TRANSFORMING HRM IN THE METAVERSE: EMPLOYEE ENGAGEMENT AND PERFORMANCE IN PHYGITAL WORKSPACES

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Abstract: *This study examined how immersive metaverse workspaces relate to employee engagement and performance in phygital work settings. A cross-sectional online survey produced 175 usable responses from employees and HR professionals aged 18–35 who had experience with Roblox, Decentraland, or Meta Horizon. The proposed model was assessed using confirmatory factor analysis and structural equation modeling. Immersive metaverse workspaces were positively associated with employee engagement ($\beta = 0.59$, $p < 0.001$), while avatar realism and social presence were positively associated with perceived employee performance ($\beta = 0.47$, $p < 0.01$). Experiential HR elements—augmented reality, NFT-based recognition, and sensory design—strengthened the relationship between immersive workspaces and engagement (interaction $\beta = 0.33$, $p < 0.05$). The study contributes by defining phygital HRM as the coordinated design of physical and immersive digital work experiences and by testing a role-consistent model grounded in employee engagement, social presence, media richness, and job resources. The findings suggest that HR managers should evaluate immersive tools as work-design resources while also addressing accessibility, privacy, digital fatigue, and ethical avatar use. Because the data were cross-sectional and self-reported, the results indicate associations rather than causal effects.*

Keywords*: Metaverse, Human Resource Management, Employee Engagement, Avatar Realism, Augmented Reality, Remote Collaboration, Virtual Training*

INTRODUCTION

Digital technologies are reshaping workplace interaction, employee development, and the organization of hybrid work. The metaverse extends this transformation by providing persistent, immersive environments in which employees can communicate, learn, and collaborate through avatars and connected devices (Hadi et al., 2024; Yoo et al., 2023). In an HRM context, these environments may support virtual onboarding, training, team interaction, and performance-related activities while connecting digital experiences with selected physical cues. This coordinated physical–digital arrangement is described here as phygital HRM (Batat, 2024; Sung et al., 2023; Kim et al., 2023).

Prior metaverse research has concentrated heavily on consumers, retailing, and marketing. That literature identifies immersion, social presence, avatar realism, augmented reality, and digital ownership as important experiential mechanisms (Ahn et al., 2024; Belk, 2024), but it does not establish how these mechanisms operate as work-design resources in HRM. Organizational research, by contrast, explains engagement through the psychological conditions of meaningfulness, safety, and availability (Kahn, 1990) and through the balance of job demands and job resources (Bakker & Demerouti, 2007). Social Presence Theory and Media Richness Theory further suggest that communication cues and media capacity can reduce psychological distance

and support understanding in distributed work (Short et al., 1976; Daft & Lengel, 1986). Integrating these perspectives provides an HRM-centered basis for examining immersive workspaces without treating employees as consumers.

1. The purpose of this study is to examine whether immersive metaverse workspaces are associated with employee engagement, whether avatar realism and social presence are associated with perceived employee performance, and whether experiential HR elements strengthen the immersive-workspace–engagement relationship.
2. The originality of this study is its operationalization of phygital HRM as a coordinated employee experience that combines immersive digital interaction with physical or sensory HR cues, and its empirical testing of this arrangement through a role-consistent HRM model rather than a consumer-purchase model.
3. The contributions of this study are threefold. First, it translates metaverse constructs into an employee-centered HRM framework grounded in engagement, social presence, media richness, and job resources. Second, it distinguishes the direct roles of immersive workspaces and avatar realism/social presence from the moderating role of experiential HR elements. Third, it offers practical guidance for designing immersive HR activities while recognizing accessibility, privacy, security, digital-fatigue, and avatar-ethics concerns.

The study addresses three research questions: RQ1: How are immersive metaverse workspaces associated with employee engagement? RQ2: How are avatar realism and social presence associated with perceived employee performance? RQ3: Do experiential HR elements moderate the relationship between immersive metaverse workspaces and employee engagement?

LITERATURE REVIEW

Metaverse and the Evolution of Virtual Workspaces

Metaverse is revolutionizing digital workspace since it provides an entrancing, practical atmosphere that advances cooperation, preparation, and correspondence between the representatives. Similarly to how the retail industry has adopted the virtual store model, HR practitioners are considering the possibility of using metaverse to provide employees with a different, interactive alternative to interact, attend meetings and collaborate in real-time virtual environments (Eggenschwiler et al., 2024; Yoo et al., 2023). Such virtual working environments, usually involving the use of avatars, allow staff members to engage in remote cooperation, virtual teambuilding activities, and professional growth training sessions. They are more engaging and interactive than traditional video conferencing and create a sense of presence and connection that overcomes the physical and digital gap at the workplace (Koles et al., 2024; Sung et al., 2023). The actual benefit to the HR departments will be the ability to elaborate phygital (physical and digital) experiences through the mixing of virtual platforms and real-life HR practices. Such a convergence enables employees to undergo onboarding experiences, virtual training experiences, and group activities in experiential ways that would not exist in a purely physical or digital setting (Yim et al., 2017; Rauschnabel et al.,

