

Ethical Concerns in Metaverse Development: A Mixed-Methods Study of Indian IT Professionals

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Abstract

The metaverse-ethics literature has converged on a recognizable taxonomy of concerns. What this taxonomy has not yet provided is a socio-technical mechanism that explains why these concerns persist at the developer interface, and why developer-level interventions remain persistently ineffective. Drawing on an exploratory sequential multi-method design comprising open-ended qualitative survey with 50 Indian IT professionals and a Fuzzy Decision-making trial and evaluation laboratory (DEMATEL) analysis with 12 metaverse experts. Based on Responsible Innovation framework, this study utilized Gioia Method to identify aggregate dimensions from the developer's perspective. This study presents the Experiential Ethical Translation Gap (EETG). EETG is defined as the gap between developers' personal, embodied, and culturally based ethical intuitions and the formal techno-ethical terms they can use to incorporate these intuitions into metaverse design. The EETG has three reflective sub-dimensions that were identified from the data: Affective-Embodied translation Loss, Avatar-identity Authenticity Negotiation, and Vernacular Ethical Resourcing. The study also found that ethical agency externalization is the way EETG leads to the eight identified concerns. In all transcripts, developers express ethical risks using a passive, predictive tone, rather than integrating these concerns into the design process as commitments. This study presents several specific managerial implications, demonstrating that the Indian IT context is theoretically significant rather than merely incidental.

Keywords: Metaverse ethics; Experiential ethical translation gap; Ethical agency externalization; Responsible innovation; IT industry; Gioia method.

1. Introduction

Ethical concerns related to the metaverse are often examined from the perspective of end-users (Kumar et al., 2024). Users' express ethical concerns while engaging with metaverse platforms, leading to a reluctance to continue their use (Kumar et al., 2024). Researchers have identified numerous interrelated ethical issues such as: privacy invasion, harassment, harm via avatars, addictive engagement cycles, and identity misuse (Fernandez & Hui, 2022; Wang et al., 2023), which are typically recognized upon direct encounter. Although metaverse development firms are striving to address customer concerns, the existing literature lacks studies adopting a proactive approach, before end-users encounter to this immersive platform.

For example, addressing end-users' ethical concerns is a responsibility shared by all stakeholders, particularly the developers who design these platforms. Immersive developers serve as a link between the administration and end-users. Therefore, it is essential to understand developers' perspectives on the precautions implemented during the creation of these immersive platforms.

This study builds upon phenomena-based, contextual, and literature gaps.

Phenomena-based gaps arise as immersive technology platforms transition from experiential applications to embedded infrastructures of work. The design choices of these platforms, including biometric telemetry, immersion depth, avatar systems, and moderation logic, have significant ethical implications. These implications are configured at the code layer prior to any user interaction (Dwivedi et al., 2022; Hennig-Thurau et al., 2023; Slater et al., 2020).

Also, Indian IT developers navigate a distinctive regulatory environment (Digital Personal Data Protection Act, 2023). Whereas, they encountered a dual normative exposure to Western clients and domestic norms, and indigenous ethical vocabularies, which is absent from the western techno-ethical canon.

Contextual-gaps are artificial intelligence and developers responsibility are explored but not metaverse and developers responsibility (Vakkuri et al., 2020). Gogoll (2026) argues that ethics in software development has been addressed at code of conduct level, not empirically validated at the developer deliberation. Further, the existing literature mostly studied the business perspectives, empirical evidences and developers perspective are still lacking (Behera et al., 2024; Vasist et al., 2025).

Among all related theories, Responsible Innovation (RI) framework offers a comprehensive framework for analyzing the initial phases of technological development. It includes four principal components: anticipation, reflexivity, inclusion, and responsiveness (Stilgoe et al., 2017; Owen et al., 2013).

These components highlight the ethical responsibility of innovators, encouraging them to evaluate the consequences of their decisions prior to the emergence of potential harms. Although RI has been successfully applied to domains such as nanotechnology and AI governance, its application to the development of immersive technologies remains largely theoretical. There is a notable absence of practical implementation grounded in the actual practices and concerns reported by developers (Brey, 2017; Umbrello & van de Poel, 2021).

The present study addresses three distinct gaps. First, there is an absence of empirical evidence from developers concerning ethical issues in immersive-platform work, particularly within the Indian IT sector (Vakkuri et al., 2020). IT industry is crucial in global back-end and platform engineering, yet it is under presented in research on immersive ethics (Dwivedi et al., 2022; Hennig-Thurau et al., 2023; Slater et al., 2020).

Second, existing studies on developer ethics frequently rely on surveys, which tend to oversimplify the complex and negotiated nature of ethical reasoning, which identify concerns but do quantify the causal relationships among them (Gogoll, 2026). Finally, RI lacks a developer-driven framework for immersive environments, limiting its effectiveness in both diagnosis and practical application.

Based on the study's motivation, theory and practical gaps discussed above, this study aims to address the following research questions:

- RQ1: What are the prevailing ethical concerns among Indian IT professionals related to immersive platforms?
- RQ2: What core thematic dimensions of metaverse platforms ethical concerns are conceptualized by Indian IT professionals?
- RQ3: What developer-level socio-technical mechanism explains the persistence of these concerns, and how does it operate?
- RQ4: What are the interrelationships and directionally dominant structure of the identified ethical factors?

The primary contributions of this study are as follows: First, this study introduces a novel socio-technical mechanism of Experiential Ethical Translation Gap (EETG) and elucidates the persistence of well-established immersive platforms ethical concerns at the developer interface.

Second, this study identifies the discursive pattern of Ethical Agency Externalization as the mediating mechanism through which EETG generates manifest concerns.

Third, this study offers empirical evidence which identifies an early cause-and-effect relationship related to developer's point of view in ethical concerns for immersive technologies. Fourth, methodologically, this study employed a sequential Gioia-RI framework (Qual)-Fuzzy DEMATEL (Quant), which can be applied by future researchers when both emergence and interdependence are critical.

Lastly, this study offers immersive-platform companies, ethics committees, and policymakers a prioritized intervention framework grounded in developers' actual experiences, rather than relying on external prescriptive checklists imposed during the design phase.

2. Background of the study

2.1 Ethical concerns in immersive-technology platforms: from user harm to design responsibility

Over the past few years, there has been a significant surge in ethics research related to immersive technologies.

The dominant analytical approach primarily addresses ethics as a user-centric issues such as; leakage of biometric and behavioral data; psychological harm stemming from prolonged immersion and repetitive engagement cycles; harassment and identity misuse enabled by avatars; algorithm driven exclusion and unresolved platform governance (Blackwell et al., 2019; Dwivedi et al., 2023; Fernandez & Hui, 2022; Freeman et al., 2022; Slater et al., 2020; Wang et al., 2023; Zallio & Clarkson, 2022).

The existing body of literature holds empirical significance but lacks analytical depth at its foundational level. This primarily documents user experiences following the deployment of immersive platforms, yet provides limited insight into the decisions taken at the designing level. Recent reviews have explicitly identified this imbalance.

Buhalis et al. (2023) and Hennig-Thurau et al. (2023) both highlight that the harms associated with immersive platforms are effectively embedded at the Software Development Kit (SDK), sensor, and moderation-policy levels prior to user interaction, leading user-centric ethics research to focus on symptoms rather than root causes.

This lack is significant for three primary reasons. First, it creates a governance blind spot, as policy measures targeting user-visible harms fail to address the underlying design decisions responsible for these harms.

Second, it diminishes the ethical role of developers, who are either overlooked or perceived merely as executors of managerial directives (Vakkuri et al., 2020).

Third, it restricts theoretical development, as ethics frameworks based solely on user-side observations cannot account for the process by which abstract values are transformed into tangible platform features (Umbrello and van de Poel, 2021).

Therefore, any credible framework for ethics in immersive platforms must incorporate a developer's perspective, elucidating how ethical issues emerge, compete, and are resolved during the design process. Further, this study focused on Indian IT developers for the reasons shown in Table 1 and the existing gaps highlighted in Table 2.

