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Distributed teams often struggle to recreate the creative energy of co-located innovation sessions. We describe a proof of concept that explored how a metaverse environment can support more dynamic distributed innovation. During a three-day immersive workshop, avatar-based interaction, informal movement and gamified facilitation enhanced engagement and ideation. Though the immersive environment enabled cross-location collaboration and unconventional idea sharing, challenges included onboarding difficulties, participant skepticism and platform limitations. The lessons learned give rise to recommendations for organizations considering immersive technologies to foster innovation across distributed teams.[1,2]

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Challenges of Innovation in Distributed Teams

Innovation is a dynamic, collaborative process typically shaped through cycles of ideation, iteration and real-time interaction.[3] Traditionally, these activities occurred in co-located settings that fostered spontaneous exchanges, hands-on prototyping and informal knowledge

1 Fred Niederman is the senior accepting editor for this article.

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3 Innovation tends to emerge through iterative cycles across individuals, teams and organizations—rather than following a linear path. See Van de Ven, A. H., Polley, D. E., Garud, R. and Venkataraman, S. *The Innovation Journey*, Oxford University Press, 1999 (reprinted 2008).

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sharing. The shift toward distributed work models, however, has introduced significant barriers to innovation.[4]

Despite advances in communication technologies, the absence of physical proximity limits informal interactions, which are critical for creativity and knowledge-sharing.[5] Remote and hybrid teams are now the norm, with an estimated 92 million digital jobs expected to be performed remotely by 2030.[6] Though distributed teams offer access to global talent, lower costs and greater flexibility, companies struggle to maintain the same level of collaborative energy and innovative output seen in traditional office settings.[7]

One of the primary challenges of innovation in distributed teams lies in communication and collaboration gaps,[8,9] which slow idea sharing and hinder real-time collective insight building. Virtual interactions often lack the spontaneity of in-person discussions, where ideas can be refined organically through quick iterations and informal brainstorming. The structured and time-constrained nature of scheduled virtual meetings often limits fluid, exploratory thinking, reducing opportunities for spontaneous creative breakthroughs.[10]

Another challenge is the lack of trust and "psychological safety"[11] in distributed teams, which can prevent employees from sharing creative but risky ideas. Virtual, avatar-based interactions can reduce social pressure and encourage participation, but they also introduce ethical concerns.[12] For example, collecting and storing biometric data—such as facial expressions and body movements—raises privacy risks, potentially discouraging participation in innovation activities.[13]

In addition to challenges related to trust and communication barriers, organizations struggle with limited knowledge sharing among distributed team members.[14] Without informal office interactions, tacit knowledge—insights that are difficult to document but crucial for creative problem solving—often remains siloed. Additionally, the lack of real-time co-creation opportunities hinders brainstorming and prototyping, making it more challenging to sustain innovation momentum.

In many leading organizations, physical innovation labs and design-thinking spaces have been intentionally designed to address these challenges.[15] Such environments often include

4 Distributed teams explore problem spaces less deeply than co-located ones, limiting creativity and informal collaboration. See Jolak, R., Wortmann, A., Liebel, G., Umuhoza, E. and Chaudron, M. R. V. "Design Thinking and Creativity of Colocated Versus Globally Distributed Software Developers," *Journal of Software: Evolution and Process* (35:5), May 2023.

5 Virtual communication disrupts informal exchanges and reduces creative idea generation, even after brief exposure. See Brucks, M. S. and Levav, J. "Virtual Communication Curbs Creative Idea Generation," *Nature* (605:7908), April 2022, pp. 108-112.

6 See *More and More Jobs Can Be Done from Anywhere*. What Does That Mean for Workers? World Economic Forum, January 9, 2024, available at https://www.weforum.org/stories/2024/01/remote-global-digital-jobs-whitepaper.

7 A systematic review highlights persistent barriers to collaboration and creativity in virtual teams. See Abi Saad, E. and Agogué, M. "Creativity in Virtual Teams: Systematic Review, Synthesis and Research Agenda," *Creativity and Innovation Management* (32:1), January 2023, pp. 117-140.

8 Pandemic-era research underscores the role of trust, communication and leadership in virtual team performance. See Garro-Abarca, V., Palos-Sanchez, P. and Aguayo-Camacho, M. "Virtual Teams in Times of Pandemic: Factors That Influence Performance," *Frontiers in Psychology* (12), February 2021.

9 Remote work fosters siloed networks and reduces synchronous collaboration, potentially hindering innovation. See Yang, L., Holtz, D., Jaffe, S., Suri, S., Sinha, S., Weston, J., Joyce, Neha, S., Sherman, K., Hecht, B. and Teevan, J. "The Effects of Remote Work on Collaboration among Information Workers," *Nature Human Behaviour* (6:1), January 2022, pp. 43-54.

10 Brucks, M. S. and Levav, J., op. cit., 2022.

11 Building trust is particularly challenging in virtual teams due to limited face-to-face interaction and reduced informal cues. See: Hao, Q., Zhang, B., Shi, Y. and Yang, Q. "How Trust in Coworkers Fosters Knowledge Sharing in Virtual Teams? A Multilevel Moderated Mediation Model of Psychological Safety, Team Virtuality, and Self-Efficacy," *Frontiers in Psychology* (13), September 2022.

12 Though avatar-mediated environments can enhance user participation, they also raise ethical concerns related to privacy, identity manipulation, consent and digital harassment—calling for robust governance frameworks and responsible design practices. See Al-Kfairy, M., Alrabaee, S., Alfandi, O., Mohamed, A. T. and Khaddaj, S. "Navigating Ethical Dimensions in the Metaverse: Challenges, Frameworks, and Solutions," *IEEE Access* (13), January 2025.

13 Privacy concerns tied to biometric tracking in virtual spaces require safeguards to protect psychological safety and user trust. See Smith, C. H., Molka-Danielsen, J., Rasool, J. and Webb-Benjamin, J. "The World as an Interface: Exploring the Ethical Challenges of the Emerging Metaverse," *Proceedings of Hawaii International Conference on System Sciences*, January 2023.

14 Knowledge sharing in virtual teams is shaped by trust, culture, motivation and ICT usage—key to performance and strategy. See Davidavičienė, V., Al Majzoub, K. and Meidute-Kavaliauskiene, I. "Factors Affecting Knowledge Sharing in Virtual Teams," *Sustainability* (12:17), August 2020.