2022). Furthermore, such tools as smartphones and wearable devices can help HR professionals make the metaverse experiences even more accessible because employees will be able to engage in the activity literally anywhere, anytime (Yim et al., 2017; Rauschnabel et al., 2022). Household names such as Nike and Gucci have not been left behind in utilizing digital showrooms in the metaverse to connect with customers, though now business is considering the idea of virtual offices where employees will have the ability to participate in active training and team-building activities (Kim et al., 2023; Bao et al., 2024). Such metaverse platforms have the potential to transform the practice of HR by making it more interactive and involvement-oriented employee experience, enhancing remote teamwork, and developing the stronger sense of the relationship between the employee and the corporate culture.

Immersive HR Experiences and Employee Engagement

Experiential HRM can be understood as the process of providing employees with the powerful, interactive, and emotionally appealing experiences along the lines similar to the techniques applied in experiential marketing. In the metaverse, HR departments will be able to take advantage of the immersive space to enhance the overall engagement of the employees by establishing an emotionally engaging experience beyond the conventional remote work (Batat, 2024; Puntoni, 2024). These include, for example, the virtual workspaces can enable the employees to discover the company culture, attend live virtual events and even express themselves personally through avatars, thus creating the sense of belonging and contentment within the company (Belk, 2013; Bélisle & Bodur, 2010). Another major innovation in the immersive HRM is the concept of avatar realism, which enables a workforce to communicate in a more natural and affective manner than that prescribed in a conventional video conferencing (Holzwarth, Janiszewski, & Neumann, 20 Avatars, sensory design (e.g., background sounds or textures), and even gamification may improve the levels of engagement among employees, as they will find it memorable and interactive. They have also been known to strengthen the emotional connection between employees and their organizations, encourage communication, and enjoy their work (Etemad-Sajadi, 2016). Also, the virtual HRM tools, including the use of avatars and social presence, may enhance collaboration by replicating a social context of a face-to-face communication, decreasing the psychological distance and increasing trust among team members (Roggeveen & Sethuraman, 2020; Barrera & Shah, 2023).

Social Presence and Avatar Realism in Virtual Workspaces

Within the HRM context, social presence and avatar realism are an essential element toward the development of emotionally attached and effective virtual environment. Organizations can use such adaptive and realistic avatars as a means of transporting employees through an immersive and realistic virtual appearance, which increases their connectedness and diminishes a sense of isolation in distributed environments (Belslie, & Bodur, 2010; Kim, et al., 2023). The element that contributes to its importance on the employee satisfaction, engagement, and performance is social presence or the sense of presence within the virtual space. The employees are more inclined to develop an emotional connection to their peers and the company when they find the avatars realistic and relatable and, hence, do not consume as many resources, communicate more

effectively, and overall, are more productive members of a team (Cyr et al., 2007; Etemad-Sajadi, 2016). Moreover, the interactions mediated by avatars do not have to be limited to social interaction, but rather involve virtual co-creation, designing products, or even taking part in an actual event, making the affiliation to the organization even stronger and encouraging collaboration (Papagiannidis et al., 2013; Gleim et al., 2024). It is expected to see better engagement of employees since the design of avatars is not a hassle, and the customization of interactions through smartphones and other devices makes the metaverse a promising platform to conduct HR duties, including training, performance evaluation, and team building (Rauschnabel et al., 2022; Lu & Mintz, 2023).

Smartphones as a Gateway to Immersive HRM

Increasingly the means of accessing immersive HRM in the metaverse is through smartphones, giving employees the flexibility to work at virtual workstations and during training programs anywhere. Incorporation of augmented reality (AR) and avatars through smartphones enable the employees to receive training materials, join virtual conferences, collaborate with other team members and feel like they are in person (Rauschnabel et al., 2022; Lu & Mintz, 2023). The concept of social presence in virtual spaces, which can be enriched with the help of smartphones, would help the HR departments make remote teams more fun and engaging to work with by providing them with a similar level of socialization and interaction as that of the regular office space. Avatars in immersive virtual environment also creating a feeling of presence between the employees and the organization reduces the psychological distance toward the organization and it gives rise to the sense of trust, enhances collaboration, and eventually the overall employee satisfaction and retention (Cyr et al., 2007; Etemad-Sajadi, 2016). By doing so, metaverse serves as a central connecting point between physical and digital that enables people to communicate, train, and collaborate in separate places without any difficulties (Papagiannidis et al., 2013; Gleim et al., 2024).