Table 1. A comparative example of metaverse challenges in Indian and other countries context. Source(s). compiled by authors

Aspect	Indian Context	Other Countries
Adoption Stage in IT Sector	Nascent stage, still emerging Behera et al. (2024) Mohanty et al. (2025)	The UAE government has pushed metaverse adoption, but it remains in an early phase, mainly in government services and select business cases Al-kfairy et al. (2025). Metaverse applications span gaming, digital marketing, finance (BFSI), tourism, retail, and virtual banking experience Ingersleben-Seip (2025). Mature experimentation by tech companies developing platforms (Meta, Microsoft, Nvidia) Grand View Research (2023)
Infrastructure & Economic Barriers	High barriers include infrastructure, investment budgets, digital literacy gaps, and lack of high-end hardware, hindering widespread adoption Agrawal and Wankhede (2025) Shardeo et al. (2024).	Infrastructure & R&D investment, U.S. metaverse market, valued at USD 27.5 billion in 2023, is projected to grow at a CAGR of 37.4% to USD 253.8 billion by 2030 Mohandes et al. (2025) Grand View Research (2023).
Regulation & Policy Environment	From Niti-Ayog Report, Meta-governance proposes virtual realms for India's e-governance, while highlighting crucial hurdles: digital divide and urgent need for regulatory framework addressing metaverse privacy and security risks Niti Aayog (2022.) Emerging (Digital Personal Data Protection Act - DPDPA); Focus on localization and "sovereign" tech.	USA section 230 of the Communication Decency Act gives platform immunity for users' illegal or harmful posts. California's AB 587 (social media transparency), California's Age-Appropriate Design Code Act (AB 2273), and Utah's accountability laws available Deloitte (2023). Established (GDPR-like state laws, FTC oversight); Focus on antitrust and safety.
Key Ethical Concerns	Data privacy, Digital Divide, poor awareness of rights, and psychological risk due to blurring realities in immersive environments Kumar et al. (2023) (2024).	Deep Privacy: Biometric surveillance, neural data-ownership, mental-health interoperability, security Pignol (2025)
Workforce Challenge	Lack of high-fidelity infrastructure (5G/HMD costs); risk of Expert Gatekeeping Mohanty et al. (2025).	High cost of specialized VR/AR talent; potential for social isolation Wang et al. (2023).

Table 2. Some ethical dimensions of the metaverse and existed gaps. Source(s). Compiled by authors

Ethical dimensions of the Metaverse	Reference	Description	Gap	Present study Contributions
Infrastructure dependency	Kumar et al. (2023)	Discussed infrastructure dependency on- Insufficient bandwidth, incompatible devices, limited coverage, unreliable power.	Focuses on B2B context, identifying Metaverse non-adoption aligned with infrastructure risk, not dependency.	Focusing on infrastructure dependency, both B2B and B2C context.
Data privacy and security concerns	Kumar et al. (2024)	Based on 45 participants' interviews, identified weak platform safeguards and unauthorized tracking.	Metaverse user-centric view, absence of quantitative validation.	Offers developers immersive experiences. Industry and subject experts, double-check these concerns.
Mental health and addiction	Lyu (2024)	Collaboration between clinicians and industry to ensure safety, effectiveness, and inclusivity.	Lack of empirical data, discussed about risks not addressed, data security, and regulation.	Provide empirical insights framing a proactive lens
Challenges in regulating innovation	Gupta et al. (2024)	Discusses conflict between innovation and regulation, Open vs Closed Ecosystems, and Economic threats.	Does not provide empirical validation.	Provide empirical validation.
Inequality and digital divide	Jin (2024)	Discussed the third level of inequality- gaps in individuals' ability to convert digital access and usage into offline benefits.	Lacking qualitative data and cross-sectional data, it cannot establish a cause-and-effect relationship, particularly with US-based samples.	Provide India-based participants with qualitative insights and causal modeling.
Shift toward expert involvement and marginalization of traditional stakeholders.	Al-Kfairy et al. (2025)	Suggest that without labor protections and equitable policies, Metaverse could replicate or worsen real-world marginalization of traditional stakeholders.	Review article (2012-2025) and no empirical data	Provide real-life experience data from two different sector experts
Job displacement and regulatory challenges	Kumar et al. (2025)	Discussed the absence of clear guidelines, the lack of industry standards	Small sample size (30) participants, only qualitative open-ended essays analyzed, and a lack of statistical validation	Utilized 50 software developers' views with statistical validation of experts
Social norms and ethical challenges	XinYing et al. (2025)	Social and technical factors influence deviant behavior in the Metaverse, and Privacy and security are taken as mediators.	Sample- users of Sandbox, Decentraland, and Axie Infinity, focus on social and technical factors only	Analyzed open-ended survey data by an inductive approach (data-driven), findings: no pre-planned factors imposed.

2.2 Theoretical landscape of metaverse ethical concerns

The literature on metaverse ethics employs various theoretical lenses to elucidate its risks. Academicians often apply Technology Threat Avoidance Theory (TTAT) to demonstrate how risks like financial exploitation and privacy breaches trigger avoidance behavior (Kumar et al., 2024). The Technology Acceptance Model (TAM) assesses how innovation and trust influence stakeholders intention (Hernández-Tamurejo et al., 2025).

For catalyzing deviance, socio-technical theory emphasizes the interactive role between social dynamics and technical affordances (XinYing et al., 2025). In contrast, to map the performance, Innovation Resistance Theory (IRT) is frequently employed (Kumar et al., 2023). These theories collectively provide useful entry points into user-acceptance and resistance phenomena, but they remain centered on user-side technological fit or psychological state.

This study follows the Responsible Innovation (RI) framework (Owen et al., 2013), which offers a proactive approach to innovation by suggesting that ethical concerns should be addressed during technology development rather than after threats materialize.

Unlike, TTAT or IRT, which map resistance after threats become salient, the RI framework intervenes earlier in the development process. RI framework' four dimensions: Anticipation, Reflexivity, Inclusion, and Responsiveness facilitate ethical pre-coding in technology design (Voegtlin & Schere, 2017). The unpredictable evolution of the metaverse requires a philosophy beyond traditional risk management (Hemphill, 2023). RI framework is well-suited to manage emerging technologies responsibly (Owen et al., 2013; Stilgoe et al., 2017).

The RI framework is inherently normative, delineating the actions that organizations and developers ought to undertake. However, it does not independently elucidate the reasons for the externalization of developer-level ethics in practice, nor does it account for the recurring presence of identical metaverse ethical concerns across numerous studies, despite a decade of advocacy aligned with RI principles. To address this persistence, a complementary theoretical construct is introduced in the subsequent subsection.

3. Methodology

This study adopts an exploratory sequential multi-method design comprising two phases. Phase 1 uses open-ended qualitative survey with 50 Indian IT professionals analyzed through the Gioia method, anchored in the RI framework, and extended through a third-order coding pass that surfaces the EETG sub-dimensions and EAE pattern. Phase 2 uses a Fuzzy DEMATEL analysis with 12 metaverse experts to establish cause-and-effect interrelationships among the eight identified concerns (Figure 1).

