Responsible metaverse

Ethical metaverse principles for guiding decision-making and maintaining complex relationships for businesses in 3D virtual spaces

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Responsible metaverse: Ethical metaverse principles for guiding decision-making and maintaining complex relationships for businesses in 3D virtual spaces

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ABSTRACT

A metaverse is a three-dimensional virtual space (3D VS) where businesses and individuals worldwide can engage, interact, communicate, transact, and exchange information in real-time through an immersive and collaborative platform. These interactions can create complex relationships influenced by the decision-making processes of businesses. Such complexity can lead to challenges in maintaining relationships, ensuring exclusiveness, preventing misuse, and addressing other ethical issues. Therefore, this study aims to identify ethical principles within the metaverse to guide decision-making and maintain complex relationships between users and businesses. Both qualitative and quantitative data were collected for analysis, and simple random sampling was employed for primary data collection. The empirical analysis was conducted using a mixed-method approach. The study identified four ethical principles that guide complex relationships within the metaverse: business benefit evaluation, fairness, explainability, and reliability principles. These principles positively influence decision-making, which, in turn, positively affects the maintenance of complex relationships within 3D VS.

1. Introduction

The metaverse is a massively scalable and interoperable network of real-time rendered 3D virtual worlds, which can be experienced simultaneously and persistently by an almost infinite number of users, leading to significant business implications that impact both work and society [1]. The metaverse has been described as a vast *three-dimensional (3D) virtual space* [2]. The increasing use of virtual spaces (VS) facilitates businesses in connecting with people, providing information and services and to market products, thereby developing a competitive advantage [3]. However, these developments transform online relationships and may lead to complex interactions between businesses and individuals. Such relationships are dynamic; individuals are accustomed to varying (online) cultures, expectations may differ, conflicting ideas and views may arise, and there can even be a divergence in perceptions of what is acceptable. Despite the importance of these issues, the literature on ethical challenges in maintaining complex relationships within 3D VS remains underdeveloped. Specifically, there is a notable gap in research addressing 3D VS, *ethical metaverse principles (EMPs)*, the structural relationship of EMPs with *ethical decision-making (EDM)*, and the impact of EDM on 3D VS. Additionally, existing literature acknowledges the presence of complex relationships within VS [4,5].

In the VS, businesses can interact with a diverse range of stakeholders, including investors, partners, prospects, customers, shareholders, suppliers, communities, and governments. Since the early 2000s, research on VS has become increasingly prevalent [6]. Businesses view VS as a cutting-edge strategy for expanding into new markets and enhancing user experiences [7]. The versatility of this technology in facilitating interactions has attracted significant attention [8]. VS

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provide social and unique experiences within persistent multi-user environments where individuals can both live and work [9]. Hence, participation in 3D VS offers businesses access to critical assets, such as industry knowledge, innovative ideas, customers, and complementary skills and expertise. In fact, 3D VS can be characterized by its digital and interactive environment supporting real-time communication among multiple users at various endpoints. From a business perspective, 3D VS can be classified into four key spaces: (1) *information space*, where businesses display information about themselves and their products or services; (2) *communication space*, for exchanging information with stakeholders, including customers, suppliers, and strategic allies; (3) *distribution space*, which serves as a channel for distributing their products or services, and (4) *transition space*, where business interactions such as orders, invoices and payments are conducted.

However, challenges exist within 3D VS, including motion sickness, high costs, and social isolation. The complexity of realizing 3D VS, including ethical considerations, is recognized by both practitioners and scholars [10]. The ethical behavior of businesses in 3D VS can significantly impact public perception and marketing success. Businesses that adhere to ethical standards within 3D VS can attract loyal customers, whereas those that do not may face a decline in customer base, negative social media campaigns, boycotts, and potential legal ramifications. Thus, embedding ethics in metaverse is crucial for addressing these challenges.

Moreover, the ethical considerations of the metaverse raise important questions: (1) how to empower individuals to control their personal data; (2) how to protect users from abuse, harassment, and other risks while providing them with the tools to safely navigate online environments; and (3) how to ensure that the metaverse and its related technologies are inclusively and universally accessible, taking into account diverse ages, cultures, abilities, genders, languages, and religions [11]. Therefore, *responsible metaverse* should adhere to the EMPs to guide EDM by businesses and subsequently assess the impact of EDM on maintaining complex relationships within 3D VS. EMPs serve as the moral framework established by businesses to govern conduct in the metaverse, providing a foundational basis for the specific ethical guidelines and the evaluation of individual behaviors within 3D VS.

Furthermore, EMPs should protect metaverse users by ensuring that these virtual environments are safe, while also facilitating secure business transactions and regulatory compliance. Additionally, successful business relationships that sustain complex interactions within 3D VS are often grounded in EMPs. These principles encompass the evaluation of business benefits, fairness, explainability, and reliability in dealings with stakeholders. EDM is the process by which businesses make choices that align with established ethical standards. The literature indicates that in business environments characterized by high ethical standards, employees tend to prioritize adherence to laws, policies, and professional norms, which in turn influence EDM [12]. EDM involves consideration of multiple factors, including financial, performance, social, and legal risks [13]. This discussion underscores the critical importance of EDM in contemporary business practice.

The significance of the connection between the metaverse and ethics has been emphasized in the literature, particularly when the metaverse is depicted as an ethical virtual world [14]. To better protect user identity data, it is essential to strengthen metaverse ethics [15]. However, there is limited knowledge about metaverse-based ethics [16]. Similarly, the relationship between VS and ethics has been highlighted in the literature, particularly in instances where community ethics are violated, such as when influential agents are deliberately placed in VS to study their impact on the discussions in and directions taken by a community [17]. Given the importance of this topic and the gaps in the literature, there is a clear need for further research on the linkage between the metaverse and ethics, including detailed investigations into the associations between specific characteristics of metaverse environments and the development of ethical guidelines for metaverse design [18]. Additionally, literature has highlighted the ethical challenges posed by the metaverse, noting that while its development offers new and intriguing connections between the real and virtual worlds, its widespread adoption presents numerous ethical dilemmas [19]. The discussions concerning the contextual background of maintaining complex relationships in 3D VS, along with the identified literature gaps, future research needs, and research challenges, justify the rationale and motivation for this study.

In summary, this study compellingly argues for its significance, as EMPs protect the dignity and rights of individuals while enabling businesses to sustain meaningful relationships within 3D VS. Furthermore, EDM allows businesses to foster sustainable trust and demonstrate respect, fairness, care, and responsibility in interactions within 3D VS. Therefore, *the study aims to understand the ethical principles and factors influencing EMPs and their impact on businesses' ability to maintain complex relationships with individuals*. This understanding is intended to contribute to the creation of a responsible metaverse. The goal of a responsible metaverse is to employ this technology in 3D VS in a manner that is safe, trustworthy, and ethical. To achieve this, the following research questions (RQs) have been formulated:

RQ1: Moral principles have been shown to positively influence EDM [20], providing a foundation for better decisions by establishing clear guidelines. Therefore, this study seeks to answer the RQ: *what are ethical principles specific to the metaverse, and how do they influence decision-making within 3D* VS?