Immersive HRM Using NFTs, AR, and Customization

Customization and NFTs (non-fungible tokens) are becoming important aspects of immersive HRM through which organizations are personalizing and offering exclusive digital assets to employees. NFTs may be used as a certificate of accomplishment, a virtual prize, or even find in the form of an avatar that will literally show the success and level of an employee in the enterprise (Sung et al., 2023; Bao et al., 2024). This does not only create a personal touch, but also provides an employee with an opportunity to feel special and possessive of his or her virtual existence in the company. On the same note, augmented reality (AR) technologies enable employees to see training materials and organizational data in 3D, which is more interactive and memorable to learn. These immersive tools positively impact employee engagement rates as they allow the employees to be more involved in training and development processes and personalize their learning experience as well as increase their emotional engagement with an organization (Tan et al., 2022; Hilken et al., 2022). Moreover, in the event that employees are given a choice on how to customize or personalize their avatars, their virtual offices, or their training space, the human resources

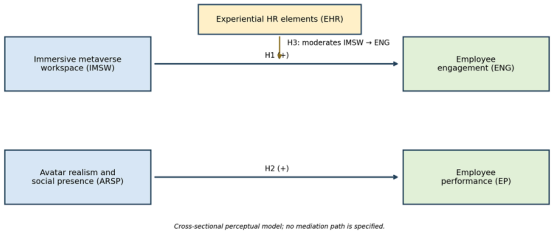
department of an organization can experience greater engagement, loyalty, and overall satisfaction among the workforce (Mehrotra et al., 2024; Roggeveen & Sethuraman, 2020). The move towards digital personalisation and immersive HRM is not a mere technological and technical innovation but a way of enhancing employee experience and developing greater organisational attachment.

Theoretical Foundation and Hypothesis Development

The model combines four complementary organizational perspectives. Employee engagement theory explains why work conditions that foster meaningfulness, psychological safety, and personal availability encourage employees to invest themselves in their roles (Kahn, 1990). The Job Demands–Resources model treats supportive technology and interaction quality as potential job resources, while also recognizing that poorly designed technology may become a demand (Bakker & Demerouti, 2007). Social Presence Theory predicts that richer interpersonal cues increase the perceived salience of colleagues in mediated interaction (Short et al., 1976), and Media Richness Theory proposes that media capable of transmitting timely and varied cues are better suited to equivocal work tasks (Daft & Lengel, 1986). Together, these theories support the following directional hypotheses.

1. Hypothesis 1 (H1): Immersive metaverse workspaces are positively associated with employee engagement.
    a. The immersion and interaction afforded by a metaverse workspace may operate as job resources by increasing involvement, feedback, and perceived connection. H1 therefore links IMSW directly to engagement; it does not claim effects on unmeasured satisfaction or collaboration outcomes.
2. Hypothesis 2 (H2): Avatar realism and social presence are positively associated with perceived employee performance.
    a. Realistic avatar cues and a stronger sense of social presence may reduce psychological distance and support coordination. In the tested model, the combined ARSP construct is a direct predictor, not a mediator.
3. Hypothesis 3 (H3): Experiential HR elements positively moderate the relationship between immersive metaverse workspaces and employee engagement, such that the relationship is stronger at higher levels of experiential HR elements.
    a. The model assigns one role to each construct: IMSW and ARSP are predictors, ENG and EP are outcomes, and EHR is a moderator. Smartphone/device usability was measured as an ancillary technology-quality construct but was not included as a control in the reported structural paths; accordingly, no control-variable effect is claimed.

Figure 1. Research model



METHODOLOGY

Research Desugn

A quantitative, cross-sectional survey design was used to examine associations among immersive metaverse workspaces, employee engagement, avatar realism/social presence, perceived employee performance, and experiential HR elements. The design

was appropriate for testing a prespecified measurement and structural model, but it does not establish temporal order or causality. SPSS was used for data screening, descriptive statistics, and internal consistency, and AMOS was used for confirmatory factor analysis (CFA) and structural equation modeling (SEM).

Variable of the Study

1. Predictor 1: Immersive Metaverse Workspaces (IMSW).
2. Predictor 2: Avatar Realism and Social Presence (ARSP).
    a. Outcome 1: Employee Engagement (ENG).
    b. Outcome 2: Perceived Employee Performance (EP).
3. Moderator: Experiential HR Elements (EHR), including AR, NFT-based recognition, and sensory design.
4. Ancillary measured construct: Smartphone/Device Usability (not included in the reported structural paths).
5. No mediation relationship or control-variable effect was tested in the reported model.

Each focal construct was represented by three survey statements reported in Tables 4.5–4.9 and rated on a five-point Likert scale (1 = strongly disagree to 5 = strongly agree). The items were adapted to the metaverse-HRM context from the conceptual domains established in prior research on immersive experience, employee engagement, avatar realism, social presence, experiential technologies, and technology usability. Construct-level reliability and convergent validity were evaluated using Cronbach's alpha, composite reliability, and average variance extracted.

Sample Size

The final sample comprised 175 HR professionals and employees aged 18–35 who reported experience with Roblox, Decentraland, or Meta Horizon. Purposive eligibility screening was used because respondents needed prior exposure to a metaverse platform. The achieved sample exceeded common minimum rules based on the number of modeled constructs and estimated paths, but adequacy should be judged jointly with model complexity, distributional assumptions, and fit rather than by a single rule of thumb. The study did not use probability sampling; therefore, population representativeness cannot be assumed.

Data Collection

Data were collected through a structured online questionnaire circulated through LinkedIn, Reddit, and HR-focused forums. Participation was restricted to HR professionals and employees with prior experience of Roblox, Decentraland, or Meta Horizon. Screening and data-cleaning procedures produced 175 complete and usable responses for analysis. The online questionnaire contained the study information, eligibility questions, demographic measures, and five-point Likert-scale construct items. The same final sample was used for descriptive analysis, CFA, and SEM.

Data Analysis

Analysis proceeded in four stages. First, frequency distributions, item means, and sample standard deviations were computed in SPSS. Second, internal consistency and convergent validity were evaluated using Cronbach's alpha, composite reliability (CR), and average variance extracted (AVE),

followed by the Fornell–Larcker discriminant-validity assessment. Third, CFA evaluated measurement-model fit using χ^2/df, CFI, TLI, RMSEA, and SRMR. Fourth, SEM tested the two direct paths and the interaction effect specified in H3. The means and standard deviations in Tables 4.5–4.9 were recalculated from the response frequencies. Critical ratios and normal-theory 95% confidence intervals for the direct paths were calculated from the reported estimates and standard errors.

DATA ANALYSIS & RESULTS

Reliability and Validity

Internal consistency was assessed using Cronbach's alpha and composite reliability (CR), and convergent validity was assessed using average variance extracted (AVE). All alpha and CR values exceeded 0.70, while all AVE values exceeded 0.50. The results therefore support acceptable internal consistency and convergent validity across the study constructs.

Table 4.1 Reliability and Validity

Construct	Cronbach's Alpha (α)	Composite Reliability (CR)	Average Variance Extracted (AVE)
Immersive Metaverse Workspaces	0.82	0.87	0.63
Employee Engagement	0.84	0.88	0.65
Employee Performance	0.86	0.89	0.67
Avatar Realism & Social Presence	0.80	0.85	0.60
Experiential HR Elements (Physical + Virtual)	0.79	0.83	0.59
Smartphone/Device Usability	0.77	0.81	0.58

Across the six measured constructs, Cronbach's alpha ranged from 0.77 to 0.86, CR ranged from 0.81 to 0.89, and AVE ranged from 0.58 to 0.67. These values indicate acceptable construct-level reliability and convergent validity for the reported measures.

Confirmatory Factor Analysis (CFA) – Model Fit

Table 4.2 Confirmatory Factor Analysis (CFA) – Model Fit

Fit Index	Value	Recommended Threshold
Chi-square/df	1.89	< 3.00
Comparative Fit Index (CFI)	0.93	≥ 0.90
Tucker-Lewis Index (TLI)	0.91	≥ 0.90
Root Mean Square Error of Approximation (RMSEA)	0.048	≤ 0.06
Standardized Root Mean Square Residual (SRMR)	0.045	≤ 0.08

The available global fit indices indicate acceptable measurement-model fit. This conclusion concerns the covariance structure of the specified measurement model; it does not by itself demonstrate predictive accuracy or causal validity.

Discriminant Validity

Table 4.3 Discriminant Validity

Constructs	IMSW	ENG	EP	ARSP	EHR	EOU
Immersive Metaverse Workspaces (IMSW)	0.79					
Employee Engagement (ENG)	0.56	0.81				
Employee Performance (EP)	0.47	0.54	0.82			

Constructs	IMSW	ENG	EP	ARSP	EHR	EOU
Avatar Realism & Social Presence (ARSP)	0.43	0.48	0.59	0.77		
Experiential HR Elements (EHR)	0.52	0.46	0.50	0.51	0.76	
Ease of Use (EOU)	0.44	0.49	0.42	0.46	0.45	0.76

Note: Diagonal values in bold represent √AVE.

For each construct, the diagonal square root of AVE exceeded the corresponding inter-construct correlations. The Fornell–Larcker results therefore support discriminant validity and indicate that the constructs captured empirically distinguishable dimensions of the phygital HRM model.