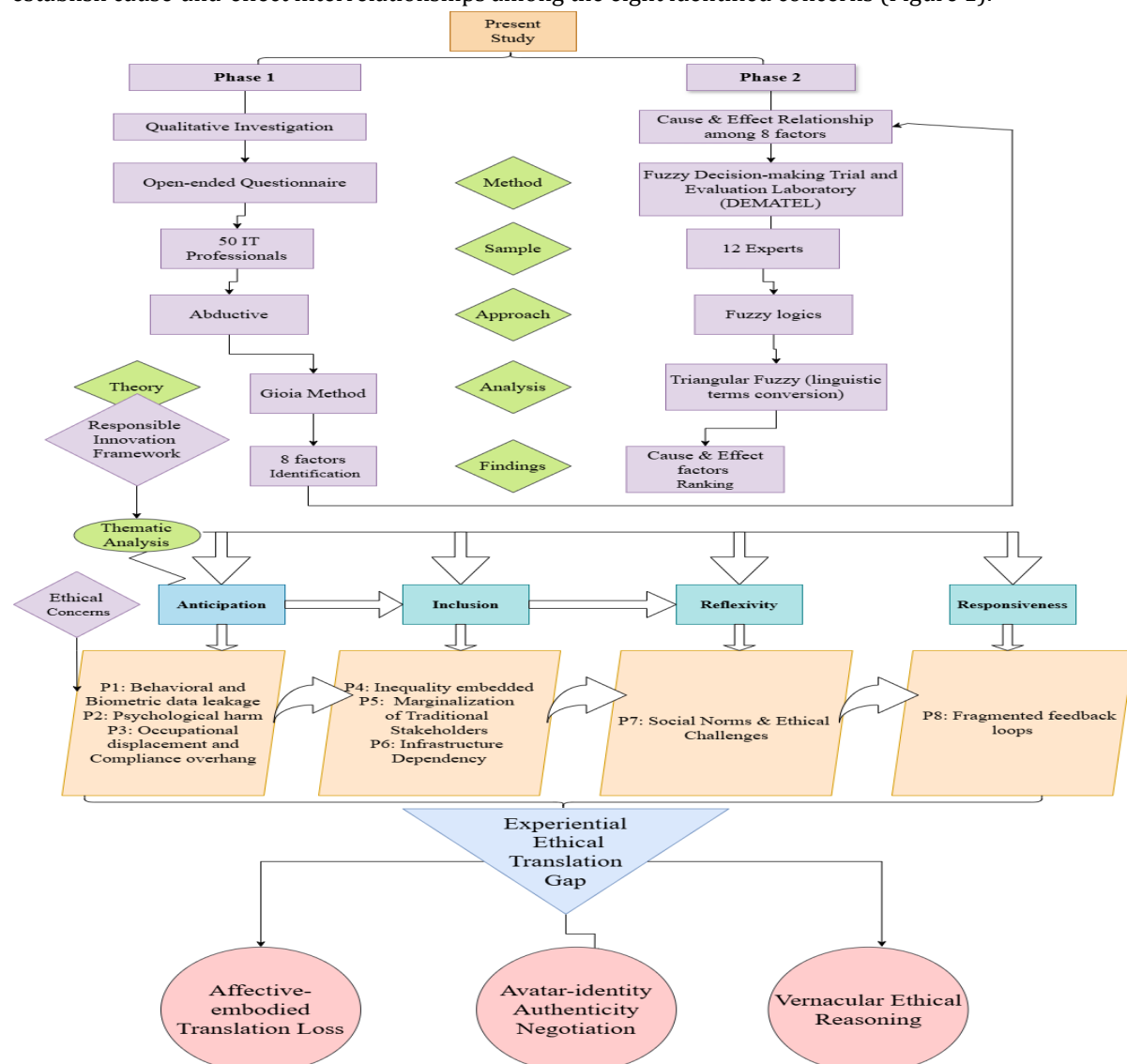


Fig. 1. Two-phased multi-method approach adopted in present study. Source. compiled by authors (P-proposition of this study)

3.1 Qualitative exploration, theme building, and factor identification

Phase 1 addresses RQ and RQ2 by examining ethical concerns regarding the metaverse among Indian IT professionals and theorizing the developer-level mechanisms involved. A qualitative approach explores the underlying reasons for perceived intentions.

(Braun & Clark, 2013), enabling researchers to comprehend phenomena within professional contexts (Patton, 1987) while maintaining flexibility (Rahman et al., 2021). Ethical approval is obtained (Ref. IIT(ISM)/IEC/12/2025). Purposive and snowball sampling target Indian IT professionals with metaverse experiences to estimate evolving ethical complexities (Abelsen et al., 2021).

The instrument is developed iteratively. From 15 initial questions, 5 high-impact questions are finalized (Weller et al., 2018), focusing on: (i) technical familiarity; (ii) user engagement; (iii) systematic impacts; (iv) technical and regulatory challenges, and (v) socio-ethical attention.

Open-ended questions allowed participants to detail their circumstances (Jackson and Trochim, 2002). Data collection involved 50 developers to ensure theoretical saturation (Saunders et al., 2018; Glaser & Strauss, 2017). Although no new data emerged after the 46th participant, this study continued to 50 for thoroughness. Appendix 1 details participant demographics.

Using an abductive approach, The Gioia method (Gioia et al., 2013) facilitates thematic analysis, grounded in theory (Magnani & Gioia, 2023). NVivo 15 supports participant-centered coding (Kumar et al., 2024), extracting raw data into sub-categories and aggregate themes (Gioia et al., 2013). This method blends inductive observation and abductive rationality, ensuring data-driven, theoretically informed results.

This study incorporates RI framework for real-world implications, with second-order sub-themes forming aggregate dimensions of ethical concerns. Figure 1 illustrates the complete research design followed in this study. Following the identification of eight ethical concerns and four RI thematic dimensions, the second order themes underwent an additional round of constant comparison and pattern-matching.

This process specifically focused on (i) discursive markers that could not be reduced to taxonomic concerns, (ii) culturally-specific narrative resources employed by participants, and (iii) the recurrent passive or forecast register used to articulate ethical concerns. The third-order coding pass resulted in the identification of the three reflective sub-dimensions of EETG and overarching pattern of EAE.

To ensure logical precision, this study utilized a double-coding mechanism, with discussions among authors until consensus is achieved (Bluhm et al., 2011). To reduce interpretive bias (Galdas, 2017), a multi-step verification protocol is implemented: credibility is ensured through respondent validation (Patton, 1987); dependability is maintained via an audit trail (Carminati, 2018); confirmability is achieved through reflexivity (Berger, 2015); and objectivity is supported by the Gioia method (Gioia et al., 2013).

Inter-rater reliability is evaluated by two subject experts using Cohens Kappa, which exceeded the methodological threshold with a value of 0.81 (Main et al., 2021).

Triangulation is further reinforced by the convergence of three independent forms of evidence: verbatim cultural-narrative content; the discursive pattern of passive-voice ethical articulation across all 50 transcripts; and the Fuzzy DEMATEL evidence (Phase 2) indicating that the eight outcomes are mutually reinforcing, consistent with a shared upstream mechanism.

A positionality note is warranted. This study operates within the Indian IT and academic context, which this study considers a methodological asset for identifying EETG, rather than a bias to be mitigated. EETG sub-dimensions such as vernacular ethical resourcing are more readily identifiable within the cultural context where they are applied.

In line with Tsoukas (2009), this study conceptualizes the Indian site as theoretically productive: a context where the mechanism becomes apparent due to the cultural and institutional conditions that highlight its significance.

3.2 Phase 2- Cause and effect modeling through fuzzy DEMATEL

3.2.1 Rationale behind Fuzzy DEMATEL

The DEMATEL method is chosen over traditional MCDM techniques for its ability to reveal nonlinear and interdependent relationships between factors (Chi et al., 2025) and distinguish between cause and effect (Wu & Lee, 2007).

Traditional MCDM methods like AHP and ISM typically analyze weights and linear hierarchies. Also, human cognitive processes often involve fuzziness due to interdependencies in digital behavior (Kazancoglu and Ozkan-Ozen, 2018). This study integrated fuzzy logic with DEMATEL method. Fuzzy logic effectively captures subjective uncertainties and linguistic ambiguities in expert evaluations, making it suitable for the current metaverse stage (Nalluri et al., 2025).

In this phase, this study again uses purposive snowball sampling. This method suits this phase as the target samples are experts with metaverse knowledge (Marcus et al., 2017). To determine the optimal sample size, this study follows Chowdhury et al. (2025), and Yadav and Barve (2018), suggesting 10-15 experts are sufficient for key insights. As discussed, India is in growing phase of metaverse adoption, with few experts.

This study uses a sample size larger than the minimum for robust insights (Chowdhury et al., 2025). Thus, 12 experts are selected for data collection.

Their demographic details are in Appendix 2. Of the 12 experts, 8 are software developers from various positions with metaverse expertise, and 4 are university professors in computer science. Combining industry and academia experts offers holistic evaluation and findings (Khatun et al., 2023).

3.2.2 The DEMATEL Algorithm

To ensure methodological rigor, this research followed the established steps outlined by Gabus and Fontela (1973) and used by Wu and Lee (2007).

Step (i) This study followed a pair-wise comparison scale consisting of four levels with scores of 0, 1, 2, 3, and 4 representing 'no influence, 'low influence, ' 'moderate influence, ' 'high influence,' and 'very high influence' respectively.

Step (ii) Next, this study asked experts to rate the direct influence of each factor i on other factors j by utilizing the defined scale. Their responses helped us generate an initial direct relation matrix using a formula.

$$Z = [z_{ij}]_{n \times n} \quad (1)$$

Where Z_{ij} is the degree to which factor i affects factor j .

Step (iii) In this step, the current study normalized the direct-relation matrix (X) to converge the total-relation matrix further mathematically. It scaled down all values between 0 and 1 available in the Z matrix. Thus, this study follows the formula-

$$X = s \times Z \quad (2)$$

$$s = \frac{1}{\max_{1 \leq i \leq n} \sum_{j=1}^n z_{ij}} \quad (3)$$

Step (iv) Now, to check direct and indirect influences among factors, the present study applied the total relation matrix (T). This study calculated the normalized matrix (X) and identity matrix (I).

$$T = X(I - X)^{-1} \quad (4)$$

Step (v) Using the T formula, the sum of rows and the sum of columns are independently denoted as c and r in the total-relation matrix (T) by these formulas (5)-(7)

$$T = t_{ij} \quad i, j = 1, 2, \dots, n, \quad (5)$$

$$c = \sum_{j=1}^n t_{ij}, \quad (6)$$

$$r = \sum_{i=1}^n t_{ij}, \quad (7)$$

When $i = j$, then $c_i + r_i$ displays all effects received and given by factor i . A causal diagram developed by mapping the dataset of $(c+r, c-r)$, the horizontal axis $(c+r)$ is formed by adding c to r , whereas the vertical axis $(c-r)$ is formed by subtracting c from r .

3.2.3 The Fuzzy Logics with DEMATEL algorithms

The current step starts with converting linguistic variables into fuzzy numbers (Table 3). As experts' opinions are highly uncertain and consist of inbuilt subjectivity. Converting these linguistic variables into fuzzy numbers minimize the uncertainty and subjectivity present in the data. These triangular fuzzy numbers (l, m, r) defined as:

$$\mu(x) = \begin{cases} 0, & x < l, \\ \frac{(x-l)}{(m-l)}, & l \leq x \leq m, \\ \frac{(r-x)}{(r-m)}, & m \leq x \leq r, \\ 0, & x > r \end{cases}$$

Here $\mu(x)$ represents a membership function and (l, m, r) is a triplet of fuzzy and real numbers, $l \leq m \leq r$. For further aggregation, a defuzzification algorithm is employed. The defuzzification method helps develop crisp values, also known as non-fuzzy performance values (Leekwijck & Kerre, 1999).

This study employed the Converting Fuzzy Data into Crisp Scores (CFCS) method proposed by Opricovic and Tzeng (2003) for the defuzzification process, as it is well-suited for management streams (Wu & Lee, 2007).

Moreover, CFCS considers the relative position of fuzzy numbers, preserves the spread and uncertainty better and produces more discriminative results. This is relevant here because the study involves expert opinions that vary widely, the amount of uncertainty is high, and the factors are closely competing. This reduces information loss and improves ranking accuracy.

Table 3. Triangular fuzzy conversion of linguistic terms. Source. Followed Wu and Lee's (2007) study

Linguistic terms	Triangular fuzzy numbers
No influence (No)	(0, 0, 0.25)
Low influence (L)	(0, 0.25, 0.5)
Moderate influence (M)	(0.25, 0.5, 0.75)
High influence (H)	(0.5, 0.75, 1.0)
Very high influence (VH)	(0.75, 1.0, 1.0)

In the CFCS method, firstly, left and right scores are determined considering fuzzy min and fuzzy max based on fuzzy numbers from the group evaluation phase. Overall, the fuzzy aggregation method follows 8-15 equations (Wu & Lee, 2007).

From equations 8 -10, delta or range refers to (max-min) or (r (max) - l (min)).

(i) *Normalization*

$$xl_{ij}^k = \frac{(l_{ij}^k - \min l_{ij}^k)}{\Delta}, \quad (8)$$

$$xm_{ij}^k = \frac{(m_{ij}^k - \min l_{ij}^k)}{\Delta}, \quad (9)$$

$$xu_{ij}^k = \frac{(u_{ij}^k - \min l_{ij}^k)}{\Delta}, \quad (10)$$

(ii) *Computation of left and right normalized value*

$$xls_{ij}^k = \frac{xm_{ij}^k}{(1 + xm_{ij}^k - xl_{ij}^k)}, \quad (11)$$

$$xrs_{ij}^k = \frac{xr_{ij}^k}{(1 + xr_{ij}^k - xl_{ij}^k)}, \quad (12)$$

(iii) *Computation of total normalized crisp value*

$$x_{ij}^k = \frac{[xls_{ij}^k(1 - xls_{ij}^k) + xrs_{ij}^k \times xrs_{ij}^k]}{[1 - xls_{ij}^k + xrs_{ij}^k]} \quad (13)$$

(iv) *Computation of crisp value*

$$z_{ij}^k = \min l_{ij}^k + x_{ij}^k \times \Delta \quad (14)$$

(v) *Integrate crisp values*

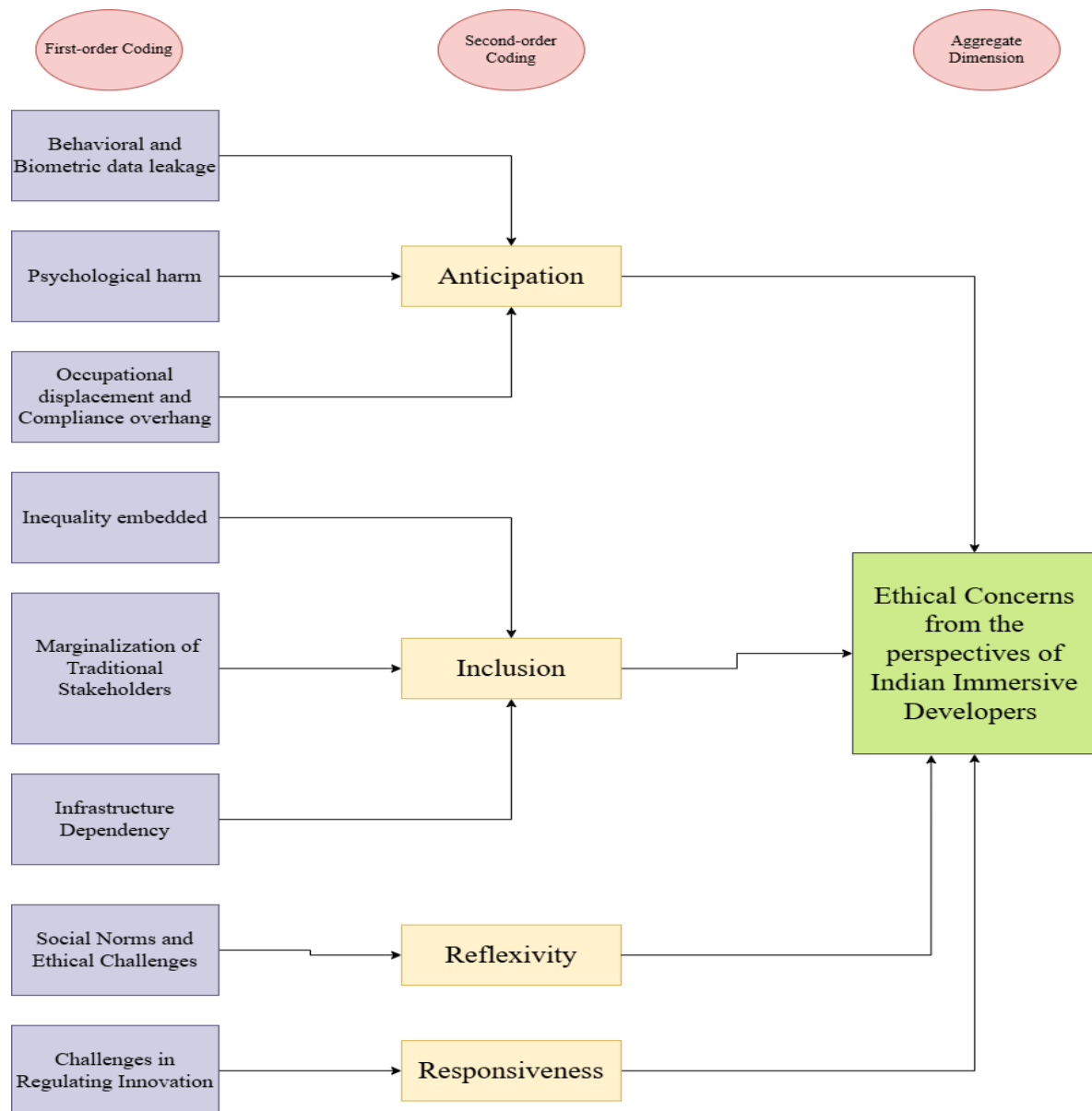
$$z_{ij} = \frac{1}{p} (z_{ij}^1 + z_{ij}^2 + \dots + z_{ij}^p) \quad (15)$$

4. Results and discussion

4.1 Phase 1: Insights from RQ1 & RQ2

The insights of RQ1 and RQ2 displayed in the figure and Table about the eight developer-articulated ethical concerns.

