducing therapies via XR, museum staff guiding immersive tours, manufacturing trainers using virtual equipment, and remote collaborators participating in virtual meetings. While not the focus of WP6 exploitation activities, this persona remains essential to real-world success. Their experience with usability, performance, and relevance directly informs feedback loops that shape adoption and future development. Other work packages such as WP1 lead validation of this user type, but WP6 recognises their value as a long-term proxy for impact.

To ensure the relevance and robustness of these revised personas, PRESENCE will undertake a targeted set of validation activities over the next project phase:

- **JBC#2 (September 2025)** will prioritise the inclusion of business developers and user decision-makers. Structured breakout sessions will focus on value proposition testing, willingness-to-pay, and business model viability from the perspective of these user types.

- **Conferences and events**: PRESENCE will actively engage in XR, cultural heritage, health, and training-related conferences where these stakeholders are present. One-on-one interviews and informal conversations will be used to test assumptions and gather further persona insights.

- **Snowball sampling through consortium partners**: Partners who already have access to relevant organisations will be asked to identify and introduce business developers and decision-makers within their networks. This will support deeper qualitative exploration through interviews or co-creation formats.

- **Cross-WP collaboration**: While WP6 leads on exploitation-focused user types, WP1 and WP4 will provide complementary insights based on operational testing and technical deployment. This ensures persona development remains coordinated across the project and grounded in actual user feedback.

These activities will ensure that the updated PRESENCE user types remain grounded in real-world needs, and that the exploitation strategy continues to reflect both the structure and the dynamics of the markets we aim to serve.

Interconnection of User Types

In PRESENCE, user types do not operate in isolation. Each represents a critical link in a larger system that connects technical innovation to market adoption. By aligning our user model to the PRESENCE DMU and value chain, we not only clarified the roles involved but also revealed how they interconnect in practice and create value within their organisation in this way. These interconnections are essential for understanding how exploitation can succeed, where friction may arise, and what kinds of coordination mechanisms need to be in place.

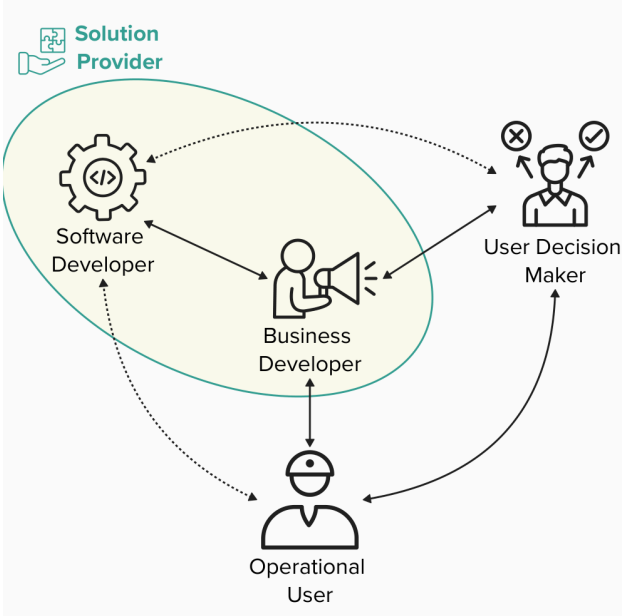


Figure 5: Interconnection of users' type

At the start of the chain, the **software developer** interacts most directly with PRESENCE technologies. They are focused on integrating SDKs and creating functional XR prototypes or applications. Their success depends not only on technical resources but also on **clear feedback from business developers**, who interpret market needs and guide feature prioritisation. The relationship between these two actors is dynamic and iterative. Business developers bring customer insights and pain points into the development process, while developers explore how PRESENCE can be leveraged to meet those requirements in technically viable ways.

The **business developer** also acts as a bridge to the **user decision-maker**. This connection is especially strategic. Business developers are often responsible for shaping the business case, matching PRESENCE-enabled solutions to procurement goals or innovation mandates. They frame PRESENCE's capabilities in terms of value, return on investment, and alignment with sector-specific challenges. The decision-maker, in turn, relies on this framing to assess adoption potential. Their willingness to move forward with a PRESENCE-based solution depends on a combination of strategic fit, organisational readiness, and confidence in long-term value delivery.

Although they may be furthest from the point of technical development, the **operational user** plays a foundational role in validating and sustaining PRESENCE adoption. Their experience feeds back into both upstream development and organisational decision-making. If tools are hard to use, misaligned with workflows, or fail to deliver meaningful impact, this feedback ultimately reaches both the business developer and software developer. In this sense, the operational user serves as both a test case and a continuous feedback node within the chain.

What emerges is a **looped rather than linear system**, in which knowledge and decision-making circulate between roles. Software developers build on input from business developers and operational feedback. Business developers refine value propositions based on what operational users actually need and what decision-makers are willing to support. Decision-makers rely on credible proposals and real-world usability to authorise adoption. Together, these interdependent relationships define how PRESENCE technologies move from possibility to practice.

This interconnected model (see figure 5: Interconnection of user types) reinforces our commitment to human-centred design. Effective exploitation requires not only understanding individual user needs, but also the **interfaces between users**, where interpretation, translation, and alignment occur. PRESENCE's exploitation strategy builds on this logic by targeting each user type with tailored tools, engagement formats, and validation mechanisms—ensuring that technical integration, business viability, institutional alignment, and practical usability are treated as mutually reinforcing elements of success.

Focus groups & User tests

User tests with the PRESENCE environments and technologies took place between March and May 2025. In March, the tests focused on evaluating the use case apps, the virtual environments created for each use case, without any other technology integrated. The aim here was to have a first validation of the use cases, the user requirements and a first overview of ethical themes relevant for further development of the technologies and their implementation in the use cases. The tests took place in Brussels (at the premises of imec-SMIT VUB) and 25 participants were involved. In May, version 0 of the playable app with integrated holoportation, IVA's and haptics was tested for the first time with end-users. Here the focus was on the evaluation of the implementation of the technical pillars into the user requirements. 21 participants registered for the tests in Brussels (at FARI, institute for AI for the common good). A detailed description of the test set-up, methodology and results can be found in D1.2 Human Centred Development Phase II - Intermediate User Testing, Presence Evaluation, Ethics, Trust & Privacy.[5]

3.4. Creation of exploitation strategies (component 2)

The creation of exploitation strategies in PRESENCE is grounded in a co-design approach that recognises the diversity of the consortium and the necessity of aligning multiple interests, domains, and technologies. As outlined in D6.1, the foundation for this component is a dual-layered strategy: developing individual exploitation plans for each partner while simultaneously building a joint exploitation strategy aligned with shared project outcomes. This dual approach ensures both ownership and coherence, enabling partners to contribute to market uptake in ways that reflect their role, capacity, and strategic priorities.

Over the past 12 months we have made several advances in laying the groundwork for these exploitation strategies. Most notably, the first Joint Business Clinic (JBC#1) has provided concrete insights into the value potential of PRESENCE technologies and enabled us to validate user types, market pain points, and preliminary value propositions. These findings, combined with the evolving understanding of the PRESENCE DMU and value chain, have informed internal partner discussions on how PRESENCE outcomes intersect with their existing business models or future ambitions. Several partners have already started mapping PRESENCE results to their internal capabilities, including potential services, IP contributions, and integration opportunities. In parallel, the first version of the Individual Exploitation Plans has been realized in August and September 2024 and will be refined over the next phase of the project. The Individual Exploitation Plans guide partners through the articulation of their exploitation intent, covering:

[5] D1.2 is not yet published at time of writing and publication but available upon request and after PRESENCE M18 through Zenodo.

- Target markets and customers
- PRESENCE components of interest
- Anticipated IP positions
- Business or research goals
- Dependencies or support needs

These plans will be continuously iterated upon as more exploitation-relevant data becomes available through technical progress, user feedback, and follow-up Joint Business Clinics.

Looking ahead, the next critical steps will be to synthesise the individual partner ambitions into a coherent joint exploitation strategy. This strategy will identify shared assets and business opportunities that may be collectively pursued, including cross-sector platform services, modular technology offerings, or standardised training frameworks. This consolidation process will begin after JBC#2, once additional user validation has taken place and willingness-to-pay insights have been gathered. By working iteratively across partner plans, market feedback, and technology readiness levels, we will ensure that PRESENCE exploitation pathways are both realistic and resilient.

3.4.1. Individual exploitation plans

Between August and September 2024, all consortium partners submitted their first iteration of the Individual Exploitation Plans. These plans build on the structure introduced in D6.1 and were designed to help partners articulate both their commercial and non-commercial ambitions for PRESENCE outcomes. The Individual Exploitation Plans serve dual purposes:

- **Exploitation**: Each partner outlines how PRESENCE technologies align with their internal strategy, business model, or research programme. This includes technological focus, target markets, and intended forms of exploitation, commercial, academic, or hybrid.
- **Validation**: The IEPs also act as early touchpoints for refining assumptions about feasibility and impact. By capturing partner expectations and target domains, the plans contribute to a feedback loop that strengthens the overall exploitation framework.

To systematically capture and analyse these submissions, the information has been summarised into a structured overview spreadsheet. This overview is presented in Annex III: Individual Exploitation Plan overview. From the consolidated data, several important cross-partner themes and patterns begin to emerge. When it comes to overall goals and ambitions for exploiting PRESENCE, three directions appear consistently across the majority of plans:

- **Strengthening XR Product Portfolios**: Many partners aim to enhance their offerings by incorporating PRESENCE technologies, particularly around immersive training, health applications, and cultural engagement. The SDKs are viewed as practical enablers of service innovation.
- **Technology Transfer and Research Valorisation**: Several academic and research partners intend to integrate PRESENCE results into their curricula, spin-off initiatives, or open-source tooling, ensuring that knowledge created in the project reaches broader audiences and stakeholders.

- **Validation of Market Fit and Viability**: A number of partners see PRESENCE as a catalyst for business model innovation. By testing PRESENCE-enabled solutions with real customers or piloting them in professional environments, they seek to validate value propositions and identify revenue models.

Several partners also articulated specific disruptive technologies that they consider essential to their exploitation plans. These recurring references point to areas where PRESENCE is expected to make a measurable technical difference:

- **AI and Intelligent Systems**: Frequently mentioned across partners was the role of AI in enhancing XR realism and interactivity, particularly through virtual humans and adaptive scenarios.
- **Haptics and Multisensory Interaction**: PRESENCE's haptics capabilities are considered a standout innovation, with multiple partners aiming to deepen user immersion in high-stakes or emotionally sensitive use cases.
- **Real-time XR Streaming and Interoperability**: Low-latency performance, SDK compatibility, and modularity are recurring technological priorities, particularly among partners with integration or productisation ambitions.

In terms of the envisioned exploitation strategies, the plans show two recurring patterns of application:

- **Commercial Productisation and Licensing**: Many partners plan to integrate PRESENCE components into existing tools or services and explore monetisation strategies, including licensing, app store offerings, and white-label solutions.
- **Non-commercial Dissemination and Educational Use**: Several universities and research centres focus on scientific publication, student engagement, and research transfer, ensuring PRESENCE leaves a legacy in the academic ecosystem.

Finally, the analysis uncovered several strategic overlaps and shared concerns that will help guide the development of a coherent joint exploitation strategy. These include both technical and organisational factors that partners see as critical for PRESENCE’s long-term success:

- There is significant overlap in focus areas, particularly in training, immersive collaboration, and user engagement.
- Partners repeatedly cite the need for interoperability, modularity, and scalability, validating the PRESENCE architecture approach.
- The SDKs are seen not only as technological artefacts but as vehicles for service innovation and ecosystem participation.
- Several partners flagged the importance of usability, documentation, and developer experience as prerequisites for uptake, an important design consideration going forward.

These insights confirm the richness and diversity of exploitation approaches within the consortium, while also pointing to concrete areas of strategic overlap. As such, this first iteration of Individual

Exploitation Plans lays a strong foundation for defining joint exploitation strategies in the next phase of the project.

3.4.2. Joint Exploitation Strategy

The development of a joint exploitation strategy in PRESENCE builds on the groundwork laid through the individual exploitation plans, customer analysis, value chain alignment, and the identification of shared assets and market orientations. The aim of this strategy is not to produce a singular, centralised business model, but rather to identify points of convergence between partners and structure opportunities for collaborative exploitation around these.

Analysis of the individual plans has highlighted several recurring patterns that serves as starting points for joint exploitation. Across partners, there is sustained interest in modular use of the PRESENCE SDKs, particularly for haptics, holoportation, and virtual humans. These components are seen as adaptable to multiple market verticals, from healthcare to training to cultural engagement. Their shared technological foundation makes them potentially ideal candidates for collaborative packaging or co-branded deployment.

Additionally, several partners are aligned in their focus on similar application domains. Training and onboarding scenarios appear as a common thread, with partners approaching them from different angles such as technical integration, scenario development, and user validation, but with overlapping goals. This presents an opportunity to explore shared demonstrators, templates, or pilot applications that build on PRESENCE components while reflecting the strengths of different consortium members.

The third cycle of the methodology will focus on synthesising these commonalities into tangible options for joint exploitation. Work will include mapping which PRESENCE outcomes have the highest uptake potential across partners, identifying where co-investment or shared IP management may be required, and articulating value propositions that span more than one sector or use case. Where relevant, we will explore whether these opportunities can be formalised into structured formats such as SDK bundles, joint training services, or integration-ready components that meet agreed standards for interoperability and documentation.

As the strategy evolves, we will also consider governance aspects. This includes how shared exploitation is managed, how credit and revenue might be distributed, and how future partners or adopters could be included in the ecosystem. The goal is to build something both actionable and durable: joint outcomes that can be launched during or shortly after the project, with a clear sense of ownership and market relevance.

Over the second part of the project, these patterns will be refined into a set of validated joint exploitation hypotheses. These will be tested both internally through partner feedback, and externally through Joint Business Clinics and follow-up stakeholder engagement. This work will culminate in a jointly articulated exploitation framework in the final deliverable (D6.3), supported by individual exploitation plans, shared asset governance structures, and concrete use cases or pilots that demonstrate PRESENCE’s value in the real world cross-checked with customer analysis, DMU, and the value chain.

3.5. Joint Business Clinic (component 3)

Embedded within PRESENCE's integrated exploitation methodology, the Joint Business Clinics (JBCs) function as structured co-creation sessions designed to align PRESENCE's technological development with market demand and stakeholder realities. Each clinic facilitates a human-centred, participatory environment in which market needs, feasibility conditions, and exploitation pathways are explored and validated with real-world actors. Rather than acting as static demonstrations, these clinics emphasize active engagement, allowing participants to shape the direction of PRESENCE in alignment with their operational contexts.

Rooted in Human-Centred Design (HCD), the JBCs serve four interlocking objectives:

	Objectives of the PRESENCE Joint Business Clinics
01	Demonstrating expected key results identified for exploitation
02	Validating the market and problem by identifying and verifying market and end-user needs
03	Exploring potential business models for the exploitation of PRESENCE
04	Investigating external partnerships with the potential to accelerate the exploitation of PRESENCE results for future market uptake

Table 1: Objectives of the PRSENCE JBC's

Each JBC builds upon the previous, establishing an iterative cycle of user-validated learning that sharpens PRESENCE's market positioning. In doing so, the clinics not only act as validation checkpoints but also as innovation catalysts, ensuring PRESENCE evolves in a direction both desirable and viable for its intended users and future commercial stakeholders.

3.5.1. The First Joint Business Clinic (JBC#1)

Figure 6: The first Joint Business Clinic

The first Joint Business Clinic was held on Friday, 13 September 2024, with 43 participants (including 13 consortium members). Through live demonstrations and facilitated breakout sessions, participants explored how PRESENCE could address relevant problems and feasibility barriers in four sectors: Health, Cultural Heritage, Manufacturing & Training, and Professional Collaboration. It marked the initial step in engaging these external stakeholders from sectors where PRESENCE's three technological pillars (holoportation, haptics, and virtual humans) could be deployed to meet concrete market challenges and add real world value.

The first JBC aimed to:

- Research and validate the relevance of the problems PRESENCE aims to solve;
- Identify feasibility constraints and drivers;
- Showcase current technical development progress;

- Co-create use-case specific personas and Value Proposition Canvasses (VPCs) in four breakout sessions: Health, Cultural Heritage, Manufacturing & Training, and Professional Collaboration.

These VPC sessions were structured to elicit both generalisable and sector-specific insights, helping the project to refine its understanding of user types, allowing PRESENCE to refine its understanding of, and formulate and test hypotheses regarding user types, value drivers, adoption barriers, common challenges, and the value PRESENCE can unlock. These insights were later consolidated and validated during follow-up consortium meetings, strengthening the foundation for exploitation and commercial planning.

Despite the diversity of domains, JBC#1 surfaced several recurring themes.

JBC#1 Key Cross-Sector Insights

Participants highlighted a consistent set of positive outcomes PRESENCE could enable, regardless of sector. Outlined as these common gains across all four use cases:

- **Increased accessibility**: PRESENCE helps users reach experiences, experts, or environments that are otherwise physically, financially, or temporally out of reach.
- **Enhanced learning and retention**: The immersive nature of XR combined with human- and haptic-centric design improves how users absorb and apply knowledge.
- **Reduced stress and risk**: PRESENCE lowers emotional or operational thresholds, whether through safer training environments, less anxiety-inducing health procedures, or more inclusive cultural experiences.

At the same time, participants voiced similar concerns across use cases that could hinder adoption or impact in the following common pains:

- **Complexity of XR technology**: A recurring theme was the steep learning curve or technical burden imposed on users unfamiliar with immersive technologies.
- **Cost and sustainability concerns**: High initial investments and uncertainty about long-term operational viability were flagged across domains.
- **Lack of measurable outcomes**: Participants across sectors raised questions about how to monitor impact, track return on investment, or validate improvements.

JBC#1 Specific Gains and Strategic Insights per Use Case

In the **Manufacturing & Training** domain, participants articulated a strong demand for XR-based solutions that allow safe, repeatable, and measurable training, particularly in high-stakes or time-sensitive environments. PRESENCE was seen as a means to reduce onboarding time, minimize operational downtime, and offer pre-production training ahead of equipment installation. Its ability to support distributed training across locations through haptic-enabled feedback and intelligent avatars was viewed as a key enabler. Yet participants flagged the importance of version control and rapid content updates in response to evolving procedures on the shop floor, as well as the need to train trainers themselves to work confidently with XR.

Within the **Health** breakout, PRESENCE was recognized for its potential to transform patient experience by creating calm, immersive spaces that ease anxiety and pain. Stakeholders saw clear value in XR for pediatric and palliative care, particularly where emotionally supportive features like holoported family members or virtual caregivers could be incorporated. However, the path to adoption hinges on minimizing operational friction. Healthcare professionals stressed that solutions must be effortless to deploy, seamlessly integrated, and impose no additional burden on time-constrained workflows.

In the **Cultural Heritage** discussion, participants imagined PRESENCE as a tool for radical inclusion, enabling remote or underserved audiences to access protected or distant heritage sites. There was strong interest in features like avatar tour guides, haptic object interaction, and temporal reconstruction of historical contexts. That said, challenges surfaced around copyright, data governance, and institutional readiness. Small heritage organisations in particular were concerned about cost, staff capability, and the balance between physical and digital engagement. PRESENCE's success in this domain will depend on its ability to demonstrate clear educational and experiential value without undermining traditional curatorial practices.

In the **Professional Collaboration** group, PRESENCE was framed as a next-generation solution for remote co-creation and real-time expert engagement. Use cases included virtual design reviews, policy consultations, and intercontinental collaboration on complex spatial tasks. The integration of holoportation and shared digital workspaces was seen as transformative for teams distributed across time zones or disciplines. However, adoption will depend heavily on ease of integration with existing software environments, intuitive user interfaces, and demonstrable gains in productivity or decision-making speed.

JBC#1 Lessons Learned and Implications

JBC#1 fulfilled its core mandate: it validated market relevance, surfaced use-case specific value propositions, and revealed feasibility conditions that will directly inform both technical development and exploitation strategy. Perhaps most significantly, it catalysed two major strategic adjustments.

First, the event made clear the need for a more detailed and dynamic mapping of the PRESENCE DMU and value chain. Participants struggled to understand how PRESENCE moved from core technology (cameras, haptics, AI avatars) to real-world deployment. This prompted a redefinition of the exploitation architecture, distinguishing between technological inputs, solution providers, and adopters such as business developers and decision-makers. These refinements are now fully integrated into the work discussed in Section 3.3 Market and customer analysis (component 1).

Second, the clinic highlighted a previously overlooked user type: the business developer who operates at the intersection of technology and organisational strategy. These professionals play a decisive role in translating PRESENCE from potential to procurement, evaluating its business fit, orchestrating adoption, and aligning its capabilities with real-world needs. Their absence from earlier user modelling was a critical gap, one that future business development and persona design activities will now explicitly address.

In conclusion, JBC#1 offered us not only external validation, but strategic clarity. It strengthened the project's human-centred design foundations, refined its value framing, and expanded the lens through which exploitation is understood. It also set the bar for the two upcoming clinics, which will

move beyond problem-solution fit to explore business model validation and partnership development as PRESENCE advances toward potential deployment and exploitation pathways.

3.5.2. The Second Joint Business Clinic (JBC#2)

PRESENCE's second Joint Business Clinic (JBC#2) is scheduled for September 2025, strategically placed after the summer period to ensure strong external and internal stakeholder engagement. This clinic corresponds to Cycle 2 (see Section 3.1 Methodology for a description of our methodology). of our human-centred validation methodology and builds directly on the insights gathered during JBC#1.

A key outcome of JBC#1 was the identification of a previously underrepresented yet strategically essential user type: the business developer. Operating at the intersection of technology and organizational strategy, business developers are instrumental in aligning emerging solutions with customer needs, internal processes, and value creation models. Their role in assessing product-market fit, guiding procurement decisions, and shaping adoption trajectories makes them a central actor in PRESENCE's exploitation architecture. As such, JBC#2 will prioritise the inclusion and engagement of this user group.

The core objectives of JBC#2 are to validate user types, including the newly identified business developer, and to refine value propositions for each group. The session will feature a demonstrator of PRESENCE's evolving capabilities, followed by a structured co-creation program. Participants will be invited to reflect on their current workflows, assess how PRESENCE could enhance their activities, and collaborate on refining persona and value proposition canvasses.

Through these activities, the clinic will deepen our understanding of how PRESENCE creates value, explore emerging revenue models, and begin to assess users' willingness to pay. Additional interviews will be conducted with hard-to-reach user groups to ensure their perspectives are represented. Outcomes from JBC#2 will directly feed into the preparation of JBC#3, where commercial pathways and business models will be validated.

3.5.3. The third Joint Business Clinic (JBC#3)

The third and final Joint Business Clinic (JBC#3), planned between Month 27 and 30, will serve as the culmination of PRESENCE's exploitation track. It aligns with Cycle 3 of our human-centred validation approach and will focus on validating the Minimum Viable Product (MVP), testing willingness to pay, and exploring viable business models.

Building on the groundwork laid in JBC#2, particular attention will be given to the role of the business developer as a strategic intermediary between technology and market application. Their insights into procurement processes, organisational dynamics, and commercial requirements will be instrumental in evaluating the real-world viability of PRESENCE. Dedicated breakout groups and tailored sessions will ensure their input directly informs PRESENCE's commercial strategy.

The session will feature a business-oriented presentation of the PRESENCE MVP, positioned within concrete use cases. Participants will assess its market readiness, articulate additional needs, and provide feedback on potential purchasing scenarios. The clinic will also facilitate discussion on licensing options, service integration, and value capture mechanisms tailored to different sectors.

Insights gathered during JBC#3 will support the formulation of one or more business models and the drafting of a Joint Exploitation Plan, anchoring PRESENCE's transition from a research innovation to a market-ready solution. The outcomes of this clinic will ensure that PRESENCE meets not only user expectations but also commercial requirements for adoption, sustainability, and growth.

3.6. PRESENCE value proposition & commercial strategy (component 4)

In D6.1, PRESENCE's value proposition was articulated per SDK, emphasising the technological differentiators of its core components: Holoportation, Haptics, and Virtual Humans. Since then, the project has progressed from a feature-driven framing toward a more integrated value narrative grounded in stakeholder needs, validated user types, and application context. This shift reflects PRESENCE's maturing understanding of how its technologies create value, not just technically, but organisationally and commercially. Not just for PRESENCE and its users, but for society as a whole.

This section presents the midterm update to the PRESENCE value proposition and outlines early hypotheses for its commercial strategy. It synthesises results from JBC#1, consortium workshops, prototype canvasses, and exploitation planning activities to define target audiences, unique selling points, customer benefits, and preliminary business model directions.

3.6.1. PRESENCE Value Proposition

Through workshops, prototype canvasses, and JBC#1, the project has shifted from a fragmented, use-case-specific perspective to a more consolidated understanding of PRESENCE's value across domains. Early personas highlighted domain-specific pain points and contextual goals. However, customer analysis, validation during JBC#1, and ongoing co-creation with partners revealed several common themes: the need for multisensory realism in XR, low-friction integration of advanced technologies, and a clear path to demonstrable outcomes for both users and decision-makers.

The development of domain-specific Value Proposition Canvasses (VPCs) during JBC#1 and earlier consortium meetings helped define what (end-)users and solution providers seek from XR technologies and where PRESENCE fits in. The findings show strong alignment around three areas: enhancing user engagement through realism, lowering technical barriers for developers, and enabling value creation for customers.

To bring these insights together, the project developed an Overarching PRESENCE Value Proposition Canvas (see Annex IV: Overarching PRESENCE Value Proposition Canvas). This canvas synthesises the common themes from the domain-specific VPCs and reflects PRESENCE's position in the DMU and XR value chain:

- Customer Jobs include deploying immersive XR solutions, reducing training risks, and engaging stakeholders across hybrid environments.
- Pains centre on integration complexity, ROI uncertainty, and fragmentation in XR development ecosystems.
- Gains include modular SDKs, improved realism and co-presence, and scalability across domains.
- PRESENCE creates value through SDKs that are interoperable, well-documented, and validated in real-world scenarios.

Defining the Target Audiences

As detailed in Section 3.3.2 Customer analysis, four consolidated user types now structure the PRESENCE DMU. Two of these play a pivotal role in realising and validating PRESENCE's value proposition:

- **Business Developers**, working within or close to solution providers, connect technical capabilities to market demand. They shape service offerings and communicate commercial relevance to clients.
- **User Decision Makers**, such as innovation managers and procurement leads, determine whether and how PRESENCE-based technologies are adopted within their organisations.

These users drive feasibility and viability assessments. Their needs and behaviours form the basis for PRESENCE's market logic. Complementary roles include **Software Developers**, who integrate PRESENCE components, and **Operational Users**, who interact with PRESENCE-powered applications in everyday contexts.

Identifying Unique Selling Points

As PRESENCE takes shape, several characteristics emerged as defining advantages, validated through workshops, partner interviews, and value proposition design work:

- **Multisensory realism**, combining volumetric presence, tactile feedback, and responsive avatars
- **Cross-SDK interoperability**, reducing friction for integration across XR pipelines
- **Modular architecture**, enabling use in isolated or bundled formats depending on the context
- **Domain versatility**, with pilots in healthcare, training, cultural engagement, and collaboration
- **Human-Centred Design foundations**, ensuring that technology meets stakeholder expectations and real-world constraints

These factors differentiate PRESENCE from more generic or siloed XR technologies (see Section 2 Market Update), positioning it as a versatile and extensible solution-building layer.

Understanding Customer Benefits

From the perspective of solution providers and adopters, PRESENCE offers tangible benefits that map directly to organisational goals:

- **Accelerated development** of immersive XR services using well-documented SDKs and templates
- **Stronger engagement and outcomes**, enabled by more natural, emotionally resonant interactions
- **Reduced implementation risk**, due to pre-validated components and support from consortium expertise
- **Adaptability across sectors**, supporting both experimental pilots and scalable deployments

Creating a Clear and Concise Message

To articulate PRESENCE's value proposition to partners, stakeholders, and potential adopters, two messaging formats have been developed.

Extended narrative:

> *The PRESENCE project enhances human interaction in XR environments by providing tools that make virtual experiences feel more realistic, immersive, and emotionally engaging.*
>
> *PRESENCE combines holoportation, haptics, and virtual humans to deliver a modular SDK suite designed to integrate smoothly into existing development pipelines.*
>
> *Holoportation improves realistic 3D interaction between remote users using live volumetric capturing and advanced compression.*
>
> *Haptics enables users to feel touch in virtual environments through tactile devices and realistic feedback systems.*
>
> *Virtual Humans support lifelike avatars and intelligent agents, mimicking human behaviours and expressions for deeper connection and usability.*
>
> *PRESENCE transforms extended reality through cutting-edge technology and interdisciplinary research. Our goal is to make XR seamless in daily life, revolutionising collaboration, training, and engagement.*

Ad lib (short format) (see Annex V: PRESENCE Ad Lib)**:**

> *PRESENCE helps solution providers and adopters build realistic and emotionally engaging XR experiences by delivering modular SDKs for touch, communication, and intelligent agents - enabling faster, lower-risk deployment across health, training, cultural, and collaboration domains.*

Next Steps and Future Validation

The overarching value proposition will continue to evolve throughout the second and third cycles of the project. During JBC#2, we will test assumptions around user needs, value creation, and willingness to pay with a refined cohort of business developers and user decision-makers. Further feedback loops will be established through consortium pilots and targeted interviews. These activities will ensure that the PRESENCE value proposition remains grounded in real-world needs and market dynamics, and that it translates effectively into scalable adoption and long-term commercial impact.

3.6.2. Use Case Commercial Potential

The commercial potential of PRESENCE has been examined through a combination of value proposition design, stakeholder engagement, domain-specific market research, and the consortium individual exploitation plans. Each of the four use cases, healthcare, cultural heritage, manufacturing and training, and professional collaboration, presents unique challenges, sector-specific regulations, and distinct decision-making contexts. Yet across these domains, our findings reveal a convergence around a shared demand for immersive, emotionally resonant, and cost-effective XR solutions.

- In **healthcare**, PRESENCE is particularly well positioned to support non-pharmaceutical pain and stress relief interventions. The combination of virtual humans and haptics creates therapeutic potential for patient engagement, especially in clinical settings focused on mental health or procedural anxiety. Business developers in this space emphasise the need for validated outcomes and integration into existing care pathways. Decision-makers, meanwhile, prioritise compliance, budget alignment, and long-term sustainability.
- In **cultural heritage**, PRESENCE technologies offer new modalities for storytelling, visitor engagement, and remote access to institutions. Holoportation and virtual guides were seen by JBC#1 participants as powerful differentiators for immersive exhibitions or guided tours. Business potential here depends on securing buy-in from curatorial and outreach teams, aligning XR deployments with funding structures, and demonstrating measurable public value. The opportunity lies not only in enhancing visitor numbers, but also in supporting education and access agendas.
- In **manufacturing and training**, PRESENCE was consistently framed as SDK for experiential learning. Operational users benefit from realistic, repeatable, and safe training environments. Haptics is viewed as especially valuable in simulating physical interaction and muscle memory tasks. From a commercial standpoint, organisations look for tools and services that integrate with existing solutions, reduce training costs, and accelerate onboarding. Decision-makers are particularly responsive to ROI models that demonstrate increased efficiency or reduced error rates.
- In **professional collaboration**, PRESENCE adds depth to remote teamwork, with potential applications in design review, knowledge transfer, and stakeholder engagement. While several organisations are already experimenting with XR-based collaboration tools, PRESENCE differentiates itself through its sensory realism and modular integration options. Monetisation opportunities in this space may involve licensing models or integration into broader digital workplace platforms. Commercial uptake will depend on the ability to demonstrate productivity gains and user acceptance.

Across all four domains, the emergence of the **business developer** and **user decision-maker** personas has proven central. These roles act as gatekeepers for adoption and are sensitive to factors such as risk, cost, interoperability, and evidence of effectiveness. Their perspectives have directly shaped the development of our MVP hypotheses (see Section 3.6.3 Towards a Commercial Strategy) and will continue to guide our exploitation focus.

The upcoming JBC#2 (see Section 3.5.2The Second Joint Business Clinic (JBC#2)) will build on these findings. It will specifically test commercial assumptions, value proposition alignment, and willingness to pay across target sectors. Participants in the final 18 months of the project will include early adopters and stakeholders with procurement or budgetary authority. This will allow PRESENCE to assess the commercial feasibility of its value offering under real-world conditions and further refine sector-specific exploitation pathways.

3.6.3. Towards a Commercial Strategy

A Minimum Viable Product (MVP) is a version of a product that contains just enough features to be usable by early adopters, who then provide feedback for further development. It serves as a bridge

between early conceptual ideas and scalable market offerings. The aim is to reduce the risk of building something nobody wants, and instead validate assumptions around desirability, feasibility, and viability through iterative testing. PRESENCE has embraced this approach to exploitation, not by designing a single technical product, but by testing a portfolio of value configurations for its modular SDKs.

To support this process, Work Package 6 (WP6) adopted the MVP Canvas method developed by Bram Kanstein.[6] This structured framework helps teams focus on what truly matters at early stages of product and service development: identifying user needs, understanding motivations, and defining testable value hypotheses. Unlike traditional MVPs focused solely on functionality, our WP6 MVP focuses on exploitation outcomes, especially around viability (business potential) and desirability (user relevance).

In this context, the PRESENCE MVP Canvas (see Annex VI: PRESENCE MVP Canvas) targets our two most critical personas: Business Developers and User Decision-Makers. The business developer represents the individual inside the solution provider organisation who explores how PRESENCE technologies can be packaged, positioned, and sold. The decision-maker, typically a client-side innovation lead or budget holder, determines whether these solutions align with organisational goals and justify investment.

Through the MVP Canvas we developed a set of key hypotheses to be tested and validated during the third methodological cycle. These include:

- That Business Developers will see PRESENCE as a valuable enabler in closing deals or expanding service offerings,
- That User Decision-Makers will be willing to engage in pilot adoption, provided PRESENCE-based solutions demonstrate a clear return on investment, ease of integration, and relevance to organisational pain points,
- That either a subscription-based model (providing recurring access to SDKs and updates) or a modular licensing approach (enabling à la carte access to individual SDKs or features) will align with existing client procurement practices, and
- That PRESENCE can be credibly positioned not as an experimental research result, but as a commercially viable component of XR solution development.

The MVP Canvas serves not just as an internal design tool, but as a testbed for structured validation through the upcoming Joint Business Clinics, targeted interviews, and iterative co-creation with stakeholders.

This process was supported by the development of prototype canvasses (see Annex VII: PRESENCE Prototype Canvasses), which were facilitated by WP6 in collaboration with the technical Work Packages. These canvasses were designed to help the partners, especially those responsible for developing SDK components, articulate early hypotheses around user value, technical delivery, and product–market fit.

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

Across the four prototype canvasses, a number of relevant insights emerged that help bridge technical development with exploitation potential. First, while PRESENCE was always envisioned as a suite of three modular SDKs, the canvasses helped surface how different teams interpret modularity in practice, whether through discrete APIs, bundled features, or solution templates. There was a strong emphasis on developer experience, including documentation quality, usability of the SDKs, and the need for example applications to accelerate adoption. Just as importantly, the canvasses highlighted the need to involve business developers early in the design and go-to-market process, ensuring that product decisions reflect actual market demand, client constraints, and monetisation logic.

These insights directly informed the MVP Canvas by clarifying which jobs, pains, and gains matter most to our intended customers. They also revealed key gaps in current understanding, such as how SDK pricing might work, or which bundling strategies align best with procurement models, that will be tested in the second cycle of exploitation activities. Together, the canvasses provide a bottom-up view of how PRESENCE technologies can be translated into value-generating offers, supported by clear messaging and sustainable business models.

To consolidate these learnings, we will continue validating and refining MVP assumptions through a combination of JBC#2, partner-level experimentation, and one-on-one engagement with early adopters. In parallel, WP6 will support PRESENCE and its partners in developing (joint) exploitation pathway, helping to position PRESENCE not only as a technical platform, but as a commercially and organisationally viable innovation framework.

The final joint exploitation strategy in D6.3 will build on these directions, formalising how PRESENCE components can be sustained, monetised, and shared beyond the lifetime of the project, ensuring lasting value creation for both consortium members and the wider XR ecosystem.

3.7. Component and IP Management (component 5)

PRESENCE brings together diverse technical innovations across haptics, holoportation, and virtual humans. These building blocks are being developed as modular software development kits (SDKs), each with its own trajectory toward technical maturity and potential commercial or research uptake. To support exploitation planning and IP management, PRESENCE tracks these developments through a Component Exploitation Matrix (see Annex VIII: Component Exploitation Matrix), capturing key details such as lead partner, component status, ownership, dependencies, and exploitation opportunities.

Since the first report in D6.1, the matrix has evolved from a conceptual mapping to a working tool for exploitation and sustainability planning. Partners have updated their component records to reflect progress on technical development and refinement of ownership arrangements. This evolving inventory allows us to assess strategic alignment between component development and the overall value proposition, ensure consistency with human-centered and user-type-based exploitation planning, and identify cross-partner opportunities.

As described in D6.1, PRESENCE follows the IP framework established in the Consortium Agreement. Lead partners are identified for each component, and co-development is clearly documented. Ownership of jointly developed assets is governed by Article 26 of the Grant Agreement and relevant sections of the Consortium Agreement. Where appropriate, licensing and

access rights for background and foreground IP are recorded internally to avoid ambiguity during future exploitation activities.

To support this process, PRESENCE collects component-level updates as a shared reference point for evaluating IP boundaries, commercial relevance, and reuse potential. The Component Exploitation Matrix also tracks interdependencies among SDKs, demonstrators, and tools. For example, the HoloMit SDK is linked to specific compression modules and capture pipelines; Virtual Human components interface with behaviour libraries and rendering tools; and haptics systems rely on firmware as well as interaction APIs. We refer to the matrix for an overview of how PRESENCE components complement each other. This mapping helps to:

- Ensure interoperability across technology pillars
- Clarify delivery responsibilities between partners
- Identify which components can stand alone as exploitation units and which rely on integrated use

In the current deliverable the columns focussing on dependencies and exploitation opportunities have been omitted, access to these insights can be requested through the coordinator of the PRESENCE project.

While a specific commercial strategy for each component is being developed as part of ongoing exploitation and value proposition validation, the matrix provides an early indicator of market relevance. PRESENCE uses this information to assess which components:

- Can be offered under open-source or research-use-only licenses
- Might be integrated into service-based business models (e.g. integration support, consultancy)
- Require additional validation or packaging before commercial release

These assessments are closely linked to the exploitation hypotheses presented in Section 3.6 PRESENCE value proposition & commercial strategy (component 4). For example, PRESENCE will test whether either a subscription-based model (providing recurring access to SDKs and updates) or a modular licensing approach (enabling à la carte access to individual SDKs or features) will better align with procurement practices in target sectors. The matrix supports this by documenting which components are technically mature, interoperable, and likely to be adopted independently or in bundles.

By documenting these pathways at midterm, PRESENCE enables forward-looking decision-making and ensures that technical development remains exploitation-aware. Our final deliverable (D6.3) will revisit this analysis, linking component readiness to validation outcomes and sustainability planning.

3.8. Results consolidation with human-centred approach (component 6)

At the core of PRESENCE's methodology lies the ambition to deliver XR technologies that are not only advanced and functional but also meaningful, usable, and sustainable. This requires balancing three overlapping criteria: **desirability** (people), **feasibility** (technology), and **viability** (business).

These dimensions form the foundation for what we refer to as the project's "sweet spot", where the solution becomes truly relevant to real-world use, scalable in the market, and worth adopting at scale.

In D6.1, we stated that this component would consolidate results from all exploitation-related activities by M36 (D6.3). In this midterm update, we begin that consolidation process by offering preliminary reflections and validated insights based on the activities of the first 18 months. These include the development of the Decision Making Unit, refined value chain, updated user personas, the first Joint Business Clinic, multiple prototype canvasses, Value Proposition Canvasses, and the initial Minimum Viable Product Canvas. Combined, these offer a multidimensional understanding of where PRESENCE stands and what still needs to be validated.

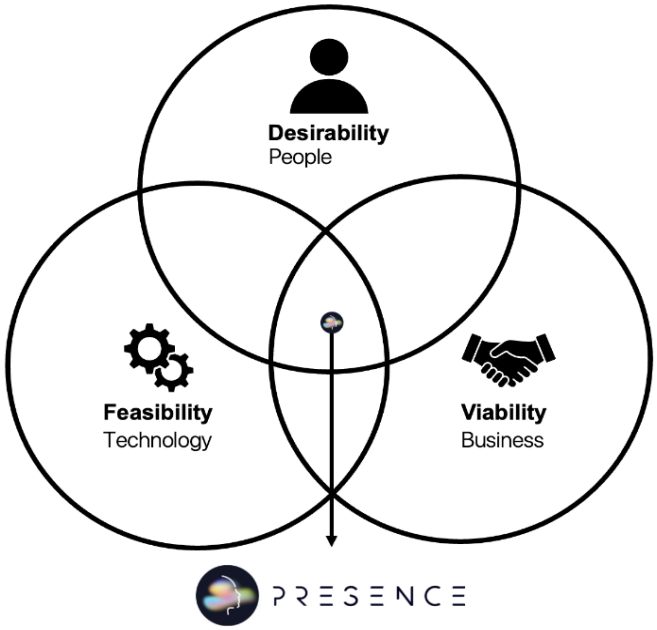


Figure 7: The 'sweet spot' of PRESENCE

Figure 7: The 'sweet spot' of PRESENCE above, captures this ambition visually. It underscores our belief that PRESENCE's success lies not in excelling at just one of these areas but in finding the right balance between them.

- **Desirability**: *Are We Solving the Right Pain Points?* Based on our findings from JBC#1 and internal workshops, PRESENCE technologies consistently address recurring pain points across domains: the high friction of XR integration, poor user onboarding, fragmented tooling, and a lack of emotional depth in virtual interactions. These pain points were echoed by both solution providers and those closer to adoption decisions. As described in Section 3.6 PRESENCE value proposition & commercial strategy (component 4) and validated through the overarching Value Proposition Canvas (see Annex IV: Overarching PRESENCE Value Proposition Canvas), PRESENCE creates value by enabling co-presence, expressiveness, and emotional realism in XR environments. This early validation of desirability provides confidence that PRESENCE is targeting problems worth solving.
- **Feasibility**: *Can PRESENCE Be Delivered in a Scalable Way?* Although full feasibility validation will be conducted through technical integration and user testing in WP1–WP5, we already observe significant progress from an exploitation point of view. The modular design

of the PRESENCE SDKs, as well as their positioning as building blocks rather than end-products, was broadly accepted by both technical and business stakeholders. Moreover, insights from the prototype canvasses (see Annex VII: PRESENCE Prototype Canvasses) suggest that PRESENCE can be feasibly integrated into various sectors without having to reinvent entire XR stacks. Ongoing validation in real-world environments will further test scalability, integration effort, and performance at the edge.

- **Viability:** *Will Customers Pay for It, and Under What Conditions?* This question was central to our development of the PRESENCE MVP Canvas (see Annex VI: PRESENCE MVP Canvas). Rather than focusing on technical readiness, this canvas explores business developer and decision-maker willingness to adopt and pay for PRESENCE-based solutions. Our current working hypothesis is that a modular licensing or subscription-based SDK model will most effectively align with customer procurement logic and support scalable adoption. Early feedback indicates that value is perceived when PRESENCE helps reduce time-to-market, improve usability, or differentiate XR offerings. However, further substantiation through JBC#2 and dedicated interviews will be necessary to define pricing logic, bundling strategies, and commercial support expectations for the third exploitation cycle.

As we move into the second half of the project, the focus will shift to substantiating these insights with harder validation. We will explore the sweet spot further by triangulating user feedback, technical viability, and business readiness. JBC#2 (September 2025) will provide a critical moment to validate both the MVP hypotheses and our assumptions about market traction. By D6.3, we aim to present a consolidated roadmap that links exploitation strategies to impact potential across sectors and user types.

The work so far confirms that PRESENCE has a meaningful contribution to make, not just as a set of technologies, but as an enabler of future XR experiences that are immersive, human, and commercially viable.

3.9. Concluding remarks on exploitation

At Month 18, PRESENCE's exploitation strategy stands on solid ground. What began in D6.1 as a conceptual architecture built around six interlinked components has now matured into a validated, actionable framework, driven by real-world engagement, internal alignment, and market-oriented experimentation.

Across this chapter, we have demonstrated how PRESENCE has progressed from early design hypotheses to concrete strategic insights. We have moved from theoretical user models to validated user types, from fragmented value claims to an overarching value proposition, and from initial partner intentions to structured individual and joint exploitation planning.

A number of important outcomes mark this midterm milestone:

- **Based on prolonged customer analysis the PRESENCE DMU and value chain** where articulated and validated as a shared reference across technical, business, and user perspectives. This clarified how PRESENCE creates value, and what our next hypotheses to text should be.

- **Four strategic user types** (Software Developers, Business Developers, User Decision-Makers, and Operational Users) are now fully integrated into the exploitation logic, guiding persona-based validation and communication.
- **JBC#1 successfully delivered** early validation of sectoral interest and feasibility conditions, laying the groundwork for commercial strategy formulation and value proposition refinement.
- **Individual Exploitation Plans** were created by, and for, each partner and synthesised into a shared map of ambitions, capacities, and potential alignments, setting the stage for exploration of potential joint exploitation pathways
- **A first MVP hypothesis** was defined and will be tested during the second half of the project. This includes testing modular licensing and subscription-based models aligned with existing procurement behaviours.
- **Component-level IP tracking** has evolved from a conceptual matrix into a working tool supporting sustainability, ownership clarity, and commercial pathway assessment.

Taken together, these developments reflect a shift from alignment around aspirations to coordinated, testable strategies supported by partner commitment and stakeholder input. In the second half of the project, exploitation efforts will move from hypotheses and early-stage validation toward market readiness and strategic consolidation. Our attention will shift toward:

- **Deepening MVP validation** through Joint Business Clinic #2 (September 2025) and ongoing talks with business developers and decision-makers.
- **Refining commercial pathways**, including pricing logic, bundling strategies, and sector-specific go-to-market narratives.
- **Expanding partner alignment** around shared exploitation assets and identifying opportunities for bundled offerings or co-branded services.
- **Formalising joint exploitation strategy** in D6.3, linking validated user value, component readiness, and organisational interest into a coherent roadmap for adoption.

These activities will unfold within the third and final cycle of our Human-Centred Design methodology. This phase focuses on validating our assumptions in real-life contexts, scaling up testing efforts, and systematically capturing evidence of user value and market alignment. The insights and learnings from this cycle will serve as the basis for the result consolidation phase in months 30-36, during which the final joint exploitation strategy will be formalised and supported by tailored adoption pathways and partner commitments.

Ultimately, PRESENCE's goal is not only to develop cutting-edge XR technologies, but to ensure their uptake by those who can derive real value from them; such as clinicians, curators, trainers, designers, and the innovators who bring XR to life. With a refined strategy, validated user types, and an iterative methodology in place, PRESENCE is well positioned to translate its promise into impact.

4. Dissemination and communication

This chapter outlines the evolution, coordination, and strategic refinement of PRESENCE's dissemination and communication activities. It provides an update on progress made since M06 and highlights key developments following the leadership transition at M12. The focus is on ensuring that PRESENCE engages relevant audiences through clear messaging, tangible materials, and consistent alignment with exploitation goals. The sections below report on responsibilities, strategy, outputs, and next steps as the project enters its second half.

4.1. Introduction and objectives

Dissemination and communication (D&C) are critical instruments in PRESENCE's broader strategy to maximise impact, foster adoption, and support exploitation. These activities are not just about visibility, but about relevance; ensuring that the project's work is meaningfully understood by those who need to know, use, or act upon it. D&C in PRESENCE operates at the intersection of awareness, understanding, and engagement, and plays a vital role in reaching a diverse set of stakeholders, from technical developers to institutional decision-makers.

In Deliverable D6.1, the consortium outlined an initial strategy for how dissemination and communication would support these aims (see table 2). The goal was to inform target audiences about the project's objectives and progress, stimulate interest in the technologies being developed, and prepare the ground for market uptake and community participation. With this midterm update (M18), we reflect on the progress made, the adjustments implemented, and the strategy being carried forward in the second half of the project.

01	Develop targeted strategies to engage stakeholders, industry professionals, and end-users effectively.
02	Create compelling narratives to articulate the significance of PRESENCE's research findings in clear and engaging ways.
03	Promote the adoption of PRESENCE's innovations within industry sectors and stakeholder communities to facilitate technology transfer.
04	Refine communication strategies through a continuous feedback loop using analytics and stakeholder input for continuous improvement.
05	Monitor the impact of dissemination activities and adjust strategies based on feedback and performance indicators for effective evaluation.

Table 2: Dissemination and Communication objectives

Since Month 12 (M12), the coordination of dissemination and communication activities has transitioned to Sound, following a mutual agreement within the consortium. This change allowed for closer integration of D&C with exploitation activities under WP6 and a renewed focus on usability, messaging clarity, and alignment with the project's evolving value propositions. The updated approach places greater emphasis on producing accessible, audience-specific content and ensuring consistency across online and offline materials.

To support this, Sound has worked closely with consortium partners to deliver updated visual assets, use-case flyers, brochures, and a redesigned roll-up banner. The website and LinkedIn presence have been refreshed with clearer messaging and more frequent updates. These materials are shaped around validated user types and use cases, aiming to speak directly to the needs and expectations of PRESENCE's intended audiences.

The following sections outline this evolution in more detail: the transition of roles, the refinement of strategy, the communication assets delivered to date, and the priorities for the coming period. Together, they show how PRESENCE is working to ensure that what it builds is not only technically advanced, but also visible, understandable, and meaningful to the people and organisations who can benefit from it.

4.2. Coordination and role transition

At the outset of the project, leadership of Task 6.1 (Dissemination and Communication) was assigned to CERTH, with additional support from Sound, UB, and other partners. As PRESENCE entered its second year, the consortium reviewed its coordination practices and identified an opportunity to strengthen the strategic coherence between communication, exploitation, and community-building activities. This reflection led to a collaborative decision: from Month 12 (M12) onward, Sound would take the lead on Task 6.1.

This transition was not about replacing effort, but about refocusing capacity. It recognised the need to link communication activities more closely to PRESENCE's overall engagement model, especially its emphasis on human-centred business design, use case validation, and value creation. Sound's central role in WP6 (exploitation, business development, and capacity building) provided a natural anchor for this integration. The handover process was collaborative and constructive, ensuring continuity in core channels and alignment on messaging priorities.

Since assuming the task lead, Sound has worked to accelerate and refocus dissemination outputs. The PRESENCE website has been updated, new blog articles have been published, a banner has been created and printed, factsheets developed, and a consistent social media presence has been established (especially on LinkedIn). These efforts have introduced a clearer editorial direction and increased activity volume, helping PRESENCE reach both its core user types and broader stakeholder networks with greater clarity and consistency.

UB is coordinating scientific dissemination within the project, focusing on publication strategy and participation in academic forums. I2CAT supports the wider dissemination effort, including content creation, copywriting, and distribution logistics. This distributed model combines strategic leadership with decentralised input, enabling the consortium to maintain a coherent communication strategy while drawing on diverse expertise.

4.3. Strategy overview: past and present

The original dissemination and communication strategy, outlined in D6.1, was built on a broad ambition: to raise awareness, support understanding, and build early engagement with PRESENCE technologies. The initial focus lay in visibility through a combination of social media outreach, web presence, participation in events, and the development of promotional materials. Communication was organised primarily around the three technological pillars of the project, which served as relatable entry points for mainly the more scientific and development centred stakeholder audiences.

Up to Month 12 (M12), dissemination activities closely followed the initial strategy, focusing on establishing a consistent online presence and developing engaging content. The social media campaign Meet the Partners, which had already been launched, was continued; introducing all participating organisations and highlighting their contributions. Promotional materials, such as event announcement posters, were created and shared via LinkedIn to support project visibility. During the General Assemblies, interviews were conducted with key consortium members, and videos were recorded from on-site demonstrations of PRESENCE technologies.

Since Month 12 (M12), following the transition of Task 6.1 leadership to Sound, this strategy is currently being further refined and extended. This refinement builds on lessons learned during the first 18 months of the project and introduces a more targeted approach. In particular, PRESENCE dissemination now seeks closer alignment with the project's exploitation priorities and human-centred design methodology. Messages will be increasingly tailored to user types, aligned with use-case contexts, and delivered through formats that support partner engagement across technical, academic, and commercial domains.

A key advancement has been the introduction of a structured audience segmentation model. This segmentation is directly informed by the PRESENCE Decision Making Unit and defines four primary user types: software developers, business developers, decision-makers, and operational users (see Section 3.3.2 Customer analysis). Each group has distinct information needs, preferred communication channels, and relevance triggers. In addition, a fifth group of researchers has been added to better address PRESENCE's scientific output and its visibility in academic networks. This group is especially relevant for ensuring impact through open-access publications, conference participation, and long-term research collaboration.

Communication activities are also now dual-anchored in both the project's use cases and its three technology pillars. Use cases provide the context and stories through which PRESENCE becomes relatable, while the technology pillars form the core of its innovation narrative. This structure allows PRESENCE to speak fluently to different segments of its ecosystem, offering both conceptual clarity and domain-specific relevance.

User Type	Preferred Channels	Key Messaging Focus
Software Developers	GitLab, Developer Docs, Technical Workshops, Dev-oriented conferences	Integration ease, SDK quality, examples, modularity
Business Developers	LinkedIn, Industry Events, Whitepapers, Webinars, Sales Toolkits	Use-case fit, monetisation potential, partnerships, go-to-market
Decision Makers	LinkedIn, Policy Briefs, Trade Journals, Conference Talks	Strategic alignment, ROI, risk reduction, implementation pathways
Operational Users	Focus Groups, User Testing, Onboarding Materials, Training Guides	Usability, relevance to daily workflows, benefits in practice
Researchers	Bluesky (growing among academia), Conferences, Open Access Journals, Arxiv, Zenodo	Scientific novelty, data sharing, citation opportunities

Table 3: Channel strategy

In parallel, the project has restructured its channel strategy (See *table 3: Channel strategy*). LinkedIn has been established as the central platform for reaching business developers and institutional decision-makers. Researchers are increasingly targeted through conference appearances and, potentially, through emerging platforms like BlueSky, where academic and open-source communities are growing. The team is also positioning GitLab as a dissemination channel for technical documentation, issue tracking, and technical transparency particularly for developer engagement during the second half of the project. Operational users remain best reached through hybrid in-person engagement via workshops, user testing, and use-case materials in accessible formats.

This strategy is being continuously refined. PRESENCE aims to finalise its updated dissemination and communication channel alignment, including decisions around Bluesky, GitLab, and use-case specific tactics, during the fourth consortium meeting and general assembly, which will take place on 1 July 2025 in Amsterdam.

This refined strategy ensures that PRESENCE not only communicates, but communicates with purpose. In doing so, it supports both the uptake of technologies and the wider understanding of what PRESENCE aims to enable in the future of immersive interaction.

4.4. Online communication tools and channels

PRESENCE's online communication strategy plays a central role in engaging stakeholders, disseminating project developments, and raising awareness about its technological and societal ambitions. This section outlines how digital platforms have been leveraged to ensure visibility, transparency, and interaction with a diverse audience of XR professionals, researchers, the identified user-types, and the broader public. The online strategy builds upon a multi-channel approach centered around the project's website, LinkedIn, newsletter, and YouTube channel. Each serving a distinct yet complementary purpose in the PRESENCE outreach architecture. The consortium also made a conscious shift away from outdated platforms (notably X), opting instead to consolidate efforts where engagement has been most impactful. Informed by analytics and audience feedback, this evolving approach ensures that PRESENCE's online presence remains responsive, focused, and aligned with its dissemination goals.

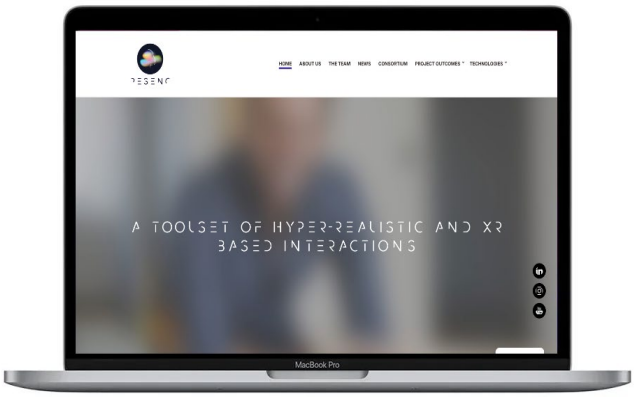


Figure 8: PRESENCE' project website (home page)

4.4.1. Website

The PRESENCE website continues to serve as a central communication hub for the project (see figure 8: our website). It plays a dual role: offering visibility to PRESENCE's core mission and technical pillars, while also anchoring content for stakeholder outreach, community-building, and project transparency. Since Month 6 (June 2024), the website has seen substantial improvements in both structure and performance. Which are reflected in traffic growth, engagement metrics, and expanded content offerings.

By Month 18 (M18), the following performance was recorded:

- 1.900 visitors since project start (M01-M18), with 1.800 visitors since M06 alone (currently exceeding the visitor KPi of more than 700 visitors in M12 by 171%)
- 2.700 sessions and 7.200 pageviews, averaging 2,7 pageviews per session
- 00:01:19 average session duration, exceeding the 1-minute average visit duration benchmark set for the website.
- 15 posts published so far, with increased posting frequency since M12. Staying a bit behind compared to the more than 50 posts by end of the project, we will give this additional effort and focus for the second half of the project.

Last month (May 2025), the site recorded 233 unique visitors and 786 pageviews, with a session duration of 00:01:08. The bounce rate improved to 33.6%, indicating that visitors increasingly engage with content rather than exiting after viewing a single page. These indicators reflect a clear improvement over the first six months of the project and demonstrate sustained audience growth, particularly since PRESENCE's communication strategy was updated at M12 (see Section 4.3). For a complete overview of the website metrics see Annex IX: PRESENCE Website Metrics).

To reinforce the project's digital presence and effectively communicate its core innovations, the website was enhanced since June 2024. The new *technologies* section offers a clear and accessible presentation of PRESENCE's three core pillars; Haptics, Holoportation, and Intelligent Virtual Humans. Developed in close collaboration with technical leaders, each pillar is introduced through concise descriptions, illustrative media, and impact statements aligned with the project's use cases. This content has proven especially valuable in explaining PRESENCE's approach to technically inclined stakeholders and potential adopters. The *team* section humanises the project by featuring short biographies and photos of consortium contributors. This helps to establish transparency, foster trust, and support community engagement and networking efforts. In addition, the first version of the *use-case landing pages* was introduced. These begin to outline the project's practical application domains of healthcare, cultural heritage, training, and collaboration, and will be enriched in future updates.

While the foundational structure is now in place, the website's second-phase development will prioritise iterative updates based on emerging project outcomes, stakeholder engagement opportunities, and partner contributions. This includes:

- Updating the Technology pages using newly developed factsheets, tutorial videos (see Section 4.4.4 YouTube), and messaging aligned with the overarching value proposition.
- Streamlining the Use Case pages based on the new brochures and latest insights.
- Boosting the number of blog posts, highlighting news from partners, event participation, community calls (e.g. co-creation sessions, focus groups), and key project milestones.

Together, these enhancements will ensure the website continues to evolve into a high-impact platform that supports PRESENCE's visibility, engagement, and exploitation goals throughout the remainder of the project.

4.4.2. LinkedIn

LinkedIn is PRESENCE's primary social media channel for strategic outreach. Unlike traditional visibility platforms, PRESENCE's use of LinkedIn is tailored to reach its two most critical external audiences: business developers and user decision-makers. These actors are key to adoption and exploitation, and LinkedIn offers a professional, low-friction setting to engage them with project updates, campaigns, and validation opportunities.

Over the past twelve months (June 2024 to June 2025), LinkedIn has become an integral part of PRESENCE's dissemination and engagement strategy. Highlights from this reporting period (M06-M18) include:

- 54 LinkedIn posts published across the year since D6.1, featuring project milestones, technical developments, use-case progress, and partner activities at events.
- The company page gained 315 new followers, for a total of **589 followers**, of whom 96 are internal consortium members (project KPI of 150 followers).
- Posts generated 49.100 impressions and 1.862 reactions, while the page itself was viewed 1.555 times by 732 unique visitors.
- The average engagement rate per post stands at 18,5%, well above industry benchmarks and an indication of strong content resonance with target audiences.[7]
- 13,5% of followers work in business development or project/program management, a strong alignment with PRESENCE's user segmentation and exploitation goals.

The editorial focus has been on quality over quantity: every post is designed to offer relevant, usable insight into the project, highlighting real-world scenarios and encouraging professional engagement. Content that showcases PRESENCE technologies in action (e.g. demo at XR Expo 2025), shares consortium expertise (e.g. our meet-the-team and quote-of-the-week campaigns), or issues direct invitations to engage (e.g. newsletter subscription campaigns and invitations to user tests) has proven especially impactful.

LinkedIn has also played a central role in cross-channel coordination. For instance, the ongoing newsletter subscriber campaign has used visual calls-to-action and partner resharing to broaden its reach beyond the internal network. This approach will continue with the promotion of technical tutorials, validation calls, and other user engagement activities in the second half of the project. Looking forward, PRESENCE will intensify its use of LinkedIn to:

- Support upcoming user testing and Joint Business Clinics by surfacing opportunities for stakeholder involvement;
- Promote SDK-related content;
- and, Highlight use-case results and insights from domain-specific validation;

[7] Statista - Average engagement on LinkedIn posts in 2023 and 2024

4.4.3. Newsletter

The PRESENCE newsletter is designed as a recurring touchpoint between the project and its wider ecosystem of stakeholders. It complements other communication channels by offering a digestible, accessible, and regular overview of project activities, progress, and opportunities for engagement. While PRESENCE is active on social media and its website, the newsletter enables more direct and curated contact with interested audiences across domains and roles, from developers and researchers to potential adopters and policy actors.

The first issue of the newsletter was released in April 2025, following the transition of communication coordination to Sound. It featured project highlights, event updates, latest blogs, and partner spotlights. However, following internal reflection, the second newsletter was strategically postponed. The reason was not lack of importance, but reach: at the time of release, only 28 subscribers were on the list, 12 of whom are consortium members. In light of this, we decided to prioritise subscriber growth before resuming regular publication. Ensuring that each edition reaches a meaningful audience and serves its purpose beyond simply fulfilling deliverable and project expectations.

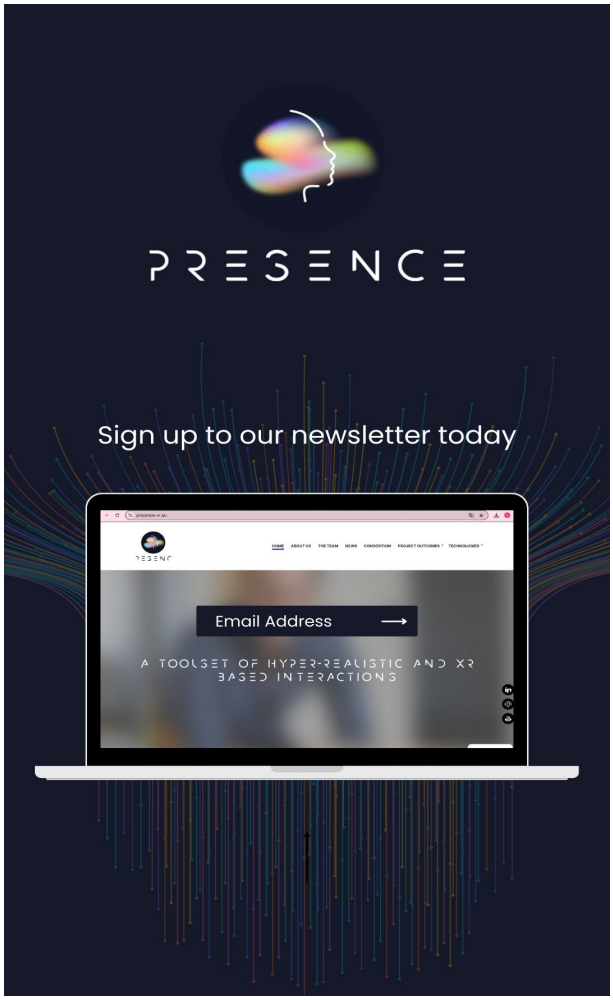


Figure 9: Newsletter visual

To address this, PRESENCE launched a LinkedIn campaign in Q2 2025 to promote the newsletter and drive subscriptions. The campaign features visually engaging posts (see *Figure 8: Newsletter Visual*), a clear value proposition, and a direct call to action. Consortium partners have been actively encouraged to amplify this effort through reposts, likes, and shares; both from institutional channels and personal accounts. The campaign will run until Month 20, at which point the team will assess subscriber growth and release the second newsletter issue accordingly.

In parallel, PRESENCE has adapted how the newsletter is presented in other communication contexts. From workshops and conference talks to project presentations and webinars, the newsletter is now actively promoted as part of the PRESENCE story. The final slide of presentation decks includes a QR code that links directly to the signup page, and speakers are encouraged to highlight the newsletter during their voiceovers as a way to invite audience engagement.

The newsletter remains a strategic tool not only for one-way dissemination, but for inviting community participation. It serves as a platform to recruit stakeholders for focus groups, share calls to action, and signal updates about upcoming Joint Business Clinics. A stronger subscriber base will enable

these efforts to have more reach and resonance. Stakeholders interested in subscribing can do so via the PRESENCE website or this page.

4.4.4. YouTube

PRESENCE's YouTube channel supports its dissemination and communication goals through accessible and engaging video content. To date, the channel features four short videos in an interview format, each highlighting perspectives from consortium members about the PRESENCE project and its core technologies (see *Figure 10: Interviewing the PRESENCE coordinator*). These videos, which collectively have over 100 views, help humanise the project and offer entry points into complex technical domains for wider audiences.