RQ2: The impact of EDM is multi-faceted [21], indicating that ethical decisions embody responsibility and care, which are essential for maintaining complex relationships in the business environment. Therefore, this study seeks to answer the RQ: *how does ethical decision-making contribute to sustaining complex relationships in 3D* VS?

To answer the research questions, the study employed a mixed-methods research approach, which combines qualitative and quantitative methods for gathering and analyzing empirical data within a single study. The qualitative method is first used from a business point of view to explore the feasibility of the relationships among EMPs and EDM and their impact on 3D VS before collecting quantitative data. Subsequently, the quantitative method is applied to assess these relationships from a customer perspective. This study's unique contributions include providing a theoretical background on 3D VS, EMPs, EDM, and the maintenance of complex relationships in 3D VS; as well as conducting a mixed-methods analysis to identify the relationships among these elements.

The rest of the paper is structured as follows: Section 2 presents the theoretical background, followed by conceptual model and research hypotheses in Section 3. Section 4 details the mixed-methods research approach and the analysis of results. Section 5 discusses the findings, and Section 6 concludes the study.

2. Theoretical background

This section discusses complex relationships and decision-making, as well as the ethical principles that guide ethical decision-making in the metaverse. Subsequently, it discussed maintaining complex relationships in 3D VS.

2.1. Complex relationship and decision-making

3D VS has transformed the way people interact and communicate, making it easier for individuals to stay connected, access information, and build new relationships for decision-making. However, the rise of 3D VS also brings challenges in maintaining complex relationships due to multiple layers of management, overlapping approval processes, and diverse stakeholder needs within a business. These challenges are further compounded by constantly shifting markets, technologies, and most importantly, changing customer behavior, which further increases with the involvement of a larger number of people and the variety of products or services a business offers. The number of interrelationships and the degree of interdependence among them significantly impact the complexity of a relationship for decision-making processes. For example, customers may place multiple orders within 3D VS, each order containing several products, which may belong to different categories and subcategories. This result in many-to-many or one-to-many complex relationships with the business complicating decision-making. The literature suggests that real ecosystems, such as metaverse platforms, are complex systems influenced by social and human factors [22]. A trust model can represent the intricate relationships among all users in the metaverse [23].

Therefore, grounded on the volume of interrelationships and the extent of interdependence involving extensive network of customers, vendors, prospective customers, banks, service providers, and government organizations, this study classifies complex relationships in 3D VS for decision-making into three categories: structural, emergent, and sociopolitical. This classification aligns with perspectives on managing stakeholder complexity in projects [24], and rational decision-making [25]. Rational decision-making aims to identify a problem, select a solution from various options, and implement a response. Theorists argue that when an innovation or system change is considered desirable or valuable, rational decision-makers are more likely to adopt it [25]. Each of these categories is elaborated below:

2.1.1. Structural

A relationship is considered structurally complex when a business operates with multiple organizational structures, such as divisions, subsidiaries, shareholders, and vendors, and engages with various stakeholders within 3D VS. These relationships involve rules, roles, and responsibilities that guide activities to achieve the business's decision-making goals.

2.1.2. Emergent

A relationship is called emergently complex when it arises from unpredictable interactions between a business and individuals within 3D VS. Some businesses strive to reduce this complexity, while others encourage its emergence due to the potential for unexpected outcomes that may help achieve decision-making goals.

2.1.3. Sociopolitical

A relationship is called socio-politically complex when it is influenced by social and political factors that may hinder business operations. Business owners often have little or no control over these factors. But, they must identify preventable risks and take steps to mitigate them.

2.2. Ethical metaverse principles (EMPs) influencing decision-making

For a business, the metaverse system that incorporates moral standards to support and guide individuals' conduct, behavior, and actions in maintaining complex relationships within 3D VS is referred to as EMP. Behera et al. [26] argue that to ensure technology aligns with regulations and fundamental organizational values, it is necessary to design, develop, and manage the ethical principles that underpin it. Therefore, this study proposes four EMPs: (1) the principle of business benefit evaluation, (2) the principle of fairness, (3) the principle of explainability, and (4) the principle of reliability. Each of these principles is further elaborated upon below.

The study strongly argues that the proposed metaverse-oriented ethical principles differ from the existing ethical principles in several ways, i.e., EMPs can guide and positively impact decisions and actions within 3D VS; they can establish ethical positions in immersive and collaborative platforms; they can differentiate between ethical challenges in virtual and physical worlds; and they can exclusively guide economic implications of these new virtual environments.

2.2.1. EMP 1 (Principle of business benefit evaluation)

An ethical principle must benefit the business. Therefore, evaluating business benefits in 3D VS cannot be an exception as it determines the merit, worth, and value of a business [27]. This evaluation provides business owners with valuable information and statistics, including the analysis of a business's market value, competition, cost savings, revenue growth, cash inflows, return on investment, and profits. Common ethical issues related to business benefit evaluation in 3D VS include discrimination, unethical accounting practices, technological abuse, and business espionage. Therefore, ethical principles must ensure that individuals and businesses in 3D VS must demonstrate (1) character (i.e., moral awareness and competence), (2) trust (i.e., adherence to business ethical standards and appropriate action), (3) conflict resolution (i.e., effectively resolve conflicts related to assumptions, technology, and personality differences), and (4) direction (i.e., understand how the business states and executes its mission, vision, and goals).

Hence, to manage the complex relationship and generalize the principle within 3D VS, businesses must develop a metaverse system by implementing (1) business benefit evaluation ethical principles, (2) ethical guidelines for conducting evaluations, and (3) evaluation standards that determine how the quality of evaluations should be judged. Additionally, an institutional review board can be established to review the ethical dimensions of business benefit evaluations. Sholihin et al. [28] discussed the effectiveness of virtual reality-based learning for teaching business ethics, which could be applied to business benefit evaluations in 3D VS to increase ethical motivation and behavior. Based on this discussion, the study defines the motivation behind upholding the ethical principle of business benefit evaluation in 3D VS.

2.2.2. EMP 2 (Principle of fairness)

Fairness in 3D VS is achieved when everyone is included and treated equally. Fairness is a fundamental principle in a virtual world constructed within the metaverse [29]. Individuals who practice fairness adhere to the business's ethical norms, build trust, and help the business develop mutually supportive relationships. For a business, fairness fosters healthy and successful relationships with various stakeholders, including investors, partners, prospects, and customers. Common ethical issues related to fairness in 3D VS include biased judgments and favoritism.

Hence, the fairness ethical principle must ensure that individuals in 3D VS demonstrate (1) justice reasoning (i.e., reasoning and weighing criteria to establish moral obligations and rights); and (2) care reasoning (i.e., empathy and the ability to understand others' perspectives). Therefore, to manage complex relationships and generalize this principle within 3D VS, businesses must develop a metaverse system by implementing (1) ethical principles that ensures fairness and (2) transparent ethical guidelines that promote mutual respect, model correct behavior, adjust rules to encourage healthy behavior, and make decisions fairly. Based on the above discussion, the study defines it as the motivation behind upholding the ethical principle of fairness in 3D VS.

