Journal of Posthumanism
2026
Volume: 6, No: 3, pp. 121–145
ISSN: 2634-3576 (Print) | ISSN 2634-3584 (Online)
posthumanism.co.uk

DOI: https://doi.org/10.63332/joph.v6i3.4069

Reimagining Research Commercialisation through Posthuman Innovation Ecologies: A Reflexive Bibliometric Cartography

Abdul Latif[1], Arief Arianto[2]*, Agung Hendriadi[3], Puji Astuti[4], Boni Benyamin[5], Yenni Bakhtiar[6], Eko Bhakti Susetyo[7], Ermi E. Koeslulat[8], Sahlan[9], Muktiyono[10], Ricky Ilhamsyah[11]

Abstract

Contemporary discussions of innovation often privilege human intention and control, overlooking how technologies and environments co-shape the inventive process. This study reconceptualises research commercialisation through a posthuman lens, treating bibliometric software not as a passive analytical tool but as a collaborator in knowledge-making. Drawing on 448 Scopus-indexed publications (2020–2025) connecting posthumanism, innovation, and commercialisation, the analysis employs VOSviewer to visualise conceptual networks and trace temporal shifts within the field. The maps reveal a philosophical and ethical core rooted in posthumanism, new materialism, and ethics. Over time, this core expands into applied domains such as entrepreneurship, gender, and innovation practice. These movements signal the emergence of posthuman innovation ecologies in which human, technological, and ecological agencies intertwine through co-creative processes. The study offers a reflexive lens to reimagine research commercialisation as an ethical and ecological practice within posthuman innovation ecologies.

Keywords: *Posthumanism; Innovation Ecologies; Research Commercialisation; Bibliometric Cartography; Algorithmic Performativity*

Introduction

The accelerating fusion of technological, ecological, and epistemic systems has disrupted long-standing humanist assumptions about innovation and knowledge production (Alaimo & Kallinikos, 2022). Conventional commercialisation models, both linear and anthropocentric, continue to centre human creativity and control as the sole engines of innovation (Etzkowitz & Leydesdorff, 2000; Shane, 2004). Yet, the rise of algorithmic and ecological infrastructures

[1] Research Center for Horticulture, National Research and Innovation Agency, Indonesia
[2] Research Center for Behavioral and Circular Economics, National Research and Innovation Agency, Indonesia, Email: arie010@brin.go.id
[3] Research Center for Behavioral and Circular Economics, National Research and Innovation Agency, Indonesia
[4] Research Center for Behavioral and Circular Economics, National Research and Innovation Agency, Indonesia
[5] Research Center for Behavioral and Circular Economics, National Research and Innovation Agency, Indonesia
[6] Research Center for Process Technology, National Research and Innovation Agency, Indonesia
[7] Research Center for Sustainable Manufacturing System, National Research and Innovation Agency, Indonesia
[8] Research Center for Sustainable Manufacturing System, National Research and Innovation Agency, Indonesia
[9] Research Center for Sustainable Manufacturing System, National Research and Innovation Agency, Indonesia
[10] Research Center for Limnology and Water Resources, National Research and Innovation Agency, Indonesia
[11] Directorate for Laboratory Management, Research Facilities, and Science and Technology Areas, National Research and Innovation Agency, Indonesia

complicates this view. Innovation is no longer exclusively human; it unfolds within relational entanglements among humans, technologies, and materials that co-produce epistemic and material outcomes. Recent bibliometric mappings of posthumanism in fields such as marketing (Sangadji et al., 2025) and education (Rasdiana et al., 2025) further support this shift, illustrating how creativity and innovation emerge through distributed human–nonhuman assemblages that challenge anthropocentric assumptions.

Recent studies on digital ethics and algorithmic governance reinforce this transformation. Guenduez et al. (2025) highlight how digital ethics increasingly shapes the design of innovation systems, while Atencio (2025) and Händel et al. (2025) reveal that ethical awareness and digital agency differ across sociotechnical contexts. These findings underscore that algorithms and data infrastructures not only mediate but also generate new ethical and ontological conditions for innovation. Policy-oriented studies extend this argument by demonstrating how posthuman and relational ethics can inform frameworks for responsible AI and sustainable innovation governance. For instance, von Schomberg (2013) situates 'responsible innovation' within a posthuman ethics of care, while Novelli et al. (2024) highlight algorithmic accountability as an ecological duty within AI policy. This posthuman repositioning aligns with Braidotti's (2019) and Barad's (2007) relational ontologies, which replace human exceptionalism with material–discursive entanglements.

Within this context, posthuman innovation ecologies have emerged as adaptive assemblages in which human and nonhuman actants co-produce knowledge. Jiao et al. (2025) provide a comprehensive review of how digital technologies reshape innovation pathways by transforming the mechanisms through which knowledge is generated, circulated, and commercialised. Their analysis highlights that emerging technologies such as AI, big data, and the Internet of Things do not merely support innovation processes but actively redefine the ontological foundations of innovation itself. Similarly, Floridi (2023) demonstrate that the ethics of planetary computation require rethinking innovation as a form of ecological participation rather than control. From a philosophical standpoint, Haraway's (2016) notion of staying with the trouble fosters an ethos of accountability within entangled technological and ecological assemblages.

Data infrastructures are central to this shift. Leonelli (2016) and Beer (2019) emphasise that data systems are not passive containers but active agents that structure epistemic visibility. Bibliometric and algorithmic analyses, traditionally viewed as neutral, can instead be read as performative practices that enact what they describe (Aria & Cuccurullo, 2017; Bryant, 2014). These algorithmic infrastructures now act as epistemic collaborators, nonhuman reading companions that participate in meaning-making within the posthuman knowledge economy.

The theoretical landscape also continues to evolve. Recent scholarship in posthumanism explores hybrid ecologies of cognition and creativity. Smith-Nunes (2025) conceptualises the body as a data artefact, while Sahu & Karmakar (2024) analyse posthuman sociality and affect in techno-cultural environments. Ferrando (2023) expand this perspective through affirmative posthuman ethics and extended cognition, framing innovation as a distributed, transhuman process across material and cognitive systems. Parallel bibliometric insights reveal similar epistemic expansions across sustainability and ecological innovation research (Dedeoğlu & Zampaki, 2023), suggesting that posthumanism's ethical orientation increasingly translates into applied, regenerative innovation models.

From an ecological standpoint, innovation must also be understood as planetary co-becoming (Braidotti, 2022). Ecological technicity (Hui, 2020; Bratton, 2021) shows how innovation participates in the biosphere's metabolism, linking knowledge-making to environmental

responsibility. These insights support Braidotti's (2022) call for an affirmative, ethical ecology of knowledge, one grounded in coexistence and interdependence rather than extraction.

However, epistemic asymmetries persist. Connell's (2007) theory of 'northern epistemology' underscores that much of posthuman and innovation research remains concentrated in the Global North. Bibliometric evidence from Prihadi & Lahbar (2025) and Abbas et al. (2021) confirms this bias, revealing underrepresentation of Southern epistemologies. Recognising this imbalance transforms bibliometric mapping into a reflexive tool, not merely an analytic technique but an ethical practice for exposing epistemic hierarchies.

Despite extensive research on innovation systems and research commercialisation, most prevailing frameworks remain rooted in anthropocentric epistemologies. Linear and managerial models, such as the Triple Helix or knowledge-transfer paradigms, continue to privilege human intentionality, creativity, and control as the primary sources of value creation (Etzkowitz & Leydesdorff, 2000; Shane, 2004). This anthropocentric bias obscures the increasingly distributed nature of innovation, where algorithmic systems, ecological infrastructures, and material agencies co-constitute knowledge production. A posthuman perspective challenges this limitation by decentring the human subject and recognising commercialisation as a relational and multi-agential process. It reimagines innovation not as a human-owned outcome but as a shared ecology of becoming, in which nonhuman entities such as technologies, data, and environments actively participate in generating epistemic and economic value.

Accordingly, this study adopts a reflexive bibliometric methodology to trace how posthuman thought permeates innovation and research commercialisation between 2020 and 2025. Using 448 Scopus-indexed documents, it generates keyword co-occurrence, density, and overlay maps in VOSviewer, framing the process as a posthuman intra-action between researcher, software, and data (Barad, 2007). Conceptually, the study offers an empirical cartography of posthuman innovation ecologies spanning ethics, materiality, and commercialisation. Methodologically, it advances bibliometric analysis as a posthuman epistemic practice that recognises algorithms as co-authors of knowledge. The findings reposition innovation as a distributed, ethical, and ecological process, an emergent co-becoming among human and nonhuman agencies in the age of algorithmic ecologies.

This study reimagines research commercialisation through posthuman innovation ecologies to explore how knowledge, technology, and ethics co-evolve. Within posthuman scholarship, the notion of ecology carries a lineage that extends beyond environmental metaphors toward relational and affective ontologies. Guattari's (2000) 'three ecologies' foreground the interdependence of mental, social, and environmental systems, while Haraway (2016) expands this sensibility through her call to 'stay with the trouble', inviting thinking-with rather than acting-upon the world. Building on these trajectories, Braidotti (2019) conceptualises posthuman knowledge as a vital network of transversal relations among human and nonhuman agencies. Framing innovation through this lineage allows the present study to treat research commercialisation not as an isolated economic function but as part of an evolving ecology of co-becoming, one that includes researchers, algorithms, institutions, and material environments in mutual transformation.

THEORETICAL FRAMEWORK

The posthuman condition signals a profound ontological and epistemological reorientation in how innovation and research commercialisation are conceived. Instead of positioning the

autonomous human subject as the primary source of creativity and value, posthumanism advances a relational ontology in which humans, technologies, and materials are co-constitutive participants in knowledge production (Braidotti, 2013, 2019; Barad, 2007; Latour, 2005). This study grounds its theoretical framework in a triadic synthesis of ontology, method, and ethics, proposing that innovation unfolds as an entangled process where agency is distributed, methods are performative, and ethics is immanent to knowledge creation. It aligns with recent scholarship that recognises bibliometric mapping and algorithmic analysis as posthuman epistemic practices (Prihadi & Lahbar, 2025).

Ontology: Distributed Agency and Relational Becoming

Posthuman ontology challenges Enlightenment humanism's conception of a rational, autonomous, and bounded individual by replacing it with a model of relational becoming, where agency arises from the entanglement of human and nonhuman forces (Barad, 2007; Braidotti, 2019; St Pierre, 2021). Barad's (2007) notion of intra-action, understood as the mutual constitution of phenomena, reveals that knowledge is not solely the product of human cognition but co-emerges through the material and discursive interplay among bodies, instruments, and environments. Knowing, therefore, is an ontological event rather than a representational act; relations create entities, not the reverse, and these entities are continually reconfigured through their entanglements.

Latour's (2005) Actor-Network Theory and Bennett's (2010) concept of vibrant matter extend this relational ontology by demonstrating that agency is not the prerogative of the human but an emergent property distributed across heterogeneous assemblages of people, technologies, infrastructures, and ecologies. Innovation, consequently, is not a linear expression of human ingenuity but a relational event of co-production that unfolds through multiple agencies operating within networks of material and cognitive exchange.

Empirical and philosophical studies increasingly affirm this distributed conception of agency. Research on algorithmic creativity and datafication demonstrates how nonhuman entities actively shape epistemic and practical outcomes (Beer, 2019; Kitchin, 2017; Leonelli, 2016). Bratton (2021) describes planetary computation as a system through which algorithmic infrastructures reorganise perception, material flows, and social coordination.

Recent theoretical developments further consolidate this shift from human-centred intentionality to relational vitality. Ferrando (2023) expands posthumanism into an ethics of affirmative coexistence, where creativity and knowledge emerge through interdependence rather than mastery. Stilgoe (2013) conceptualises algorithmic innovation as a socio-technical process within adaptive, distributed systems in which human judgement and machine learning continually negotiate creative and ethical agency. Hui (2020) position these dynamics within technological cosmologies, showing that infrastructures of computation constitute ontological and co-creative ecologies of thought, matter, and planetary energy.

Within this distributed ontology, research commercialisation no longer appears as a linear transfer of human knowledge but as a multiscalar process of co-becoming, in which laboratories, databases, patents, funding systems, and AI architectures collectively enact creativity and value. Ontology thus shifts from human mastery to distributed vitality, recognising that machines, materials, and ecosystems act alongside humans in the continual production of novelty (Gabrys, 2016; Ferrando, 2023). This posthuman ontology provides a living epistemic ecology through which innovation can be understood as a collaborative unfolding between the human and the

nonhuman, the cognitive and the material, the organic and the algorithmic. On this foundation, the next section turns to methodology, not as a neutral procedure but as a performative practice that materialises these relations. In this way, method becomes the operational expression of distributed agency within posthuman inquiry.

Method: Epistemic Cartography and Algorithmic Collaboration

Methodologically, this study adopts epistemic cartography (Braidotti, 2019) as a posthuman practice of mapping relations rather than representing static realities. Unlike positivist scientometrics, which treat bibliometric tools as neutral instruments, this approach recognises software environments such as Bibliometrix (Aria & Cuccurullo, 2017) and VOSviewer (van Eck & Waltman, 2010) as nonhuman collaborators, that is, algorithmic agents that participate in the production of knowledge. Rather than operating outside the research process, these computational systems are intra-actively entangled with it, shaping what becomes visible, thinkable, and measurable within the epistemic field.

Following Barad's (2007) principle of agential cuts, each computational operation, including data extraction, keyword clustering, or visualisation, constitutes a performative boundary-making act. These operations do not simply depict pre-existing knowledge structures but bring them into being. Algorithms thus function as epistemic co-authors, crafting specific material-discursive realities through their coded architectures and operational thresholds (Leonelli, 2016; Beer, 2019). What appears as an objective map is therefore the outcome of entangled agencies: the researcher's interpretive judgement, the software's algorithmic logic, and the dataset's material affordances collectively co-constitute the representation.

Stilgoe (2013) extends this view by describing algorithmic innovation as an adaptive mode of automation in which human and machine agencies co-evolve through iterative decision-making and sense-making. Rather than acting as passive intermediaries, algorithms actively configure the epistemic conditions of inquiry, performing theory in practice and shaping how knowledge and value are co-produced. Smith-Nunes (2025) deepens this interpretation by portraying data embodiment as an epistemic artefact, where the algorithm's capacity to sense and sort parallels human perception. Similarly, Sahu and Karmakar (2024) illustrate how algorithmic environments mediate new forms of sociality and affect, underscoring the ontological continuity between cognition and computation in posthuman systems of knowledge.

Empirical bibliometric research echoes this reflexivity. Studies by Tutar et al. (2023) and Abbas et al. (2021) show that bibliometric mapping has evolved into a reflective epistemic method through which scholars theorise knowledge production by examining its digital traces. Mapping is never neutral; it is an act of conceptual composition where algorithm and analyst together enact the field they seek to visualise.

In this study, bibliometric cartography becomes a philosophical experiment in thinking with machines (Alaimo, 2016; Braidotti, 2022; Verbeek, 2023). The analytical process is treated as a site of algorithmic collaboration, where human interpretation and machinic computation are entwined in shared epistemic labour. Through iterative dialogue with the software, adjusting parameters, validating clusters, and interpreting patterns, the researcher co-produces the very data under examination. To map is thus to make, and to analyse is to co-create the world one studies. This methodological stance resonates with Stilgoe's (2013) argument that algorithmic innovation functions as a distributed organisational logic through which human and machinic cognition jointly produce epistemic and economic outcomes across digital ecologies. Accordingly, the

present study situates bibliometric mapping not as a technical procedure but as a posthuman epistemic practice, one that performs knowledge rather than merely describing it. In a posthuman paradigm, methodology becomes a site of ethical and ontological enactment: a performative ecology of cognition where researchers, algorithms, and materials co-create the very conditions of knowing. If knowing is an act of world-making, then every methodological decision is also a moral one. The following section therefore turns to ethics as the immanent dimension of posthuman innovation, where responsibility emerges from relational coexistence rather than external regulation.

Ethics: Innovation as Ecological Coexistence

Following this methodological orientation, posthuman ethics dissolves the long-standing divide between ontology and responsibility, asserting that every act of knowing is simultaneously an act of world-making (Barad, 2007; Haraway, 2016). To understand the world, in this sense, is to participate in its continual becoming. Haraway (2016) reminds us that to "stay with the trouble" is to remain accountable to the multispecies and material relations that constitute existence, inhabiting the complex entanglements of living and non-living agencies without seeking mastery or transcendence. Ethics, therefore, is not an external rule but an embodied, situated practice of attentiveness and care within the more-than-human world.

Building upon this insight, Braidotti's (2019, 2022) affirmative ethics reframes ethical life as a celebration of interdependence, multiplicity, and generative vitality. It proposes an ethics of coexistence and co-evolution that resists both anthropocentric instrumentalism and techno-optimistic determinism. Within such a framework, the human ceases to be the sole moral agent, as ethics emerges from the entanglement of heterogeneous actants, including biological, technological, and ecological entities, each participating in the co-constitution of worlds. Bennett's (2010) concept of vital materialism echoes this sensibility, emphasising that ethics is not imposed from above but arises immanently from the shared vitality of matter itself.

In the context of research commercialisation and innovation studies, these ethical commitments acquire tangible resonance. As Crawford (2021) observes in Atlas of AI, computational infrastructures, data centres, and extractive economies are not ethically neutral; they reorganise planetary resources, epistemic hierarchies, and ecological futures. Birch et al. (2020) similarly describe data-driven innovation as a form of posthuman capitalism that transforms information into material power, raising questions of justice, access, and sustainability. The same infrastructures that enable scientific progress also reproduce exclusion, dependency, and environmental strain (Gabrys, 2016). Accordingly, ethics becomes inseparable from the infrastructures that sustain technological and epistemic life.

Recent scholarship deepens this ethical turn by situating posthumanism within planetary, technological, and decolonial ecologies. Floridi (2023) articulates digital ethics as an ecological duty rather than a regulatory mechanism, while Bratton (2021) conceptualise planetary computation as a moral field where technological progress intersects with environmental survival. Mbembe (2021) introduce decolonial perspectives, insisting that posthuman ethics must also address the material histories of extraction and epistemicide that underpin the Anthropocene. Ferrando (2023) advances an ethics of coexistence-in-difference, foregrounding relationality and mutual flourishing as the basis of posthuman responsibility.

In this light, posthuman innovation ecologies are not merely analytical constructs but ethical commitments to think and act within worlds of distributed agency. Innovation must therefore be

reimagined as a process of ethical coexistence: not the pursuit of efficiency or optimisation, but a negotiation among entangled planetary forces. Such an approach calls for attentiveness to the infrastructures and ecosystems that sustain technological life, from the energy grids that power computation to the biological and ecological systems that underpin production. Barad's (2010) notion of response-ability, understood as the capacity to respond within webs of relationality, offers an ethical horizon for this practice. To innovate, in the posthuman sense, is to cultivate this responsiveness, to sense, to care, and to remain answerable to the consequences of one's entanglements. Ethics thus becomes ecological praxis, a continuous, situated negotiation with the more-than-human world.

Ultimately, posthuman innovation ecologies are both theoretical and moral propositions. They call for a reorientation of research and commercialisation, moving from extraction to relation, from control to collaboration, and from efficiency to care. To enact such ethics is not to moralise technology but to live responsibly within its material flows, recognising that every algorithm, device, and idea participates in the shared task of world-making.

Synthesis: Toward a Posthuman Triadic Framework

The posthuman condition reconfigures ontology, method, and ethics by revealing their inseparability. In the humanist paradigm, ontology defined what is real, methodology prescribed how to know it, and ethics governed how to act upon it. Posthumanism collapses these separations; to exist is already to know and to act within entangled material and epistemic relations (Barad, 2007; Braidotti, 2019). This section synthesises these three dimensions into a triadic framework of posthuman innovation in which being, knowing, and doing emerge together as dynamic co-productions of human and nonhuman agencies.

Ontologically, innovation unfolds through distributed agency. Creativity does not emanate from an isolated inventor but arises within assemblages of people, algorithms, materials, and infrastructures (Latour, 2005; Bennett, 2010). These entities co-constitute one another through intra-action (Barad, 2007), forming plural ecologies that underlie research, design, and commercialisation. Innovation becomes an event of relational becoming, a field of potentiality where new configurations of knowledge and value continually emerge. Ferrando (2023) reminds us that posthuman ontology affirms coexistence and multiplicity, situating innovation within networks of interdependence rather than domination.

Methodologically, this ontology requires a performative epistemology—a mode of knowing that recognises its own material participation in the phenomena it studies. Epistemic cartography, as applied here through bibliometric mapping, is not detached observation but an act of world-making (Leonelli, 2016). Algorithms, software, and datasets do not merely process information; they enact agential cuts (Barad, 2007) that shape visibility and relational intensity within knowledge systems.. Embracing these agencies renders method reflexive, responsive, and co-creative, exemplifying what Braidotti (2022) calls thinking with machines.

Ethically, this framework extends towards ecological coexistence, recognising that every innovation participates in planetary systems of matter, energy, and care. Haraway's (2016) notion of response-ability encapsulates this sensibility: to innovate is to remain accountable to the more-than-human world that sustains it. Innovation, therefore, cannot be confined to market efficiency; it is a moral and material negotiation among actants within planetary ecologies (Floridi, 2023; Mbembe, 2021). Ethics is not external to ontology or method; it is their continuous enactment, the relational awareness that animates posthuman practice.

Integrating these dimensions yields a triadic framework for posthuman innovation: ontology as distributed agency and relational vitality, method as performative epistemic cartography, and ethics as ecological coexistence and response-ability. These are not discrete categories but mutually reinforcing modalities of posthuman becoming. Ontology provides the condition of entanglement, method enacts it, and ethics orients it towards care and responsibility. Each is already present in the others, forming a recursive loop of world-making.

Within this synthesis, bibliometric analysis transcends its instrumental role to become an epistemic enactment of posthuman thought. Mapping, linking, clustering, and visualising are philosophical gestures that materialise relations among heterogeneous entities, both human and algorithmic. In this performative process, innovation is not simply studied but enacted. Such a framework reflects the notion of technogenesis, understood as the co-evolution of technology and thought, alongside Tsing's (2015) idea of contaminated diversity, where collaboration and friction generate novelty. Posthuman innovation is thus not pure creation but co-becoming through complexity, situated in the interstitial spaces where data meets discourse, where ethics meets infrastructure, and where life, human and otherwise, persists through entanglement.

Ultimately, this triadic framework positions posthuman innovation ecologies as both philosophical orientation and methodological practice. To innovate is to engage ethically and materially with the distributed vitality of the world; to map these relations is to acknowledge participation in them. Commercialising research within this paradigm entails cultivating responsiveness and co-creating futures that are equitable, ecological, and alive.

This triadic synthesis provides the conceptual scaffolding for the empirical analysis that follows. If ontology, method, and ethics are inseparable in posthuman inquiry, then mapping knowledge must itself become a performative enactment of this triad. The next section translates these philosophical commitments into methodological practice by treating bibliometric cartography as a posthuman experiment in thinking with machines, where theory becomes materially operational within the entangled intra-actions of researcher, algorithm, and data.

METHODOLOGY

Building upon the preceding theoretical synthesis, this section translates posthuman principles into a reflexive methodological framework. Within a posthuman paradigm, methodology is not conceived as a neutral sequence of procedures but as a performative and relational field where human and nonhuman agencies co-produce knowledge (Barad, 2007; Braidotti, 2019). The study therefore positions bibliometric mapping as a form of epistemic cartography, a practice of tracing relations between texts, concepts, and algorithms. Software environments such as R (Bibliometrix v4.2.1) and VOSviewer v1.6.20 were not treated as external analytical tools but as algorithmic collaborators participating in the production of meaning (Leonelli, 2016; Beer, 2019). