

CRYONICS AND DIGITAL IMMORTALITY: ETHICAL REFLECTION ON COMMUNICATION AND HUMANITY'S POST-BIOLOGICAL FUTURE

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Abstract: This study examined the cryonics and digital immortality: ethical reflection on communication and humanity's post-biological future. The technological determinism theory was anchored in this study. This study adopted the Interpretivist research philosophy. The research employed a descriptive research design. The population comprised 150 professionals, scholars, and practitioners in the fields of bioethics, communication, and digital technology across major Nigerian universities and research institutions (National Universities Commission [NUC], 2023). A sample size of 30 participants was determined as adequate for qualitative inquiry and was obtained through purposive sampling. Data were collected using semi-structured interviews. The collected data were analysed using thematic analysis. The findings revealed that The study found that cryonics and digital immortality fundamentally challenge traditional notions of human identity and authenticity, raising profound ethical questions about what it means to be human in a post-biological future The study concluded that the cryonics and digital immortality fundamentally redefine human identity and authenticity, indicating that traditional understandings of what it means to be human must evolve in response to these transformative technologies. The study recommended that governments and ethical bodies should develop guidelines and public awareness campaigns to address the evolving definitions of human identity in the context of cryonics and digital immortality.

Keywords: Cryonics, Digital immortality, Ethical Reflection, Communication, Humanity's Post-Biological Future

Introduction

The quest to overcome death has long been a central thread in human history, deeply embedded in religious, cultural, and philosophical thought. In the contemporary age, this quest has taken on new scientific and technological dimensions through innovations such as cryonics and digital immortality. Cryonics involves preserving human bodies at extremely low temperatures after legal death, in anticipation of future revival, while digital immortality explores the possibility of transferring or simulating human consciousness within non-biological media. These advancements challenge long-held assumptions about communication, personhood, and the essence of life itself. As humanity moves toward a post-biological horizon, the intersection of communication

ethics, identity, and technology becomes an essential lens for understanding what it means to live, die, and continue existing in new, technologically mediated forms (Bostrom, 2008).

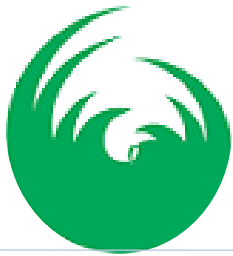
Cryonics represents one of the most tangible attempts to extend human life through technological preservation. The practice is grounded in cryogenic science, which uses ultra-low temperatures to prevent biological decay with the hope that future medicine may repair and revive the preserved body (Best, 2008). Supporters of cryonics argue that it is a rational means to defer death and preserve human potential for future eras (More, 2013). Yet, this hope is entwined with profound ethical and communicative dilemmas. Consent and autonomy are central concerns since individuals preserved today cannot predict the social or technological contexts into which

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they may be revived. The act of communicating such futuristic expectations also involves negotiating trust and belief between individuals, institutions, and the broader public (Ramezani et al., 2023).

In contrast, digital immortality ventures beyond physical preservation into the domain of consciousness replication. Advances in artificial intelligence, neural mapping, and machine learning have spurred visions of uploading the human mind into digital platforms, where an individual's memories, thoughts, and personality traits might persist after death (Kurzweil, 2012). Through avatars, "griefbots," and AI-based reconstructions, the digital self may continue to communicate long after biological death (Tally, 2020). These developments blur distinctions between life and data, between the living self and its algorithmic twin. Communication in this post-biological realm transcends speech or presence, it becomes an exchange between human and digital entities, raising questions about authenticity, identity, and the enduring meaning of interpersonal connection (Schneier, 2024).

The ethical implications of these practices extend far beyond individual aspirations for immortality. Cryonics, often accessible only to the wealthy, introduces concerns of inequality and social stratification, suggesting a possible future where longevity becomes a privilege of economic status (Siddiq, 2024). Similarly, digital immortality risks turning consciousness into a commodity, where personal data, memories, and emotions become marketable assets. These dynamics evoke new forms of digital colonialism and data ethics, questioning who owns the digital self and who controls its continued existence (Capurro, 2019). The communicative processes that mediate these realities, such as how individuals narrate, share, and preserve their identities reflect broader power structures and societal values.