2.2.3. EMP 3 (Principle of explainability)

Explainability in 3D VS occurs when the outcomes of decisions or actions are clearly explained to individuals or businesses. Explainability is a powerful tool for increasing trust by identifying biases and flaws in data, and it can provide new insights into the issues at hand, which is essential for improving transparency [30]. Common ethical issues related to explainability in 3D VS include data and decision-making biases. Hence, the explainability ethical principle must ensure that individuals and businesses in 3D VS (1) provide relevant information, logic, and evidence supporting their decisions, including limitations, uncertainties, and assumptions that affect the decision; and (2) enhance the understanding, acceptance, and confidence in decisions, as well as the ability to receive feedback and learn from mistakes.

Therefore, to manage the complex relationships and generalize this principle within 3D VS to a large degree, businesses must develop a metaverse system by implementing (1) explainability ethical principles and (2) integrating these principles with explainable artificial intelligence (XAI). XAI comprises practices and strategies that enable understanding and trust in the output and results of machine learning (ML) algorithms and artificial intelligence (AI) models [31]. XAI provides users with explanations for its decisions, outcomes, or actions [32]. Pamucar et al. [8] discussed the integration of XAI in metaverse and its practical applications. Integrating AI into the metaverse produces personalized and engaging experiences based on dynamic virtual environments that adapt to user actions [33]. Therefore, integrating XAI with metaverse systems can help businesses reduce mistakes, minimize bias, avoid errors, adopt ethical practices, and make informed decisions in 3D VS. Future developments should aim at creating autonomous systems capable of perceiving, learning, and acting independently. Based on this discussion, the study defines the motivation behind upholding the ethical principle of explainability in 3D VS.

2.2.4. EMP 4 (Principle of reliability)

Reliability in 3D VS is achieved when individuals and businesses ensures that the data and information that they provide are complete, accurate, and free from bias. Without reliability, desired outcomes may fail as they rely on the consistency of values, emotions, actions, and results. Moreover, the fairness dimension is closely tied to the reliability of the data or information provided by a business [34]. Common ethical issues related to reliability in 3D VS include dissemination of confidential information, misrepresentation of data or information, and inability to verify the content before its release, which can lead to negative perceptions of individuals or businesses.

Therefore, the ethical principle of reliability must ensure that individuals and businesses in 3D VS (1) clearly define their objectives and establish metrics for measuring them; (2) evaluate the quality and credibility of data sources and tools, checking for biases, errors, or inconsistencies; (3) exclude irrelevant, duplicate, incomplete, or inaccurate data that could distort results or create confusion; and (4) modify and improve data sources, tools, goals, and metrics based on feedback and results. Therefore, to manage the complex relationships and generalize the principle within 3D VS to a large degree, businesses must develop a metaverse system by implementing (1) reliable ethical principles and (2) establishing criteria for reliable sources and tools. This includes seeking established and up-to-date sources of data and information and avoiding content from anonymous sources. Based on the above discussion, this study defines the motivation to uphold the ethical principle of reliability in 3D VS.

2.3. Ethical decision-making (EDM)

As a rational process that includes cognitive activity and moral evaluation of decisions, EDM is the ability to arrive at the best conclusion regarding an ethical issue based on intuition, ethical principles, codes of ethics, and moral reasoning [35]. EDM involves problem recognition, problem identification, alternative evaluation, and decision-making [36]. The literature highlights the need to integrate EDM into business processes, particularly as algorithmic design can introduce bias in decision-making [37]. While numerous factors influence individual EDM, business research reveals that cultural differences across geographic regions significantly impact individuals' ethical intentions and perspectives [38]. This study posits that EDM is relevant to any business or industry that communicates with stakeholders in 3D VS, irrespective of business forms such as sole proprietorships, partnerships, or corporations.

Building on the discussion above, this study argues that EDM in 3D VS can foster and sustain trust; demonstrate responsibility, fairness, and care and align with the principles of good corporate citizenship. By establishing ethical principles as the foundation for behavior, EDM process necessitates three key components: (1) *Commitment:* the determination to execute the proper decision-making action; (2) *Consciousness:* the ability to make moral decision-making; and (3) *Competency:* the ability to gather and assess data, generates alternatives, and anticipate risks and consequences. The EDM process can lead businesses to improved productivity, a strong public image, enhanced loyalty, and reduced legal risks. Therefore, businesses must design and implement EDM models in metaverse systems by integrating AI. Rodgers et al. [37] discussed the AI algorithm approach to EDM, which can amplify AI's role in decision-making within metaverse environment.

2.4. Maintaining complex relationships in 3D VS

Businesses are exploring novel ways of cooperating with stakeholders to address the complexities of their operating environments, which is also applicable to 3D VS [39]. Building strong business relationships is critical, with the real advantage lying in their reinforcement. The metaverse offers new opportunities for organizations to engage and establish connections with their target audiences [40]. In 3D VS, individuals seeking to establish good relationships with businesses heavily rely on their experience and expertise, which require ongoing maintenance. Thus, mutual benefit and ongoing communication are essential for success. Moreover, close and trustworthy relationships provide businesses with a long-term advantage. Consequently, businesses can increasingly form relationships with people across various sectors, segments, and geographies, adding a layer of complexity. Complex relationships can arise from divergent views on a business's primary goals, poor communication techniques, inadequate governance procedures, and the inability to recognize and swiftly implement necessary changes in response to evolving market conditions or other business circumstances. Additionally, differing expectations, engagement levels, priorities, and boundaries further complicate the relationships.

3. Conceptual model and research hypotheses

To achieve the study's objective, this section presents a conceptual model followed by the research hypotheses.

3.1. Proposed conceptual model

The study proposed a novel conceptual model to achieve its objectives. The model includes constructs such as business benefit evaluation expectancy, fairness expectancy, explainability expectancy, reliability expectancy, EDM, and 3D VS impact. The operational definitions of these constructs are provided in Table 1.

Each construct is thoroughly identified and elaborated. As a result of

Table 1
Operational definition of constructs.

Construct	Operational definition	Reference
Business benefit evaluation expectancy	Degree to which the business benefits evaluation EMP impact the business for EDM in 3D VS.	[41]
Fairness expectancy	Degree to which the fairness EMP impact the business for EDM in 3D VS.	[42]
Explainability expectancy	Degree to which the explainability EMP impact the business for EDM in 3D VS.	[43]
Reliability expectancy	Degree to which the reliability EMP impact the business for EDM in 3D VS.	[44]
EDM	The ability of metaverse to facilitate the decision-making options with EMPs, intuition, codes of ethics, and moral reasoning regarding an ethical issue in 3D VS.	[35]
3D VS impact	The predictable realization of benefits representing values by a business in maintaining complex relationships with people in 3D VS. The values can minimize bias and mitigate risks.	[41]

evaluating the business benefits of information technology (IT) spending, there is a greater emphasis on developing and evaluating efficient procedures and mechanisms to determine which IT resources and initiatives should be deployed, as well as how, by whom, and when [45]. Fairness in decision-making has become increasingly important, as a model's output must not be biased against any group, including those based on their ethnicity, gender, or age [46]. A lack of explainability complicates the use of information systems (IS) due to the inability to verify the decisions [47]. Decision-makers should exercise their best judgment by considering reliability, as it determines confidence in their decisions [48]. EDM takes into account how employees prioritize laws, policies, and professional conventions in environments with high ethical standards [49]. User experiences can be transitioned to a virtual environment through 3D VS [2]. The unique conceptual model is depicted in Fig. 1, guiding hypotheses that aim to provide a structured and comprehensive view of the impact of 3D VS in maintaining complex relationships. The unidirectional model captures five hypotheses, and it is important to note that the reversal of those hypotheses is not possible.