15 Spatial design, physical proximity and facilitation boost collaboration—yet are often lacking in digital settings. See Donadon, E., Thévenard-Puthod, C. and Berthinier-Poncet, A. "Physical Spaces, Digital Spaces, and Facilitation: The Winning Triptych for Collaborative Innovation Spaces in the Post-COVID-19 Era," in Windsperger, J., Cliquet, G., Galak, O., Hendrikse, G. W. J. (eds.) *Managing Networks in the Digital Economy*. Contributions to Management Science, Springer, 2025, pp. 297-320.

flexible layouts, visual artifacts, informal seating arrangements and interactive whiteboards. However, distributed teams lack access to these dedicated creative spaces, relying instead on static videoconferencing platforms (e.g., Microsoft Teams, Zoom) that offer limited support for dynamic, fluid interactions. The absence of an equivalent "virtual innovation space" presents a critical barrier for distributed innovation initiatives.[16]

Metaverse Platforms Offer Virtual Spaces for Distributed Team Innovation

A promising approach to providing virtual innovation spaces is to adopt metaverse platforms, which offer immersive environments designed to recreate the dynamics of in-person collaboration. Definitions of the metaverse vary, with some authors proposing a comprehensive vision encompassing persistent virtual worlds, interoperable platforms, digital economies and continuous identity layers.[17] In this article, we describe a proof of concept of such an immersive virtual environment designed to facilitate team interaction and creativity in distributed settings. During a three-day innovation workshop, participants accessed the virtual space using a computer or smartphone in a study-specific restricted setup. Though this implementation does not fully reflect the broader metaverse vision, it allows us to analyze initial organizational dynamics as companies experiment with immersive collaboration tools for geographically distributed work environments.

The proof of concept for supporting innovation processes in distributed teams is based on a real-life organizational initiative at "ITCom," a pseudonym for a Brazilian digital transformation company with over 20 years of experience analyzing the enabling factors and challenges its clients face when implementing IT applications. ITCom's proof of concept demonstrates the ways immersive environments can help overcome innovation barriers in distributed work. We describe the lessons learned from the initiative and, based on ITCom's experience, provide recommendations for organizations exploring immersive collaboration tools. The findings from the proof of concept contribute to a deeper understanding of the role of immersive environments in distributed innovation and virtual collaboration. Our research approach, which included interactions with 26 ITCom participants, is described in the Appendix.

Distributed Innovation Challenges Faced by the Case Company (ITCom)

ITCom faced growing challenges in fostering innovation in its distributed teams. With employees across multiple locations, the company struggled to conduct engaging and productive workshops capable of generating novel product ideas and supporting cross-team collaboration.

A key driver behind these innovation efforts was the need to replace three legacy information systems, each maintained by separate teams in different cities. The goal was to create a more robust, maintainable solution that could better meet evolving client demands by incorporating emerging Industry 4.0 technologies, including artificial intelligence. However, geographic dispersion made it difficult to bring together diverse perspectives essential for innovation.

In addition to geographic constraints, the legacy system teams had limited prior interaction and operated in silos. The lack of familiarity and trust made it difficult to establish the open, collaborative atmosphere needed for creative problem solving. Without informal relationships, participants hesitated to share unpolished or unconventional ideas, limiting breakthrough potential. As one manager noted: "We need to motivate these separate teams to start thinking as one—they will have to create and maintain the new system together."

To overcome geographic barriers, the company initially relied on Microsoft Teams-based innovation workshops, but these were largely ineffective. Employees often kept cameras off and contributed minimally, while the structured

16 Recent work highlights how physical and virtual spaces influence creativity and collaborative innovation. See Leminen, S., De Vita, K., Westerlund, M. and Ritala, P. "Places and Spaces of Collaborative R&D and Innovation: Navigating the Role of Physical and Virtual Contexts," *R&D Management* (54:2), March 2024, pp. 201-213.

17 For a detailed discussion of the evolving concept of the metaverse, see Ball, M. *The Metaverse: Building the Spatial Internet*, Liveright Publishing Corporation, 2024.

Table 1: ITCom's Innovation Process Challenges

Key Challenge	Participant Quote
Lack of existing trust and familiarity across teams responsible for legacy systems	"We need to motivate these separate teams to start thinking as one—they will have to create and maintain the new system together."
Low engagement in Microsoft Teams-based workshops	"People don't feel part of the process when everything happens in scheduled meetings."
Lack of fresh ideas due to siloed innovation	"It's hard to think differently when you're always working with the same people."
Hesitation to share unconventional ideas due to lack of psychological safety	"In traditional meetings, I always felt like I had to filter my ideas to make sure they weren't too risky or unrealistic."
Need for a more interactive and engaging environment	"We needed an environment where people could play with ideas rather than just talk about them."

nature of video calls limited spontaneity and dynamic collaboration. As one manager described: "People don't feel part of the process when everything happens in scheduled meetings. The discussions feel forced, and there's no flow of ideas."

Realizing these limitations, ITCom tried an on-site approach, running separate workshops at each office. Though engagement improved, this created new problems. One software engineer reflected on this issue: "We come up with ideas, but they always feel like extensions of what we're already doing. It's hard to think differently when you're always working with the same people." Teams continued working in familiar groups, producing incremental rather than disruptive ideas. The lack of exposure to different perspectives limited ideation, and running workshops at multiple locations required considerable time and resources, reducing scalability.

In our initial sessions with ITCom employees, they expressed hesitation to contribute openly, fearing judgment or resistance to unconventional ideas. One participant recalled, "In traditional virtual meetings, I always felt like I had to filter my ideas to make sure they weren't too risky or unrealistic." These conditions led to incremental thinking. Sessions also had to be time-efficient due to competing work demands. An innovation leader summarized the urgency: "We needed an environment where people could feel like they were somewhere different, where they could play with ideas rather than just talk about them."

These challenges underscored the need for an innovation strategy that would enable cross-location collaboration, foster a more stimulating environment and ensure psychological safety for bold, unconventional ideas. Table 1 summarizes key barriers reported by participants in prior innovation efforts.

Identifying an Immersive Metaverse Environment as a Virtual Innovation Workspace

Our involvement with ITCom employees revealed their frustrations with existing approaches to innovation and their expectations for more effective collaboration. The challenges with distributed innovation workshops highlighted the need for a new environment to better support creativity, engagement and cross-location idea generation.

We explored alternatives to overcome barriers to innovation in distributed teams. A key challenge was the absence of a virtual equivalent to physical innovation spaces typically used for creative workshops. In physical settings, organizations rely on specially designed rooms with visual stimuli, spatial flexibility and informal zones.

Together with the company's leadership, we formed the view that an immersive metaverse environment could serve as a promising

Figure 1: Screenshot of the SoWork Virtual Workspaces

virtual workspace for innovation. This idea was encapsulated in a hypothesis: *Could an immersive, avatar-based environment recreate some of these dynamic features in a fully distributed context?* We anticipated that avatar-based interactions, informal movement and spatial cues would foster more dynamic engagement, enabling employees to collaborate more spontaneously. By simulating office-like dynamics, the metaverse could help reintroduce informal knowledge sharing and fluid interactions often missing from traditional video meetings.

Initial discussions with ITCom leadership revealed diverging opinions about this approach. Two innovation leaders were enthusiastic, with one expressing optimism: "If we're going to do something creative, it needs to feel different. The metaverse gives us the chance to break away from the usual patterns." Others, however, were hesitant. One raised concerns about potential technical difficulties that could frustrate participants and questioned whether such platforms—often linked to gaming—could truly support professional collaboration. Nevertheless, we decided to go ahead with a proof of concept.

Designing and Structuring the Metaverse-Based Innovation Proof of Concept

To address the concerns expressed by ITCom innovation leaders, we co-designed a three-day metaverse-powered design-thinking proof of concept workshop. Grounded in an action research approach (see the Appendix), this exploratory intervention enabled us to iteratively diagnose challenges, plan interventions, implement actions and reflect with organizational stakeholders. We selected the SoWork[18] platform as the basis for this initiative because of its ease of use, avatar and space customization, and interactive spatial layout. ITCom's innovation leaders prepared multiple SoWork virtual rooms, including brainstorming areas, informal lounges and interactive whiteboard spaces (see Figure 1). This layout aimed to foster spontaneous conversation, cross-team interaction and dynamic ideation while minimizing complexity for users unfamiliar with immersive environments.

The virtual workspaces reflected creativity-enhancing principles (see Table 2). For example,

18 SoWork is a commercially available, browser-based immersive platform for avatar-based interaction in distributed teams. For information about SoWork, see *The Virtual Workspace for Remote Teams*, SoWork, available at https://sowork.com.

Table 2: Creative Workspace Principles in the Metaverse-Based Proof of Concept

Design Principle	Rationale	Application in SoWork
Affordances of Space	Different spatial layouts support creativity	Custom-configured rooms (e.g., brainstorming, lounges, whiteboards)
Stimulating Exploration	Creative settings promote ideation	Open layout with free avatar navigation
Zones and Transitions	Alternating zones stimulate creativity	Distinct formal (work) and informal (social) areas
Personalization	Fosters ownership and engagement	Custom avatars, room visuals, virtual objects
Immersion	Enhances focus and presence	Avatar-based environment with fewer distractions than Microsoft Teams
Facilitator Role	Supports focus and group cohesion	Active guidance, regular check-ins
Visual Cues	Aid ideation and expression	Whiteboards and other tools for real-time brainstorming
Playfulness	Encourages creativity	Informal visuals, avatars, relaxed atmosphere
Social Interaction	Informal chats spark ideas	Lounges for spontaneous cross-team exchanges
Minimized Distractions	Promotes sustained engagement	Immersive space helped block external interruptions
Embodiment	Enhances social presence	Avatar movement and visual expression
Simulated Movement	Boosts engagement	Free avatar navigation across zones
User Control	Personal control fosters engagement	Users controlled pace, space use and interactions
Time Structuring	Balances focus and exploration	Daily agenda: warm-up, ideation, debrief
Creative Atmosphere	Inspires idea generation	Light, inspiring visual setup
Novelty + Comfort	Safety encourages risk-taking	Gradual onboarding + ongoing support
Seclusion Periods	Space for reflection and exploration	Unstructured time for exploration
Psychological Framing	Labeling space as experimental boosts safety	Mindset recaps, sketch-style visuals, icebreakers

the "Sala Marmita" workspace was used for ideation with whiteboards ("Affordances of Physical Space"), while "Papo Furado" supported informal chats ("Zones and Transitions"). Participants also personalized avatars and spaces ("Personalization"), reinforcing engagement and ownership.

During the planning stage, leaders raised concerns about participants being distracted by work demands—common in Microsoft Teams sessions, where users remain reachable via chat or notifications. To mitigate this, we aimed to create an immersive, focused environment. In addition to exploring metaverse tools, we adopted design principles for creativity-enhancing workspaces based on recent studies in the architecture of creativity. Table 3 summarizes the key design considerations adopted to address these challenges.

Prior research highlights how spatial features—such as immersion, zoning, embodiment, social interaction and playfulness—

Table 3: Key Design Considerations to Mitigate Anticipated Challenges

Anticipated Challenge	Design Consideration
Technical difficulties may disrupt participant engagement	Chose a user-friendly platform (SoWork) and offered onboarding to ease adoption
Platform may seem too playful	Created customized professional spaces aligned with work goals
Participants may feel overwhelmed	Started with warm-up activities to encourage gradual familiarization
Limited experience with immersive environments	Provided facilitator support during all sessions
Risk of loss of focus or dispersion	Designed structured agendas with frequent check-ins to sustain engagement
Risk of external work interruptions and divided attention during sessions	Used an immersive platform less prone to distractions, guided by creativity-enhancing workspace principles (see Table 2)

can stimulate creativity.[19] We incorporated these principles into the proof of concept using SoWork's features: avatar-based movement, customizable zones, interactive whiteboards, informal lounges and structured facilitation. Table 3 above illustrates how these elements translated into our metaverse configuration.

The proof of concept was structured as a three-day immersive workshop. Though immersion was a core principle (see Table 2), we were mindful of its trade-offs—particularly fatigue in digital settings.[20] To mitigate this risk, the workshop schedule balanced intensity and flexibility: Participants engaged in two hours of immersive activity in the morning and three in the afternoon, with unstructured time left for informal exploration or reflection. This pacing aimed to sustain engagement without causing overload.

Each day involved at least five hours in SoWork: structured, agenda-driven sessions plus optional time for platform exploration. Day 1 focused on familiarization with the environment. On Day 2, design-thinking sessions generated solution concepts for the new system. Day 3 centered on refining and presenting ideas. Daily debriefings captured participant feedback.

To stimulate creative thinking and set the tone, each morning began with a brief lightning talk (a short presentation, typically lasting 3 to 5 minutes, designed to provide a quick, clear overview of a topic) by ITCom innovation leaders, presenting emerging technologies and provocations aligned with system development goals. The lightning talks were followed by active listening exercises to prompt reflection before ideation. Icebreaker activities opened each session to foster psychological safety and early engagement. Visual collaboration was supported by a combination of SoWork's embedded whiteboards (via Mapmaker customization[21]) and external Miro[22] boards. Miro enables real-time idea organization, clustering and iteration, particularly during design-thinking stages. Icebreakers also used Miro to help less tech-savvy participants engage from the start.

The schedule also included extended unstructured periods—longer lunches and open time at day's end—allowing individual exploration of SoWork's virtual spaces,

19 Thoring et al. (2021) provide a comprehensive empirical framework identifying how specific workspace design elements—such as spatial layout, sensory stimuli and psychological safety—can causally influence creative processes in teams. See: Thoring, K. C., Gonçalves, M., Mueller, R. M. and Desmet, P. M. A. "The Architecture of Creativity: Toward a Causal Theory of Creative Workspace Design," *International Journal of Design* (15:2), 2021, pp. 17-36.

20 Immersive environments can trigger fatigue, overload and stress, reducing engagement in long sessions. See Souchet, A. D., Lourdeaux, D., Pagani, A. and Rebenitsch, L. "A Narrative Review of Immersive Virtual Reality's Ergonomics and Risks at the Workplace: Cybersickness, Visual Fatigue, Muscular Fatigue, Acute Stress, and Mental Overload," *Virtual Reality* (27:1), March 2023, pp. 19-50.

21 Mapmaker enables virtual office customization with zones and interactive tools to support collaboration. See *How to Customize Your Office with Mapmaker*, SoWork, available at https://help.sowork.com/How-to-Customize-Your-Office-with-Mapmaker-26cb2190ba-6b803397e2f0eb2594e146.

22 Miro is a visual collaboration platform for real-time co-creation using virtual boards and design tools. See *Get from Brainstorm to Breakthrough with Miro*, Miro, available at https://miro.com.

experimentation with design elements and asynchronous refinement of ideas. This aligned with recommendations that personal autonomy and intermittent withdrawal can enhance creativity.

To promote psychological safety, facilitators framed the sessions as protected creative spaces. Each day began with a "mindset recap," reinforcing that unconventional ideas were welcome. The double diamond model[23] was introduced via a casual sketch, highlighting the workshop's experimental nature. On Day 1, the facilitator joked while drawing the model: "We're in a laboratory where anything is possible. Take a look at my sketch—do you like it?" This moment helped lower barriers, signaling that imperfect contributions were expected and valued.

The proof of concept combined diagnostic insights, creativity-supporting principles, and metaverse capabilities into a structured process. The intervention was staged to allow participants to progressively engage with the immersive environment, build psychological safety, and iteratively generate and refine solution ideas. To guide this process, the workshop adopted the double diamond model as an overarching framework, offering a balance between divergence and convergence in two phases: problem exploration and solution development. The first diamond emphasized broad exploration followed by shared problem framing. The second mirrored this flow, moving from idea generation to solution filtering and refinement.

The Three-Day Proof of Concept Workshop Process

The proof of concept workshop spanned three consecutive days. While SoWork enabled immersive spatial and social interaction, Miro served as the primary platform for structured collaboration. Because SoWork lacked built-in visual facilitation tools, custom Miro boards were developed with templates tailored to each workshop phase. Active listening boards captured insights from lightning talks; brainstorming grids guided idea generation, and prioritization matrices helped participants filter and refine emerging concepts. This visual layer supported real-time collaboration, clustering and iteration—enhancing engagement and knowledge retention.

Figure 2 summarizes the key phases and activities of the workshop process. The preparation phase before the workshop involved onboarding, workspace customization and technical setup, all coordinated by the innovation facilitators. The three days—immersion, creation, and demonstration—were mapped to the double diamond structure and included both facilitator-led actions, such as challenge framing and guidance, and participant-led activities, such as ideation, prototyping and personalization of virtual spaces. This design enabled participants to progressively build confidence in the metaverse environment while engaging in meaningful innovation tasks across distributed locations.

The proof of concept involved 26 ITCom professionals, including software engineers, developers and innovation leaders engaged in designing the new system. Participants were strategically selected to represent key areas of expertise and foster cross-location collaboration among previously siloed teams. To enable focused collaboration, they were divided into five groups—four with five members and one with six—with each one facilitated by an innovation leader.

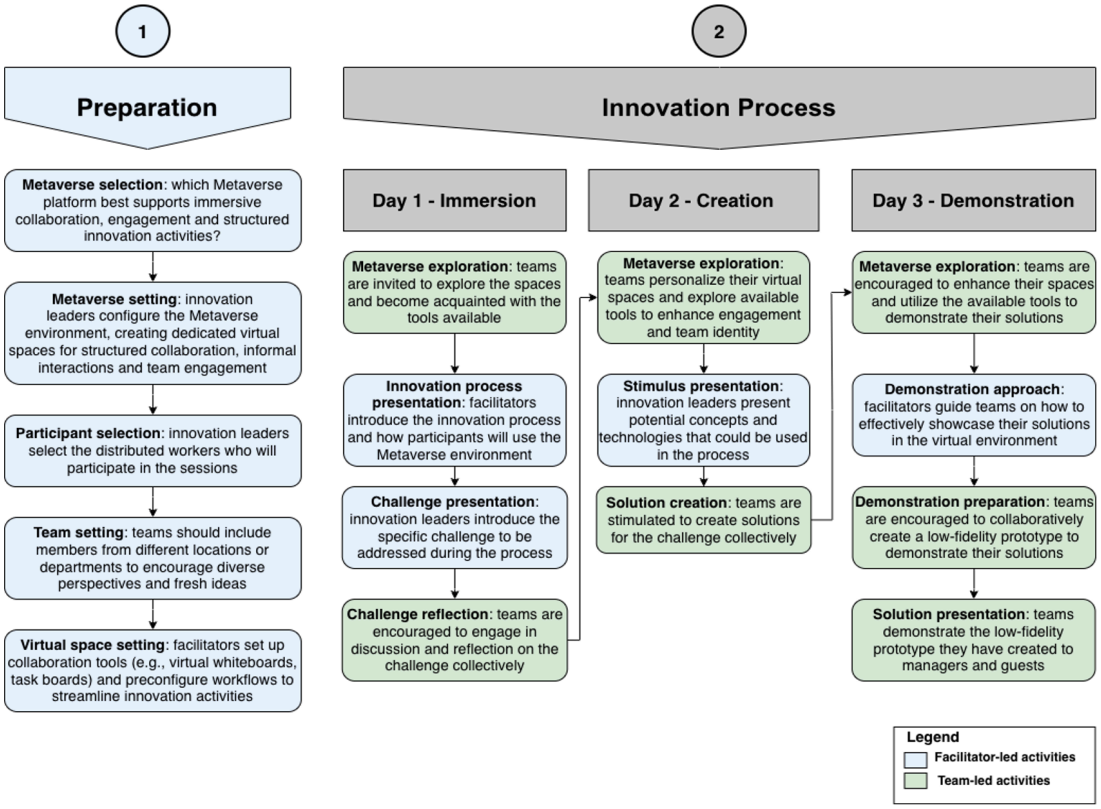
These leaders also decided on the composition of the groups, deliberately mixing roles and locations to ensure multidiscipline and distributed perspectives. Though the groups remained stable to support team dynamics and continuity, participants were encouraged to visit other virtual workspaces. This cross-group interaction aimed to spark idea building, stimulate inspiration through informal observation and reinforce knowledge sharing. All teams addressed the same overarching innovation challenge but were free to explore distinct solution paths.

Outcomes of the Metaverse-Based Innovation Proof of Concept

To evaluate the proof of concept outcomes, we used continuous observation, chat transcripts,

23 For a discussion on the Double Diamond model's adaptability across design contexts, see Kochanowska, M. and Gagliardi, W. R., with reference to Jonathan Ball, "The Double Diamond Model: In Pursuit of Simplicity and Flexibility," in Raposo, D., Neves, J. and Silva, J. (eds) *Perspectives on Design II: Research, Education and Practice*, Springer, 2022, pp. 19-32.

Figure 2: Process Design for the Metaverse-Based Proof of Concept



video recordings of immersive sessions, daily post-session surveys and a final focus group. This multimethod approach captured both real-time behavioral dynamics and participants' reflections on the experience. Full methodological details are included in the Appendix.

The three-day proof of concept was ITCom's first immersive, metaverse-based collaborative workshop. Unlike previous Microsoft Teams sessions with low engagement and limited cross-team interaction, the initiative aimed to foster spontaneous conversations, cross-location collaboration and psychological safety in a distributed setting. The novelty of the approach, however, introduced its own challenges—participants were unfamiliar with SoWork, uncertain about its professional relevance and hesitant about collaborating with distant colleagues. As one software engineer noted: "Honestly, I wasn't sure what to expect. I've never used anything like this for work, and I thought it might be more of a distraction than an actual tool for innovation." These reservations shaped Day 1, where careful facilitation was critical to build early comfort with the environment.

During the metaverse exploration step on Day 1, a technical onboarding phase ensured participants could navigate the platform confidently. Employees received a walkthrough to customize avatars, practice navigation and explore SoWork's virtual workspace. Despite simulating a collaborative office with breakout rooms and shared spaces, some participants expressed skepticism. To preserve a professional tone, real names were displayed above avatars, reinforcing presence and supporting group interaction.

Day 1. Immersion and Familiarization

On Day 1, participants explored the platform through guided activities. Facilitators encouraged movement between rooms, interaction with whiteboards and informal peer conversations. Some were unsure whether the environment could support serious work. One engineer

remarked: "At first, it felt like a game. I was skeptical about whether we could have serious discussions in this kind of space." Icebreakers and informal dialogue helped lower barriers and foster comfort. As familiarity increased, teams moved into problem mapping using Miro boards to document pain points in ITCom's development process. Common themes emerged across the virtual workspaces. By the end of the day, engagement had grown noticeably, with hesitant participants contributing actively.

Day 2. Creation and Ideation

Teams began structured design-thinking exercises focused on creative problem solving. A lightning talk from an innovation leader opened the session, framing the challenge and prompting disruptive thinking. Facilitators followed with active listening exercises before ideation. Using the whiteboards available in SoWork and Miro, the teams captured, clustered and refined ideas. By midday, concepts ranged from process improvements to new system architectures. One innovation leader commented: "In a traditional video meeting, people either talk over each other or there's a long silence. Here, it felt more like real collaboration—you could walk up to a group, listen in, and then jump in when you had something to add." The metaverse environment supported more fluid exchanges than conventional video calls. By day's end, teams had selected and refined their most promising ideas for prototyping.

Day 3. Demonstration and Presentation

Teams finalized their proposals using Miro templates for personas, validation scenarios, feasibility-impact matrices and interface wireframes. By midday, pitches were ready. The workshop concluded with a virtual pitch event in SoWork's auditorium. The teams presented their pitches to ITCom leadership, which reacted positively. As one manager noted: "This was one of the most engaging innovation sessions we've had. The ideas were not only creative but also well-structured. It's clear that the metaverse created a different level of collaboration."

Participant Reactions

Daily debriefings captured evolving perceptions. Participants reported that immersion increased their sense of presence and enabled spontaneous dialogue. Initial skepticism gave way to engagement. One participant shared: "At first, it felt odd, but after some time it felt like we were really working together in the same space." Another noted: "I shared ideas I wouldn't have dared to bring up in a regular Teams call."

Lessons from the Proof of Concept

ITCom's proof of concept workshop offered valuable insights into how immersive metaverse environments can support innovation in distributed teams. Based on participant experiences, facilitator observations and leadership feedback, we synthesized six lessons, which are summarized in Table 4 and described below.

1. Enhancing Psychological Safety

The use of playful design elements (customized avatars, informal visual metaphors, lounges) combined with daily mindset recaps made participants feel more comfortable sharing unconventional or partially formed ideas. Several noted that the atmosphere "felt less intimidating" compared to prior innovation sessions.

2. Enabling Engagement and Creativity

One of the clearest lessons was the importance of spatial immersion and informal movement in stimulating creative exchanges. These proved to be distinctive benefits of the metaverse environment, compared to conventional videoconferencing tools such as Zoom or Microsoft Teams. The avatar-based virtual workspace allowed participants to drift naturally between conversations, join spontaneous discussions and form ad hoc clusters. Though participants were initially assigned to predefined groups to support focused collaboration, they were explicitly encouraged to explore other teams' spaces throughout the workshop. This freedom simulated the dynamics of a physical innovation lab, where cross-pollination and informal observation often spark new insights. The ability to observe, join or leave subgroup discussions enhanced fluidity and promoted real-time knowledge exchange. The visibility of avatars across spaces created peripheral awareness and proximity cues typically absent

Table 4: Lessons from ITCom's Metaverse-Based Innovation Proof of Concept

Lesson Learned	Key Insight from the Initiative
1. Psychological safety was enhanced	The immersive setting lowered social pressure, encouraging participants to share unconventional ideas without fear of judgment.
2. Creativity and engagement were enhanced	The spatial configuration of the metaverse fostered creativity. The use of avatars in an immersive setting allowed free movement in the virtual space and peripheral awareness of ongoing conversations, creating informal cues for knowledge exchange.
3. Mixed teams improved group dynamics	Teams that mixed employees from different locations produced more diverse and unexpected solutions compared to past site-specific workshops.
4. Combining tools facilitated collaboration	Integration with Miro compensated for SoWork's limited collaboration features, enabling structured brainstorming and visual idea organization. Design-thinking techniques (e.g., SCAMPER, reverse brainstorming) remained effective but required minor adjustments to fit the immersive metaverse context.
5. Addressing barriers to adoption was important	Early technical onboarding reduced initial skepticism and enabled participants to engage confidently in the immersive environment.
6. Facilitation was essential to sustain engagement	Innovation leaders acted as facilitators, guiding discussions, maintaining momentum, and ensuring inclusive participation.

in isolated breakout rooms. This spatial flexibility directly supported ideation fluency and broadened creative input across teams. The metaverse configuration was also designed to foster creativity, with distinct areas for innovation labs, informal lounges, brainstorming and visual interaction. These zones aimed to emulate the feel of physical innovation spaces—stimulating ideation and experimentation in ways that traditional platforms cannot.

3. Improving Group Dynamics by Creating Mixed Innovation Teams

The metaverse environment allowed frequent, informal check-ins without interrupting group dynamics. Group composition also shaped collaboration. By mixing participants from different sites, the workshop exposed teams to diverse viewpoints—disrupting habitual thinking patterns that often stifle innovation in siloed settings.

4. Combining Tools to Facilitate Structured and Unstructured Collaboration

ITCom's initiative highlighted the value of combining multiple tools to offset the limitations of individual platforms. While SoWork enabled spatial immersion, Miro's visual boards supported idea clustering, documentation and prototyping. This hybrid setup allowed teams to shift fluidly between exploration and structuring activities. From a process standpoint, balancing structured design tasks with unstructured exploration time was essential. Extended breaks and open periods gave participants space to reflect and iterate at their own pace, promoting creative incubation.

5. Addressing Barriers to Adoption

Despite overall positive outcomes, several barriers emerged in ITCom's proof of concept. Technical unfamiliarity initially hindered some participants, particularly those less comfortable with gaming-like interfaces. Though onboarding reduced this friction, additional pre-session practice might have eased the transition further. Some participants struggled to maintain full cognitive presence. Occasional distractions from remote work settings persisted, even in the immersive environment, suggesting that external contexts still shape participant focus. Additionally, the lack of rich nonverbal cues (e.g., facial expressions, posture)—despite avatar embodiment—limited certain group dynamics,

such as detecting hesitation or disengagement during discussions.

6. Recognizing the Importance of Facilitation

The integration of lightning talks, active listening boards and structured debriefings maintained participant engagement while preserving enough structure to keep discussions focused. Facilitators also played a pivotal role in maintaining momentum and supporting engagement. Unlike conventional videoconferencing, facilitators could move freely through the virtual space alongside participants, offering real-time technical assistance in a nonintrusive manner. Their presence guided transitions between activities and encouraged broad participation.

Recommendations for Adopting Immersive Metaverse Environments

The lessons from ITCom's proof of concept give rise to five recommendations for organizations exploring metaverse-based innovation. Though grounded in ITCom's specific context, challenges such as fostering collaboration across locations and legacy structures are common in many organizations. However, the recommendations provide guidance for designing immersive workshops, integrating these environments into broader routines and anticipating future extensions such as hybrid or asynchronous formats.

1. Assess Readiness for Adopting and Scaling Immersive Innovation Workshops

While the proof of concept yielded promising results, scaling metaverse-based innovation requires careful assessment of organizational readiness. The IT infrastructure must ensure stable connectivity and compatible hardware to support multi-user immersive environments. Equally important is participant digital maturity: teams familiar with collaborative tools are more likely to adapt quickly, whereas novice users may need extended onboarding. Visible leadership support legitimizes experimentation and reduces perceived risk, encouraging participation. A phased approach—starting with small pilot groups—can ease organizational learning and adaptation.

2. Recognize the Importance of Facilitators for Adoption and Sustained Engagement

Beyond infrastructure, sustaining engagement requires attention to psychological and organizational dynamics. As novelty wears off, participant enthusiasm may decline. Periodic changes to room layouts or thematic variations can refresh the experience. Balancing structured agendas with open-ended exploration was a critical design feature of ITCom's proof of concept: While structure ensured focus, freedom to navigate the environment fostered creativity and autonomy. Continuous facilitator presence played an essential role. Facilitators not only maintained momentum and guided transitions but also created psychological safety and nurtured engagement.[24] However, this facilitation is difficult to replicate. It demands a combination of general facilitation capabilities and platform-specific expertise. Without proper preparation, adoption of immersive workshops may falter—making facilitator readiness both a critical success factor and a potential barrier relative to in-person settings.

Reflections after the proof of concept underscored the critical importance of facilitator readiness. The success of the initiative relied on close involvement from the research team. Internal facilitators expressed concern about their ability to independently conduct similar sessions, especially in managing both the creative process and the technical platform. This highlights the need for structured training programs tailored to immersive facilitation as a precondition for broader adoption of immersive environments.

24 Facilitators play a central role in sustaining collaboration technologies by designing, applying, and managing both the process and its technical support. See Kolfschoten, G. L., Niederman, F., Briggs, R. O. and De Vreede, G.-J. "Facilitation Roles and Responsibilities for Sustained Collaboration Support in Organizations," *Journal of Management Information Systems* (28:4), April 2012, pp. 129-161.

3. Take Account of Trade-Offs in Avatar Design[25]

High-fidelity avatars allow users to express individuality, potentially enhancing engagement and information sharing.[26] Yet, this realism can reinforce social hierarchies and performance pressure.[27] Simpler avatars may foster psychological safety by reducing social cues[28] but can also cause disengagement or negative behaviors such as cyberbullying.[29] Moreover, the extent to which avatars communicate nonverbal signals depends on device capabilities. Virtual reality headsets enable richer embodiment but remain constrained by cost, complexity and cybersickness. Decisions about avatar design must account for technology readiness, cultural context and participant preferences.

4. Strategically Integrate Virtual Workspaces into Organizational Innovation Practices

The World Economic Forum highlights the industrial metaverse as a driver of innovation in the future.[30] Immersive environments can extend physical innovation spaces, allowing distributed teams to collaborate without the friction of travel. Rather than replacing in-person workshops, metaverse platforms can augment hybrid formats—enabling collaboration before, during and after co-located events. Embedding these environments in internal capability-building efforts can normalize their use and build comfort over time. Repeated exposure to immersive tools for brainstorming and prototyping may gradually strengthen collaboration across locations and roles.

5. Address Ethical Risks

Immersive metaverse environments introduce ethical risks related to anonymity, surveillance and biometric data. While no negative incidents were observed during the proof of concept, this was likely due to several mitigating factors: participants belonged to an existing team with shared norms, facilitators were present throughout all activities and the virtual space maintained a professional design. Future implementations should retain these safeguards to prevent harmful behaviors. Though motion tracking or haptic devices were not used in the ITCom case, organizations exploring such technologies should proactively address privacy and data protection concerns.

Concluding Comments

Our study examined how immersive metaverse environments can support innovation processes in distributed teams. The ITCom proof of concept revealed that, when thoughtfully designed, metaverse-based collaboration can foster higher engagement, psychological safety and spontaneous creative exchanges that often fall short in conventional video-based settings. These outcomes were not solely driven by the novelty of the technology but also by the deliberate orchestration of spatial design, onboarding processes, facilitation techniques and continuous

25 While engaging, virtual reality may hinder creativity and practicality in prototyping and brainstorming unless carefully integrated. See Bauerová, R., Halaška, M. and Kopřivová, V. "User Experience with Virtual Reality in Team-Based Prototyping and Brainstorming," *International Journal of Human-Computer Interaction*, March 2025, pp. 1-19.

26 Immersive virtual reality and realistic avatars can enhance collaboration by increasing participants' embodied and psychological engagement. See Suh, A. "How Virtual Reality Influences Collaboration Performance: A Team-Level Analysis," *Information Technology & People*, December 2024.

27 Metaverse environments influence how individuals socialize within organizations, shaping behavior through avatar design, spatial context and interaction patterns. See: Gräf, M., Zöll, A., Wahl, N., Ellenrieder, S., Hager, F., Sturm, T. and Vetter, O. A. "Designing the Organizational Metaverse for effective socialization," *Proceedings of Pacific Asia Conference on Information Systems*, July 2023.

28 Avatar similarity (between a user and their online avatar) affects task engagement differently: It enhances performance in procedural tasks but may hinder creativity by reinforcing habitual thinking. See Zhu, R. and Yi, C. "Avatar Design in Metaverse: The Effect of Avatar-User Similarity in Procedural and Creative Tasks," *Internet Research* (34:1), February 2024, pp. 39-57.

29 Ensuring user safety in the metaverse requires proactive, user-centric security models to mitigate risks such as harassment, identity theft and data misuse. See Sharma, S., Singh, J., Gupta, A., Ali, F., Khan, F. and Kwak, D. "User Safety and Security in the Metaverse: A Critical Review," *IEEE Open Journal of the Communications Society* (5), 2024

30 The industrial metaverse is positioned as a strategic enabler of future innovation, allowing organizations to accelerate collaboration and overcome geographic and operational barriers. See *Navigating the Industrial Metaverse: A Blueprint for Future Innovations*, World Economic Forum Insight Report, available at https://www3.weforum.org/docs/WEF_Navigating_the_Industrial_Metaverse_A_Blueprint_2024.pdf.

attention to participant experience throughout the initiative.

For organizations considering similar initiatives, the lessons from ITCom's proof of concept highlight the importance of treating immersive environments as intentional innovation spaces—on par with the planning and care applied to physical creative labs. Key enablers include structured facilitation to support psychological safety and group flow, leadership sponsorship to legitimize experimentation and phased implementation strategies that allow gradual acclimatization to immersive tools. Supplementary platforms, such as shared digital whiteboards, can address functional gaps and anchor collaborative activities in more familiar formats.

While the findings from the proof of concept are promising, the study also revealed several limitations. It is difficult to determine the extent to which the observed results stemmed from the immersive system itself or from the enthusiasm and creativity of the design team. The semi-structured nature of the problem, which lacked significant zero-sum conflict, may have also influenced the outcomes. Future research could explore how similar approaches perform in more adversarial or competitive contexts, with different facilitation styles, or when applied by teams with no prior involvement in system design. Each of the six key lessons we identified could be examined further to determine equivalent variations or threshold conditions for achieving similar benefits.

The primary contribution of this study lies in showing that, in at least one organizational context, participative researchers can identify barriers to creativity, explore design systems to address these and lead workshops that achieve the desired outcomes. While not prescribing a step-by-step formula, the lessons learned point to critical considerations for others seeking to customize their own approaches to immersive metaverse-based collaboration.

It is difficult to extrapolate too far into the future, but the ITCom proof of concept may represent the first of many continually refined initiatives. We envision a future in which collaboration in digital spaces within and between organizations, their clients, and other stakeholders becomes a regular and valuable occurrence—manifesting in diverse forms, across various locations and over time. Such a vision underscores the potential of immersive technologies to shape the long-term evolution of innovation practices, fostering new forms of collaboration that adapt and thrive across contexts, locations and time horizons.