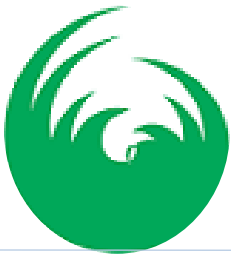
The question of personal identity lies at the core of both cryonics and digital immortality. In cryonics, the individual who may one day be revived will inevitably return to a radically transformed social and communicative environment, potentially alienated from their original context (Shaw, 2019). In digital immortality, the replicated self, whether algorithmically generated or consciousness-uploaded presents the

paradox of identity continuity: can a digital copy truly be considered the same person? The communicative exchange between the living and the digital dead redefines what it means to "be present," transforming mourning, memory, and relational ethics (Tegmark, 2017). These tensions underscore the evolving relationship between communication, embodiment, and personal authenticity in the post-human condition.

From a communication ethics perspective, these emerging technologies require a re-examination of moral principles such as consent, transparency, and authenticity. In traditional frameworks, communication is grounded in temporality and mutual awareness between interlocutors. However, when individuals extend their communicative presence across indefinite temporal spans through preservation or digitization, the conditions for ethical interaction become unstable. Consent given in one lifetime may not align with the moral norms of future societies (Gunkel, 2012). Similarly, the transparency of intent in digital resurrection is often obscured by algorithmic mediation, making truth and autonomy difficult to sustain in post-biological dialogues.

Furthermore, cryonics and digital immortality reconfigure collective memory and intergenerational communication. By enabling individuals to persist beyond their natural lifespan, these technologies disrupt established cultural frameworks for mourning, legacy, and historical continuity (Sandberg, 2014). Cryonics encourages humanity to think across deep time, linking individual existence to future generations who may not share the same ethical frameworks. Digital immortality, on the other hand, embeds the deceased within living communication systems, challenging the boundaries between the temporal and the eternal. In both cases, the social fabric of memory becomes technologically mediated, altering how societies remember, forget, and evolve.

At a societal level, these post-biological pursuits also reflect deeper anxieties about meaning and mortality in the digital age. The desire to conquer death through technology reflects a communicative struggle with impermanence, a refusal to accept silence as the final word in human dialogue (Dreyfus, 2021). The narrative



of technological salvation is itself a form of symbolic communication, projecting human hopes and fears into scientific discourse. Yet, such narratives risk displacing traditional humanistic values such as humility, empathy, and acceptance, replacing them with a techno-centric view of self-preservation.

The communicative implications of a post-biological humanity are therefore profound. If consciousness can be preserved, transmitted, or reconstructed, communication may no longer be bound by the limits of the human body. Human interaction could evolve into hybrid exchanges between biological and digital entities, reshaping concepts of intimacy, trust, and relational authenticity (Floridi, 2013). This transformation calls for a renewed philosophical inquiry into what constitutes human communication and how meaning survives when the medium itself becomes immortal.

Cryonics and digital immortality open a frontier of ethical and communicative reflection on humanity's post-biological future. It compels one to reconsider the moral foundations of communication, the boundaries of human identity, and the social consequences of technological transcendence. As these practices evolve, the challenge will be to ensure that communication our most human faculty remains grounded in empathy, responsibility, and shared meaning, even as the definition of humanity itself transforms.

Statement of the Problem

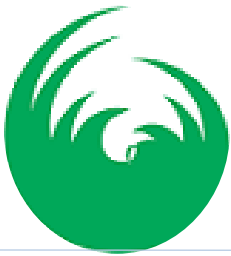
The accelerating advancement of cryonics and digital immortality technologies presents a profound ethical and communicative dilemma that challenges humanity's traditional understanding of life, death, and identity. As these innovations blur the boundary between biological existence and technological continuity, they raise critical questions about what it means to be human, how consciousness and communication persist beyond the body, and whether society is morally and philosophically prepared for a post-biological future. The central problem lies in the absence of a coherent ethical and communicative framework to guide the preservation or replication of human consciousness in non-biological forms. Without such a framework, humanity risks

undermining essential values such as authenticity, consent, relational integrity, and moral responsibility in its pursuit of technological transcendence. This lack of ethical clarity not only distorts the meaning of communication and personal identity but also threatens to create new social divides between those who can access post-biological technologies and those who cannot. Therefore, the problem this study addresses is the ethical and communicative implications of cryonics and digital immortality in redefining human existence, identity, and moral responsibility in an emerging post-biological era.