3.2. Research hypotheses

The results of the hypotheses validate each RQ; therefore, RQ1 is related to H1 to H4, while H5 is related to RQ2.

3.2.1. Business benefit evaluation expectancy and EDM

In the short term, poor EDM can benefit a business. However, in 3D VS, where businesses operates within a complex web of relationships, it is easy to enhance business benefits by leveraging these relationships. In the long run, though, the true advantages for the business lie in managing dishonesty, corruption, conflicts of interest, and other unethical behaviors. Therefore, a business benefit evaluation in the metaverse system will likely experience more stable growth, gain public support, and be better equipped to withstand disruptive political, social, and environmental factors. This aligns with the prior study by Vidgen et al. [50], which suggests that to thoroughly evaluate the business benefits, it is necessary to consider the ethical aspects. An organization may experience long-term benefits by making a greater effort to uphold ethical standards and regulations [51]. Hence, the hypothesis is stated as:

H1. Business benefit evaluation expectancy is positively associated with EDM in 3D VS.

3.2.2. Fairness expectancy and EDM

Since fairness involves the equitable treatment of others, even in the face of unfair action, it fosters long-term connections in 3D VS. Fairness is defined by equal opportunity, objectivity, open communication, and justice, all of which are closely linked to EDM. Therefore, a fairness metaverse ethical principle (MEP) in the metaverse system will promote mutual understanding, where individuals share meaning and communicate honestly. This aligns with the prior study by Memarian et al. [52], which suggests that fairness is closely associated with EDM. Fairness encourages reflections on EDM [53]. Hence, the hypothesis is stated as:

H2. Fairness expectancy is positively associated with EDM in 3D VS.

3.2.3. Explainability expectancy and EDM

At their core, people and businesses need to explain the decision-making process in multi-dimensional way, which provides actionable insights to meet various business needs. This approach must comply with the right to explanation. Therefore, explainability MEP in the metaverse system will ensure that the explanation is accurate, informative, or intelligible by providing arguments in support of a decision at an acceptable level. This aligns with the prior study by Stahl et al. [54], which highlights the increasing use of technical tools and approaches to address ethical issues like explainability. Although explainability is crucial, decision-making is necessary for its proper implementation [55]. Hence, the hypothesis is stated as:

H3. Explainability expectancy is positively associated with EDM in 3D VS.

3.2.4. Reliability expectancy and EDM

There is no doubt that 3D VS can transform business practices worldwide due to its flexibility, convenience, and ability to present information in almost any format at any given moment. Therefore, a reliability MEP in the metaverse system will ensure that businesses and individuals can trust the reliability of the information they consume. This aligns with the prior study by Bag et al. [56], which emphasizes that reliability is a key component of ethics. The discussion between distrust and trust expresses ethical values associated with reliability [57]. Hence, the hypothesis is stated as:

H4. Reliability expectancy is positively associated with EDM in 3D VS.

3.2.5. EDM and 3D VS impact

With the metaverse, businesses are increasingly aware of potential ethical issues that could arise in 3D VS environments, which are crucial for managing complex relationships. Therefore, to ensure that their operations in 3D VS are both sustainable and responsible, firms prioritize EDM in their decision-making processes. In addition, EDM plays a crucial role in shaping how people interact with each other and with businesses within 3D VS environments. In this information age, the EDM manages social contracts among individuals, prompting businesses to transform societal interaction platforms into dynamic 3D VS environments to showcase their potential and navigate complex relationships. This aligns with the prior study by Nelkin et al. [58], which emphasizes that EDM requires extensive professional knowledge, including an understanding of diverse personal value systems, cultures, and ever-evolving contexts for maintaining complex relationships. The determinants of EDM are complex [21]. Hence, the hypothesis is stated as:

H5. EDM is positively associated with 3D VS in maintaining complex relationships.

4. Research methodology

This study employed a mixed research methodology, combining qualitative and quantitative approaches. By integrating several sources and offering a broader range and depth of information, the mixed methodology enhances confidence in the findings and provides a more comprehensive understanding of a phenomenon [59]. According to

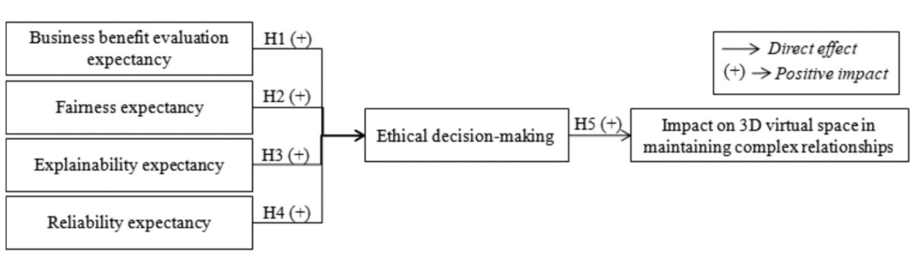

Fig. 1. Proposed conceptual model (Authors' own conceptualization).

Behera et al. [60], a single case study is advantageous because it (1) provides more evidence for developing an effective theory; (2) offers the researcher a deeper understanding of the topic; (3) facilitates the examination of a group of competent participants working together toward a common objective; (4) avoids the high costs and time-consuming nature of multiple case studies; and (5) differs from a multiple case study, which involves analyzing several circumstances to identify similarities and differences. Based on the above arguments, this study adopts a single case study.

The empirical study was conducted in two phases. Phase 1 involves a qualitative study, while Phase 2 focused on a quantitative study. Data were gathered through online interviews conducted between August 2023 and October 2023 (Phase 1) and November 2023 to January 2024 (Phase 2). The first phase focused on collecting the business perspective, while the second phase aimed to gather the customer perspective of the businesses discussed in Phase 1. The qualitative study aimed to explore participants' motivations, behaviors, thoughts, or emotions related to the study's goals, whereas the quantitative study aimed to analyze and validate the conceptual model. Nine experienced interviewers fluent in English collected the qualitative and quantitative data. Respondents provided consent by signing a form and a narrative explaining the study's purpose. The data triangulation approach enhances the reliability of the findings [61]. The study included industries such as e-commerce, gaming, travel, education, real estate, and banking, with primary data sourced from India, the world's fastest-growing developing economy [62].