These ethical considerations, as perceived by IT professionals in a developing country, provide a contrast to prior research, which predominantly focused on user perspectives. The complete initial findings of both the RQs shown in the Figure 2 and Table 4.



[Note: key references: P1- Huawei et al. (2023)* *; P2-Alcántara et al., (2024), P3- Dengler and Gundert (2021), P4-Kumar et al. (2023), P5- Marx et al. (2025), P6-Kumar et al. (2023)* *; P7-Hine (2023), P8-Gauttier et al. (2022)]

Figure 2. Initial findings followed by Gioia method and RI framework. Source. Adapted from Gioia et al. (2013)

Table 4. Eight identified concerns and thematic association. Source(s). compiled by authors

RI dimension	Sub-dimension (developer-articulated concern)	Origination of developers framing	Representative developer articulation	Key supporting references
Anticipation	(i)Behavioral and biometric data leakage P1. Behavioral and biometric data leakage emerge as critical ethical concerns that may manifest as unintended consequences of metaverse uses.	Origination of downstream data harms through sensor-configuration decisions	'Privacy issues arise due to extensive data collection and the potential misuse of personal information at deeper level. Security risks also increase, with deep threats like Biometric and behavioural surveillance and cross-border data governance in virtual environments.' (#P20)	Business at OECD and USCIB (2024), Mosharraf (2025), National Law School of India University (2023)
	(ii)Psychological harm P2. Psychological harm as critical ethical concerns that may manifest as unintended consequences of metaverse platforms.	Origination of psychological load through immersion-architecture choices	'The test metaverse experience was amazing, little bit synchronization issue between my brain activity vs my body stability after preparing it for long time, rest I enjoyed the test experience of metaverse platform made by me.' (#P29)	Giannelos (2026); Tunca (2025); Slater et al. (2020)
	(iii)Occupational displacement and compliance overhang P3. Occupational displacement and compliance overhang emerge as critical ethical concerns that may manifest as unintended consequences of metaverse uses.	Origination of workforce displacement and de facto policy-making in a legal grey area	'Metaverse can revolutionize industries and jobs in the next 5-10 years by enabling virtual collaboration, creating new business models, and enhancing customer experiences but it may sideline the traditional stakeholders.' (#P14)	Nah et al. (2025); Biasi & Murgio (2023); Tu & de Castro e Silva (2025); Dengler & Gundert (2021)
Inclusion	(iv)Inequality embedded P4. Inequality embedded (Inclusion of digital elite), especially among vulnerable and underrepresented communities significantly associated with metaverse	Proximate responsibility for exclusion encoded into minimum-viable-experience specifications	'There is a risk of creating a “digital elite” if access to advanced hardware or high-speed internet is uneven, potentially exacerbating existing social inequalities.' (#P32)	Agarwal & Alathur (2023); Zallio & Clarkson (2022)
	(v)Marginalization of traditional stakeholders P5. Marginalization of traditional stakeholders are significantly associated with metaverse.	Epistemic narrowing of whose voice reaches specification-stage design	'Companies will need experts to build and maintain virtual environments, develop immersive experiences, create virtual goods and services, manage virtual economies, and ensure the security and privacy of users.' (#P31)	Egliston et al. (2025); Owen et al. (2013)
	(vi)Infrastructure dependency P6. Infrastructure dependency significantly associated with ethical concerns of metaverse.	Structural authorship constraint: reach determined by upstream vendor decisions rather than developer intent	'Metaverse adoption requires robust hardware and internet infrastructure, limiting accessibility in underdeveloped regions.' (#P22)	Huawei et al. (2023)
Reflexivity	(vii)Social norms and ethical challenges P7. Social norms and ethical challenges are	Ethical affiliation by default: normative substrate encoded through	'Content moderation becomes challenging, raising concerns about harassment and inappropriate content.	Hine (2023); Voegtlin et al. (2022)

	significantly associated with ethical concerns of Metaverse use	settings that appear technical	Additionally, ownership and control of virtual assets and intellectual property rights could spark debates over platform centralization and digital asset regulation.' (#P20)	
Responsiveness	(viii)Challenges of regulating innovation P8. Challenges in regulating innovation is significantly associated with ethical concerns of Metaverse use.	Individual regulatory hedging in the absence of institutional response capacity	'There are jurisdictional ambiguity and lack of clear regulations in India could lead to monopolization and unethical corporate practices.' (#P40)	Gauttier et al. (2022); India's Digital Personal Data Protection Act, (2023)

4.2 Insights from RQ3: Experiential ethical translation gap (EETG)

Till RQ2, we identified three developers-perspective thematic dimensions: anticipation, inclusion, reflexivity, and responsiveness. This reveals the explicit ethical concerns express by participants during the design process.

We extended, Gioia method with third-order coding of the corpus identified an additional element: socio-technical mechanism which underlying the eight explicit concerns and four RI dimensions. This mechanism s termed as Experiential Ethical Translation Gap (EETG) in this study. While previous sections examined developers' ethical perceptions, EETG addresses a foundational question: at what experiential level do developers conceptualize, negotiate, and integrate ethics into the immersive platforms they create?

The corpus analysis identified three reflective sub-dimensions, each operating at a distinct analytical level from the taxonomic surface of the eight explicit concerns and, crucially, each extending rather than replicating the developer-originated framework.

4.3.1 Affective-embodied translation loss (EETG1)

Participants of this study expressed significant concern regarding the affective bandwidth of immersive systems, specially the metaverse's ability to convey emotional fidelity, empathic exchange, compassion, somatic synchrony, and the unscripted spontaneity inherent in face-to-face professional interactions. This issue extends beyond mental health and addiction, which are secondary manifestations; it fundamentally questions whether immersive translation can maintain the ethical significance of interpersonal interactions.

A participant who is responsible for managing virtual board meetings directly addressed this concern: 'I wonder will it address the emotions and face expressions, social handling and very idea of compassion.' (#P33)A participant who had tested an immersive system described the experience of brain-body desynchronization as an ethical concern about embodied cognition, not as a usability bug: 'Little bit synchronization issue between my brain activity vs my body stability.' (#P29)

Several participants expressed concerns regarding the potential erosion of human spontaneity, as exemplified by the statement, 'human spontaneity will be compromised if we rely too much on metaverse' and the difficulty of preserving emotional dimensions of work. A succinct yet theoretically significant expression of this concern is encapsulated in the phrase 'empathetic decision making.'

Collectively, these observations underscore a distinct issue, separate from privacy, addiction or harassment: the apprehension that immersive design may diminish the affective and embodied characteristics essential for the transmission of interpersonal ethics. This phenomenon, termed Affective-embodied translation loss, represents the initial reflective sub-dimension of EETG.

4.3.2 Avatar identity authenticity negotiation (EETG2)

A second cluster of articulations addresses the ethical issue concerning the divergence between one's physical self and avatar self.

This issue is distinct from identity theft, which is well-documented in existing literature, and from privacy concerns, which are also extensively covered. This pertains to the legitimacy of identity performance in mediated environments. One participant articulated this concern directly:

'The ethical concerns regarding how a person is as opposed to their own screen avatars is concerning.' (#P11) In the Indian context, this concern extends into the labor domain, highlighting the issue of moonlighting, which gained prominence in the Indian IT sector during 2022-23:

'Apart and beyond moonlighting will happen. This is a concern for managers.' (#P30)

Moonlighting becomes increasingly feasible and less detectable when avatar work is mediated through avatars, making parallel employment difficult to identify and regulate contractually. The negotiation of avatar-identity authenticity aligns more closely with Books's and Goffman's (1969) ethics of self-presentation than with concerns related to identity theft. This negotiation represents the second reflective sub-dimension of EETG.