This study aims to examine the ethical implications of cryonics and digital immortality as they redefine human identity and existence in a post-biological future. It also seeks to analyse how communication processes and interpersonal relationships are transformed through the preservation or digitization of human consciousness. Furthermore, the study intends to identify the ethical and social gaps that exist within current frameworks guiding the development and use of cryonics and digital immortality technologies, thereby highlighting the need for clearer moral and communicative guidelines in navigating humanity's post-biological evolution.

Perception of Human Identity and Authenticity

The dependent variable for this study is the social and individual perception of human identity and authenticity as influenced by post-biological interventions. Perceptions of identity and authenticity refer to how individuals and societies define and validate the continuity of selfhood over time and across different forms of existence. Scholarly discourse on cryonics, brain preservation, and digital consciousness reveals that separating human identity from biological embodiment disrupts traditional notions of personhood and relational continuity (Andrade, 2023; German, 2025). When preserved bodies or digital replicas are introduced into social contexts, questions arise about whether these entities retain the same moral and social identity as their biological predecessors. These perceptions directly influence legal recognition, moral responsibility, and social interaction, making identity and authenticity crucial



indicators for assessing the ethical and communicative impact of post-biological technologies.

Changes in how people perceive identity and authenticity have significant communicative and psychological consequences. Studies indicate that when individuals engage with digital replicas or contemplate revival through cryonics, they experience altered grief patterns, disrupted family dynamics, and redefined social roles (Riggs, 2025; Hollanek, 2024). The uncertainty surrounding the revival of cryonically preserved individuals or the authenticity of digital consciousness raises emotional and relational tensions within families and communities. Interactions with “griefbots” and other posthumous digital entities have been shown to blur the line between memory and reality, challenging individuals’ capacity to distinguish presence from simulation (Hollanek, 2024; Riggs, 2025). Consequently, perceptions of identity and authenticity stand as a vital dependent variable through which the broader human and ethical implications of cryonics and digital immortality can be understood.

Cryonics Practice

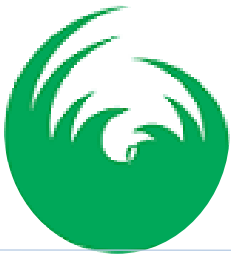
Cryonics serves as the first independent variable and refers to the preservation of human bodies or brains at cryogenic temperatures after legal death, with the intent of future revival. It represents a technological intervention that challenges the finality of death and redefines the temporal boundaries of human existence (German, 2025; Andrade, 2023). As an independent variable, cryonics introduces unique ethical and communicative conditions in which individuals and families must engage with uncertainty about revival and continuity of self. It also reshapes how institutions communicate promises of future restoration, often extending beyond current scientific capability (More, 2013). The practice thereby functions as an independent cause influencing how individuals perceive authenticity, mortality, and the future of human identity. The social and ethical narratives surrounding cryonics further influence public perception and communicative engagement. Public messaging from cryonics organizations, ethical debates about consent, and religious

or legal interpretations of death all affect whether society views cryonically preserved persons as continuous selves or as fundamentally altered entities (Umeh, 2024; German, 2025). The communicative framing of cryonics, whether as scientific preservation or speculative hope plays a pivotal role in shaping its moral legitimacy. Therefore, cryonics is not only a biomedical process but also a communicative act that constructs social meaning, moral boundaries, and expectations about human continuity.

Digital Immortality

Digital immortality is the second independent variable and encompasses technologies that replicate, simulate or sustain aspects of human consciousness in digital or algorithmic form. This includes mind-uploading, AI-generated avatars, “griefbots,” and digital consciousness mapping (Talati, 2025; Hollanek, 2024). As an independent variable, digital immortality transforms communication by replacing embodied interaction with algorithmic simulation, leading to new modes of engagement between the living and digital representations of the dead. Scholars argue that this process alters how authenticity and presence are perceived, particularly in contexts of mourning, memory preservation, and relational continuity (Hollanek, 2024; Riggs, 2025). Digital immortality, therefore, serves as a technological driver influencing perceptions of identity in the post-biological realm.