The rationale for considering diverse industries is as follows: In e-commerce, the metaverse could revolutionize the industry through virtual storefronts and online auctions. In online gaming, successful metaverse applications like Sandbox, Sorare, and Axie Infinity keep user connected to the game platforms. In travel, the metaverse offers a 360-degree virtual travel experience, benefitting those unable to travel long distances. In education, the metaverse can connect learners with global experts, providing access to extensive knowledge and experience. In real estate, metaverse property tours save time by allowing buyers to view multiple properties virtually. In banking, the metaverse provides a comprehensive overview of physical banks. These factors suggest that the study's findings may be applicable to other industry contexts.

The choice of India as a data source is justified by its prominent IT industry, which has driven the country's growth for nearly two decades [63]. India is also crucial for the future development of metaverse technologies, as evidenced by an Indian couple's metaverse wedding reception, which garnered significant attention. Additionally, India's substantial user base for video games and social media contributes to the growing number of metaverse applications across industries such as e-commerce, gaming, travel, education, real estate, healthcare, banking, remote and hybrid workplaces, entertainment, and manufacturing. This study argues that similar metaverse development scenarios are present in other developing and developed countries, making the research findings generalizable.

Primary data were collected using simple random sampling, which is well suited for exploring targeted phenomena and shedding light on previously unclear subjects [64]. After each interview, snowball sampling was employed to identify additional respondents willing to participate. Li et al. [65] note that snowball sampling is practical because it (1) is cost-effective and convenient; (2) helps participants who wish to remain anonymous; and (3) simplifies referrals. Participants were located worldwide and contacted through both in-person and online methods. To reduce respondent- and interviewer-induced bias and enhanced reliability, the interviews were recorded. Inclusion criteria for respondents were being an Indian citizen, fluent in English, and having foundational knowledge of ethics and the metaverse. Exclusion criteria included inability to read or write in English, failure to complete the online survey, lack of Internet access, and insufficient foundational knowledge of ethics and the metaverse.

4.1. Phase 1: The qualitative study

According to Edmondson et al. [66], qualitative research is the preferred method for researchers exploring unexplored phenomena and developing innovative theories. Therefore, this study [67] employed a combination of key informant interviews (KII) and thematic analysis as the primary methods. The main objective of KII was to gather information from senior-level experts with knowledge in the metaverse, augmented reality (AR), virtual reality (VR), mixed reality (MR), techno ethics, and business ethics, as well as familiarity with IT and IS. Thematic analysis was conducted on the qualitative interview data, utilizing transcripts from the interviews. These transcripts contained detailed notes and recordings, which facilitated in-depth analysis. Consequently, the study adopted a semi-structured, open-ended interview format to extract as much information as possible. The benefits of this format include a deeper understanding of respondents' views and motivations [68].

Primary data were collected through face-to-face discussions with 12 senior-level respondents from various businesses. Qualitative investigations typically require a sample size of at least 12 to achieve data saturation [69,70]. Therefore, 12 key respondents were deemed an adequate sample size to minimize or eliminate sample bias. Furthermore, senior-level respondents aged 50 to 60, with firsthand knowledge of ethics, AR, VR, MR, and the metaverse, were selected to further reduce bias. The sample size of 12 was considered saturated, indicating that additional samples would not significantly enhance the study's value. This aligns with the findings of [69], who assert that data saturation is typically reached with a sample size of 12.

The respondents' information is summarized in Table 2, which includes details on firm size, firm experience, and interview durations in minutes. The table shows that three women and nine men in senior positions participated. Their firms ranged in size from 1 and 99, 100 to 1000, and more than 1000 employees. The firms' experience varied from less than 5 years, 5–10 years and more than 10 years, and the respondents were aged between 50 and 60 years, with the average interview lasting around 55 min. Notably, only three of the twelve respondents were women, indicating that women are underrepresented in these roles across industries. A possible explanation for the predominance of men in senior positions in the businesses studied may be a lack of specialized leadership and coaching programs for women in India.

The rationale for considering various business in the metaverse is as follows: (1) The e-commerce industry, including B2C and B2B business, can leverage virtual showrooms, host virtual events, and improved customer interactions; (2) The education industry, covering tutoring, music, and language coaching business, can engage students in a 3D world of imagination, providing an immersive learning experience; (3) The real estate industry, including property management and dry land business, can offer virtual spaces for their customers and investors to buy, sell, or rent properties with cryptocurrencies; (4) The travel industry, including tour operators and travel reservations business, can offer immersive travel experiences, allowing travelers to explore and experience different destinations interactively without leaving their homes; (5) The gaming industry, including e-sports business, can offer a platform that brings together communities of players to compete in online games; and (6) The banking industry, including commercial banking business, can offer virtual branches where customers interact with service staff in an immersive virtual environment for account management, loan applications and financial consultations.

MAXQDA was used not only to capture and transcribe the interviews but also for data analysis and coding. To protect privacy, the identities of respondents and firms were anonymized. The researchers evenly divided their time between conducting interviews and analyzing the results. In some cases, it was necessary to draw on theoretical understandings of data analysis to determine what information would be most useful. The study utilized a five-step procedure for qualitative data analysis as its methodological framework: step one involved data

Table 2
Respondents' demographic profile.

Serial No.	Gender	Firm size	Age	Business	Experience	Interview length
1	Male	> 1000	58	B2C	< 5	45
2	Female	> 1000	58	Tutoring	> 10	35
3	Male	1–99	52	Property management	<5	40
4	Male	> 1000	55	Tour operator	> 10	55
5	Female	> 1000	53	B2C	> 10	55
6	Male	1–99	59	Dry land	< 5	45
7	Male	> 1001	50	Music	5–10	60
8	Male	100–1000	53	B2B	< 5	35
9	Male	1–100	54	e-sports	< 5	60
10	Female	100–1000	56	Commercial bank	< 5	65
11	Male	100–1000	55	Language coaching	< 5	65
12	Male	> 1000	55	Travel reservation	> 10	40

collection, step two data organization, step three theoretical coding, step four data analysis for insights, and step five reporting the analysis's insights. The primary objective of this study was to evaluate qualitative patterns using theoretical coding to identify themes in the form of main categories and subcategories, understand participants' motivations of EMPs in EDM, and assess their impact on 3D VS in maintaining complex relationships.

The results of the analysis and theoretical coding are presented in Table 3, where 'N and %' represent the number and percentage of quotes from the participants. The core category of thematic codes consists of the top-level actionable variables that management addresses. According to the participants, while best-of-breed products, services, and revenues are central to successful businesses, the proper design and implementation of EMPs, along with managing and maintaining complex relationships in 3D VS, are the foundation of success, as unethical decision-making can disrupt businesses across industries. Participants' motivations emphasize the time-sensitive prioritization of metaverse-enabled ethical actions over other goals and needs. Moreover, to build an ethical business, participants' behavior suggests the need for careful planning and the promotion of ethical behavior by creating an environment where ethical conduct supports the basic psychological needs for autonomy, competence, and relatedness. Participants' emotions indicate that a deep consideration of EMPs shapes EDM, which, in turn, positively impacts the maintenance of complex relationships in 3D VS.