Figure 10: Interviewing the PRESENCE coordinator

The original goal was to produce two videos over the course of the project. However, given the role video plays in visualising PRESENCE's potential and explaining its unique contribution to XR development, this scope has been broadened. A number of potential video formats are now under consideration to strengthen PRESENCE's messaging and reach:

- Short explainers to introduce the PRESENCE SDKs and how they relate to user needs
- Event recaps and interviews that share key takeaways and partner insights
- Use-case highlights to make real-world relevance more tangible for targeted audiences
- How-to tutorial videos tied directly to the three technological pillars (Holoportation, Haptics, and Virtual Humans)

These tutorial videos are especially relevant for developers, researchers, and technically inclined stakeholders, and are further detailed in Section 4.5.4 Capacity building and workshops . They will demonstrate how to integrate and work with each PRESENCE SDK, lowering barriers to experimentation and encouraging adoption.

By using YouTube as a hub for high-quality, reusable content, PRESENCE supports a wide range of communication objectives, from raising awareness and clarifying technical value to inviting hands-on exploration. The goal is to reach at least 500 cumulative views by Month 36, a target that reflects not only visibility, but meaningful engagement with the project's vision and technologies.

4.4.5. Additional Channels: our move away from X

As part of the clarified audience segmentation strategy outlined in Section 4.3 Strategy overview: past and present, PRESENCE has undertaken a critical review of its social media presence and future communication channels. A key decision has been to cease activity on X (formerly Twitter). This decision was not taken lightly, but reflects a growing misalignment between the platform's

direction and PRESENCE's values as a Horizon Europe project grounded in collaboration, inclusivity, and public trust. The platform's declining moderation standards, the increasing prevalence of disinformation, and, ultimately, a highly publicised gesture by its owner that echoed a "Roman salute:, marked a definitive turning point. PRESENCE cannot credibly promote inclusive innovation while remaining on platforms that contradict its European ethical foundations.

This decision has prompted us to explore new communication avenues that align more closely with its strategic aims and core values. The clarified audience segmentation, now centred on four key user types (Software Developers, Business Developers, User Decision-Makers, and Operational Users) as well as researchers, requires distinct, audience-appropriate outreach strategies. As previously outlined, LinkedIn remains the dominant channel for reaching business developers and decision-makers. Website updates and the newsletter are being positioned as cross-cutting tools, suitable for all audiences depending on content design and timing.

For researchers and technically oriented audiences, PRESENCE is currently exploring whether to establish a presence on Bluesky, a federated platform that is increasingly popular among academics, technologists, and progressive policy actors. Early feedback suggests that Bluesky may offer a more relevant and value-aligned space to reach open science advocates and thought leaders. Which are groups that are highly relevant to PRESENCE's goals around standardisation, interoperability, and long-term longevity and exploitation pathways.

Similarly, for reaching software developers, technical stakeholders, and potential early adopters of PRESENCE SDKs, the consortium explored and implemented the use of GitLab as a supplementary channel. While GitLab is not a communication platform in the traditional sense, it is an essential ecosystem hub for developers. The goal is not only to host open-source components and documentation but to engage through issues, releases, and lightweight community management practices. Through GitLab PRESENCE aims to make life of developers, and especially in the integrators of the use-cases, easier, while they can track all technical issues. As such it is an important PRESENCE communication channel between partners, developers, and integrators.

These developments are part of a broader reorientation toward purposeful channel alignment. The aim is not to be everywhere, but to be present where PRESENCE matters; speaking in the right tone, to the right audiences, through the right media. The fourth Consortium Meeting and General Assembly on 1 July 2025 in Amsterdam will serve as the key forum for confirming this revised channel strategy, achieving consortium consensus, and assigning responsibilities for rollout and content management.

Although PRESENCE maintains an Instagram account, it has not played a central role in the project's communication strategy and was not part of the original proposal or associated KPIs. For now, the account will be retained in a dormant state, with no active content planning or performance targets. The consortium's communication efforts will instead prioritise more strategically aligned platforms, particularly LinkedIn, Bluesky, and GitLab, where target user types and engagement outcomes can be better supported.

By reallocating focus and effort toward better-suited channels, PRESENCE is laying the foundation for more targeted, higher-quality engagement in the second half of the project. The anticipated impact includes stronger traction with strategic user groups, deeper alignment between communication and exploitation, and increased potential for community-building around the

PRESENCE SDKs. This realignment ensures that dissemination and communication activities will continue to scale with project progress and remain rooted in relevance, resonance, and ethical responsibility. Simply put, by focusing our communication efforts on these platforms, we can better reach and interact with our community, ensuring that our updates and activities are seen by the people who matter most to our project.

4.5. Offline communication and materials

In addition to digital outreach, PRESENCE has prioritised the creation of high-quality offline materials that support in-person engagement, increase visibility at events, and reinforce the project's identity. These assets are designed to complement the project's online presence, making the PRESENCE message tangible, memorable, and actionable in physical settings such as conferences, booths, and stakeholder meetings. Offline materials have become particularly important as PRESENCE ramps up its participation in external events and deepens its outreach to institutional stakeholders, including business developers, researchers, and user decision-makers.

4.5.1. Roll-up banner

The PRESENCE roll-up banner (see figure 11: PRESENCE Roll-up Banner) was developed as a versatile, minimalist asset designed to offer immediate brand recognition and facilitate actionable engagement. Its visual layout communicates PRESENCE's identity clearly and confidently: the project name, logo, and design elements reflect the updated visual language introduced across all communication materials. The banner also communicates PRESENCE's status as an EU-funded initiative, with the required grant acknowledgment placed visibly at the bottom.

The centerpiece of the banner is a prominently featured QR code, which links directly to the PRESENCE Linktree. This design choice serves a dual purpose: it allows PRESENCE to provide a single, scannable point of access to a range of digital channels, while remaining flexible and adaptive. The Linktree aggregates PRESENCE's social media accounts, website, and newsletter subscription form, and can be updated to feature campaign-specific resources such as focus group invitations, stakeholder surveys, or event registration pages.

Figure 11: PRESENCE Roll-up banner

The banner was first used during PRESENCE's presence at Laval Virtual 2025 and later during XR Expo 2025, and has since become a standard part of the project's event kit. It is intended for deployment at future conferences, booths, workshops, and public-facing engagements, where it helps create a coherent and recognisable visual anchor for PRESENCE.

By directing physical foot traffic into a dynamic and updateable digital ecosystem, the roll-up banner exemplifies PRESENCE's commitment to both coherence and modularity in its outreach tools. It ensures that PRESENCE remains easy to access, easy to share, and always current.

4.5.2. Leaflets and brochures

Since the publication of D6.1 in M6, PRESENCE has significantly expanded its suite of printed communication materials. These materials serve both informational and strategic purposes by supporting awareness-raising, aiding face-to-face engagement, and visually reinforcing the PRESENCE identity at events, partner workshops, and stakeholder meetings.

Building on the original project brochure created at the start of the project, PRESENCE has developed three technical factsheets (see *Figure 12*), each corresponding to one of the project's core technology pillars: Holoportation, Haptics, and Intelligent Virtual Humans. These factsheets provide accessible summaries of the SDKs' capabilities, use scenarios, and integration value, making them especially suitable for outreach to software developers, technical partners, and business developers. A detailed view of the content and design of these factsheets is provided in Annex X: Technical Factsheets.

Figure 12: Holoportation factsheet

In parallel, four use-case brochures were designed to speak directly to domain-specific audiences: Health, Cultural Heritage, Manufacturing & Training, and Professional Collaboration. These brochures highlight real-world application scenarios, connecting PRESENCE's capabilities to stakeholder needs and illustrating potential benefits for decision-makers and operational users. Full overviews of each brochure's structure and messaging are included in Annex XI: Use-Case Brochures.

Together, these materials bring the current total of PRESENCE print-ready brochures and factsheets to eight, with strategic distribution across events, conferences, and institutional visits. The number of target events for each material type is set at six, and to date, technical factsheets have been deployed at two events. The project has set a distribution goal of 400 printed items over the course of its lifetime. As of M18, approximately 120 units have been shared with audiences across different formats and locations.

All materials were designed in A4 format and stored in a shared folder accessible to all consortium partners. Making it easy for partners to print and deploy materials independently, strengthening PRESENCE's visibility through local and domain-specific outreach.

4.5.3. Events and booths

Over the past 18 months, PRESENCE consortium partners have actively engaged in a diverse array of events, conferences, and trade shows to disseminate project outcomes, foster collaborations, and gather stakeholder feedback. An events tracker detailing these activities is available in Annex XII: PRESENCE Event tracker.

To date, consortium members have participated in 47 events, ranging from XR conferences to industry trade shows (with an KPI of Presence in over 20 conferences and trade shows. Furthermore, currently 6 of 16 partners have visited 2 or more networking events). Notably, PRESENCE hosted its own booths at Laval Virtual 2025 (see figure 13: PRESENCE team at Laval Virtual 2025)and XR Expo 2025 (*Figure 14: PRSENCE at XR EXPO 2025*), providing immersive demonstrations of the project's technologies and facilitating direct interactions with a broad audience of XR professionals, researchers, and potential adopters.

Figure 13: PRESENCE team at Laval Virtual 2025

Figure 14: PRSENCE at XR EXPO 2025

At both Laval Virtual and XR Expo, PRESENCE showcased one of the three core technical pillars of the project: holoportation. Visitors to the booth experienced live demonstrations of volumetric capture and streaming, which allowed remote users to appear as 3D holograms in a shared XR space. These real-time demos simulated face-to-face communication across distances and illustrated how holoportation can be used in fields such as education, healthcare, culture, and collaborative training. The demos were powered by the PRESENCE HoloMit SDK and attracted a mix of researchers, technologists, and industry professionals. Feedback highlighted the realism, responsiveness, and cross-platform potential of PRESENCE solutions. Beyond showcasing technology, these events

enabled PRESENCE to connect with other innovators in the XR ecosystem and reinforced the project's visibility and relevance.

As PRESENCE enters the second half of the project, the strategy around event participation is evolving. Based on insights from exploitation validation activities, the Decision Making Unit, value chain, and the refined user types, the focus is shifting toward connecting more directly with business developers and user decision-makers. These user types have been identified as essential for PRESENCE's exploitation success: business developers act as key translators of technological potential into customer value, and decision-makers are responsible for procurement and long-term adoption within organisations.

To engage these groups effectively, PRESENCE will prioritise sector-specific trade shows and conferences that align with the application domains of the project. This targeted approach helps ensure PRESENCE reaches stakeholders with both the need and authority to adopt XR innovations. As such consortium partners have visited and showcased PRESENCE use-cases and solutions at, for example, the Europeana 2025 Conference which focused on digital(izing) cultural heritage and public engagement through immersive technologies, MECSPE 2025 which is one of the most important B2B trade fair for technologies and innovations in the manufacturing and supplier sector for mechanical engineering, and the healthcare congress Euroanaesthesia 2025 which focused on innovative techniques in anaesthesiology and intensive care. By strategically selecting events that align with both domain needs and key user roles, PRESENCE aims to deepen its impact, accelerate uptake, and ensure that its technologies are recognised and applied in the most relevant contexts. This refined event strategy complements ongoing dissemination and exploitation activities and contributes directly to PRESENCE's long-term sustainability and ecosystem positioning.

4.5.4. Capacity building and workshops

Capacity building plays a dual role in PRESENCE. It is both a means of transferring knowledge and skills within the consortium and a mechanism for preparing external stakeholders to adopt, use, and build on PRESENCE results. The strategy combines educational goals with user engagement, aligning closely with the project's human-centred approach to exploitation. Activities in this area are designed not just to inform, but to upskill, activate, and co-create; whether through workshops, tutorials, hackathons, summer schools, or targeted user testing.

Figure 15: Technical coordinator giving keynote at IEEE VR workshop

To structure this effort and plan ahead, we have developed a Capacity Building Framework (see *Figure 15*). This framework distinguishes between two dimensions:

- **Development Focus**:
  - *General Development*: Building knowledge and capacity around XR and related topics (e.g. AI, haptics, immersive media).
  - *Use of PRESENCE*: Training on PRESENCE-specific tools such as the SDKs and deployment scenarios.
- **Timeframe**:
  - *Year 1 & 2*: Emphasis on co-creation, workshops, and early validation.
  - *Year 3*: Focus on SDK tutorials, use-case piloting, and MVP testing.

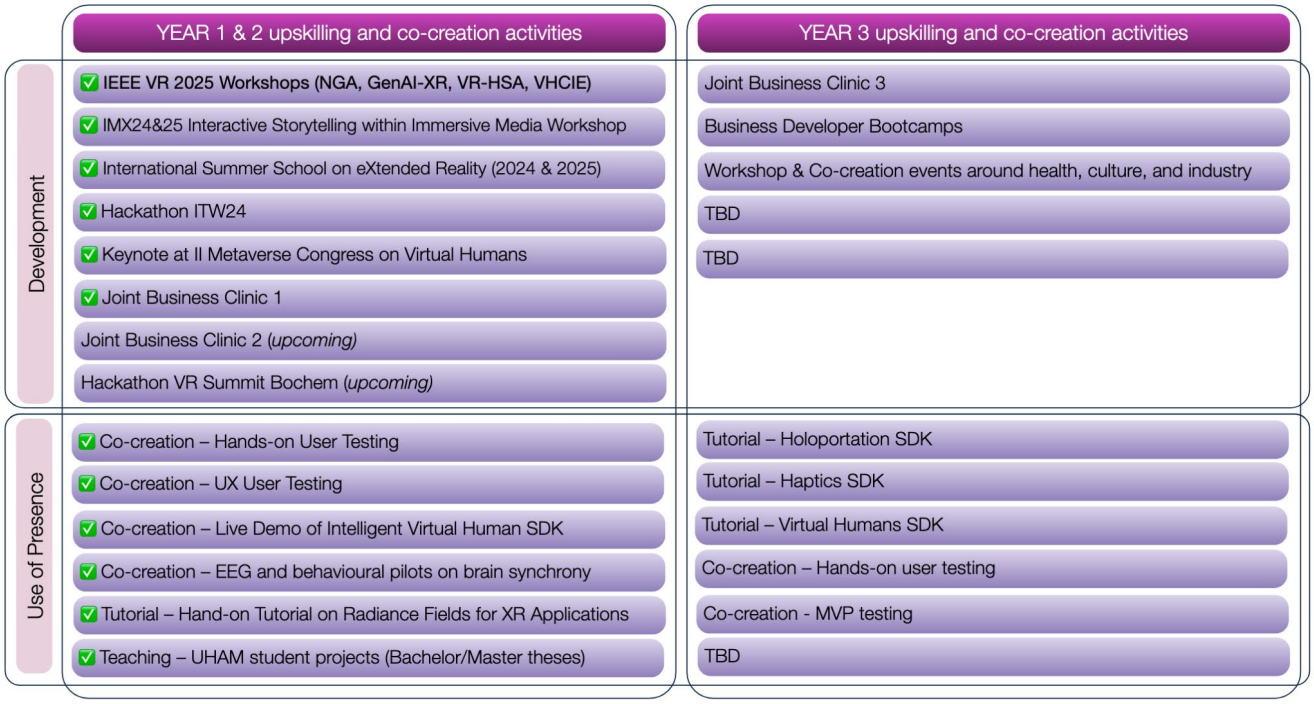


Figure 16: Capacity building framework

The matrix allows PRESENCE to visualise activities across four quadrants: general upskilling workshops (e.g. IEEE VR and IMX workshops), PRESENCE-specific training (e.g. tutorials on holoportation, haptics, and virtual humans), and forward-looking MVP and SDK testing formats. Each quadrant represents a mix of audience types, from researchers and students to business developers and technical integrators.

In the first 18 months of the project, PRESENCE has made substantial progress in this area, already surpassing multiple KPIs defined under Task 6.3:

- 14 (e-)meetings, workshops, and training modules delivered (vs. KPI ≥3)
- 530+ participants in those activities (vs. KPI of 300)
- 1.128 stakeholders reached through user engagement formats (vs. KPI of 3.000 for M36)

These activities ranged from training to user validation, from public events to high-level conferences. Highlights include PRESENCE' presence at conferences such as IEEE VR 2025 where multiple workshops and keynotes where given by PRESENCE partners (see *Figure 15: Technical coordinator giving keynote at IEEE VR workshop*), the Interaction and Storytelling with(in) Immersive Media Workshops at both IMX2024 and IMX2025 (Figure 17: The ISIM workshop participants), and the International Summer School on eXtended Reality Technology and eXperience 2024 (*Figure 18*).

Figure 18: The ISIM workshop participants

Figure 17: International Summer School on sXtended Reality technology and eXperience in Madrid 2024' participants

This year PRESENCE will be co-organizing the 2025 edition of the International Summer School on eXtended Reality Technology and eXperience as well between on 7 to 10 July. Partners also ran hackathons (e.g. at ITW24, co-organised by SenseGlove and the upcoming Hacakthon at VR Summit Bochem 2025 with a joint effort by University of Barcelona and SenseGlove) and held thematic workshops and sessions on presence in XR and human-AI synergy. Educational activities included thesis supervision and lectures at UHAM, pilots conducted by UB on brain synchrony and co-presence, and input to conference workshops, though for example presentations and keynotes, by i2CAT on immersive media accessibility and holographic communication.

These activities serve not only capacity-building purposes, but also strategic goals for dissemination and exploitation. Many workshops double as visibility opportunities for PRESENCE, providing a platform to present SDK capabilities, generate feedback, and recruit early adopters. Similarly, developer tutorials are planned in synergy with the MVP validation strategy and form part of the open innovation approach. The framework supports deeper alignment across Work Packages. WP1 and technical Work Packages provide technical depth and UX methods, WP6 brings value alignment and market orientation, and all partners contribute through co-organisation, domain knowledge, and stakeholder outreach.

Looking ahead to month 36, PRESENCE will continue expanding its footprint in both technical and applied domains. Capacity building efforts will scale up through, for example, the release of SDK tutorial videos, GitLab developer documentation, further user testing,and activities tied to Joint Business Clinics and conference showcases. These coordinated efforts will ensure PRESENCE leaves behind not just results, but a knowledgeable community capable of taking them forward.

4.6. Dissemination: scientific & academic contributions

Over the last 18 months, scientific dissemination within the PRESENCE project has gained considerable momentum. Of the 13 papers planned to be published within the PRESENCE project, so far, we have published one peer-reviewed journal article. One additional paper has been accepted and is currently in press. Four further journal manuscripts have been submitted and are under review, all of them are available as preprints to ensure early community access. This brings the total to six journal papers: one published, one accepted, and four under review.

Also there were 16 of the overall planned 25 conference contributions, of which five have already been published, including four open access and one more with an accompanying preprint. Two others have been accepted and are awaiting publication, and seven additional conference papers have been submitted, again, all with preprints already made available.

This output not only positions us well with respect to the KPIs outlined in the original dissemination plan but also suggests a strong trajectory moving forward. If current review and acceptance rates hold, we expect to meet or exceed all academic dissemination goals by the end of the funding period.

To ensure coordination among partners and to identify synergies and opportunities for joint dissemination, we initiated a regular Scientific Dissemination Update format in Q2 2025. This 30-minute monthly check-in with scientific partners serves three purposes: to give a brief overview of what has been published, to identify what is currently in preparation, and to explore opportunities for upcoming conference submissions or special issues. If formalized, this routine would be an excellent candidate for consolidation in D6.2 as a structured format for ongoing research alignment.

Furthermore, we are about to launch as special issues with the research topic “Enhancing Interdisciplinary and Cross-Cultural Communication in Virtual Collaborative Environments” *Frontiers in Virtual Reality*,

Looking ahead, scientific dissemination will also benefit from community-facing formats like the PRESENCE VR Hackathon, which we will organize on October 18 and 19 in Bochum as an official satellite event of the VR Summit (https://vrsummit.ruhr-uni-bochum.de/)t. The 2025 VR Hackathon will focus on haptics in VR. Teams will be provided with SenseGlove hardware and will be challenged to design novel interaction paradigms that showcase the role of tactile feedback in immersive experiences. In addition to seeding new ideas, we see the hackathon as a strategic dissemination event bridging academic research, creative prototyping, and applied impact.

4.7. Concluding remarks on dissemination & communication

The dissemination and communication strategy of PRESENCE has matured significantly in the first 18 months of the project. What began as a visibility-oriented roadmap has evolved into an integrated approach focused on reach, relevance, and resonance. Through a combination of online engagement, physical presence at key events, community-building, and co-creation efforts, PRESENCE has successfully introduced its vision to a broad range of stakeholders across industry, academia, and society.

Digital outreach has delivered strong results. The PRESENCE website has exceeded its visitor target by over 171%, with 1.900 unique visitors by M18, compared to a KPI of 700 for M12. This growth

has been supported by continuous iteration of the site's structure and content, most notably the addition of dedicated pages for PRESENCE's technology pillars, use-cases, and project team. Similarly, LinkedIn has become the flagship channel for reaching business developers and user decision-makers, with 583 followers (of which 13.5% work in business or project development), over 49,000 post impressions, and an average engagement rate of 18.5% per post.

Offline communication has gained momentum, particularly through PRESENCE's expanding presence at events. Across the first 18 months, 47 conferences, exhibitions, and trade shows were attended by partners, including dedicated booths at Laval Virtual 2025 and XR Expo 2025. These booths were supported by a visual identity toolkit including banners, brochures, and factsheets, with over 120 physical copies distributed to date.

Capacity-building and user engagement activities have been a success story. PRESENCE has delivered 14 workshops, (e-)meetings, or training modules (vs. a KPI of ≥3), and reached more than 530 direct participants (vs. a KPI of 300). In parallel, broader user engagement activities (including user testing, webinars, guest lectures, and conference demos) have collectively reached over 1.128 individuals toward our 3.000-visibility KPI. These sessions do more than inform, they offer participants hands-on experience with PRESENCE technologies and gather feedback that strengthens the project's real-world grounding.

Of the 13 planned journal articles, 7 are already completed or under review (2 published, 1 accepted, 4 under review - 3 all with preprints). On the conference side, 17 of 25 contributions have been made, with 8 accepted or published (including 5 with open access or preprints). A new monthly Scientific Dissemination Update meeting launched in Q2 2025 has improved coordination and synergy across partners. If current trends continue, we are well on track to meet or exceed all dissemination KPIs. Upcoming highlights include a special issue in Frontiers in Virtual Reality and the PRESENCE VR Hackathon (Oct 2025), further boosting academic visibility and impact.