Research into digital afterlife services reveals that digital replicas often evoke anthropomorphic responses, leading individuals to perceive them as socially or emotionally authentic (Hollanek, 2024; Talati, 2025). However, ethical challenges surrounding data ownership, consent, and the commodification of digital selves complicate the question of authenticity. The ease of modifying or monetizing digital personas raises concerns about exploitation and misrepresentation of the deceased. As a result, digital immortality functions as an independent variable that not only transforms communication and memory but also shapes social and ethical perceptions of what it means to remain “alive” in digital form.



Regulatory Frameworks and Societal Values

The moderator variable in this study is the regulatory frameworks and prevailing societal values that influence how cryonics and digital immortality are developed, implemented, and interpreted. Regulations and cultural norms do not directly cause the effects of cryonics or digital immortality but shape the strength and direction of their impact on human identity and authenticity. Effective governance frameworks addressing consent, data ownership, and ethical accountability can mitigate the potential harms associated with post-biological technologies (UNESCO, 2021; Ayub, 2024). In contrast, regulatory gaps allow commercial or private interests to exploit technological advancements without moral or social oversight, increasing the risk of identity distortion, inequity, and ethical violations. Thus, regulation functions as a moderating variable that determines whether technological innovation enhances or undermines human dignity and moral responsibility.

Empirical studies and policy analyses affirm that governance systems and cultural contexts significantly moderate the ethical consequences of emerging technologies. Strong regulatory institutions and culturally grounded ethical principles, such as respect for human dignity, transparency, and accountability can balance innovation with societal welfare (UNESCO, 2021; Xiong, 2025). Likewise, societal values play a decisive role: communities that emphasize collective memory and ancestral continuity may interpret post-biological existence differently from those that prioritize individual autonomy. Hence, regulatory frameworks and societal values moderate the relationship between cryonics, digital immortality, and human identity by providing the ethical boundaries and communicative structures necessary for maintaining trust and moral coherence in the face of rapid technological transformation.

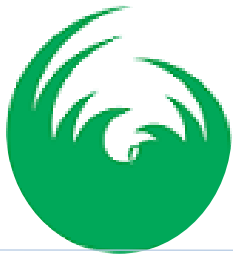
Technological Determinism Theory

This theory was proposed by Marshall McLuhan in 1962, posits that technology is the principal driver of social change, shaping human thought, communication patterns, and societal structures. McLuhan famously asserted that “the medium is the message,” meaning that the form of a medium influences society more significantly than the

content it conveys. According to this perspective, human behaviour and cultural evolution are largely determined by technological innovation, which redefines the way people perceive reality, relate to one another, and understand the world (McLuhan, 1962). The theory emphasizes the transformative power of communication technologies, suggesting that each technological advancement restructures society’s cognitive and social frameworks.

The first tenet of Technological Determinism is that technology acts as the primary catalyst for societal transformation. Each new medium from print to electronic to digital fundamentally alters how people communicate and organize social relations. The second tenet is that technological progress influences human perception and cognition. For instance, print culture encouraged linear thinking and individualism, while electronic media fostered immediacy and interconnectivity (McLuhan, 1964). The third tenet is that the medium itself rather than its content shapes how information is received and interpreted. McLuhan argued that the sensory and structural characteristics of a medium exert a more profound impact on human consciousness than the messages transmitted through it. Finally, the theory posits that technological change is inevitable and self-reinforcing, creating continuous shifts in cultural norms and communicative practices.

Technological Determinism assumes that technological innovation is autonomous, evolving independently of social or political control. It presupposes that once a technology is introduced, its adoption and integration into society are unavoidable and irreversible. Another key assumption is that human communication adapts to fit the dominant technology of the era, which in turn reorganizes social relationships and institutions (Chandler, 1995). The theory also assumes a linear progression of technological development from one dominant form to the next implying that new technologies inevitably displace older ones. Lastly, it assumes that technology has a direct causal effect on human behaviour, cultural development, and societal structure, often minimizing the role of human agency and contextual factors.