Demographic Profile of Respondents

The final sample consisted of 175 respondents with prior exposure to at least one listed metaverse platform. The demographic table shows that all respondents were aged 18–35; this corrects the earlier methodological statement of 18–45.

Table 4.4 Demographic Profile of Respondents

Variable	Category	Frequency	Percentage
Gender	Male	101	58%
	Female	74	42%
Age	18–25	127	73%
	26–35	48	27%
Education	Undergraduate	114	65%
	Postgraduate	52	30%
	Others	9	5%
Metaverse Usage	Occasionally	119	68%
	Frequently	39	22%
	Rarely	17	10%
Platforms Used	Roblox	94	54%
	Decentraland	63	36%
	Meta Horizon	18	10%

Most respondents were male (58%), aged 18–25 (73%), and undergraduates (65%). Metaverse use was most often occasional (68%), and Roblox was the most frequently reported platform (54%). This profile indicates a young, digitally experienced convenience sample and limits generalization to older employees, specific industries, countries, or organizations.

Descriptive Statistics

Tables 4.5–4.9 report response frequencies for the five-point Likert items. All means and sample standard deviations were recalculated directly from the displayed counts (n = 175 per item). Percentages are rounded to whole numbers and may therefore differ marginally from values computed from the counts.

Table 4.5 Perceptions of Immersive Virtual Environments with Physical HR Elements

Statement	1 (SD)	2 (D)	3 (N)	4 (A)	5 (SA)	Mean	SD
The virtual workspace, integrated with physical elements (e.g., sensory design, real-time interactions), felt realistic and engaging.	3 (2%)	7 (4%)	21 (12%)	98 (56%)	46 (26%)	4.01	0.84
I felt fully immersed in the virtual work environment, where physical HR elements were incorporated.	2 (1%)	8 (5%)	25 (14%)	97 (55%)	43 (25%)	3.98	0.82

Statement	1 (SD)	2 (D)	3 (N)	4 (A)	5 (SA)	Mean	SD
The design of the workspace, combining both virtual and physical elements, increased my engagement and focus on tasks.	4 (2%)	6 (3%)	28 (16%)	98 (56%)	39 (22%)	3.93	0.85

Agreement or strong agreement with the three immersive-workspace statements ranged from 78% to 82%. Recalculated means ranged from 3.93 to 4.01, with sample standard deviations from 0.82 to 0.85. These responses indicate generally favorable perceptions, not objective evidence of productivity or causal effects.

Table 4.6 Employee Engagement in Phygital HRM Environments

Statement	1 (SD)	2 (D)	3 (N)	4 (A)	5 (SA	Mean	SD
I enjoyed participating in virtual training sessions, enhanced by physical elements, through my smartphone.	2 (1%)	5 (3%)	20 (11%)	99 (57%)	49 (28%)	4.07	0.78
I felt actively engaged in the phygital HR experience, combining virtual and physical HR elements.	3 (2%)	4 (2%)	21 (12%)	97 (55%)	50 (29%)	4.07	0.81
The experience motivated me to contribute more to team projects, blending physical and virtual interactions.	3 (2%)	6 (3%)	22 (13%)	96 (55%)	48 (27%)	4.03	0.83

Employee-engagement item means ranged from 4.03 to 4.07 after recalculation, with sample standard deviations from 0.78 to 0.83. Agreement or strong agreement ranged from 82% to 85%, indicating high self-reported engagement in this sample.

Table 4.7 Employee Performance in Phygital HRM Environments

Statement	1 (SD)	2 (D)	3 (N)	4 (A)	5 (SA)	Mean	SD
I would consider participating in more HR activities if physical elements were integrated into the virtual work environment.	5 (3%)	10 (6%)	31 (18%)	89 (51%)	40 (23%)	3.85	0.94
The phygital HR experience (with both physical and virtual elements) increased my motivation to engage in team projects.	4 (2%)	9 (5%)	26 (15%)	95 (54%)	41 (24%)	3.91	0.89
I am more likely to recommend this type of HR experience to my colleagues.	6 (3%)	7 (4%)	33 (19%)	89 (51%)	40 (23%)	3.86	0.93

The three perceived-performance items had recalculated means of 3.85–3.91 and sample standard deviations of 0.89–0.94. Because these items capture intentions and self-reported motivation or advocacy rather than independently rated job output, the construct is interpreted conservatively as perceived employee performance.