Looking further ahead, the integration of generative AI (GenAI) into immersive collaboration offers exciting opportunities. GenAI tools can generate real-time design alternatives, interactive assets and visual content—accelerating the transition from ideas to tangible outputs. Platforms like Miro are already embedding AI-assisted features to support layout generation and content structuring. Although not tested in the ITCom proof of concept, these capabilities may further enhance metaverse-based innovation by streamlining early-stage prototyping.

Appendix: Research Approach and Participants

Our study adopted an action research approach[31] to explore innovation challenges in distributed teams and evaluate the use of a metaverse environment (based on the SoWork platform) to support collaborative innovation. We conducted a full action research cycle following the five stages of diagnosing, planning, acting, evaluating and specifying learning,[32] in close collaboration with ITCom managers and innovation leaders. The figure below summarizes the sequence of activities across these stages and shows the timeline for our study. Throughout the entire process, the first author engaged in continuous participant observation,[33] providing

31 Baskerville, R. and Myers, M. D. "Special Issue on Action Research in Information Systems: Making IS Research Relevant to Practice: Foreword," *MIS Quarterly* (28:3), September 2004, pp. 329-335. This foundational work highlights the role of action research in information systems as a collaborative and iterative process designed to address real-world organizational problems while simultaneously contributing to scientific knowledge.

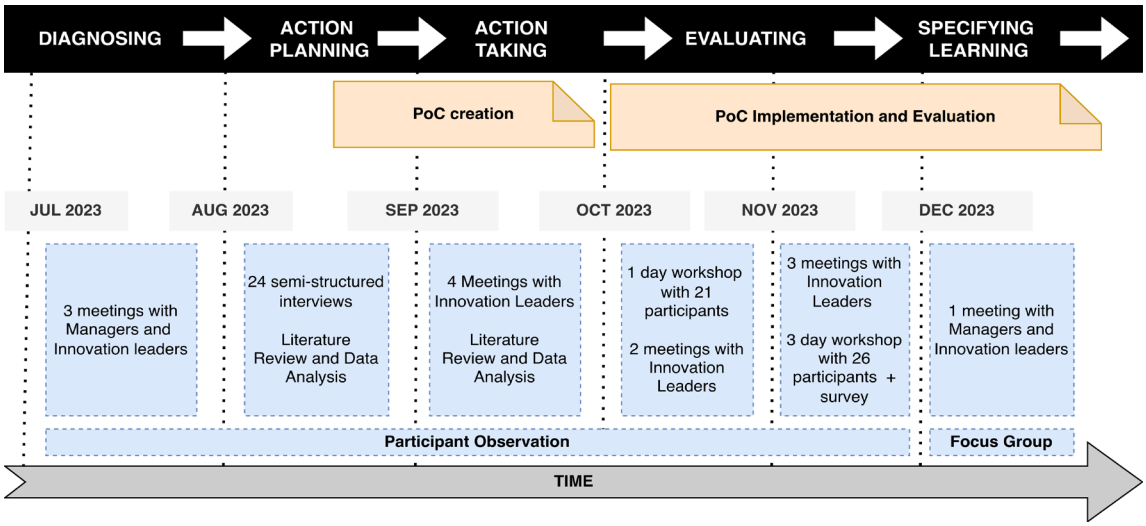
32 Susman, G. I. and Evered, R. D. "An Assessment of the Scientific Merits of Action Research," *Administrative Science Quarterly* (23:4), December 1978, pp. 582-603. This seminal paper defines the canonical five-stage action research cycle widely adopted in organizational studies.

33 Spradley, J. P. *Participant Observation*. Waveland Press, 2016. This classic work introduces the participant observation method, emphasizing immersion in the organizational setting to gain insider perspectives and uncover contextual dynamics that may not emerge through detached observation alone.

Distribution of the 24 ITCom Participants

Position	Development Engineers	7
	Development Managers	2
	Deployment Manager	1
	Deployment Engineer	1
	Support	3
	Commercial	10
Gender	Male	22
	Female	2

Action Research Cycle and Proof of Concept Timeline



insider access to the evolving organizational dynamics.

An initial diagnostic phase involved in-depth interviews with 24 professionals across ITCom's development, deployment, support and commercial departments, complemented by meetings with six innovation leaders. The table above shows the distribution of the 24 interviewees during this diagnostic phase, which helped map organizational pain points related to distributed innovation processes and provided the foundation for subsequent analysis.

In parallel, we conducted a focused literature review to contextualize the identified challenges and inform the theoretical framing of the study. The qualitative data collected through interviews and observations was analyzed thematically[34] to uncover recurring patterns, barriers and opportunities for intervention.

We also conducted a one-day in-person workshop in October 2023 involving selected customers, and ITCom innovation leaders, managers, developers and staff from supporting areas such as marketing and commercial operations. A total of 21 participants were

34 Gioia, D. A., Corley, K. G. and Hamilton, A. L. "Seeking Qualitative Rigor in Inductive Research: Notes on the Gioia Methodology," *Organizational Research Methods* (16:1), January 2013, pp. 15-31. This approach provides structured coding procedures to inductively extract themes and aggregate dimensions from the qualitative data.

organized into four groups—three with four participants and one with three. Six innovation leaders facilitated the workshop activity: four were assigned to specific groups; the other two acted as roaming facilitators, moving across teams. The workshop's aim was to capture key client pain points, expectations and evaluation criteria to inform the design of the new solution. The composition of the groups was intentionally diverse in terms of roles and expertise (e.g., commercial, marketing, development) to ensure a broad perspective on the innovation challenge.

Building on these insights, the research team collaboratively designed and implemented the three-day proof of concept workshop using the SoWork immersive metaverse environment. A total of 26 professionals participated directly in the metaverse-based workshop, including software engineers, developers and six innovation leaders who also served as facilitators. Participants were divided into five groups: four with five participants and one with six, each guided by an innovation leader who also facilitated the group's activities throughout the three-day event. These leaders ensured each group had a mix of professional backgrounds and geographic locations to foster multidisciplinary and distributed collaboration.

Though each group remained unchanged over the three days, participants were actively encouraged to move through the virtual environment and visit the spaces of other teams. This design choice aimed to promote creative inspiration, support idea-building across groups and create an environment of open exchange without compromising group ownership.

The evaluation of the proof of concept outcomes used multiple methods: daily debriefings to capture immediate feedback, observational notes from facilitators, participant surveys and a concluding focus group to reflect on the perceived value of and lessons learned from the immersive experience.

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