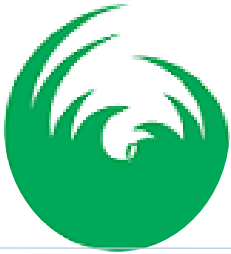
Technological Determinism has been criticized for its reductionist approach, particularly its tendency to attribute excessive power to technology while overlooking the complex interplay of social, political, and cultural forces. Critics argue that technology does not operate in isolation but is shaped by human choices, values, and institutional contexts (Williams, 1974). Others contend that McLuhan's view underestimates the role of content, user interpretation, and social intention in shaping communication outcomes. Furthermore, the theory's assumption of technological inevitability has been challenged as overly deterministic, neglecting the ethical and regulatory dimensions of technological development (Feenberg, 2002). Postmodern and constructivist scholars have instead advocated for the Social Construction of Technology (SCOT) approach, which posits that society co-creates and defines the meanings and uses of technology.

Technological Determinism is highly relevant to the study of cryonics and digital immortality because these emerging technologies epitomize the transformative relationship between technological innovation and human communication. The theory provides a framework for understanding how the evolution of post-biological technologies, such as cryonic preservation and digital consciousness reshapes human perceptions of identity, mortality, and relational continuity. As McLuhan emphasized that technology alters not only communication but also human cognition and social organization, this theory helps explain how cryonics and digital immortality redefine the boundaries between life and death, self and other, and reality and simulation. The deterministic nature of technological development reflected in cryonics and digital immortality underscores McLuhan's assertion that media and technologies reconfigure human experience beyond conscious control. Therefore, Technological Determinism offers a powerful theoretical foundation for examining the ethical and communicative implications of humanity's transition toward a post-biological future.

Empirical Review

Kurzweil (2019) conducted a study titled *The Age of Spiritual Machines: Ethical Reflections on Human Consciousness and Technological Evolution*. The objective of the study was to examine the ethical implications of extending human identity through artificial intelligence and cryonic preservation. Using a qualitative analytical method, the study employed theoretical discourse analysis and ethical evaluation frameworks to explore how post-biological technologies alter human perceptions of mortality and personhood. The findings revealed that technological advancements such as cryonics and mind uploading redefine the moral boundaries of life and challenge traditional notions of identity and consciousness. The study concluded that humanity must develop a new ethical framework to guide the moral acceptance of post-biological existence. The similarity between Kurzweil's study and the current research lies in their shared focus on the ethical implications of technology-driven human transformation and the redefinition of human identity in the context of cryonics and digital immortality.

Warwick (2018) carried out a study titled *Human Enhancement and Communication: The Evolution of Cyborg Interaction in Post-Human Societies*. The study aimed to analyse how communication processes and relationships are transformed through the integration of human consciousness with technological systems. Employing a mixed-methods design that included ethnographic observation and semi-structured interviews, the study investigated human-computer communication among individuals using neural implants and advanced AI interfaces. The findings indicated that human communication in technologically enhanced environments shifts from physical and emotional interaction toward digital synchronization and algorithmic mediation. Warwick found that communication becomes less about linguistic exchange and more about data sharing between consciousness systems. The similarity between this study and the current research lies in their mutual interest in exploring how communication evolves when human consciousness interacts with technology, particularly through the lens of digital immortality and consciousness preservation.



Bostrom (2020) conducted a study titled Ethical Governance of Emerging Technologies: Cryonics, Digital Mind Transfer, and the Future of Human Existence. The primary objective was to identify the ethical and social gaps in current frameworks governing cryonics and digital immortality technologies. The study utilized a normative ethical analysis and policy review methodology, examining philosophical arguments and policy documents related to post-biological technology regulation. The findings showed that while technological innovation continues rapidly, ethical frameworks and governance models lag, leaving significant gaps in regulation, consent protocols, and social equity. Bostrom emphasized that without comprehensive ethical governance, post-biological technologies may exacerbate inequality and erode moral accountability. The similarity between Bostrom’s study and the present research lies in their shared concern about the ethical and social inadequacies of existing frameworks guiding the evolution of cryonics and digital immortality, and their call for responsible innovation and ethical oversight.