Table 4.8 Avatar Realism & Social Presence in Phygital HRM

Statement	1 (SD)	2 (D)	3 (N)	4 (A)	5 (SA)	Mean	SD
The avatar felt lifelike and relatable, enhancing	4 (2%)	7 (4%)	25 (14%)	98 (56%)	41 (23%)	3.94	0.86

Statement	1 (SD)	2 (D)	3 (N)	4 (A)	5 (SA)	Mean	SD
my virtual work experience.							
I felt a strong social presence through avatar interactions in the virtual workspace.	3 (2%)	6 (4%)	28 (16%)	95 (54%)	43 (25%)	3.97	0.84
The avatar helped me feel more connected to my colleagues in the virtual workspace.	3 (2%)	5 (3%)	29 (17%)	95 (54%)	43 (25%)	3.97	0.83

The avatar realism and social presence items had recalculated means of 3.94–3.97 and sample standard deviations of 0.83–0.86. The results indicate favorable perceived connection through avatar-mediated interaction; they do not directly measure trust or emotional attachment.

Table 4.9 Experiential HR Elements (AR, NFTs, Sensory Design) in Phygital HRM

Statement	1 (SD)	2 (D)	3 (N)	4 (A)	5 (SA)	Mean	SD
Augmented Reality, integrated with physical elements, improved my understanding of HR processes.	4 (2%)	7 (4%)	24 (14%)	92 (53%)	48 (27%)	3.99	0.88
NFT-based rewards and certifications enhanced my sense of accomplishment in the virtual workspace.	6 (3%)	8 (5%)	26 (15%)	94 (54%)	41 (23%)	3.89	0.93
The virtual workspace effectively used sensory design (visuals, sounds, tactile interactions) to create an engaging HR experience.	3 (2%)	6 (4%)	22 (13%)	91 (52%)	53 (30%)	4.06	0.85

The experiential HR items had recalculated means of 3.89–4.06 and sample standard deviations of 0.85–0.93. Respondents evaluated AR-supported understanding and sensory design favorably, while the NFT-based recognition item received a slightly lower mean.

Structural Model and Hypothesis Testing

The structural model tested three prespecified relationships: IMSW → ENG (H1), ARSP → EP (H2), and the IMSW × EHR interaction predicting ENG (H3). No mediation path, satisfaction outcome, collaboration outcome, or device-usability control path was included in the reported structural model.

Structural Model Fit

The structural model demonstrated acceptable fit: $\chi^2/df = 1.95$, CFI = 0.94, TLI = 0.92, RMSEA = 0.049, and SRMR = 0.043. Each index satisfied its stated threshold, supporting the overall adequacy of the specified structural model.

Table 4.10 Structural Model Fit

Fit Index	Value	Recommended Threshold
Chi-square/df	1.95	< 3.00
Comparative Fit Index (CFI)	0.94	≥ 0.90
Tucker-Lewis Index (TLI)	0.92	≥ 0.90
RMSEA (Root Mean Square Error of Approximation)	0.049	≤ 0.06
SRMR (Standardized Root Mean Square Residual)	0.043	≤ 0.08

Acceptable global fit supports proceeding to interpretation of the prespecified paths. It does not establish causality, eliminate alternative models, or demonstrate out-of-sample prediction.

Direct Path Analysis

H1 was supported: immersive metaverse workspaces were positively associated with employee engagement (β = 0.59, SE = 0.08, CR = 7.38, p < 0.001, normal-theory 95% CI [0.43, 0.75]). H2 was also supported: avatar realism and social presence were positively associated with perceived employee performance (β = 0.47, SE = 0.10, CR = 4.70, p < 0.01, normal-theory 95% CI [0.27, 0.67]).

Table 4.11 Direct Path Analysis

Hypothesis	Relationship	Estimate (β)	Standard Error	CR and 95% CI	p-value result
H1	Immersive Workspaces → Employee Engagement	0.59	0.08	7.38; [0.43, 0.75]	< 0.001; Supported
H2	Avatar Realism & Social Presence → Perceived Employee Performance	0.47	0.10	4.70; [0.27, 0.67]	< 0.01; Supported

The direct-path estimates show positive associations in the specified sample. Because the study is cross-sectional and self-reported, the estimates should not be described as causal effects.

Moderation Analysis

Moderation analysis tested whether experiential HR elements changed the strength of the relationship between immersive metaverse workspaces and employee engagement.

The interaction coefficient was positive and statistically significant (β = 0.33, p < 0.05), supporting H3. This is a moderation result, not mediation.

Table 4.12 Moderation Analysis

Moderation Effect	Estimate (β)	p-value	Result
Immersive Workspaces × Experiential HR Elements → Engagement	0.33	< 0.05	Supported

The positive interaction indicates that the relationship between immersive metaverse workspaces and employee engagement became stronger as experiential HR elements increased. This result supports the proposed boundary condition: immersive workspaces were associated with particularly strong engagement when reinforced through AR, NFT-based recognition, and sensory design.

Summary of Hypotheses Testing

All three specified hypotheses were supported: IMSW was positively associated with engagement, ARSP was positively associated with perceived performance, and EHR positively moderated the IMSW–engagement relationship. No conclusions are drawn for satisfaction, loyalty, trust, collaboration, organizational performance, or mediation because these outcomes or mechanisms were not tested in the reported model.