4.3.4 Vernacular ethical resourcing (EETG3)

A third, methodologically significant cluster of articulations pertains to the cultural-narrative resources utilized by participants when considering metaverse ethics. Indian IT professionals in this study referenced Indian culture to reason about runaway AI, as opposed to relying on the Western techno-ethical canon:

'If it is not controlled in ethically, it may arise the problem like in ROBOT movie. (#P07)'

Their reasoning regarding emotional fidelity drew upon references to 'the very idea of compassion.' These references are rooted in religious-philosophical reference points, rather than in Floridi's (2013) information ethics. The methodological observation is that Indian IT professionals incorporate ethical considerations into technology through indigenous narrative resources constitutes a significant finding.

4.4 Ethical Agency Externalization (EAE): a cross cutting discursive pattern

In addition to the three EETG sub-dimensions, the third-order coding pass revealed a discursive pattern that this study considers the most theoretically significant observation within the corpus.

Throughout all 50 transcripts, participants consistently expressed their ethical concerns using passive voice and a predictive register, exemplified by statements such as 'data will be leaked', 'users will become addicted', 'regulation will fail', and 'unemployment will rise'.

Rarely, the participants express through the active voice design commitment, such as we, as developer, will design 'X' differently to prevent 'Y'. This study names this discursive pattern Ethical Agency Externalization, the systematic portrayal of developers as forecasters of harm rather than as integrators of ethics within design.

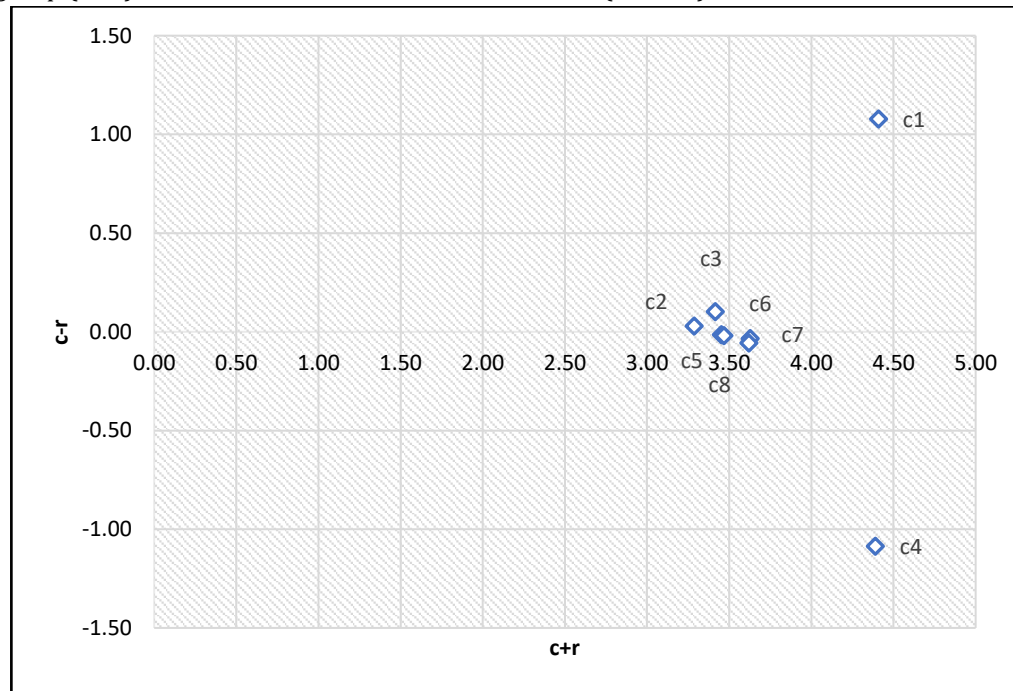
This pattern is noteworthy because the participants, by virtue of their occupations, are the very architects of these systems. Their professional roles should, in theory, enable them to act as ethics-embedders. However, this discursive infrastructure necessary for such positioning is unavailable to them.

This study theorizes that high EETG produces high EAE: when developers get articulated as predictions about systems-in-the-world rather than as commitments-in-the-design. This mediating mechanism connects the latent EETG construct to the eight ethical concerns already identified in the literature.

4.5 Phase 2: Insights from RQ4-Fuzzy DEMATEL

To address RQ4, this study utilized the Fuzzy DEMATEL technique to ascertain the cause-and-effect interrelationships and directional dominance of the identified factors. By analyzing data from 12 experts using triangular fuzzy numbers and CFCS defuzzification technique, this study examined 8 factors within a causal diagram (Figure 3).

The results identify three cause groups (C-R)-C1, C2, and C3-as key drivers of ethical erosion, while the effect group (C+R) illustrates the outcomes of these drivers (Table 5).



(C1- behavioral and biometric data leakage; C2- Psychological harm; C3- Occupational displacement and compliance overhang; C4- Inequality embedded; C5- Marginalization of traditional stakeholders; C6- Infrastructure dependency, C7- Social norms and ethical challenges and C8- Fragmented feedback loops)

Fig. 3. Digraph of the cause-and-effect relationship. Source. Compiled by authors

Table 2. Relationship identification (cause-effect and ranking). Source. Compiled by authors

Criteria/ factors	c	r	c+r	c-r	Relationship	Rank
C1	2.7442	1.6652	4.4094	1.0789	Cause	1
C2	1.6585	1.6294	3.2879	0.0291	Cause	8
C3	1.7588	1.6570	3.4158	0.1018	Cause	7
C4	1.6526	2.7380	4.3906	1.0854	Effect	2
C5	1.7189	1.7334	3.4524	0.0145	Effect	6
C6	1.7979	1.8312	3.6291	0.0333	Effect	3
C7	1.7814	1.8384	3.6198	0.0570	Effect	4
C8	1.7242	1.7438	3.4680	0.0196	Effect	5

Behavioral and biometric data leakage (C1) emerge as the strongest drivers, with the highest prominence value of 4.41 and the most significant positive relationship value of 1.08. C1 also acts as the primary catalyst for cyber vulnerabilities, identifying misuse and financial threats. Psychological harm, Occupational displacement and compliance overhang (C2 and C3) are less dominant in the cause group, yet they underscore how prolonged interaction with metaverse platforms may negatively impact individuals' well-being (Ud Din and Almogren, 2023). Additionally, the rapid use of the metaverse disrupt current job displacements, leading to increased regulatory challenges.

Table 6. Initial direct relationship matrix (Fuzzy DEMATEL). Source. Compiled by authors

	C1	C2	C3	C4	C5	C6	C7	C8
C1	0.25	0.28	0.26	0.76	0.29	0.30	0.31	0.29
C2	0.19	0.17	0.20	0.27	0.19	0.21	0.23	0.20
C3	0.20	0.19	0.18	0.29	0.23	0.23	0.22	0.22
C4	0.20	0.19	0.20	0.25	0.20	0.22	0.22	0.19
C5	0.20	0.21	0.21	0.28	0.18	0.21	0.21	0.22
C6	0.21	0.21	0.22	0.30	0.21	0.19	0.23	0.23
C7	0.21	0.21	0.19	0.30	0.22	0.24	0.19	0.22
C8	0.21	0.19	0.20	0.28	0.21	0.23	0.23	0.18

Table 6 presents the initial direct relationship matrices for all 8 factors. In contrast, inequality embedded (C4) is most affected among the C4-C8 factors, with a prominence of 4.39 and the strongest negative relationship of -1.09. This study's findings indicate that when users perceive a lack of data privacy and security, it fosters mistrust, resulting in non-participation among non-tech-savvy users and exacerbating the digital divide.

This is the widening gap between metaverse users and non-users. Secondary effects from C5-C8 reflected unintended consequences, such as marginalization of traditional stakeholders, infrastructure dependency, social norms and ethical challenges, and fragmented feedback loops affected by causal factors (Kumar et al., 2024).

Overall, this study's findings reveal that behavioral and biometric data leakage (C1) indicating a strong influence on other factors. C1 associated issues are prerequisites for metaverse continued usage.

5. Implications of the study

5.1 Theoretical implications

This study's primary theoretical contribution is the articulation of a novel socio-technical mechanism, 'Experiential Ethical Translation Gap (EETG)'. It elucidates the persistence of eight ethical concerns at the developer interface despite a decade of normative advocacy under the RI framework.

Although these concerns are well considered in the literature, what has been missing is an account of why developer-level interventions yield limited, uneven progress (Kumar et al., 2024).