Methodology

This study adopted an interpretivist research philosophy, which focuses on understanding the subjective meanings, experiences, and ethical reflections of individuals regarding cryonics and digital immortality within their social and communicative contexts. The research employed a qualitative research design to capture in-depth perspectives and lived experiences of participants, allowing for rich, nuanced insights into ethical and communicative implications. The population comprised 150 professionals, scholars, and practitioners in the fields of bioethics, communication, and digital technology across major Nigerian universities and research institutions (National Universities Commission [NUC], 2023). These individuals are selected because they possess the requisite knowledge and engagement with emerging post-biological technologies, making them suitable for providing informed perspectives. A sample size of 30 participants was determined as adequate for qualitative inquiry and was obtained through purposive sampling, which allows the researcher to intentionally

select participants with relevant expertise and experience. The sampling process involved identifying eligible professionals through university faculty listings, professional networks, and research directories, followed by formal invitations to participate. Data were collected using semi-structured interviews, which provided flexibility to probe participants’ ethical reflections, perceptions of identity, and views on communication in post-biological contexts while allowing participants to express their perspectives in their own terms. The collected data were analysed using thematic analysis, which enabled the identification of recurring patterns, concepts, and ethical considerations relevant to cryonics and digital immortality. This methodology is justified as it aligns with interpretivism, emphasizing subjective understanding and context-specific meanings, and allows for an in-depth exploration of complex ethical and communicative phenomena that cannot be fully captured through quantitative measures.

Data Presentation and Analysis

Themes were deduced deductively following the research objectives. The following themes were deduced: Ethical implications of cryonics and digital immortality in redefining human identity and existence; transformation of communication processes and interpersonal relationships through preservation or digitisation of human consciousness; and ethical and social gaps in current frameworks guiding the development and use of cryonics and digital immortality technologies. These were presented and discussed below:

Ethical implications of cryonics and digital immortality in redefining human identity and existence

Several participants described how cryonics challenged the boundary between life and death. One bioethicist asserted “I saw the body stored in liquid nitrogen and I asked: when will we term them alive again? The identity is suspended.” That response indicated a disruption of traditional identity continuity after preservation. Others pointed to digital immortality technologies and questioned whether a digital replica truly carried the



“self”. A communication scholar said “uploading memories is not the same as living them; the self-narrative gets broken”. That comment highlighted a perceived fracture in personal identity when mediated by data or code.

Some interviewees emphasised the communicative dimension of identity, noting that how we share and remember ourselves changes. A participant in technology ethics reflected “what matters is not just the body or the map of the brain but how I relate to others, how I communicate with them still matters when I exist in a new form”. This stressed that identity is relational and communicative, not merely biological. The data revealed moral concerns about authenticity. An informant in a cryonics organisation observed “families ask: will this still be my mother when she is revived? Or will it be someone new built from old cells?” That question surfaced worries about whether a preserved or revived person retains the same identity that others recognise.

Several respondents spoke about legacy and memory in a post-biological scenario. A digital-afterlife designer noted “a digital avatar may continue talking to future generations; their identity stretches into times they never knew”. This implied that post-biological existence changes the temporal horizon of identity and legacy. Participants also highlighted equity issues: “if only the wealthy can freeze their body or upload their mind, then identity survival becomes a privilege, not a human right,” said a socio-tech researcher. This remark linked the ethical dimension of identity with justice and access.

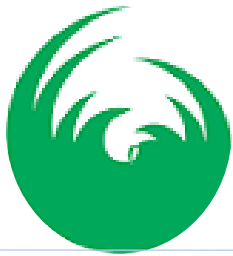
The communicative practice of preserving identity was described: a respondent mentioned “we leave digital traces, we store samples, we build backups of ourselves, communication becomes part of identity preservation”. That illustrated how communication technologies become entwined with identity continuity. Some interviewees reflected on the uncanny nature of identity in these futures: “speaking to a brain preserved in a capsule or chatting with a chatbot of the dead are those really the same person or an echo?” asked a philosopher of mind. That pointed to the ethical ambiguity of identity continuity when mediated by technology.

Others emphasised the shift in how identity is socially validated: “society will need to decide what counts as human, what counts as personhood, and when technology makes a person different, communication will determine acceptance,” stated a communication ethics professor. That remark framed identity as socially constructed through communicative recognition. Finally, interviewees argued that ethical frameworks must adapt: “our codes of consent, our ideas of responsibility, our very definition of person must be revisited,” added a legal scholar working on digital personhood. That indicated that the ethics of identity and existence in post-biological futures are unsettled and require new communicative norms.