The business perspectives of EMPs, EDM, and their impact on 3D VS for maintaining complex relationships were generated from the qualitative approach. The insights are valuable for cross-referencing with customer views and generalizing the implications through a quantitative approach. In summary, the qualitative approach conducted on a small sample, provided insights into business perspectives, however, they may be speculative due to the absence of measurement instruments. In contrast, the quantitative approach, conducted on a larger sample, was used to validate the hypotheses. Therefore, a mixed-method approach was employed to examine both narratives.

4.2. Phase 2: The quantitative study

The respondents in Phase II were customers of the businesses discussed in Phase 1, and their demographic profiles are detailed in Table 4. Approximately 1500 customers voluntarily agreed to participate in Phase 2 of the study. After validation, 302 valid responses were included in the analysis. More than 1200 responses were discarded due to missing, incorrect, or incomplete responses to the survey items, which could have negatively affected the generalizability of the results.

A questionnaire using a five-point Likert scale, ranging from '1' (strongly disagree) to '5' (strongly agree), was created. Table 5 provides the details of the questionnaire. Based on the recommendation by Behera et al. [70], a combination of qualitative and scale modification approaches was used to operationalize the measurement instruments, as existing questionnaires specific to the metaverse could not be identified. Both deductive and inductive techniques were employed to develop the semi-structured questionnaire. The responses were collected after considering scale items from the literature (deductive), followed by questions to respondents specifically about the metaverse (inductive). Surveys were conducted with as many respondents as possible until saturation was reached and no further responses could be obtained. Seven practitioners and three academics with expertise in the metaverse were invited to provide feedback and assess the importance and relevance of the semi-structured questionnaire. Each qualitative response was divided into three scale items based on behavioral patterns (i.e., the need for authentic experiences for shopping, socializing, and attending events in a hypothetical virtual world). Moreover, the scale items were tailored to capture customer perspectives, as customers expect an immersive experience for connecting with others.

The validity of the quantitative study was performed using structural equation modeling (SEM) with IBM AMOS 28.0. The study employed covariance-based SEM (CB-SEM) over partial least squares-based SEM (PLS-SEM) to test the hypotheses. The results discuss the evaluation of common method variance (CMB) and measurement and structural models.

4.2.1. Assessment of CMB

A self-administered survey is susceptible to CMB. To address this, this study has performed Harman's single-factor test [77], a widely used technique for evaluating CMB. According to this method, the estimated cumulative variance value should be below 50 %. The study reported a value of 27.21 %, indicating the absence of CMB. Additionally, the variance inflation factor (VIF) was used to assess the extent of multicollinearity. VIF scores below four suggest no significant bias in the data [78]. In this study, VIF values were found to be less than 3.0, indicating that there were no multi-collinearity issues or CMB threats in the data.

4.2.2. Assessment of measurement model

When Cronbach's alpha (CA) and composite reliability (CR) are greater than 0.70, and when factor loading (FL) and average variance extracted (AVE) are greater than 0.50, all factors considered by the measurement model have reached convergent reliability [31]. The convergent validity is supported (see Table 6), which presents FL for each construct item, along with the CA, CR, and AVE for each construct. Additionally, the table includes Skewness and Kurtosis values for each construct. According to Hair et al. [79], data is deemed normally distributed if the Skewness falls between −2 and + 2 and the Kurtosis falls between −7 and + 7. The table indicates the normality of the data, as these values fall within the suggested range.

Discriminant validity was used to verify unrelated interrelationships across constructs. Table 7 shows that all diagonal items (i.e., $\sqrt{AVE}$) are greater than the off-diagonal elements in their corresponding rows and columns, satisfying the condition for discriminant validity. Another indicator of discriminant validity is the Heterotrait-Monotrait ratio (HTMT) of correlation, where a value less than 0.90 indicates acceptable discriminant validity [80]. Table 8 provides evidence supporting the

Table 3
Category of codes with sample quotes and analysis outcome.

Core category	N	%	Sample quotes	Analysis outcome
Business benefit evaluation expectancy	11	92	"Business benefit evaluation in 3D VS can ethically determine the impact of the recommendations related to the organization's mission, purpose, strategy, and competitive advantage".	By fostering better relationships with people in 3D VS, firms can obtain competitive advantages through truth-telling business benefit evaluations. Incorporation of business benefit evaluation EMP in the metaverse system can help to witness what is right or wrong in an ethical situation, which helps to make ethical decisions for the business benefits.
Fairness expectancy	11	92	1. "The fairness should not systematically disadvantage a group of people in 3D VS". 2. "In 3D VS, metaverse model should understand and recommend actions for correction of biases". 3."Business must investigate and research the causes of bias in data".	In 3D VS, the foundation of fairness is that all equals should be treated equally, and those who are not equal owing to relevant differences should be treated differently in a way that is fair and commensurate with their differences. Incorporation of fairness EMP in the metaverse system can increase trust and avoid misunderstandings, which are essential for maintaining business reputation.
Explainability expectancy	11	92	1. "Explainability must describe the ethical purpose, rationale, and decision-making in a way that every member in 3D VS can understand". 2. "Explainability in 3D VS must increase trust among members".	In 3D VS, the explanation of the decision as a whole, including the data used, appropriate usage of the algorithm, warnings regarding the weakness of the algorithm, and the use cases to be conveyed to people on why a decision has been made. Incorporation of explainability EMP in metaverse systems can witness its better adoption in business operations.
Reliability expectancy	10	83	1. "Reliability in 3D VS must produce correct recommendations at a given time". 2. "Reliability in 3D VS must continue and deliver result on corrected and uncorrected data".	In 3D VS, people and businesses must demonstrate reliability because a lack of it leads to a failure of the intended outcome, and it should be built on consistency of values, emotions, actions, and outcomes by saying what to do and doing what to say. Incorporating reliability EMP into the metaverse system can ensure that decisions are sound, and results are accurate.
EDM	12	100	1. "In making ethical decisions in 3D VS, it is necessary to perceive and eliminate unethical options and select the best ethical alternative". 2. "Ethical decisions in 3D VS generate ethical behaviors and provide a foundation for good business practices". 3. "Ethical decision-making in 3D VS protects the interest and well-being of members and positively address social challenges".	In 3D VS, people and businesses must make decisions based on EMPs. To do so, metaverse systems must be built with EMPs by adhering to business and industry policies and more importantly, by ruling out any unethical solution by following a tangible set of steps and choosing the best ethical alternative. Also, understanding the difference between short-term and medium- to long-term objectives is crucial. Making ethical decisions requires having a method or structure, and businesses must look for ways to automate it within the metaverse system while simultaneously maintaining the complex relationship in 3D VS.

Table 4
Respondents' demographic profile.

Characteristics	# of respondent	Respondent proportion
Firm existence in years		
Less than or equal to 10 years	166	55 %
More than 10 years	136	45 %
Firm category		
E-commerce	100	33 %
Education	30	10 %
Real estate	86	28 %
Travel	51	17 %
Gaming	20	7 %
Banking	15	5 %

validity of the source data, as all HTMT values are below 0.90, confirming the acceptability of discriminant validity.