EETG supplies that account by identifying the translation deficit between developers lived ethical intuitions and the formal vocabularies available for embedding those intuitions into design.

The contributions operate at three levels. At the mechanism level, three sub-dimensions of EETG specify the translation deficit. At the discursive level, identifying EAE as a passive-voice pattern explains how EETG produces risks: developers articulate ethics in forecast rather than design-commitment because latter's translation infrastructure is unavailable.

At the integration level, EETG complements the RI framework, with RI specifying the normative response stance and EETG the developer-level mechanism for RI intervention. Figure 4 shows the conceptual framework proposed by this study.

This figure shows that the eight manifest concerns are what is visible on the surface once EETG and EAE have jointly transformed developer ethical experience into a particular discursive form. While Table 7 illustrates the logical connection among ethical concerns, EETG and EAE.

This study extends the ethics-as-practice literature in information systems (Madaio et al., 2020; Shilton, 2018; Vakkuri et al., 2020) by specifying a mechanism those literatures have left implicit. While ethics-as-practice scholars have advocated for situated, practice-level accounts of how ethics is implemented in technology development, EETG provides a concrete construct which can be operationalized, measured, and acted upon.

This construct is grounded in primary qualitative data from non-Western IT-services context, thereby extending the predominantly Western evidence base of the ethics-as-practice literature.

A further theoretical contribution concerns the productive specificity of the Indian IT sectors. Following Tsoukas (2009), this study argues that India is a theoretically productive site for surfacing EETG: a place where the mechanism becomes visible because the cultural and institutional conditions render it salient.

This study suggest that India is the place where EETG has been first rendered visible. Replication studies in other IT-services contexts would provide important boundary tests.

Methodologically, this study contributes a third-order extension to the Gioia approach. Where the standard Gioia method moves from zero, first and second order themes to an aggregate dimension. This study adds an explicit third-order pass which aggregates the second-order themes into a latent socio-technical mechanism with its own theoretical specification.

This novel methodological move may be useful in other contexts where the empirical surface of a phenomenon is well-rehearsed but a generative mechanism remains untheorized.

Ultimately, Fuzzy DEMATEL evidence acquires a novel theoretical interpretation under the EETG framework. The data privacy and security observed as the dominant driver and inequality and digital divide as the dominant receiver, consistent with shared upstream causation.

The DEMATEL evidence complements the qualitative theorizing rather than competing with it. A follow-up empirical study is recommended to operationalize EETG as a latent construct, EAE as a mediator, and the eight identified concerns as outcomes, allowing the mediation hypothesis to be tested quantitatively.

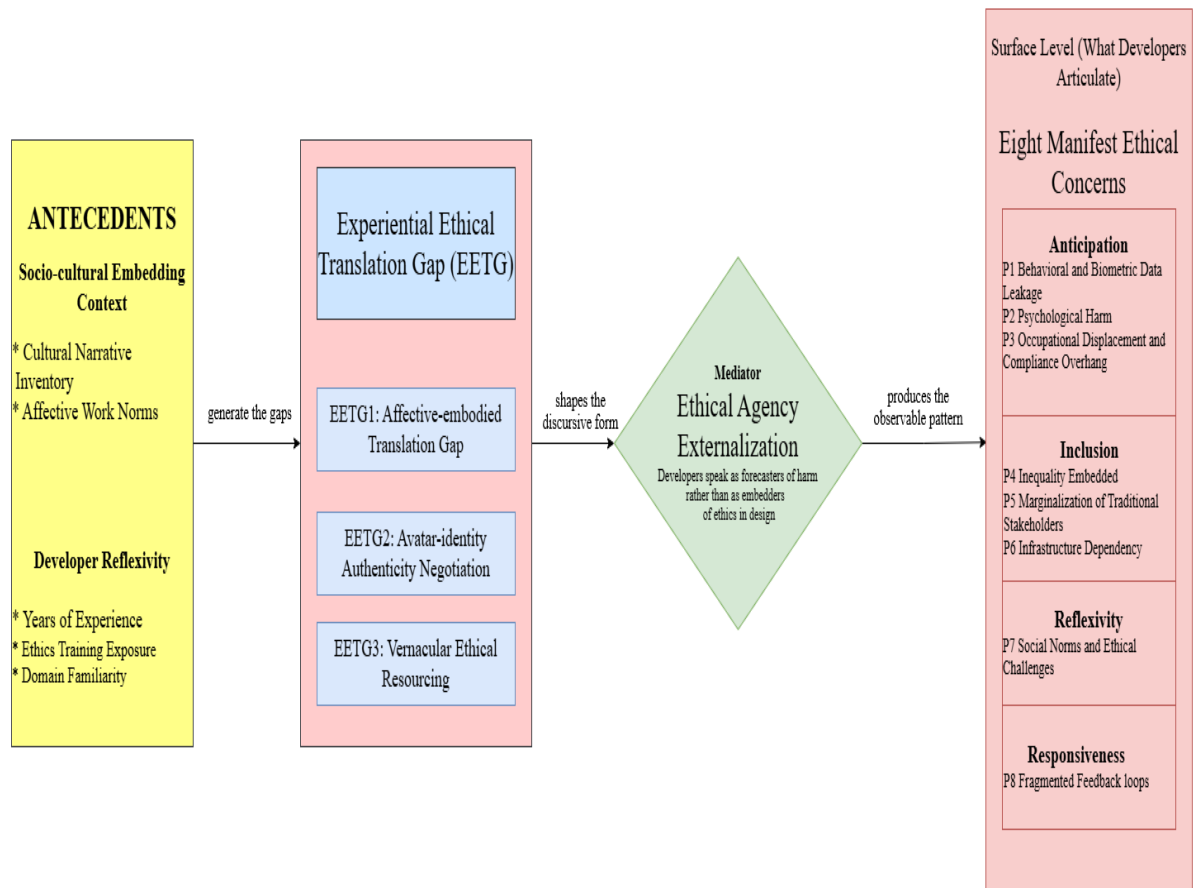


Figure 4. Proposed Conceptual framework. Source. Compiled by authors

Table 7. Ethical concerns, EETG mechanism through externalization. Source. Compiled by authors

Identified Ethical concern	Primary EETG driver(s)	Mechanism through Externalization	Illustrative quote	Reference
Behavioral and biometric data leakage	EETG ₂	Developers forecast breach as inevitable rather than design preventive architectures; sovereignty concerns are not embedded into data-residency choices.	“Biometric and behavioural information ... protecting this data from misuse or breaches will be a critical concern.”	Vasist et al. (2025)
Psychological harm	EETG ₁	Affective bandwidth loss is forecast as user outcome rather than encoded as design constraint on immersion duration, affective signal preservation, or de-immersion affordances.	“The immersive nature ... could lead to addiction, social isolation, or blurred boundaries between virtual and real life.”	Flavián et al. (2024)
Occupational displacement & compliance overhang	EETG ₂	Labour-ethics concerns surface but do not get translated into avatar-architecture choices or HR-facing audit affordances inside the platforms developers build.	“Moonlighting will happen. This is a concern for HR.”	Giacalone et al. (2026)
Inequality embedded	EETG ₃	Access inequity is articulated as a societal forecast; few developers describe it as a	“High costs for VR/AR devices	Vasist et al. (2025)

		constraint they could encode (e.g., low-bandwidth fallbacks, device-tier design).	and fast internet may exclude lower-income groups, deepening inequality.”	
Marginalization of traditional stakeholders	EETG ₃	Non-IT colleagues lack vocabulary to negotiate ethics; vernacular resources are not translated into formal stakeholder-participation design.	“Slow growth of metaverse in non-IT professionals due to poor exposure in comparison to IT professionals.”	Loia et al. (2025)
Infrastructure dependency	EETG ₃	Hardware/bandwidth dependency is forecast as deployment problem rather than treated as sovereignty/extraction concern at the architecture level.	“Reliable internet connectivity and advanced hardware ... could be barriers to entry, creating digital divides.”	Kumar et al. (2023)
Social norms & ethical challenges	EETG ₁ ; EETG ₂ ; EETG ₃	Norm-loss is articulated through cultural-narrative resources (ROBOT, compassion, spontaneity) but those resources do not enter formal content/moderation policy.	“If it is not controlled in ethically, it may arise the problem.”	Eltanbouly et al. (2025)
Fragmented feedback loops	EETG ₂	Regulatory failure is forecast through prior tech-precedent (generative AI) rather than embedded as developer-led self-governance protocol.	“With recent incidents on generative AI it shows how difficult it is to maintain ethics in this platform.”	Vasist et al. (2025)

5.2 Practical and managerial implications

5.2.1 Embed vernacular ethics translators in development teams

Organizations should create explicit roles whose mandate is to surface develop-team ethical intuitions in their native cultural-narrative vocabulary including moonlighting concern and the compassion gap.