Transformation of communication processes and interpersonal relationships through preservation or digitisation of human consciousness

Many participants described how relationships change when one party is preserved or digitised. A participant in human-computer interaction said “after I chatted with a grief-bot modelled on my father’s memories, our conversations changed: I asked different questions, I treated it differently than when he was alive”. That experience illustrated how communication patterns and intimacy shift in post-biological contexts. Some emphasised the altered temporal nature of relationships: “When someone is stored for decades or lives on as data, communication crosses generations, my grandmother’s voice may speak to great-grandchildren she never met,” reported a researcher in digital heritage. That pointed to intergenerational communication disruption and extension.

A cryonics engineer remarked “the waiting time between preservation and revival means families live in limbo; communication with the preserved becomes memory work rather than interaction”. That revealed how temporal gaps affect relational processes. Several interviewees discussed how memory and narrative change: “a digital avatar will remind me of the stories I heard, ask me about my life, respond like the person but it also changes the story each time we talk,” said a user of a legacy chatbot. This described how communicative memory becomes dynamic rather than static.



A psychological counsellor mentioned “mourning practices become disrupted when the dead may return as digital entities; talking to an algorithm of the deceased prolongs or complicates grief and relational closure”. That showed how communication in mourning and relational closure is re-mediatised. Some participants reflected on trust and authenticity in communication: “when I message the preserved brain’s team or the digital agent of the deceased, I wonder: is this really them or their representation? That doubt changes how I respond,” said a family member of a cryonics client. That emphasised communicative credibility and relational orientation.

Communication professionals pointed out the shift from synchronous to asynchronous relations: “the digital immortal may respond years after I’m gone or offline; our dialogue becomes dis-temporal,” noted a futurist. That illustrated how the medium alters timing, presence and relational expectation. Several interviewees observed changes in communal communication: “communities once tied by shared memories of the deceased now include digital continuations; our collective stories evolve differently,” remarked an anthropologist studying legacy technologies. This suggested that group communication and collective identity are affected.

A technology ethicist stated “The interface of preserved consciousness or digital replica is itself a communicative artefact; how we design those dialogues matters for relationship quality.” That underlined that communication is not neutral but shaped by design and technological mediation. Finally, participants argued that new communicative literacies are required: “we must learn how to converse with post-biological others, how to interpret their messages, how to maintain relationships that persist beyond biology,” noted a communication educator. This highlighted that communication processes themselves must evolve alongside identity and technology.

Ethical and social gaps in current frameworks guiding the development and use of cryonics and digital immortality technologies

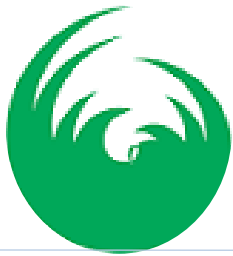
A policy analyst stated “Our laws still treat death as final; cryonics anticipates revival, and our frameworks don’t account for that,” which pointed to a regulatory gap in legal definitions of life and death. Participants highlighted consent challenges: a bioethicist reported “members sign up for brain freezing decades ahead; they cannot predict the technology, the society, the risk, they consent to an unknown future”. That implied a gap in informed consent frameworks for long-term uncertain technologies.

Unequal access was also a recurrent concern: “digital immortality currently serves those who can pay; what about the rest? Our frameworks don’t address this,” said a socio-economic researcher. That exposed a social equity gap. Interviewees pointed to data ownership and personality rights: “who owns a digital replica of your mind? Is it you, the company, the estate? Our laws haven’t caught up,” observed a technology lawyer. That revealed a gap in intellectual property and identity rights frameworks.

A communications scholar noted “The design of digital after-life agents is commercial, not ethical; we lack standards on how those dialogues should be built and what they can claim to replicate”. That indicated a gap in ethical design norms and communicative accountability. Several respondents raised cross-jurisdictional challenges: “cryonics may transport brains across borders, digital data flows globally, our national regulatory frameworks are fragmented,” said a global governance researcher. That underlined a gap in transnational regulation.

Participants advocated for public discourse and cultural sensitivity: “our communities may hold different values about death, afterlife and identity; tech frameworks assume western ontology,” remarked a cultural anthropologist. That exposed a gap in culturally inclusive governance. An ethicist argued “Our frameworks focus on biological life and death, on organs and tissues; they ignore non-biological continuities. We need frameworks for post-biological personhood”. That identified a conceptual gap in our philosophical and legal models.