4.2.3. Assessment of structural model

The path coefficient (β), t-statistics (t-value), standard error (std. error), and significance level (*p*-value) are used to analyze the causal relationship between hypotheses. A hypothesis is considered significant and supported when the *p*-value is less than 0.05 [31]. Table 9 provides a summary, showing that H1 to H5 are supported. The path analysis confirms the significance of the paths for hypotheses H1 to H5. The table also presents the model fit indices, indicating that χ^2/df should be between 1 and 3, RMSEA should be less than 0.08, values for CFI, TLI, IFI, RFI, NFI, AGFI, and GFI should be greater than 0.90 indicates a better fit [31]. The coefficient of determination (R^2) values are 0.264 for EDM and 0.509 for IMP.

5. Discussion

This resulting model offers firms an approach to the responsible design and development of the metaverse, ethically influencing business and personal decision-making while guiding complex relationships within 3D VS. The validation of RQ1 is supported by hypotheses H1 to H4, and RQ2 by H5. The research gaps concerning 3D VS and EMPs have been addressed through a solid theoretical foundation. The structural

Table 5
Measurement items.

Construct	Items	Scale Item	Source
Business Benefit Evaluation Expectancy (BBEE)	BBEE1	The evaluation of business benefits EMP in 3D VS helps the business earn better business profit.	[71]
	BBEE2	The evaluation of business benefits EMP in 3D VS helps the business become more competitive.	
	BBEE3	The evaluation of business benefits EMP in 3D VS helps the business become more innovative.	
Fairness Expectancy (FE)	FE1	The fairness EMP in 3D VS helps discuss each other's needs.	[72]
	FE2	The fairness EMP in 3D VS helps duly consider the suggestions.	
	FE3	The fairness EMP in 3D VS helps consult viewpoints in the decision-making process.	
Explainability expectancy (EE)	EE1	The explainability EMP in 3D VS makes its reasoning process clear.	[73]
	EE2	The explainability EMP in 3D VS helps understand how recommendations are made.	
	EE3	The explainability EMP in 3D VS helps understand why recommendations are made.	
Reliability Expectancy (RE)	RE1	The reliability EMP in 3D VS helps to understand the worthiness of the information.	[74]
	RE2	The reliability EMP in 3D VS helps to understand the information is verifiable.	
	RE3	The reliability EMP in 3D VS helps to understand the information is accurate and factual.	
Ethical Decision-Making (EDM)	EDM1	In 3D VS, the best information is available for EDM.	[75]
	EDM2	In 3D VS, circumstances do not limit EDM capability.	
	EDM3	In 3D VS, quick responses are made to EDM.	
Impact on 3D VS in maintaining complex relationships (IMP)	IMP1	In 3D VS, I feel close enough to maintain the relationships.	[76]
	IMP2	In 3D VS, I feel comfortable to maintain the relationships.	
	IMP3	In 3D VS, I feel fascinated to maintain the relationships.	

relationship between EMPs and EDM, and between EDM and its impact on 3D VS, has been explored through an in-depth qualitative study followed by a quantitative analysis, which provided insights into participants' motivations, behaviors, thoughts, or emotions. Therefore, the study's objectives have been achieved through a discussion of the theoretical underpinnings, the support of hypotheses, and the proposal of a novel conceptual model. This enables businesses and individuals within 3D VS to adopt a responsible metaverse. The research implications point to an emerging field, termed the *responsible metaverse*, which focuses on morality, ethics, and legal principles, offering unprecedented opportunities to businesses. This philosophy enables businesses to shape key objectives and establish governance strategies, including minimizing unintended bias and mitigating risks for the benefit of people and businesses within 3D VS. This aligns with Clarke [81], which suggests that the goal of responsible IT is to guide businesses and individuals in fulfilling their responsibilities and the systems based on them.

Table 7
Discriminant validity.

Construct	IMP	EDM	BBEE	FE	EE	RE
IMP	**0.760**					
EDM	0.506	**0.736**				
BBEE	0.390	0.681	**0.826**			
FE	0.265	0.344	0.342	**0.782**		
EE	0.247	0.080	−0.099	0.024	**0.797**	
RE	0.070	0.158	0.026	−0.016	−0.016	**0.800**

Table 8
HTMT ratio.

Construct	IMP	EDM	BBEE	FE	EE	RE
IMP						
EDM	0.506					
BBEE	0.390	0.681				
FE	0.265	0.344	0.342			
EE	0.070	0.158	−0.099	0.009		
RE	0.070	0.159	0.026	−0.016	0.025	

Table 9
Hypothesis results.

Hypothesis	Relationship	β	Std. Error	t-value	p-value
H1	BBEE ➔ EDM	0.66	0.069	10.186	<0.01
H2	FE ➔ EDM	0.16	0.052	2.994	0.003
H3	EE ➔ EDM	0.15	0.059	2.797	0.005
H4	RE ➔ EDM	0.15	0.068	2.765	0.006
H5	EDM ➔ IMP	0.51	0.067	7.354	<0.01

[Note: Goodness-of-fit: $\chi^2 = 175.925$; df = 130; $\chi^2/\text{df} = 1.353$; RMSEA = 0.034; CFI = 0.982; TLI = 0.978; IFI = 0.980; RFI = 0.922; NFI = 0.934; AGFI = 0.922; GFI = 0.940].

Table 6
Convergent validity.

Construct	Items	FL	CA	CR	AVE	Skewness	Kurtosis
BBEE	BBEE1	0.778	0.863	0.865	0.683	−0.048	−0.664
	BBEE2	0.822					
	BBEE3	0.791					
FE	FE1	0.852	0.826	0.826	0.612	0.382	−0.997
	FE2	0.832					
	FE3	0.847					
EE	EE1	0.868	0.837	0.839	0.635	0.034	−0.597
	EE2	0.862					
	EE3	0.855					
RE	RE1	0.894	0.834	0.840	0.640	−0.194	−0.343
	RE2	0.875					
	RE3	0.816					
EDM	EDM1	0.747	0.874	0.875	0.700	−1.05	0.096
	EDM2	0.733					
	EDM3	0.757					
IMP	IMP1	0.814	0.804	0.804	0.578	−0.477	−0.578
	IMP2	0.811					
	IMP3	0.805					

In addition, the study aligns with previous research on the significance of EDM and 3D VS, and its findings are consistent with these studies. EDM is positively impacted by individuals' moral intensity [20] and it facilitates collaboration with others [82]. An ethical environment also plays a crucial role in shaping EDM [83]. These are equally applicable to businesses and individuals operating in 3D VS. The metaverse, a 3D VS where users can interact with each other is widely acknowledged [84]. As an extension of offline existence, individuals can participate in various social, commercial, and recreational activities with the enduring ED VS [85]. Through the World Wide Web, users can access the 3D VS of the metaverse, enhancing their communications with this interactive technology [86]. The metaverse transforms the Internet by merging mixed reality with physical reality, bringing stakeholders together in 3D VS [87]. Based on this discussion, it can be concluded that people and businesses can effectively adopt a responsible metaverse.