Hypothesis	Statement	Estimate (β)	p-value	Status
H1	Immersive workspaces positively influence employee engagement.	0.59	< 0.001	Supported
H2	Avatar realism and social presence positively influence employee performance.	0.47	< 0.01	Supported
H3	Experiential HR elements moderate the immersive experience effect.	0.33	< 0.05	Supported

Overall, the results support the proposed association-based phygital HRM model within this sample. The evidence is strongest for self-reported engagement and perceived performance and should be interpreted in light of the cross-sectional design, purposive recruitment, and incomplete item-level SEM diagnostics.

DISCUSSION

The findings extend metaverse research into an HRM and organizational-behavior context. The positive IMSW–engagement relationship is consistent with Kahn's (1990) view that employees invest themselves more fully when work conditions support meaningful involvement and psychological availability. It is also compatible with the Job Demands–Resources model: immersion, timely feedback, and interactive cues may function as resources that facilitate involvement (Bakker & Demerouti, 2007). However, the design cannot determine whether immersion caused engagement; engaged employees may also evaluate immersive tools more favorably. The positive ARSP–performance association is consistent with Social Presence Theory and Media Richness Theory, because salient interpersonal cues and richer communication can reduce ambiguity in distributed work (Short et al., 1976; Daft & Lengel, 1986). This HRM interpretation is more appropriate than treating employees as consumers or inferring loyalty and brand effects that were not measured.

The positive moderation result suggests that AR, sensory design, and digital recognition may strengthen the association between an immersive workspace and engagement. For HR practice, the implication is selective rather than universal adoption: organizations should match immersive features to the task, provide accessible alternatives, train users, and evaluate employee outcomes before scaling. Managers should also establish safeguards for biometric and behavioral data, avatar identity, harassment, NFT ownership, security, and informed participation. Immersive technology can also create job demands through cognitive overload, surveillance concerns, equipment inequality, and digital fatigue. These boundary conditions qualify any claim that metaverse workspaces necessarily improve employee experience.

CONCLUSION

This study found that immersive metaverse workspaces were positively associated with employee engagement, avatar realism and social presence were positively associated with perceived employee performance, and experiential HR elements strengthened the immersive-workspace–engagement relationship. The study's contribution lies in defining phygital HRM as coordinated physical and immersive digital work design and in testing a model that assigns consistent roles to its predictors, moderator, and outcomes. The evidence supports cautious experimentation with immersive HR activities, not claims of disruption, competitive advantage, loyalty, or organizational-performance improvement. Decisions to adopt metaverse tools should therefore be based on task fit, employee accessibility, privacy and security controls, ethical avatar governance, and continuing outcome evaluation.

Limitations

The study has several limitations.

1. its cross-sectional design captures

associations at one point in time and does not establish causality. Second, t

2. The use of self-reported measures may introduce social-desirability and common-method bias.
3. Purposive online recruitment and the predominance of respondents aged 18–25 restrict generalization to older employees and the wider workforce.
4. Perceived employee performance was measured through respondent evaluations rather than supervisor ratings or archival performance indicators.

These limitations define appropriate boundaries for interpreting the findings.

Directions for Further Research

1. Future research should use longitudinal, experimental, or time-lagged designs to establish temporal order and compare metaverse-based HR activities with video-conferencing and face-to-face alternatives.
2. Multi-source studies should combine employee responses with supervisor-rated or objective performance indicators. Researchers should validate the measurement model across countries, industries, age groups, and levels of digital literacy; test measurement invariance; and distinguish avatar realism from social presence.
3. Further work should examine psychological safety, trust, technostress, privacy concern, accessibility, and digital fatigue as mechanisms or boundary conditions.
4. Qualitative studies can additionally explore employee consent, identity, inclusion, surveillance, and the ethics of avatar- and NFT-enabled HR practices.

REFERENCES

Ahn, S., Jin, B. E., & Seo, H. (2024). Why do people interact and buy in the metaverse? Journal of Business Research, 175, 114557. https://doi.org/10.1016/j.jbusres.2024.114557

Bakker, A. B., & Demerouti, E. (2007). The Job Demands–Resources model: State of the art. Journal of Managerial Psychology, 22(3), 309–328. https://doi.org/10.1108/02683940710733115

Bao, W., Hudders, L., Yu, S., & Beuckels, E. (2024). Virtual luxury in the metaverse: NFT-enabled value recreation. International Journal of Research in Marketing.

Batat, W. (2024). Phygital customer experience in the metaverse: A study of sensory perception. Journal of Retailing and Consumer Services, 78, 103786.