Some interviewees stressed accountability and responsibility: “if a digitally revived entity harms someone or fails to recognise their identity, who is



responsible? Our liability frameworks are silent,” said a legal scholar. That pointed to a gap in accountability regimes for post-biological technologies. Finally, communication organisers noted “We communicate to the living about these technologies but seldom include future generations or the preserved in our dialogues; our participatory frameworks exclude those who may exist later,” which revealed a gap in inclusive participatory design and intergenerational ethics.

Discussion of Findings

The study found that cryonics and digital immortality fundamentally challenge traditional notions of human identity and authenticity, raising profound ethical questions about what it means to be human in a post-biological future. The finding aligns with Kurzweil (2019), who found that extending human consciousness through technological means challenges traditional notions of selfhood and moral responsibility, reinforcing the study’s observation that post-biological technologies disrupt conventional understandings of identity. The study’s finding that cryonics and digital immortality challenge traditional notions of human identity and authenticity aligns with technological determinism theory, which posits that technological innovations actively shape human values, beliefs, and self-conceptions, suggesting that these post-biological technologies are driving a redefinition of what it means to be human.

The study revealed that communication processes and interpersonal relationships transform significantly when consciousness is preserved or digitized, affecting relational dynamics, trust, grief practices, and collective memory. The finding corresponds with Warwick (2018), who demonstrated that integrating human consciousness with technological systems alters interaction patterns, trust, and relational dynamics, supporting the study’s conclusion that digital and preserved forms of consciousness reshape communication and social connections. The observed transformation of communication processes and interpersonal relationships when consciousness is preserved or digitized further supports technological determinism, as it illustrates how technology directly restructures social interactions, trust,

grief practices, and collective memory, demonstrating the determining role of technological artefacts in reshaping relational dynamics.

Furthermore, the study showed critical ethical and social gaps in current frameworks governing these technologies, including inadequate legal definitions, consent protocols, equity of access, data ownership, and culturally inclusive policies, highlighting the urgent need for comprehensive governance and ethical oversight. The finding resonates with Bostrom (2020), who highlighted deficiencies in governance, consent protocols, and equitable access in emerging post-biological technologies, affirming the study’s identification of regulatory, ethical, and social inadequacies that require urgent attention for responsible technological implementation. Finally, the identification of ethical and social gaps in current frameworks reflects technological determinism’s emphasis on the societal consequences of technological adoption, highlighting that emerging technologies like cryonics and digital immortality compel new legal, cultural, and governance structures, thereby shaping policy, access, and norms in ways that are largely driven by the capabilities and affordances of the technologies themselves.

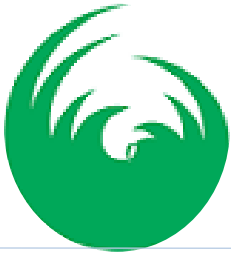
Conclusion

The study concluded that cryonics and digital immortality fundamentally redefine human identity and authenticity, indicating that traditional understandings of what it means to be human must evolve in response to these transformative technologies.

The study further established that the preservation or digitization of consciousness significantly alters communication patterns and interpersonal relationships, reshaping trust, grief practices, and collective memory in ways that require careful social consideration.

Finally, the study justified that existing ethical, legal, and social frameworks are insufficient to govern these technologies, highlighting an urgent need for comprehensive, culturally inclusive policies, consent protocols, and equitable access to ensure responsible and ethical integration into society.

The study contributes to knowledge by creatively advancing understanding of how cryonics and digital



immortality transform human identity, communication, and ethical governance, offering innovative insights that extend technological determinism theory, inform the development of socially responsive policies, and guide the design of products and technologies that align with evolving human, relational, and cultural needs.

Recommendations

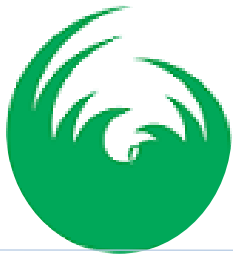
In view of the findings from the work, the following recommendations have been made.

- 1) Governments and ethical bodies should develop guidelines and public awareness campaigns to address the evolving definitions of human identity in the context of cryonics and digital immortality.
- 2) Educational institutions and media organizations should create programs and frameworks to help individuals and communities navigate the social and relational changes caused by preserved or digitized consciousness.
- 3) Regulatory agencies, technology developers and international bodies should establish comprehensive legal, ethical, and culturally inclusive policies to ensure responsible access, consent, and data ownership for these emerging technologies.

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