5.1. Theoretical implications

This study has two significant theoretical implications. First, with the growing importance of building responsible technology across various industries, a responsible metaverse-based ethical model grounded in EDM has been proposed for maintaining complex relationships in 3D VS. The suggested model is constructed with four EMPs as independent variables, EDM as an intermediate variable, and the impact on maintaining complex relationships in 3D VS as the dependent variable. Specifically, this model is designed to study the moral evolution of metaverse principles and their impact on 3D VS from the perspective of EDM. EDM addresses particular problems or situations that require ethical behavior and judgment [88]. Therefore, the responsible metaverse aligns with human rights law, supporting not only moral and legal accountability but also the development of a human-centric metaverse for the common good. Individuals in 3D VS increasingly demand that businesses consider metaverse ethics when developing trustworthy products and services. Consequently, businesses must continue to innovate, foster trust, and enhance compliance through a responsible metaverse model. Therefore, this study introduces a new phenomenon of decision-making in ethics literature, grounded in the metaverse.

Second, the research integrates ethics with metaverse [89], promoting the adoption of a responsible metaverse in the ethical domain and creating new possibilities for businesses to contribute to the public good. Several businesses have already begun utilizing or plan to utilize the responsible metaverse, which has gained considerable momentum. Therefore, incorporating the responsible metaverse into a business strategy involves carefully weighing the advantages and disadvantages of introducing a relatively new product, service, or business model before making it available to the public [90]. Additionally, the impacts of the relationships between individuals, businesses, and society can be examined within 3D VS. People's preferences for digital interaction could be shaped by the underlying economic mechanisms of metaverse platforms. As a result, responsible metaverse-based products, services, and business models are preferred when potential societal benefits can be maximized and their potential drawbacks minimized. Therefore, this implication exemplifies sociological imagination.

5.2. Managerial implications

The study offers valuable insights for practitioners due to its significant managerial implications. First, decision-making is crucial as it determines the effectiveness of practical solutions in addressing pressing ethical issues within a specific context. Consequently, this study advocates for scenario-based, responsible metaverse systems that prioritize the decision-making paradigm. When it comes to ethical decision-making, multi-faceted challenges are best addressed by leveraging the strengths of the business [91]. The structured steps outlined in this study build on each other, helping businesses navigate the often complex path to ethical decision-making [92]. By adopting this methodical approach, organizations can foster greater confidence in the ability of responsible metaverse systems to make ethical choices.

Second, an optimal IT infrastructure is recommended for businesses to implement responsible metaverse systems that fully uphold ethical principles. Data is backed up and stored securely in case of a disaster, and a data recovery option is also provided by high-performance storage devices [93]. Low-latency networks, powered by commercial-grade hardware, significantly reduce data transfer lag. Businesses may keep their customers' trust by using secure infrastructure to prevent data breaches and cyberattacks, regardless of where such data are physically located [94]. Wide area networks (WANs) regulate the network by providing bandwidth to specific programs based on their relative importance. Virtualization accelerates server deployment, improves uptime, strengthens disaster recovery, and reduces energy consumption. To keep operating costs low and maximum revenue, zero downtime minimizes disruptions, ensuring organizations can operate seamlessly.

5.3. Limitations and future research directions

This study has some limitations, which open avenues for further investigation. First, the proposed ethical norms may be challenging for some industries to implement. In addition, putting these principles into practice requires a solid grounding in VS, the metaverse, decision-making, and ethics. As a result, skilled personnel are essential for successful implementation, and any mistakes could have severe financial consequences for businesses. This can significantly impact productivity and increase the costs associated with technology and infrastructure. Therefore, considering people's expertise as a moderating factor in future studies could be valuable, and its effectiveness can be assessed through qualitative methodologies. In addition, the role of voluntariness (i.e., co-creation) in contributing to smooth business innovation activities warrants further investigation. In the context of 3D VS, co-creation refers to a product or service design process where input from individuals plays a central role from start to end. Businesses must demonstrate flexibility by allowing knowledgeable individuals to contribute their ideas, designs, or content.

Second, this study has not explored social responsibility [95], which is increasingly important for businesses. In 3D VS, businesses can engage in social responsibility initiatives to boost their competitiveness, create wealth, meet societal demands, and benefit both people and society. According to the ethical principle of social responsibility, individuals are responsible for fulfilling their social responsibilities, and their actions must benefit society. Therefore, businesses can consciously engage in social responsibility efforts to enhance their reputation. Often, the ethical implications of decisions or actions are overlooked for personal gain, with the focus typically on material benefits. This is frequently observed in businesses that attempt to bypass regulations. Hence, future research can consider how EMPs influence social responsibility, considering it as an additional intermediate variable in the conceptual model. A qualitative research methodology can then be applied to measure its effectiveness.

Third, this study has not delved into privacy and security, accountability, traceability, and transparency EMPs. In 3D VS, privacy refers to the ability of individuals and businesses to control how the data is collected, viewed, and used in a compliant manner. Similarly, security pertains to protecting individuals and businesses from threats, hackers, or cybercriminals, ensuring no unauthorized access to data. Accountability involves individuals and businesses taking responsibility for their actions by showcasing responsibility, answerability, enforcement, blameworthiness, and liability. Traceability refers to the ability of individuals and businesses to successfully trace the sender and receiver of messages. Transparency involves openness, communication, and accountability, where individuals and businesses admit mistakes, respond ethically to concerns and questions, and apologize when necessary. Hence, future research could consider using a mixed-methods approach to explore how these EMPs influence EDM.

6. Conclusions

This study introduces a novel concept of the responsible metaverse. We have developed a theoretical conceptualization of 3D VS decision-making and explored the complex relationships based on ethical metaverse principles. These ethical principles include business benefit evaluation, fairness, explainability, reliability; ethical decision-making; and maintaining complex relationships in 3D virtual space. Subsequently, this study performs qualitative and quantitative analysis to propose a novel conceptual model and establish relationships among the proposed hypotheses. The responsible metaverse can assist businesses in ensuring that their metaverse systems, guided by ethical metaverse principles, produce fair outcomes, protect privacy, and comply with regulations. By taking responsibility for these aspects, businesses can maintain complex relationships, boost trust, and build a solid reputation as responsible organizations. Adhering to ethical behavior will also help them sustain relationships with their customers. Following this proposed conceptual model, businesses can leverage the responsible metaverse as a future framework to build and maintain customer relationships, offering a wealth of opportunities by prioritizing metaverse ethical principles in their business operations.

CRediT authorship contribution statement

Rajat Kumar Behera: Writing – original draft, Methodology, Investigation, Formal analysis, Conceptualization. **Marijn Janssen:** Writing – review & editing, Supervision, Conceptualization. **Nripendra P. Rana:** Writing – review & editing, Validation, Supervision, Methodology, Conceptualization. **Pradip Kumar Bala:** Writing – review & editing, Supervision, Methodology, Investigation, Conceptualization. **Debarun Chakraborty:** Validation, Supervision, Formal analysis.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

The data that has been used is confidential.

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