These insights should then be converted into design constraints, requirement specifications, and architectural decisions before finalization.

This role functions similarly to a user-experience but focuses on translating ethics. This aims to bridge the gap between experience and encoding, directly addressing EETG.

5.2.2 Reverse the ethics brief

Instead of cascading top-down ethical guidelines from policy to development teams, organizations should require teams to author the ethical concerns they would raise in their own discursive register. Thereafter, map upward to formal policy.

This could redistribute ethical authorship and weakens EAE. Since, developers are positioned as ethics-originators rather than ethics-forecasters. This mechanism is consistent with participatory design but applied to ethics rather than to features.

5.2.3 Moonlighting-aware avatar architecture

In the context of Indian IT companies, this study highlights a labor-ethics issue that has not been previously discussed in the metaverse-ethics literature.

Avatar-mediated metaverse work makes dual employment harder to detect and harder still to contractually govern, especially given India's strict moonlighting regulations.

To address this, organizations must create metaverse workplaces that include clear audit-trail capabilities and establish policies regarding avatar-mediated parallel employment. In this setting, avatar architecture serves a similar role to access control in labor governance.

5.2.4 Affective fidelity audits

Organizations may conduct periodic audits to determine whether immersive design choices are diminishing the emotional and empathetic bandwidth of work interactions, such as board meetings, HR conversations, customer empathy, and conflict resolution.

The audit can be operationalized using existing affect-recognition tools, but it should be applied as ethics governance rather than user-experience optimization. This responds to EETG1 (affective-embodied Translation Loss).

5.2.5 Avatar-self alignment policy

Organizations need to clearly stance on avatar-self divergence within professional metaverse environments, determining whether it is allowed, encouraged, or restricted. This is an ethical issue distinct from identity verification or fraud detection. Different organizational settings, such as HR review, customer interaction, and technical teamwork might require varied approaches. By framing EETG2 as a policy, it becomes actionable rather than remaining a source of unsolved discomfort.

5.2.6 Bridge the awareness-ethics gap to non-IT colleagues

Organizations may establish programmes that bring non-IT colleagues into metaverse ethics discussions before deployment. Participants of this study explicitly noted that non-IT professionals cannot meaningfully participate in ethics discussion because they lack the technological exposure. Inclusion here is not a diversity measure but a precondition for the eight identified factors to be addressed at the stakeholder level rather than the user-victim level.

5.2.7 Vernacular ethics curricula for developer training

Developers' ethics training should be rooted in the local-context narrative such as Indian philosophy and jurisprudence rather than in imported case studies. The empirical finding of EETG3 indicates that developers naturally use this vocabulary when discussing ethics.

Therefore, formal curricula should align with the ethical reasoning developers already employ. This approach is a cost-effective and impactful intervention that directly tackles Ethical Agency Externalization by providing developers with a language that makes design-commitment accessible to them.

5.3 Limitations, and future research

Like other, this study has several limitations need to be acknowledged. First, while this study involved a significant sample size of 50 participants and 12 experts, future studies could adopt longitudinal approaches to observe how the cause-and-effect relationships and the EETG mechanism develop as the metaverse progresses.

Second, the qualitative theorization of Ethical Agency Externalization as a mediator between EETG and eight ethical factors based on patterns found across all 50 transcripts.

A follow-up study using PLS-SEM for quantitative validation would bolster the mediation claim. Third, expanding the participant pool across diverse industries globally would enhance the generalizability of both the EETG construct and the DEMATEL causal structure.

This study highlighted three specific directions for future research. A PLS-SEM study operationalizing EETG (three reflective indicators), Ethical Agency Externalization (formative indicators from discursive markers), the eight identified concerns (existing measure from the literature), and organizational ethical scaffolding (formative) would test the full mediation model quantitatively.

Also, cross-country comparative work would test the productive-specificity claim. Lastly, intervention studies that experimentally manipulate organizational ethical scaffolding (reverse ethics briefs, vernacular ethics translator roles) would test manipulability of EETG and the downstream effect of the eight concerns.

6. Conclusion

This study aimed to address four RQs: RQ1 identified eight ethical concerns related to metaverse and Indian IT professionals. RQ2 categorized these concerns into four thematic dimensions of Responsible Innovation (RI): Anticipation, Inclusion, Reflexivity, and Responsiveness. RQ3, a novel inquiry introduces in this study, uncovered the Experiential Ethical Translation Gap (EETG) as a latent socio-technical mechanism.

This mechanism comprises three reflective sub-dimensions: Affective-embodies Translation Loss, Avatar-identity Authenticity Negotiation, and Vernacular Ethical Resourcing.

Additionally, Ethical Agency Externalization (EAE) serves as the mediating discursive pattern through which EETG manifests concerns. RQ4 employed a Fuzzy DEMATEL analysis, revealing that data privacy and security concerns are the most influential drivers, while inequality and the digital divide are the most affected outcomes.

The constructs outlined here is adequate to support subsequent programs, and this study offers it as a foundation rather than a final word.

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Appendix 1

Demographic details of present study participants. Source(s). Compiled by authors

Code no.	Gender	Age	Firm Size	Experience	Response time (in minutes)
P1	Male	41	Large	15	38
P2	Male	28	Medium	07	22
P3	Female	29	Small	06	21
P4	Male	32	Medium	10	20
P5	Male	21	Small	0	21
P6	Male	26	Small	08	23
P7	Male	36	Large	15	21
P8	Male	36	Large	16	24
P9	Male	38	Large	19	23
P10	Male	31	Medium	08	24
P11	Male	34	Large	10	21
P12	Male	29	Small	8	23
P13	Male	28	Small	05	20
P14	Male	27	Small	05	19
P15	Male	22	Medium	0	17
P16	Male	41	Large	22	25
P17	Male	35	Large	12	21
P18	Male	26	Small	06	15
P19	Male	26	Small	03	24
P20	Male	47	Large	24	24
P21	Male	27	Small	08	16
P22	Male	41	Large	18	19
P23	Male	30	Medium	08	17
P24	Male	27	Small	06	16
P25	Male	43	Large	25	20
P26	Male	42	Large	22	20
P27	Male	34	Medium	15	22
P28	Male	37	Large	17	19
P29	Female	39	Large	16	18
P30	Female	34	Medium	15	18
P31	Male	41	Large	18	26
P32	Male	26	Medium	05	20
P33	Male	32	Medium	13	17
P34	Male	42	Large	24	27
P35	Male	30	Medium	10	22
P36	Male	23	Medium	0	24
P37	Male	23	Medium	02	24
P38	Male	28	Small	07	24
P39	Male	30	Large	08	24
P40	Female	22	Medium	0	15
P41	Female	29	Small	08	20
P42	Male	32	Large	10	18
P43	Male	32	Large	10	23
P44	Male	30	Medium	08	26
P45	Female	35	Large	10	17
P46	Male	26	Small	05	18
P47	Male	33	Medium	11	16
P48	Male	26	Medium	03	22
P49	Male	26	Small	07	16
P50	Male	38	Medium	15	27

(Large firm >1001, Medium firm >100-1000, Small firm 1-99) (Lin et al., 2021)

Appendix 2

Demographic details of 12 experts. Source(s). compiled by authors

Expert ID	Age	Gender	Work Experience (Years)	Role	Position Level
1	50	Male	26	Software Developer	Senior
2	45	Male	20	Software Developer	Senior
3	40	Male	18	Software Developer	Senior
4	42	Female	22	Software Developer	Lead
5	38	Male	15	Software Developer	Lead
6	36	Female	12	Software Developer	Lead
7	32	Male	10	Software Developer	Junior
8	28	Female	08	Software Developer	Junior
9	48	Male	25	IT Professor	Associate Professor
10	50	Female	26	CS Professor	Professor
11	43	Male	20	IT Professor	Associate Professor
12	45	Male	22	CS Professor	Professor