Belk, R. (2013). Extended self in a digital world. Journal of Consumer Research, 40(3), 477–500.

Belk, R. W. (2024). The digital frontier as a liminal space. Journal of Consumer Psychology, 34(1), 167–173.

Belk, R., Humayun, M., & Brouard, M. (2022). Money, possessions, and ownership in the metaverse. Journal of Business Research, 153, 198–205.

Barrera, K. G., & Shah, D. (2023). Marketing in the metaverse: Framework and research agenda. Journal of Business Research, 155, 113420.

Bélisle, J. F., & Bodur, H. O. (2010). Perception of consumers based on avatars in virtual worlds. Psychology & Marketing, 27(8), 741–65.

Cyr, D., Hassanein, K., Head, M., & Ivanov, A. (2007). The role of social presence in e-service loyalty. Interacting with Computers, 19(1), 43–56.

Daft, R. L., & Lengel, R. H. (1986). Organizational information requirements, media richness and structural design. Management Science, 32(5), 554–571. https://doi.org/10.1287/mnsc.32.5.554

Eggenschwiler, M., Linzmajer, M., Roggeveen, A.

L., & Rudolph, T. (2024). Retailing in the metaverse: Managerial considerations. Journal of Retailing and Consumer Services, 79, 103791.

Etemad-Sajadi, R. (2016). Real-time interactivity using avatars. Computers in Human Behavior, 61, 227–232.

Gadalla, E., Keeling, K., & Abosag, I. (2013). Metaverse-retail service quality. Journal of Marketing Management, 29(13-14), 1493–1517.

Gleim, M., McCullough, H., Ferrell, O. C., & Gabler, C. (2024). Metaverse: Shifting the reality of services. Journal of Services Marketing, 38(1), 13–27.

Gleim, M. R., Stevens, J. L., & Johnson, C. M. (2023). Platform marketplaces and virtual exchange. European Journal of Marketing, 57(1), 1–28.

Hadi, R., Melumad, S., & Park, E. S. (2024). The Metaverse: A new frontier for consumer behavior. Journal of Consumer Psychology, 34(1), 142–166.

Hennig-Thurau, T., et al. (2023). Social interactions in the metaverse: Initial evidence and roadmap. Journal of the Academy of Marketing Science, 51(4), 889–913.

Hilken, T., et al. (2022). Bridging imagination gaps via AR. Journal of Interactive Marketing, 57(2), 356–75.

Holzwarth, M., Janiszewski, C., & Neumann, M. M. (2006). Influence of avatars on shopping behavior. Journal of Marketing, 70(4), 19–36.

Kahn, W. A. (1990). Psychological conditions of personal engagement and disengagement at work. Academy of Management Journal, 33(4), 692–724. https://doi.org/10.2307/256287

Kim, D. Y., Lee, H. K., & Chung, K. (2023). Avatar realism and user-avatar relationship. Journal of Retailing and Consumer Services, 73, 103382.

Koles, B., Audrezet, A., et al. (2024). Authentic virtual influencers in the metaverse. Journal of Business Research, 170, 114325.

Lu, S., & Mintz, O. (2023). Marketing on the metaverse: Opportunities and challenges. AMS Review, 13, 151–166.

Mehrotra, A., et al. (2024). Customer experience in metaverse retailing. Journal of Retailing and Consumer Services, 79, 103876.

Papagiannidis, S., et al. (2013). Simulated experience in virtual retail and purchase intentions. Journal of Marketing Management, 29(13-14), 1462–1492.

Puntoni, S. (2024). Already here: Metaverse in touch and sound. Journal of Consumer Psychology, 34(1), 174–176.

Rauschnabel, P. A., et al. (2022). What is AR marketing? Journal of Business Research, 142, 1140–1150.

Roggeveen, A. L., & Sethuraman, R. (2020). Customer-interfacing retail technologies. Journal of Retailing, 96(3), 299–309.

Short, J., Williams, E., & Christie, B. (1976). The social psychology of telecommunications. John Wiley & Sons.

Sung, E. (Christine), et al. (2023). NFT luxury brand marketing in the metaverse. Psychology & Marketing, 40(11), 2306–2325.

Tan, Y. C., Chandukala, S. R., & Reddy, S. K. (2022). AR in retail and impact on sales. Journal of Marketing, 86(1), 48–66.

Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. MIS Quarterly, 27(3), 425–478. https://doi.org/10.2307/30036540

Yim, M. Y. C., Chu, S. C., & Sauer, P. L. (2017). AR technology for e-commerce: Interactivity perspective. Journal of Interactive Marketing, 39(1), 89–103.

Yoo, K., Welden, R., Hewett, K., & Haenlein, M. (2023). The merchants of Meta: Future of metaverse retail. Journal of Retailing, 99(2), 173–192.