Looking forward, PRESENCE's dissemination and communication efforts will focus on scaling impact. Priorities for M18-M36 include: increasing the number of website posts (news, partner updates, calls to action); launching Bluesky as a channel to reach researcher;; iterating materials for use-case messaging and SDK onboarding; and strengthening cross-linkages between dissemination, exploitation, and community-building. In parallel, upcoming events, such domain-specific trade shows, will provide further opportunities for public visibility, partner promotion, and stakeholder engagement. To support this strategic evolution, the second half of the project will prioritise:

- Increasing newsletter subscribers and converting mailing list growth into engagement.
- Iterating website content based on new factsheets, videos, and use-case brochures.
- Launching and consolidating PRESENCE's presence on GitLab and Bluesky.
- Preparing for long-term legacy via evergreen content and partner amplification.
- Reinforcing the link between dissemination and co-creation activities, including JBC#2 and JBC#3.
- 7/13 papers published, accepted or under review
- 17/25 conference papers completed; 8 accepted/published

5. Standardization

The PRESENCE project has continued to drive innovation and collaboration in the standardization of haptics, light field representations, and AI technologies. Our consortium's active participation in various standardization bodies and events has led to significant progress, setting the stage for the future of immersive technologies.

Over the past year, our partners have made notable contributions in three major areas:

- **Light Field Representations**: Raytrix (RAYTRIX) has advanced the JPEG Pleno format, focusing on light-field, holographic, and point cloud data. This work is essential supporting the project's holoportation goals.
- **Haptics**: Interhaptics (INTER), SenseGlove (SG), and Actronika (ACTRO) have played pivotal roles in the Haptic Industry Forum and Khronos (OpenXR). Their efforts are crucial for both the consortium and the broader industry.
- **AI Technologies**: JOANNEUM RESEARCH (JRS) has continued to lead neural network compression activities in MPEG, for enabling efficient deployment trained NN models, and commented on standards for trustworthiness and validation in ISO/IEC JTC1 SC42 and CEN/CLC JTC21, ensuring reliable AI for virtual humans in XR applications.

One of the most significant milestones for haptics achieved in this period is the adoption of the MPEG haptics standard by the consortium. This standard has been recognized for its superior perceptual rendering fidelity, signal compression, and platform compatibility as illustrated in the author's publication. The MPEG haptics standard allows haptic files to be encapsulated and delivered alongside audio and video in standardized MPEG media formats, marking a major step forward in integrating haptics into mainstream media experiences.

The consortium has actively supported the adoption process, with partners such as Interhaptics, SenseGlove, and Actronika leading the way. Their collaborative efforts have ensured that the MPEG haptics standard meets the highest performance and compatibility criteria, paving the way for widespread industry adoption.

We have shown our implementation to all the consortium during our plenary meeting in Porto, and the feedback was overwhelmingly positive. The partners appreciated the cool and innovative approach, highlighting the practical benefits and seamless integration of the MPEG haptics standard into various devices.

We illustrate below some consortium members during the plenary meeting.

Figure 19: Users immersed in a VR scene using SenseGlove nova Haptic gloves and Actronika's Skinetic vest

5.1. Relevant standardization groups

Our consortium's involvement in various standardization groups and events has been instrumental in advancing key standards. Below is a summary of the significant meetings and contributions:

Event	Type	Site	Date	Partner
Haptic Industry Forum Haptics for VR working group	Meeting	Online	Ongoing bi-weekly meeting	INTER, SG, ACTRO
Open XR (online) meeting	Meeting	Seattle, USA	8/13-Sep-2024	INTER
MPEG148	Meeting	Kemer, Turkey	3/8-Nov-2024	JRS
Metaverse Standards Forum: Volumetric Media Town Hall	Meeting	Online	26-Nov-2024	JRS

Event	Type	Site	Date	Partner
Open XR (online) meeting	Meeting	San Francisco, USA	10/13-Feb-2025	INTER
Open XR (online) meeting	Meeting	online	Ongoing weekly meeting	INTER
MPEG149 in	Meeting	Geneva, Switzerland	20/24-Jan-2025	JRS
Joint JPEG/MPEG Workshop on Radiance Fields	Meeting	Online	31-Jan-2025	JRS
MPEG150	Meeting	Online	31 Mar/4-Apr-2025	JRS
WordHaptics 2025	Conference	Sowon, South Korea	8/11-Jul-2025 [Planned]	INTER
MPEG151	Meeting	Daejon	30-Jun/4-Jul-2025 [Planned]	JRS

Table 4: Standardisation activities 2024-2025

Over the past reporting period (M06–M18), the PRESENCE consortium has been actively engaged in numerous meetings and events to support and advance standardization efforts in the XR domain.

Regarding the KPI for significant contributions to XR standards, which targeted participation in more than 10 meetings, the consortium has exceeded expectations by attending over 13 meetings. This number is even higher when accounting for recurring bi-weekly sessions.

In terms of the KPI for standardization contributions (target: at least 3 contributions), the consortium has made notable progress. Key contributions include:

- Participation in the publication of the Haptic MPEG standard.
- Co-development of a new standard (in collaboration with Meta and Razer) for updating the OpenXR Haptic APIs.

The Haptic Industry Forum Haptics for VR working group has held ongoing bi-weekly meetings, where members from INTER, SG, JRS, and ACTRO have focused on ideating the OpenXR haptics standard. During the Open XR meeting in Seattle from September 8-13, 2024, INTER followed up on advancements in OpenXR standards, ensuring alignment with ongoing developments. Weekly Open XR online meetings have continued, with INTER representatives actively contributing to the ongoing development of OpenXR standards (for details see *Table 4: Standardisation activities 2024-2025*).

At the MPEG meetings in the period (details see ***Table 4***), JRS chaired the NN Compression Ad Hoc Group. After completing the second edition including conformance testing and reference software, the work focuses on elaborating requirements for applying NNC to tensorial data such as 3DGS and running exploration experiments to gather evidence for this task. JRS also attended the Metaverse Standards Forum: Volumetric Media Town Hall on November 26, 2024, to gain an overview of emerging activities at MSF. The Joint JPEG/MPEG Workshop on Radiance Fields on January 31, 2025, provided JRS with insights into work across SC29 groups and beyond. In addition, JRS

provided comments on a number of draft standards from European and international AI standardisation via the Austrian Standards mirror committee for ISO/IEC JTC1 SC42 and CEN/CLC JTC21.

The consortium has already scheduled several key events. JRS will participate in the MPEG151 meeting, where they will chair the NN Compression AhG and prepare the report on experiments related to NNC for generic tensor coding.

As we look to the future (M18-M36), a wide range of events, conferences, and meetings are already scheduled, with more expected to be announced. Our ongoing commitment to active participation ensures that the number of engagements will continue to grow, supporting the achievement of our KPI of three standardization contributions—and potentially surpassing it.

The PRESENCE consortium remains firmly dedicated to maintaining a strong presence within key standardization bodies. Through consistent involvement and meaningful contributions, we aim to shape and influence the future of immersive technologies.

5.2. Standardization planning

To ensure effective collaboration and progress tracking, we have implemented a robust communication framework that promotes ongoing alignment among partners. This framework includes practical information exchanges that keep all parties informed of ongoing conferences, meetings, and advancements. By tracking the activities of the different standardization efforts, we can celebrate achievements and identify areas for further collaboration. A dedicated shared spreadsheet (see Annex XIV: Standardization Overview) has been created to keep track of each activity, ensuring a clear understanding of past, current, and planned initiatives. This approach fosters collaborative planning and strategic alignment, ensuring that all efforts are directed towards making a significant impact on standardization bodies as proven by the outcome obtained in the first part of the project.

5.3. Concluding remarks on standardization

From M09 to M18, the consortium has made significant and measurable progress in shaping the future of immersive technologies through its standardization efforts, as outlined previously. Our contributions to the OpenXR haptics standard, the MPEG Haptics reference software, and the neural network compression requirements for tensorial data are not just milestones—they are concrete outcomes that underscore our leadership and influence in the field.

These accomplishments reflect the deep technical expertise of our partners and their sustained engagement with key standardization bodies. By actively contributing to the development of interoperable and scalable frameworks, the consortium is laying a strong foundation for robust, cross-platform immersive experiences that will drive the next generation of XR technologies

Looking forward, we will build on these concrete results by:

- Expanding our role in OpenXR and MPEG to ensure continued evolution of haptics and media standards.
- Translating our AI standardization work into practical tools and guidelines for industry adoption.

- Aligning future contributions with the needs of developers and end-users to ensure relevance and usability.

Our commitment is not just to innovation, but to delivering standards that are adopted, impactful, and future-proof, ensuring that the technologies we help define today become the foundation of tomorrow's immersive ecosystems.

In the remaining phase of the project, we will continue to actively promote the standards we have contributed to, particularly the MPEG Haptics reference software, and maintain momentum in advancing our contributions to the OpenXR haptics standard. Our engagement in the AI standardization space will also persist, with ongoing participation in bi-weekly meetings. While a definitive publication date has not yet been set due to the evolving nature of discussions, our commitment to shaping and supporting these standards remains strong.

6. Annexes

6.1. Annex I: KPI tracker

6.1.1. Communication & Dissemination KPIs for M18 (T6.1)

Project Month: Alles selecteren | M1 | M16 | M17 | **M18** | M2 | M3 | M4 | M5 | M6

Category	KPI	M18 Som van Value	M18 ProgressF
Brochure	Brochures distributed: 400	120,00	30%
	No. of events where brochure is used: >5	0,00	0%
	No.of Brochures: 2	8,00	400%
Factsheet	No. events where factsheet is used: >5	2,00	33%
LinkedIn	LinkedIn Group of 150 People	487,00	325%
Networking	2 networking events per partner (# of partners reached)	6,00	38%
	Presence in over 20 conferences and trade shows	47,00	235%
Newsletter	Number of quarterly e-Newsletters published: 9	1,00	11%
	Size of dissemination list > 200	16,00	8%
Poster	No. of events where poster is used: >5	1,00	17%
Press Releases	No.of Press Releases: 8	1,00	13%
Publication	2 publications (e.g. white papers) per project partner (# of partners reached)	1,00	6%
	At least once a month an industry newsletter, article, or social media postings	18,00	50%
	Publications in ≥2 journal special issues	0,00	0%
	Publications in conference proceedings (>25)	6,00	24%
	Publications in science journals (>13)	2,00	15%
Video	No. of videos = 2	4,00	200%
	Video views > 500	124,00	25%
Website	Average duration of website visits: 1:00 (per month)	1,05	105%
	number of posts published on website > 50	15,00	30%
	Number of website visitors by M12 > 700 (from M1)	1.900,00	271%
Workshop	(Co-)Organizing a minimum of 5 workshops and 2 tutorials with a participating audience of 20-60 people per event	8,00	114%
	Participating in at least 8 (virtual) exhibitions in total (with at least a booth)	2,00	25%

6.1.2. Exploitation, Community & Capacity-Building and Standardization KPIs for M18 (T6.2, T6.3 & T6.4)

Task: Alles selecteren | **T6.2** | **T6.3** | **T6.4**

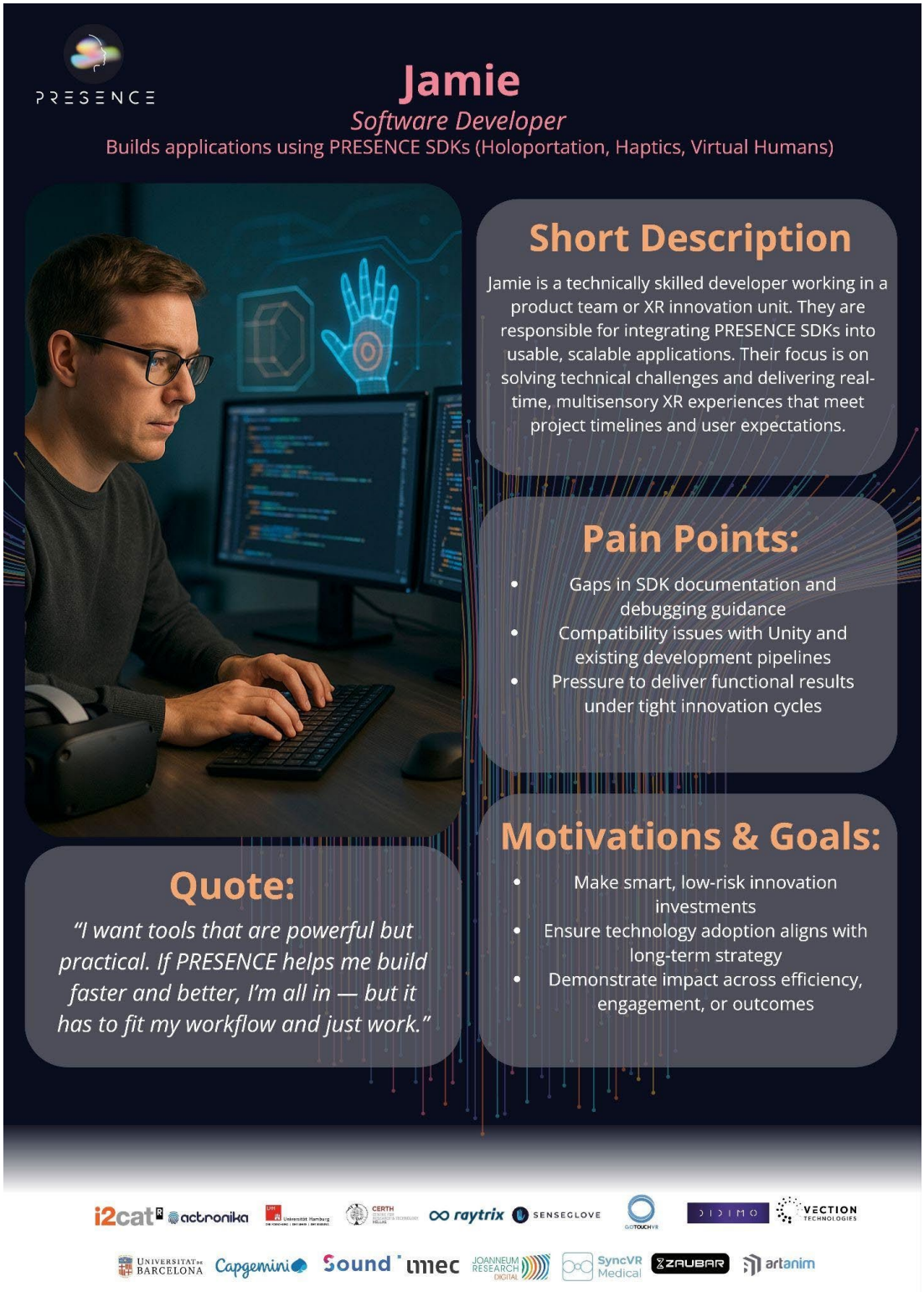
Task	KPI	Actual	Target	Progress
T6.2	Community of companies and organisations across Europe (>200)	38	200	19%
T6.2	Engage in cross-fertilization through commercial talks with at least 3 industry players in microelectronics, 5G/6G, edge/cloud computing, and AI.	1	3	33%
T6.2	Execute a permanent screening of the market in the most relevant fields of work of the project >6 updates (from M12 onwards)	3	6	50%
T6.2	Joint Business Clincs >3	1	3	33%
T6.2	present PRESENCE at relevant international conferences like Immersive Tech Week, Laval, MWC, WebSummit, SXSW etc.	8	10	80%
T6.3	(e-)meetings, workshops and (e-)learning modules (≥3)	14	3	467%
T6.3	(e-)meetings, workshops and (e-)learning modules reaching >300 participants that start an (e-)learning module.	530	300	177%
T6.3	Meetings with policy makers >4	2	4	50%
T6.3	Webinars, training and user engagement = aiming to reach a potential audience of over 3,000 end-users.	1158	3000	39%
T6.4	Significant contributions to XR standards (at least 3 contributions).	2	3	67%
T6.4	Significant contributions to XR standards (over 10 meetings).	13	11	118%

6.1.3. Partner Obligation Tracker

Partner	Som van # Articles	Min 2 articles	Som van # Events	Min 2 Events
ARTANIM	0	No	0	No
CAP GEMINI	0	No	1	On track
CERTH	1	On track	0	No
DIDIMO	1	On track	0	No
i2CAT	1	On track	6	Yes
IMEC	1	On track	2	Yes
INTER	0	No	2	Yes
JRS	1	On track	1	On track
RAYTRIX	0	No	0	No
SG	1	On track	8	Yes
SOUND	1	On track	1	On track
SyncVR	1	On track	1	On track
UB	0	No	1	On track
UHAM	2	Yes	5	Yes
VECTION	0	No	7	Yes
ZAUBAR	0	No	13	Yes

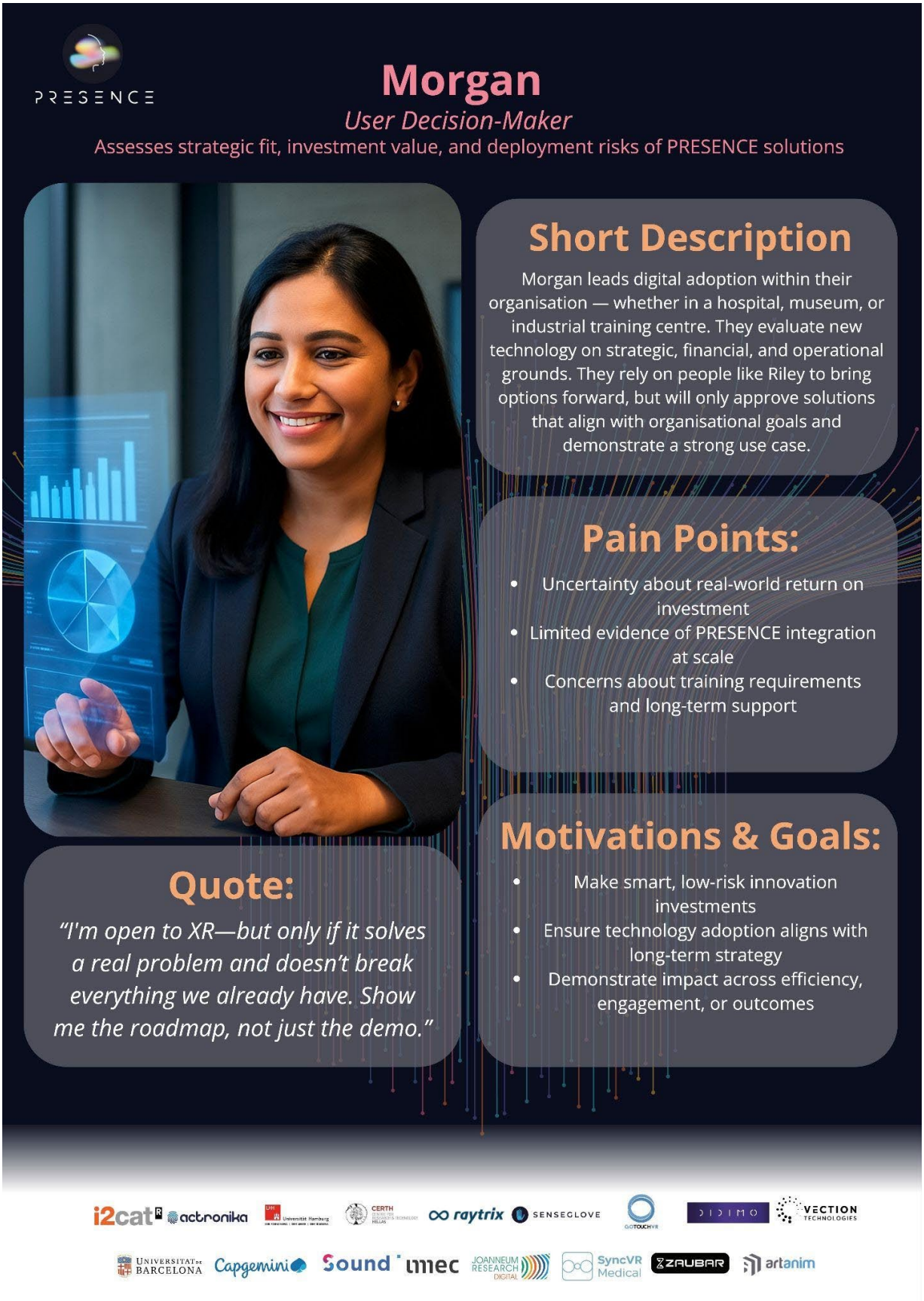
6.2. Annex II: PRESENCE User Types

6.2.1. Software Developer User Type



6.2.2. Business Developer User Type

6.2.3. User Decision-Maker User Type



6.2.4. Operational User User Type

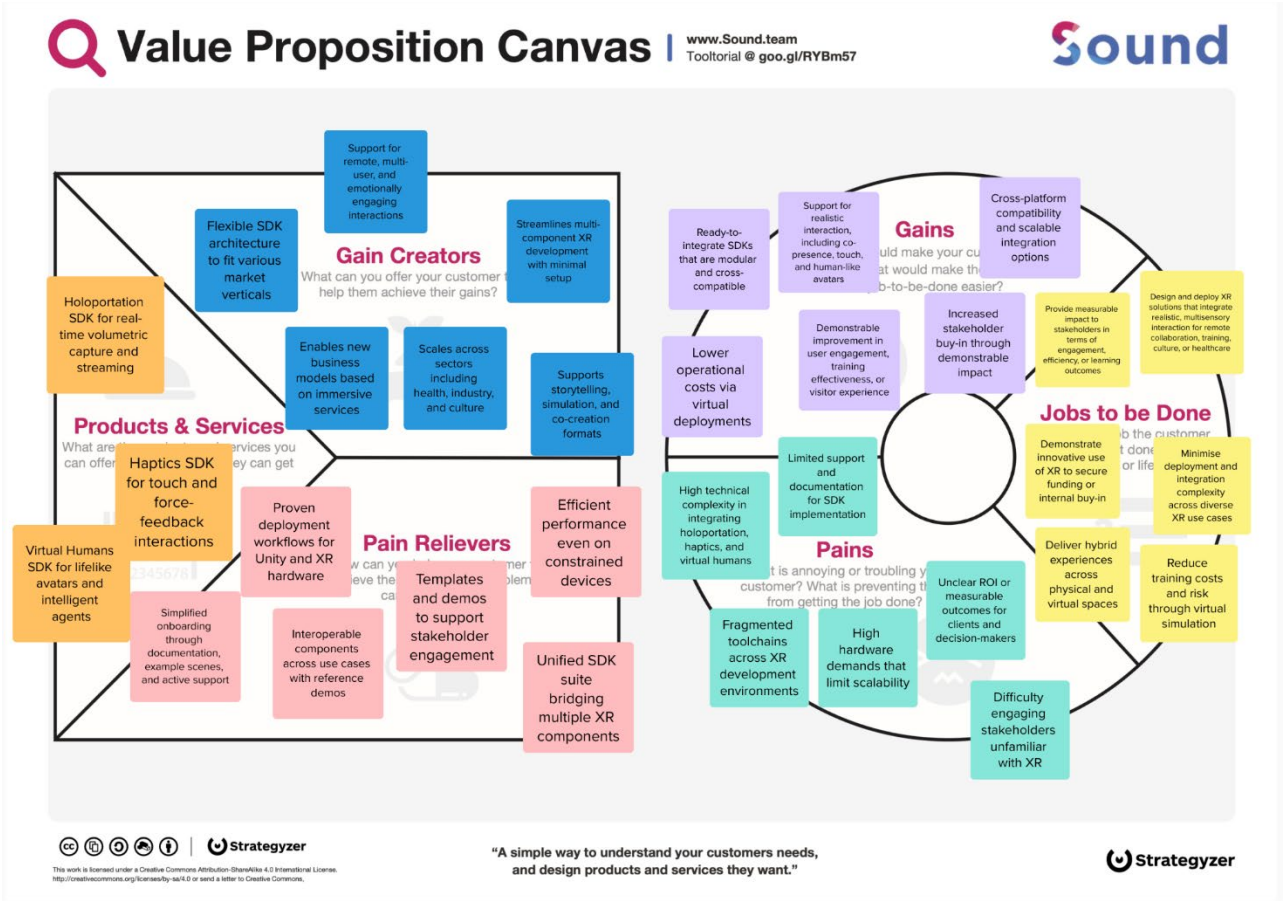
6.3. Annex III: Individual Exploitation Plan overview

Partner	PRESENCE Goals	Exploitation Focus	Relevant Highlights
Capgemini	- Prototype real-time immersive twin for training; showcase PRESENCE SDK integration - Aligns with organisational mission - Seeks measurable user impact	- Internal demonstration projects; client PoCs in manufacturing and logistics - Tailored to sector-specific needs - Involves internal and/or external deployment scenarios	- Strong interest in haptics and holoportation; targets internal innovation units and B2B clients - Highlights existing assets or platforms - Notes projected market relevance - Indicates stakeholder alignment - Points to scalability potential
Raytrix	- Augment virtual production workflows with presence technologies - Aligns with organisational mission - Seeks measurable user impact	- Media sector pilots; integration with creative production pipelines - Tailored to sector-specific needs - Involves internal and/or external deployment scenarios	- Potential synergy with broadcasters and cultural heritage applications - Highlights existing assets or platforms - Notes projected market relevance - Indicates stakeholder alignment - Points to scalability potential
Artanim	- Use PRESENCE to upgrade cultural heritage installations - Aligns with organisational mission - Seeks measurable user impact	- Museum and exhibition markets; licensable immersive content - Tailored to sector-specific needs - Involves internal and/or external deployment scenarios	- Well-positioned to productize cultural XR guided tours - Highlights existing assets or platforms - Notes projected market relevance - Indicates stakeholder alignment - Points to scalability potential
i2CAT	- Position PRESENCE SDKs as public sector XR enablers - Aligns with organisational mission - Seeks measurable user impact	- Support SMEs and public orgs with platform components - Tailored to sector-specific needs - Involves internal and/or external deployment scenarios	- Catalyst role as integrator and testbed; potential public adoption focus - Highlights existing assets or platforms - Notes projected market relevance - Indicates stakeholder alignment - Points to scalability potential
CERTH	- Demonstrate core PRESENCE tech via internal PoCs - Aligns with organisational mission - Seeks measurable user impact	- Academic visibility and collaboration with technology transfer office - Tailored to sector-specific needs - Involves internal and/or external deployment scenarios	- Strong technology contributor; academic dissemination focus - Highlights existing assets or platforms - Notes projected market relevance - Indicates stakeholder alignment - Points to scalability potential
Interhaptics	- Extend commercial SDK offer with PRESENCE features - Aligns with organisational mission - Seeks measurable user impact	- Commercial haptics integrations for XR hardware/software clients - Tailored to sector-specific needs - Involves internal and/or external deployment scenarios	- Clear monetization logic; interested in interoperability and standards - Highlights existing assets or platforms - Notes projected market relevance - Indicates stakeholder alignment - Points to scalability potential

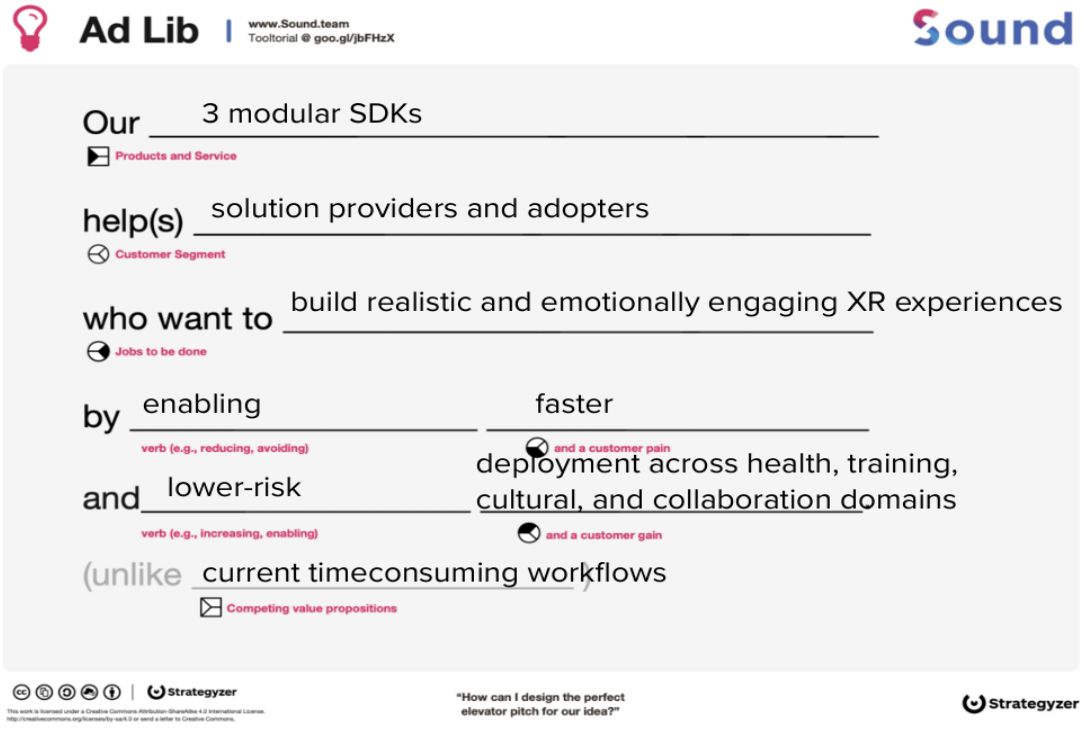
Partner	PRESENCE Goals	Exploitation Focus	Relevant Highlights
IMEC	- Explore PRESENCE as part of multisensory human-centric systems - Aligns with organisational mission - Seeks measurable user impact	- Research-to-industry transfer; integration into cognitive interfaces - Tailored to sector-specific needs - Involves internal and/or external deployment scenarios	- Explores cross-sector applications; possible spin-off potential - Highlights existing assets or platforms - Notes projected market relevance - Indicates stakeholder alignment - Points to scalability potential
JRS	- Integrate XR design principles in applied R&D - Aligns with organisational mission - Seeks measurable user impact	- Joint industry labs and funded R&D projects - Tailored to sector-specific needs - Involves internal and/or external deployment scenarios	- Sees PRESENCE as research infrastructure input for future calls - Highlights existing assets or platforms - Notes projected market relevance - Indicates stakeholder alignment - Points to scalability potential
Sense Glove	- Support glove integration into PRESENCE workflows - Aligns with organisational mission - Seeks measurable user impact	- Hardware sales; SDK adoption by XR developers - Tailored to sector-specific needs - Involves internal and/or external deployment scenarios	- Emphasises ease of integration and developer onboarding - Highlights existing assets or platforms - Notes projected market relevance - Indicates stakeholder alignment - Points to scalability potential
Sound	- Support exploitation via market design and validation - Aligns with organisational mission - Seeks measurable user impact	- Lead WP6; bridge technology, strategy, and customer fit - Tailored to sector-specific needs through consultancy - Involves internal and/or external deployment scenarios	- Transversal role; synthesises use case learnings into go-to-market strategy - Highlights existing assets or platforms - Notes projected market relevance - Indicates stakeholder alignment - Points to scalability potential
SyncVR	- Extend SyncVR's offering for clinical and therapeutic use; enrich product suite with validated pain relief tools - Aligns with organisational mission - Seeks measurable user impact	- Integration into existing commercial VR applications; upselling to current hospital clients; expansion to rehabilitation centres - Tailored to sector-specific needs - Involves internal and/or external deployment scenarios	- Focus on hospitals and therapy clinics; project results will be marketed through SyncVR App Store; 20–150% projected growth depending on funding availability - Highlights existing assets or platforms - Notes projected market relevance - Indicates stakeholder alignment - Points to scalability potential

Partner	PRESENCE Goals	Exploitation Focus	Relevant Highlights
Vection	- Leverage PRESENCE outcomes to explore new XR verticals and market applications - Aligns with organisational mission - Seeks measurable user impact	- Develop new business solutions aligned with PRESENCE components; conduct technical-market opportunity alignment - Tailored to sector-specific needs - Involves internal and/or external deployment scenarios	- Business model and canvas not yet filled; concrete commercial steps still in development - Highlights existing assets or platforms - Notes projected market relevance - Indicates stakeholder alignment - Points to scalability potential
UB	- Advance scientific understanding of presence in XR; apply findings in DEI training and second-language learning - Aligns with organisational mission - Seeks measurable user impact	- Knowledge transfer to spin-off (kiin.tech); integrate findings into DEI products and applied research - Tailored to sector-specific needs - Involves internal and/or external deployment scenarios	- No short-term exploitation plan; impact expected in DEI, therapy, and education via improved realism and engagement - Highlights existing assets or platforms - Notes projected market relevance - Indicates stakeholder alignment - Points to scalability potential
UHAM	- Enhance the Virtual Human SDK and evaluate user interaction patterns - Aligns with organisational mission - Seeks measurable user impact	- Non-commercial academic use; dissemination through publications, workshops, and curriculum development - Tailored to sector-specific needs - Involves internal and/or external deployment scenarios	- No commercial exploitation planned; focus on open-source SDK, academic visibility, and further research funding - Highlights existing assets or platforms - Notes projected market relevance - Indicates stakeholder alignment - Points to scalability potential

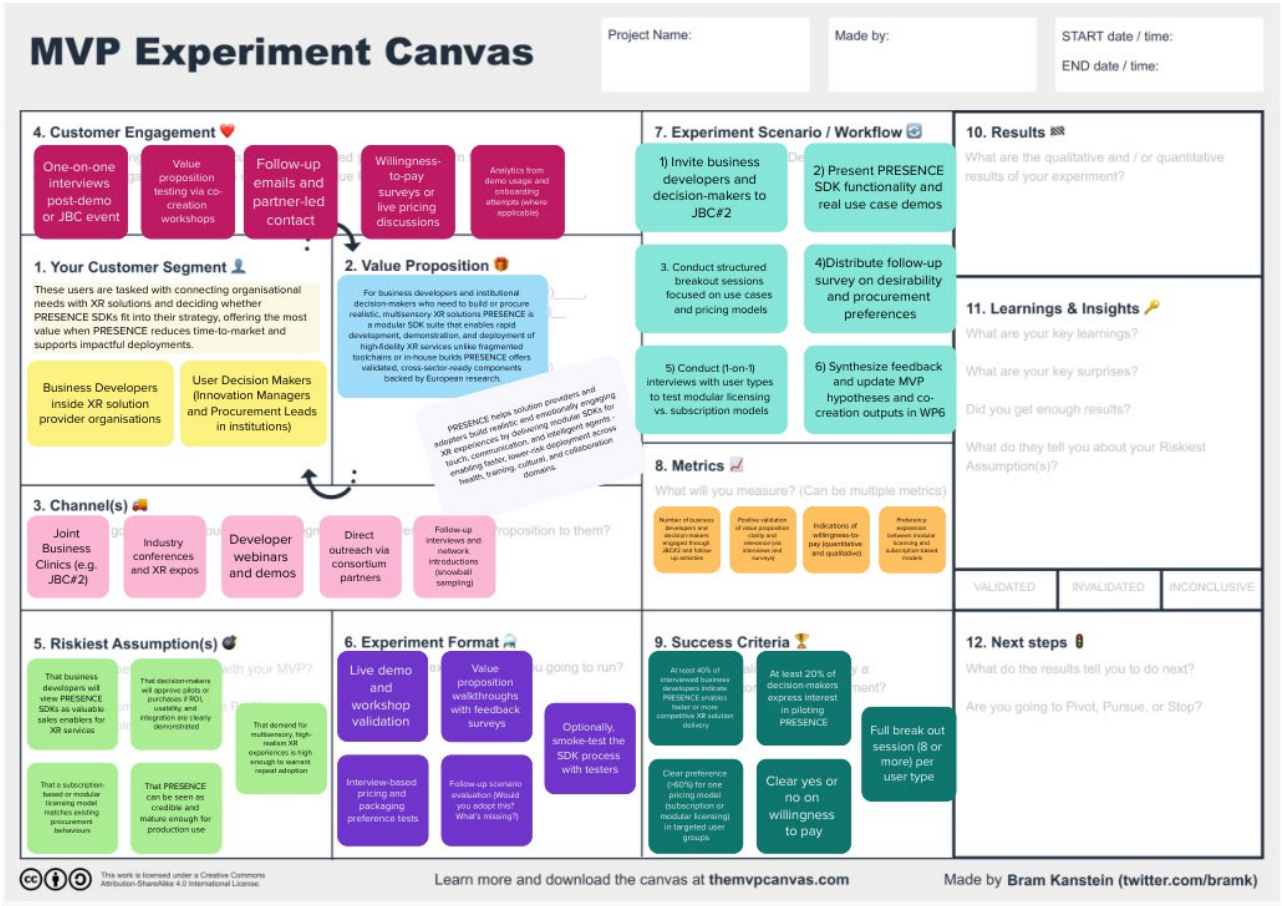
6.4. Annex IV: Overarching PRESENCE Value Proposition Canvas



6.5. Annex V: PRESENCE Ad Lib

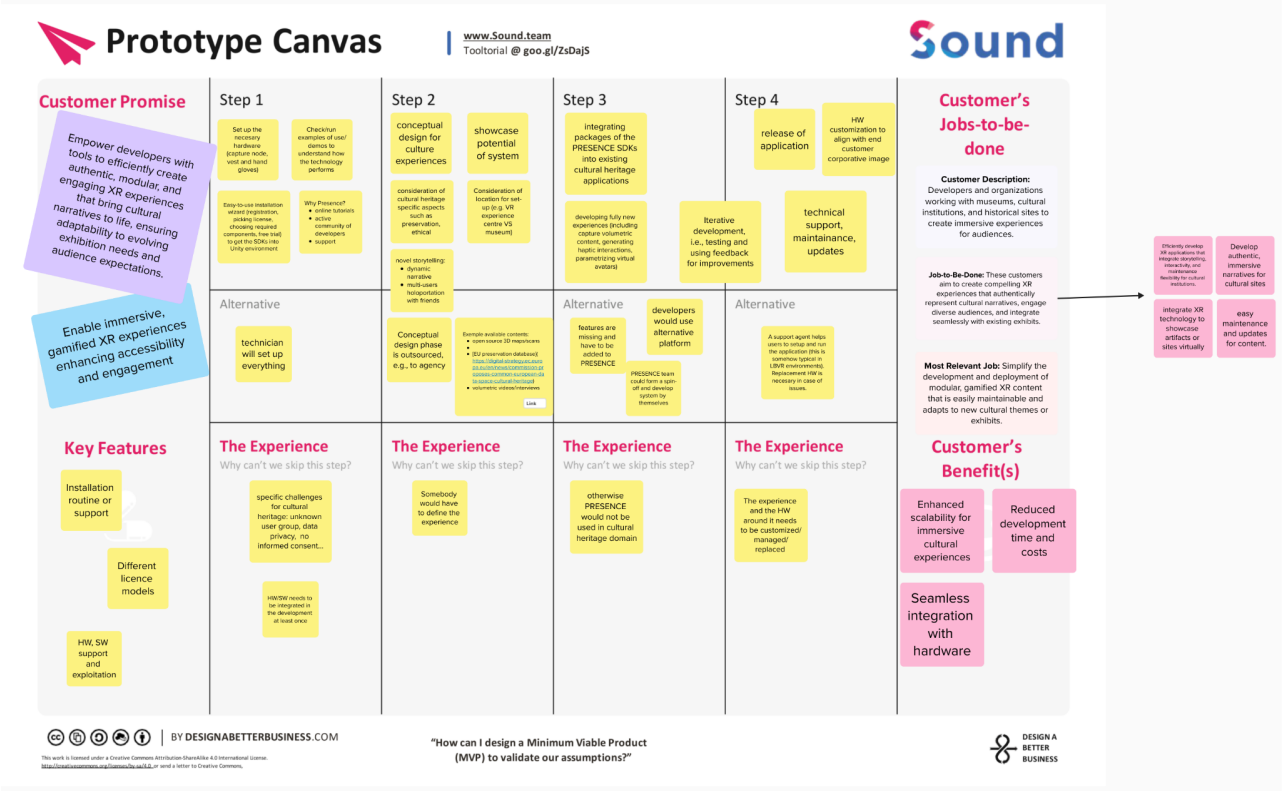


6.6. Annex VI: PRESENCE MVP Canvas

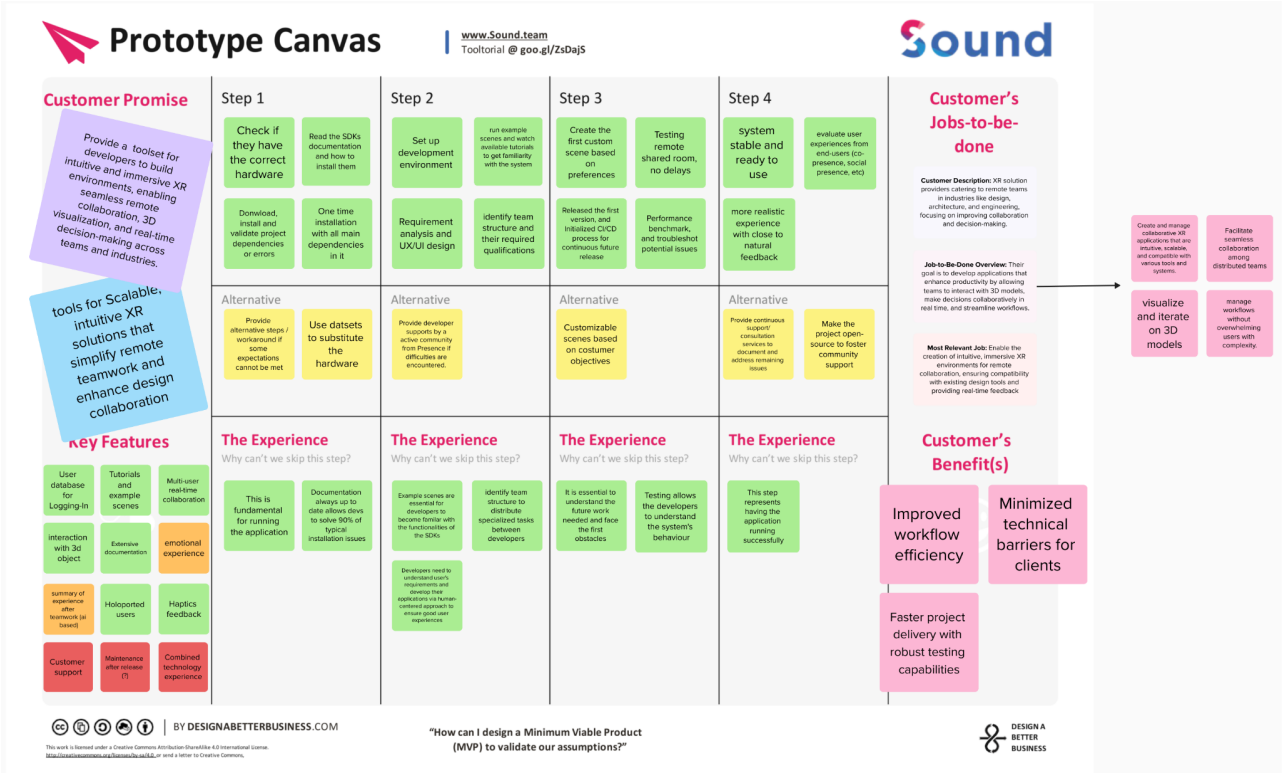


6.7. Annex VII: PRESENCE Prototype Canvasses

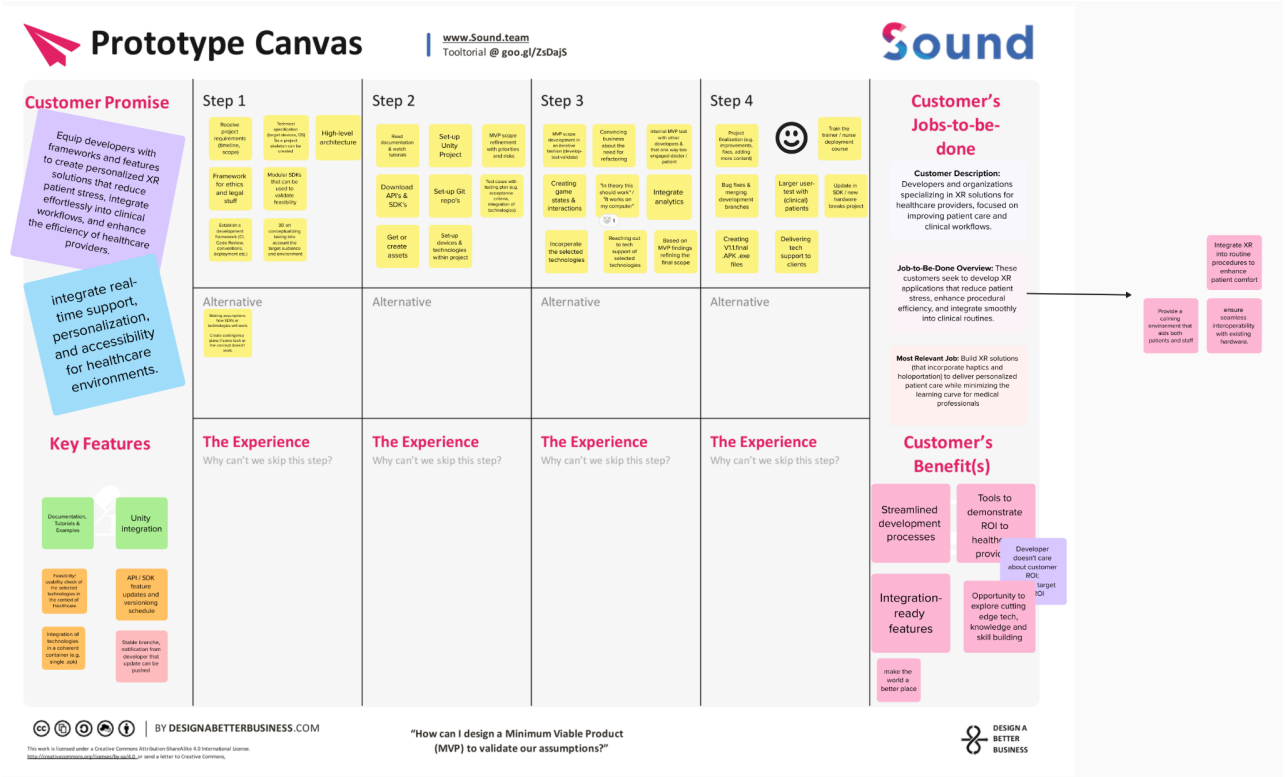
6.7.1. Cultural Heritage Prototype Canvas



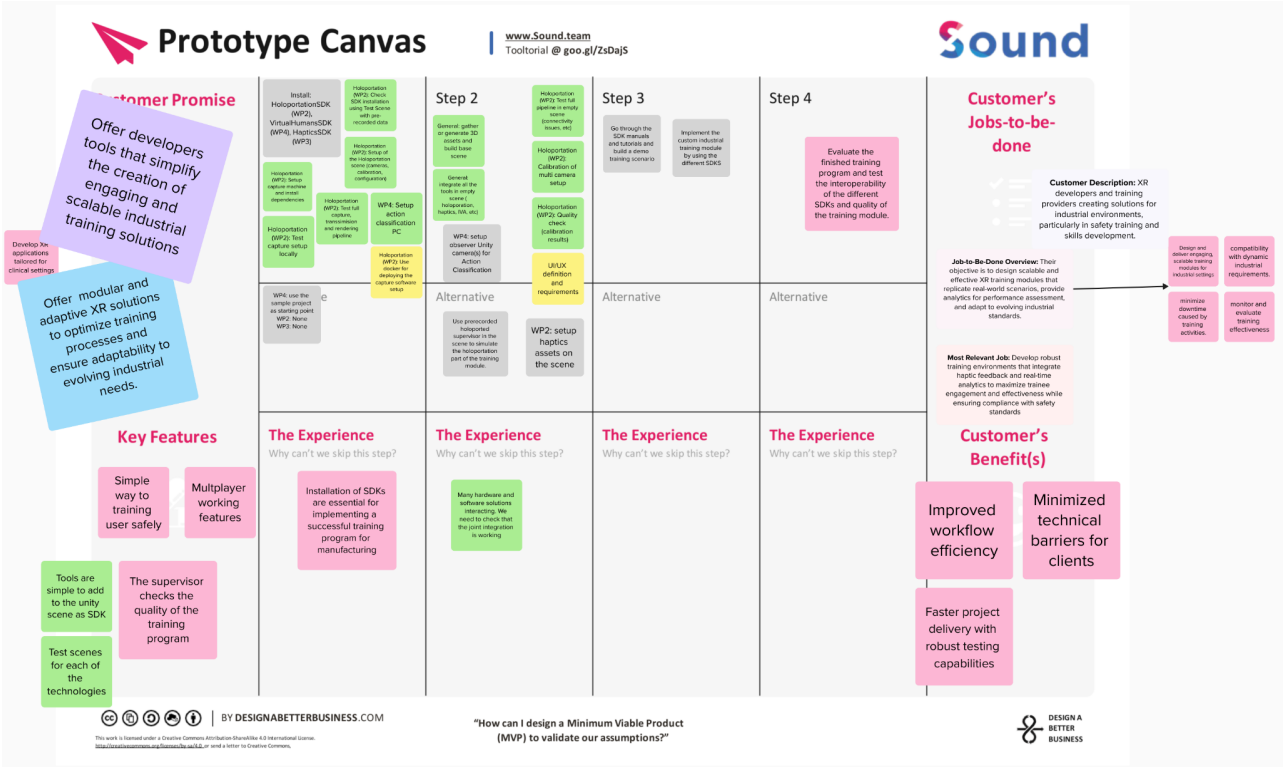
6.7.2. Professional Collaboration Prototype Canvas



6.7.3. Health Prototype Canvas



6.7.4. Manufacturing & Training Prototype Canvas



6.8. Annex VIII: Component Exploitation Matrix

	Attribute	Owner	Component	Description Technical Level	Description User Level
Holoportation					
Raytrix, CERTH, I2CAT	XR Capturer	Raytrix	Capturer SDK	The Light-Field SDK is a set of tools for processing light fields and integrating Raytrix's light-field camera. It encompasses camera controls, calibration, and spawns image processing units (IPUs) for processing light-field into various formats.	The Light-Field SDK converts light-field into usable RGBD data. A user-friendly calibration for light-field cameras will be avilable.
		Raytrix	R32 light-field camera	A light-field camera optimized for capturing high-resolution, 30fps+ light-field images of humans in confined spaces, featuring wide-angle lenses, high-banwidth interface, and thermal stabilization.	A camera able to capture 3D light-field of humans.
	XR Reconstructor	CERTH	VolReco	Human 4D real-time reconstruction	Users experience a 4D reconstructed model of themselves either in pointcloud or 3D meshes representation
	XR Compressor	i2Cat	HoloMIT SDK	Unity Engine Package with DLL that enables volumetric reconstruction, compression, transmission and rendering.	Unity Package that enable multi-session and multi-user holoconferencing
		i2Cat	HoloCalibration	C++ & Python script for automatic estimation of camera extrinsics in a multi-RGBD camera setup. The calibration process relies on feature detection on the color space and	Users can use this tool to easily and automatically estimate the extrinsic positions of a multi-RGBD camera setup. Is device agnostic.

	Attribute	Owner	Component	Description Technical Level	Description User Level
				point matching on the 3D space.	
		i2Cat	HoloCapturer	Collects the inputs from different cameras, it manages the frames from the devices and provides them as an input to HoloCuda	Dynamic library used for managing the capturing devices. The collected input is sent to the HoloCuda library for processing
		i2Cat	HoloCuda	Processes the provided frames and it offloads the work to the GPU and compute point clouds	GPU-based Dynamic library for point cloud processing.
	XR Network	i2Cat	Index / Resource Manager	Keeps track of the available / used in-cloud media components for forwarding, mixing and transcoding	In-cloud component in charge of keeping track and signaling the employed in-cloud components for communication and media processing
		i2Cat	Decision Maker	Balances workload of geometry provision by clustering the session in multiple player subsets, assigniong each subset to a given SFU/MCU.	In-cloud component in charge of ensuring scalability and stability of multiuser sessions. Deploys multiple SFU/MCUs to leverage session workload
		i2Cat	SFU	Forwards geometry packets received from each player to the rest of players, all within a given session.	In-cloud component in charge of forwarding media streams from origin to destination clients. Forwards player provided geometry to rest of the sessionn players.
		i2Cat	Transcoder	Provides the SFU with a LoD system that compresses the data further according to desired quality and bandwith consumption.	In-cloud component communicating directly to the SFU. Recompresses player data streams to reduce network bandwith usage.

	Attribute	Owner	Component	Description Technical Level	Description User Level
Haptics					
ACTRO (terminated), **SG, INTER**	*Content Creation Pipeline*	Interhaptics	Haptics Composer		
		Actronika	Unitouch Studio	Tool to create vibrotactile haptic data using various format that can be used and imported into a large variety of audio tools.	Tool for creating haptic sensations for Skinetic
		SenseGlove	Extended SenseGlove Unity Plugin	Extension of the SenseGlove Unity plugin that outputs vibration and force-feedback effects in the format used by the Main Haptics API Layer.	Tool to define stiffness (force feedback) and vibrotactile effects within the Unity Engine. Also a way to retrieve hand tracking data from the glove.
	Main Haptics API layer	SenseGlove / Actronika	Base Haptics API	API to pass Haptic Effects defined via the Content Creation Pipeline to the relevant implementation written by a Device Manufacturer (e.g. SenseGlove). Interface for device manufacturers to implement their own interpretation of these function calls	For developers; Static functions to call, with parameters such as "the haptic effect to play" and "location on the body". For device manufacturers: A series of functions to implement.
		SenseGlove / Actronika	Materials & Bodies System	Hooks into the Unity Collision System to detect when the user is 'touching' objects that trigger haptics. Collect relevant parameters and calls the corresponding function in the Base Haptics API. Mean to ease the implementation of Haptics within a project.	Unity Component(s) to add to Colliders that can either 'emit' or 'receive' haptics. With fields to assign various parameters, such as 'material properties', or which body part they are meant to represent.

	Attribute	Owner	Component	Description Technical Level	Description User Level
	Haptic rendering & interpretation engine; Device layer	SenseGlove	SenseCom & SenseGlove API	Allows sending haptic signals to the SenseGlove in formats the SenseGlove can interpret. And handles connections and sensor output to the application	Component that renders haptic feedback to the SenseGlove
		Actronika	Skinetic API	Allows haptic effect playback in the Skinetic vest	Component that renders haptic feedback in the vest
		Interhaptics	Quest Interpreter	Interprets MPEG format to Quest 3 and Quest Pro cotroller	
	Haptic hardware	SenseGlove	SenseGlove Nova 2	Enables natural interactions in XR by providing tactile, kinesthetic, and contact feedback	Component that provides tactile feedback to a user interacting with VR
		Actronika	Skinetic vest	The Actronika Skinetic vest is a high-definition haptic device featuring 20 vibrotactile voice-coil motors that deliver precise, localized tactile feedback across the torso, enabling immersive sensations such as raindrops, impacts, and environmental effects in virtual and augmented reality experiences	Component that provides rich tactile sensations that are targetted at the human torso
		Interhaptics	Freyja haptic cushion	The Razer Freyja is an HD haptic gaming cushion equipped with six high-definition voice coil actuators powered by Razer Sensa HD Haptics, delivering precise, multi-directional tactile feedback that synchronizes with in-game audio to enhance immersion	Component that provides tactile sensation during seated down XR experience to the back of the user

	Attribute	Owner	Component	Description Technical Level	Description User Level
Virtual Humans					
Didimo, UHAM, ARTANIM, JRS	*Virtual Human Generation*	Didimo	Face Random agent generation	Algorithms to generate a set of random fully-rigged virtual humans based on a description of parameters (e.g., gender, ethnicity, age range etc.)	
		Didimo	Face Photo to avatar	Algorithms to generate a fully-rigged virtual humans based on a facial photo of a user	Users can experience an avatar of themselve or somebody known from the picture
		Didimo	Character Editor (face/body/garments/accessories)	Virtual human editing based on parameters	
	Virtual Human Language Processing	UHAM	Speech-To-Text	Translates spoken language to written text	Users can communicate information to the virtual human within a voice interaction
		UHAM	Text-To-Speech	Translates written text to spoken language	Users can perceive dynamically generated content expressed by intelligent virtual agents during voice interactions
		UHAM	Visual Language Processing	Processes the context of a conversation by integrating visual information (e.g. an image from the virtual human's egocentric perspective, or a webcam) along side user's speech or texts.	The agent could see the user and the user's virtual/real environments while interacting with the user.
		UHAM	Natural Language Processing	Synchronizing the virtual human's lips with its current voice output	Users can have a natural conversation with the virtual human
	Virtual Human Face Animation	UHAM	Lip-Sync	Synchronizing the virtual human's lips with its current voice output	User can see the virtual human's lips moving during an voice interaction

	Attribute	Owner	Component	Description Technical Level	Description User Level
		UHAM	Facial Expression	Animating the facial expression of a virtual human according to the user's face (smart avatars) or according the interaction content (intelligent virtual humans)	User can have more natural interaction with virtual humans.
		UHAM	Body Language	Animating the agent's body motion based on traditional state-based animations	User can have more natural interaction with virtual humans
		UHAM	Eye Movement / Eye Blinks	Implements eye movement and eye blinks either by eye-tracking (smart avatars) or by algorithms (intelligent virtual humans) to realize a more natural user interaction	User can have more natural interaction with virtual humans.
	Virtual Human Body Animation and Locomotion	ARTANIM	Kinematic Imitator (state-based physics controller)	Re-implementation of DReCon algorithm in Unity3D using the Mujoco Physics Engine. Example demo scenes combining path-finding and Motion Matching with DReCon	This kind of physics controller is trained to follow a kinematic movement. In practical terms it means that the interactive part (locomotion, grasping an object, turning hte head, etc.) is dealt with kinematic methods (inverse kinematics, motion matching, etc.). The contribution of the physics controller is comply with physical constraints (inertia when turning, bumping on obstacles, etc.)
		ARTANIM	Sensorimotor Controller (non-state-based physics controllers)	In progress, not yet settled on the algorithmic details	Sensorimotor controllers work through pure perception-action loops. The interactive reactivity of the character is achieved directly by the physics controllers. It is a much more technically challenging problem

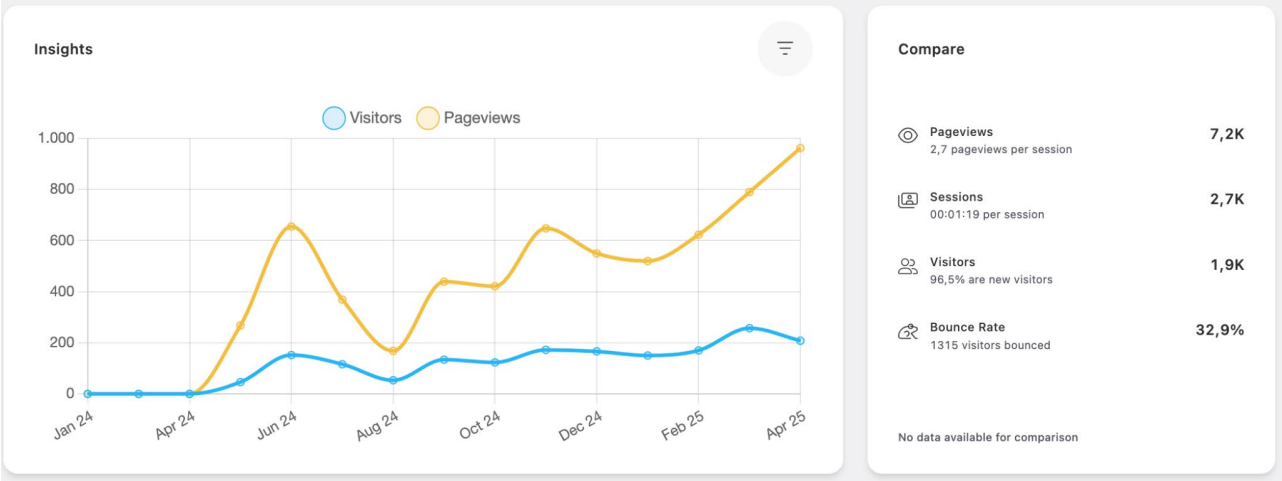
	Attribute	Owner	Component	Description Technical Level	Description User Level
					(this means that the interactivity needs to be introduced within the training procedure), but can potentially give more flexible controllers.
	Recognition, Detection, and Tracking (Human, Emotion, and Object)	JRS	Human action recognition [to be developed]	Real-time recognition of a human's action from a 2D video	-
		JRS	Facial emotion recognition [to bde developed]	Real-time emotion recognition from a user's face (potentially wearing a head-set)	-
		JRS	Object detection and tracking [to be developed]	Real-time object detection and tracking (e.g. of a face, or certain tool) from a 2D video. Employ open-set (zero-shot) object detector for adding new classes without retraining.	-
Demonstrators					
UNITY, VECTION, SyncVR, ZAUBAR	Demonstrator Template	Unity Technologies	"Unity Presence Scenario"	Allows creators to develop PRES immersive scenarios	Creators use it in Unity to create PRES immersive experiences
		Vection Technology	Immersive Collaboration Experience	Use the technology of haptic gloves, Virtual humans and holoportation to create a multiuser Manufacturing experience to execute a training scenario. Users will interact using haptic gloves to touch the environments, holoportation to have a more realistic representation of the people, and the IVA for a easy	Users can execute and/or evaluate training in a more immersive environment through the holoportation and the haptic feedback. They will also have the help of an Intelligent Virtual Agent that can help them with the training itself in a natural speech interaction

	Attribute	Owner	Component	Description Technical Level	Description User Level
				interaction with the training	
		Vection Technology	Immersive Training Experience	Use the technology of haptic gloves, Virtual humans and holoportation to create a multiuser Professional collaboration experience to design an armchair. Users will interact using haptic gloves to touch the environments, holoportation to have a more realistic representation of the people	Users can interact with each other in a more immersive environment letting them to feel the sensation of the objects, and with a more realistic environment
	Pain Relief Demonstrator	SyncVR Medical	Haptic relax & distract	Use sensor data from haptic gloves and haptic vest to increase immersion in distracting/relaxing experience for patients during medical interventions	a) Patients: the most immersive experience to distract them from and relax during medical procedures b) Healthcare staff: a time-saving method to treat the most anxious patients
		SyncVR Medical	Ava	Use human avatar interaction to increase immersion in distracting/relaxing experience for patients during medical interventions, using an Intelligent Virtual Avatar to inform and instruct patient throughout the intervention	a) Patients: the most immersive experience to distract them from and relax during medical procedures b) Healthcare staff: a time-saving method to treat the most anxious patients

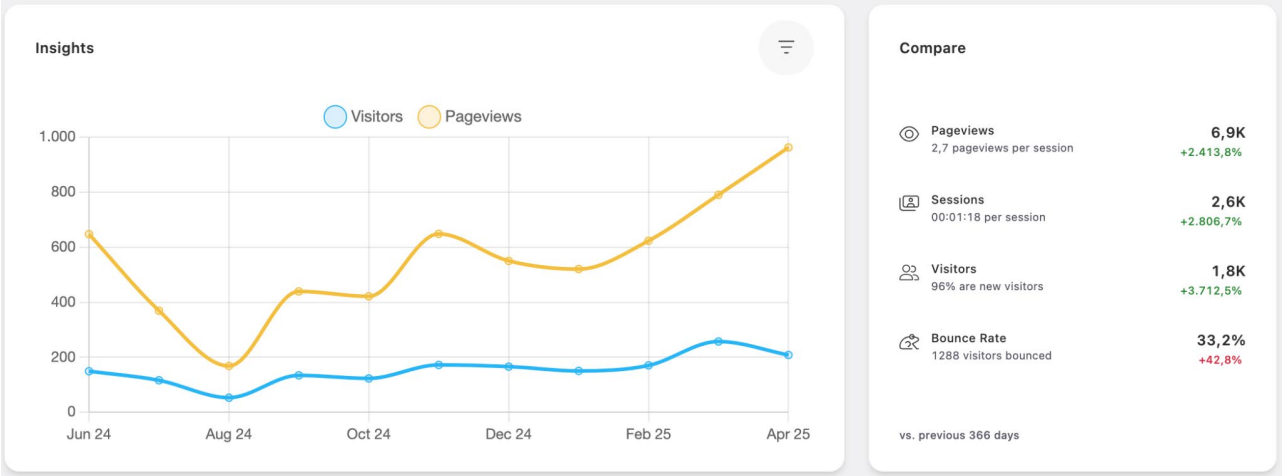
	Attribute	Owner	Component	Description Technical Level	Description User Level
		SyncVR Medical	Buddy	Use holoported familiar person (friend/family, "buddy") inside the VR environment to maximise relaxation and distraction and minimise pain/anxiety experience. The buddy comforts the patient with words (i.e. voice audio) and gestures.	a) Patients: decrease pain/anxiety experience by interacting with familiar person to become more relaxed b) Healthcare staff: saving time by being able to focus on intervention while Buddy comforts the patient
	Tourism Demonstrator	ZAUBAR	Holistic Location-Aware Experience (for touristic and educational purposes)	Combine Avatar and Character Creation, Speech and Language Processing, Facial and Body Animation, Recognition and Emotion Analysis and Visual Perception and Tracking with immersive storytelling and straightforward UX for a user-friendly experience releasable to test groups. Technology: Partners' APIs, Partners' Hardware, Unity, ZAUBAR CMS, Apple Vision Pro)	Tourists are able to relive the experience of fleeing through the tunnel going from 1980s East to West Berlin. Tour guides and time witnesses are able to communicate the experience from those times in a more meaningfull and immersive way.

6.9. Annex IX: PRESENCE Website Metrics

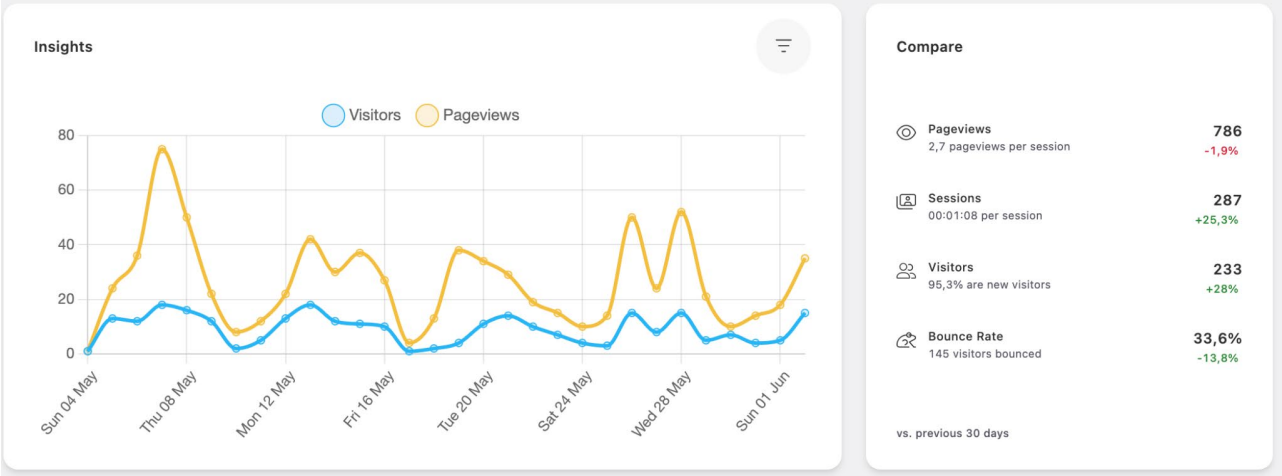
6.9.1. Website Metrics M01-M18



6.9.2. Website Metrics M06-M18



6.9.3. Website Metrics M17

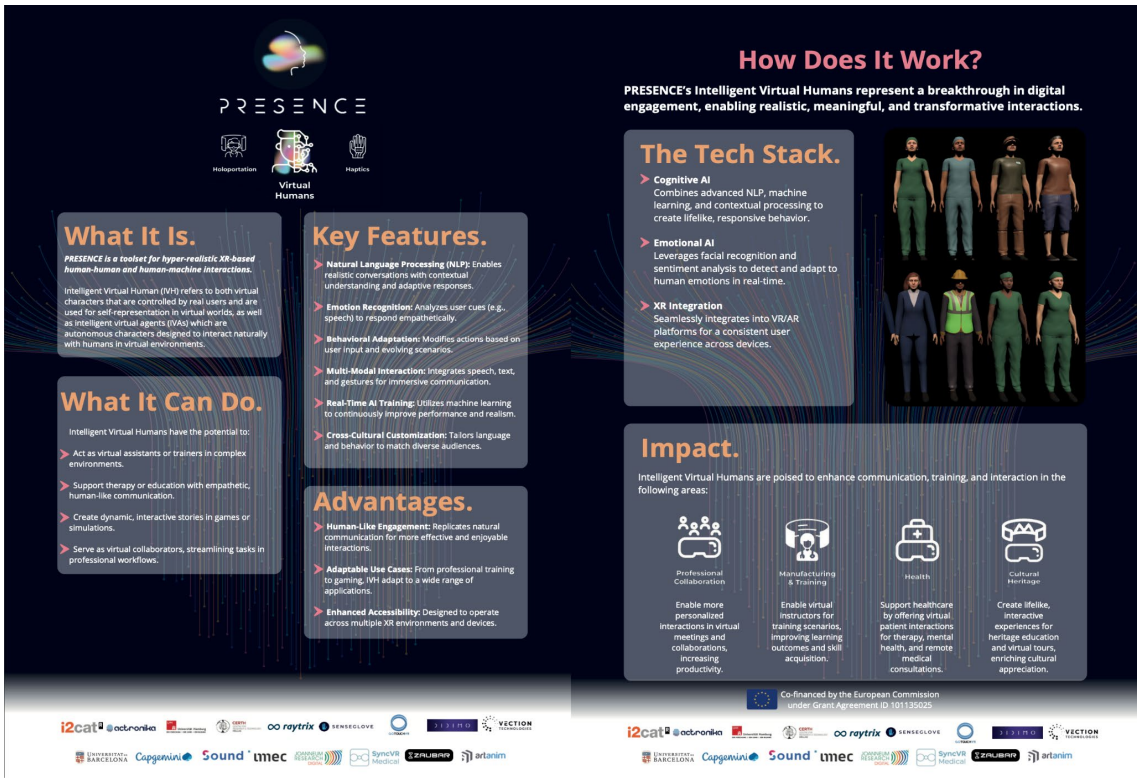


6.10. Annex X: Technical Factsheets

6.10.1. Holoportation Factsheet

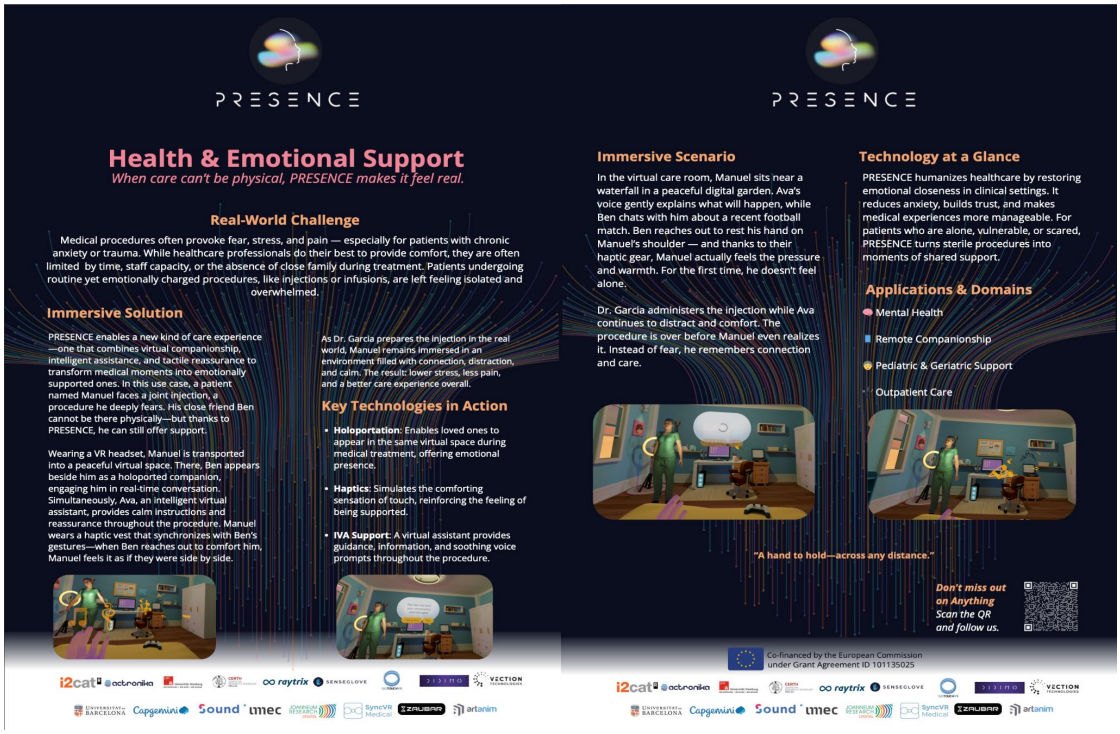
6.10.2. Haptics Factsheet

6.10.3. Intelligent Virtual Humans Factsheet



6.11. Annex XI: Use-Case Brochures

6.11.1. Health Use-Case Brochure



6.11.2. Cultural Heritage Use-Case Brochure

6.11.3. Manufacturing & Training Use-Case Brochure

6.11.4. Professional Collaboration Use-Case Brochure

6.12. Annex XII: PRESENCE Event tracker

Event	Date	Participation by Partner
Beyond Borders	22-Feb-2024	Vection Italy
Laval Virtual 2024	10-Apr-2024	SenseGlove
MWC 2024	26-Apr-2024	i2CAT, SenseGlove
ISIM 2024	6-Jun-2024	i2CAT, IMEC
AWE USA 2024	18-Jun-2024	ZAUBAR
Eurohaptics 2024	7-Jul-2024	INTERHAPTICS
ITSEC 2024	12-Jul-2024	SenseGlove
Measuring Presence in XR: State-of-the-art and Outstanding Challenges	27-Jul-2024	UB
AWE Asia 2024	24-Aug-2024	SenseGlove
Startup Open Air (SOA) 2024	29-Aug-2024	ZAUBAR
GI VR/AR	17-Sep-2024	UHAM
DSC VR	18-Sep-2024	SenseGlove
NEM SUMMIT 2024	3-Oct-2024	i2CAT
ACM SUI	7-Oct-2024	UHAM
ACM VRST	9-Oct-2024	UHAM
GITEX	14-Oct-2024	Actronika, Zaubar
AI Hardware Meetup Vol. 1	15-Oct-2024	ZAUBAR
AWE Europe 2024	29-Oct-2024	INTERHAPTICS
Euro naval	1-Nov-2024	Vection Italy
WEB SUMMIT LISBON	11-Nov-2024	ZAUBAR
OpenLab	14-Nov-2024	IMEC
SLUSH	20-Nov-2024	ZAUBAR
AI Hardware Meetup Vol. 2	30-Nov-2024	ZAUBAR
Immersive Tech Week 2024	4-Dec-2024	SenseGlove
NAD Event	8-Feb-2025	Vection Italy
WAICF	13-Feb-2025	Vection Italy
AI MEETS XR	17-Feb-2025	ZAUBAR
IVRHA	25-Feb-2025	SenseGlove

Event	Date	Participation by Partner
MWC 2025	3-Mar-2025	ZAUBAR, SenseGlove, I2CAT
MECSPE	6-Mar-2025	Vection Italy
SXSW AUSTIN	7-Mar-2025	ZAUBAR
IEEE VR 2025	8-Mar-2025	UHAM
DIDACTA	12 March 2025	Vection Italy
GTC 2025	17-Mar-2025	JRS
AI MEETS XR	27-Mar-2025	ZAUBAR
Messe Hannover	31-Mar-2025	Capgemini
Laval Virtual 2025	9-Apr-2025	PRESENCE Booth (i2CAT, SOUND, SenseGlove)
ACM CHI 2025	26-Apr-2025	UHAM
Museen Stärken Demokratie	4-May-2025	ZAUBAR
Lamiera	6-May-2025	Vection Italy
XR EXPO 2025	8-May-2025	PRESENCE Booth (i2CAT)
GovTech 2025	20-May-2025	ZAUBAR
Euroanaesthesia 2025	26-May-2025	SyncVR
IMX 2025	3-Jun-2025	IMEC, i2CAT
Innovationstag	5-Jun-2025	ZAUBAR
Europeana Conference 2025	11-Jun-2025	ZAUBAR
VIR	25-Jun-2025	ZAUBAR
AI for good summit 2025	*8-Jul-2025*	*SenseGlove*
FARETE	*3-Sep-2025*	*Vection Italy*
IBC	*14-Sep-2025*	*TBD*
BIMU	*13-Oct-2025*	*Vection italy*
EXPO Industria	*28-Oct-2025*	*Vection italy*
SAMU EXPO	*5-Feb-2026*	*Vection italy*
ITB 2026	*3-Mar-2026*	*ZAUBAR*
MECSPE	*4 March 2026*	*Vection italy*
SXSW 2026	*12-Mar-2026*	*ZAUBAR*
Immersive Tech Week 2026	*23-Jun-2026*	*Sound, SenseGlove, TBD*
PROSA2026 Conference	*10-Sep-2026*	*SyncVR*

Event	Date	Participation by Partner
Euroanaesthesia 2026	*6-Jun-2026*	*SyncVR*
AI&VR Festival – Multiverse World	*1-Oct-2026*	*Vection italy*
United XR Europe	*8-Dec-2025*	*Sound, SenseGlove, TBD*

6.13. Annex XIII: PRESENCE publication and conference proceedings tracker

Publisher	Authors	Title	Status	Date
IEEE TVCG/ IEEE International Symposium on Mixed and Augmented Reality (ISMAR)	Ke Li, Mana Masuda, Susanne Schmidt, Shohei Mori	Radiance Fields in XR: A Survey on How Radiance Fields are Envisioned and Addressed for XR Research	submitted	
IEEE TVCG/ IEEE International Symposium on Mixed and Augmented Reality (ISMAR)	Similde Mair, Fariba Mostajeran, Joan Llobera, Mel Slater, Frank Steinicke	Laughing Together: The Role of Virtual Agents in Emotional Contagion, Conformity, and Opinion Shaping in a Virtual Stand-Up Comedy Club	submitted	
IEEE TVCG/ IEEE International Symposium on Mixed and Augmented Reality (ISMAR)	Lina Kaschub, Bado Völckers, Uğur Turhan, Philipp Huesmann, Lucie Kruse, Frank Steinicke	Comparing Deictic Interactions with an Intelligent Assistant using Extended Reality Technologies	submitted	
The ACM Symposium on User Interface Software and Technology (UIST)	Ke Li , Fariba Mostajeran, Sebastian Rings, Michael Arz, Frank Steinicke	Anthropomorphic AI: A Toolkit for Generating Interactive Embodied Intelligent Virtual Agents	submitted	
25th ACM International Conference on Intelligent Virtual Agents	Helen Kuswik, Anastasia Poletaykina, Annika Rittmann, Lucie Kruse, Frank Steinicke	Instruct me! Comparing Virtual Agents and Static Picture Instructions in Therapeutic Virtual Reality Exercises	submitted	
25th ACM International Conference on Intelligent Virtual Agents	David Egelhofer, Jiafan Gao, Nils Heinsohn, Sherwin Khabari, Lucie Kruse, Frank Steinicke	Effects of Verbal Interruption in Conversations with an Intelligent Virtual Agent in Virtual Reality	submitted	
25th ACM International Conference on Intelligent Virtual Agents	Ayko Schwedler, Celestina Hermida da Costa, Leon Korkmaz, Rateb Karanzie, Lucie Kruse, Frank Steinicke	Nuance in Non-Verbal Communication: How Emotional Granularity Impacts Perception of Intelligent Virtual Agents	submitted	

Publisher	Authors	Title	Status	Date
IEEE Virtual Reality 9th Workshop on Virtual Humans and Crowds in Immersive Environments (VHCIE)	Fariba Mostajeran, Ke Li, Sebastian Rings, Lucie Kruse, Erik Wolf, Susanne Schmidt, Michael Arz, Joan Llobera, Pierre Nagorny, Caecilia Charbonnier, Hannes Fassold, Xenxo Alvarez, André Tavares, Nuno Santos, João Orvalho, Sergi Fernández, Frank Steinicke	A Toolkit for Creating Intelligent Virtual Humans in Extended Reality	published	1.2025
IEEE VR 2025	Ke Li, Fariba Mostajeran, Sebastian Rings, Lucie Kruse, Susanne Schmidt, Michael Arz, Erik Wolf, Frank Steinicke	I Hear, See, Speak & Do: Bringing Multimodal Information Processing to Intelligent Virtual Agents for Natural Human-AI Communication	published	1.2025
IEEE ISM 2024	Fassold, H.	LiveSkeleton: High-Quality Real-Time Human Tracking and Pose Estimation	published	12.2025
ACM MMSys 2024 (Doctoral Symposium)	Mohamad Hjeij, Mario Montagud, and David Rincón	Multiuser Virtual Experiences powered by Holoportation Technologies and Multimodal Human-Computer Interaction (HCI)	published	12.2024
ACM IMX ISIM workshop 2025	Elias Blanckaert, Fariba Mostajeran, Louise Hallström, Iris Jennes	Methodological Reflections on Early-Stage Requirement Gathering and Prioritization for Immersive Extended Reality Applications	published	6.2025
OpenLab Conference	Aline Duelen, Arno Verhofstadt, Elias Blanckaert, Louise Hallström, Iris Jennes, Wendy Van den Broeck	A Comprehensive Elaboration on Time Constraints in Living Labs: Practical Challenges in Four Interdisciplinary European Projects	accepted	
IEEE International Symposium on Broadband Multimedia Systems and Broadcasting (BMSB) 2025	Mario Montagud, Marc Martos, Álvaro Egea, Sergi Fernández	Social Virtual Reality (VR) with multi-user holo-portation: toward a new medium for rich interactive shared media consumption	accepted	

Journal	Authors	Title	Status	Date
IEEE Transactions on Broadcasting	Mario Montagud, Marc Martos, Álvaro Egea, Sergi Fernández	Social VR with holographic comms: enablers for new engaging experiences	accepted	

Journal	Authors	Title	Status	Date
		within the TV / video consumption landscape		
IEEE Transactions on Visualization and Computer Graphics	*Esen Küçüktütüncü; Francisco Macia-Varela; Joan Llobera; Mel Slater*	The Role of Sensorimotor Contingencies and Eye Scanpath Entropy in Presence in Virtual Reality: a Reinforcement Learning Paradigm	published	3.2025
	Ana Zappa, Polina Osokin, Sergi Panisello, Nils Anderssen, Raphael Fargier, Xim Cerda-Company, Imac Zambrana, Antoni Rodriguez-Fornells, Mel Slater	Eyes on the prize: gaze-guided learning of foreign words in social VR interactions	submitted	
Computers & Graphics	Michael Wiesing, Mel Slater	A Real-Time VR Rendering Survival Guide for Human Scientists	submitted	
PLOS One	Ramon Oliva, Michael Wiesing, Jaime Gallego, Masahiko Inami, Victoria Interrante, Anatole Lecuyer, Rachel McDonnell, Florian Nouviale, Xueni Pan, Frank Steinicke, Mel Slater	Where Extended Reality and AI May Take Us: Ethical Issues of Impersonation and AI Fakes in Social Virtual Reality	submitted	
Virtual Reality	Michael Wiesing, Alessandro Clocchiatti, Brenda Ryan, Roger Montserrat, Agata Marta Soccini, Mel Slater	The Elephant in the Room: People Respond with Greater Stress in Mixed Compared to Virtual Reality	submitted	

6.14. Annex XIV: Standardization Overview

Event	Site	Date	Partner	Type	Details (What has been done)
Open XR in person meeting Brussels	Brussel, Belgium	22/25-May-2024	INTER	Meeting	Meta submitted a proposal co-developed with Razer for updated openXR Haptics APIs Submitted vendor ID MR for Razer Haptics Extensions
MPEG146 in person meeting Rennes	Rennes, France	22/26-Apr-2024	INTER, JRS	Meeting	INTER: Conformance code development +Reference code development JRS: Chaired NN Compression AhG, attended sessions for preparing CfP for implicit neural video representations
MWC Barcelona	Barcelona, Spain	26-Apr-2024/1-Mar-2024	INTER	Conference	Presented a prototype of MPEG haptics streaming in partnership with Interdigital
MPEG147 in Sapporo	Saporo	15/19-Jul-2024	JRS	Meeting	Chair NN Compression AhG, issued NNC ed2 reference SW and conformance, discussion on simple tensor coding profile to support eg coding of 3D Gaussian splatting
AWE 2024	California, USA	18/20-Jun-2024	INTER	Conference	Presented a prototype of MPEG haptics streaming in partnership with Interdigital
Eurohaptics 2024	Lille, France	30 Jun - 3 Jul	INTER	Conference	Presented a prototype of MPEG haptics streaming in partnership with Interdigital
Haptic Industry Forum Haptics for VR working group	Online	Ongoing bi-weekly meeting	INTER, SG, ACTRO	Recurring Meeting	Ongoing ideation of OpenXR haptics standard
MPEG Haptics reference software published	-	31-May-2024	INTER	Publishing	Online repository reference software. https://github.com/MPEGGroup/HapticReferenceSoftware
Open XR (online) meeting Seattle	Seattle, USA	8/13-Sep-2024	INTER	Meeting	Advancement followup
MPEG148 in Kemer	Kemer, Turkey	3/6-Nov-2024	JRS	Meeting	Chair NN Compression AhG, elaboration of requirements for simple technology applying NNC to tensorial data such as 3DGS
Metaverse Standards	Online	6-Nov-2024	JRS	Meeting	Attended meeting to get overview of emerging activity at MSF

Event	Site	Date	Partner	Type	Details (What has been done)
Forum: Volumetric Media Town Hall					
Open XR (online) meeting	online	Ongoing weekly meeting	INTER	Recurring Meeting	Ongoing ideation of OpenXR standards
MPEG149 in Geneva	Geneva, Switzerland	20/24-Jan-2025	JRS	Meeting	Chair NN Compression AhG, elaboration of requirements for simple technology applying NNC to tensorial data such as 3DGS
Joint JPEG/MPEG Workshop on Radiance Fields	Online	31-Jan-2025	JRS	Meeting	Attended to follow work on the topic across SC29 groups and beyond
WordHaptics 2025	Sowon, South Korea	8/11-Jul-20025	INTER	Conference	international event covering all aspects of haptics, including scientific findings, technological developments, algorithms, and applications
MPEG150 online	Online	31-Mar-2025. / 4-Apr-2025	JRS	Meeting	Chair NN Compression AhG, analysis of applying NNC to tensorial data such as 3DGS
MPEG151 Daejon	Daejon	30-Jun-2025. 4-Jul-2025	JRS	Meeting	Chair NN Compression AhG, preparation of report of experiments on NNC for generic tensor coding

7. Abbreviations and definitions

3D	3 Dimensional
5G	Fifth-generation cellular network
AhG	Ad Hoc Group
AI	Artificial Intelligence
AI Act	Artificial Intelligence Act
AR	Augmented Reality
CAD	Computer-Aided Design
CE	Conformité Européenne (CE marking)
DMA	Digital Markets Act
DMU	Decision Making Unit
DSA	Digital Services Act
EAA	European Accessibility Act
EEC/EEA	European Economic Area
GDPR	General Data Protection Regulation
GPSR	General Product Safety Regulation
HCD	Human-Centered Design
IDC	International Data Corporation
IP	Intellectual Property
IPR	Intellectual Property Rights
ISO/IEC	International Organization for Standardization/International Electrotechnical Commission
IVA	Intelligent Virtual Agents
IVAS	Integrated Visual Augmentation System
JBC	Joint Business Clinic
JPEG	Joint Photographic Experts Group
JTC	Joint Technical Committee
KPI	Key Performance Indicator
MPEG	Moving Picture Experts Group
MR	Mixed Reality
MVP	Minimum Viable Product
NFT	Non-Fungible Token
NNC	Neural Network Compression
NPC	Non-Player Character

PWC	PricewaterhouseCoopers
QA	Quality Assurance
R&D	Research and Development
ROI	Return on Investment
SDK	Software Development Kit
SME	Small and Medium-sized Enterprise
UKRI	UK Research and Innovation
WEF	World Economic Forum
Web3	Web 3.0 (blockchain-based protocols)
WP	Work Package
VPC	Value Proposition Canvas
VR	Virtual Reality
WP	Work Package
XR	eXtended Reality
XRA	XR Association

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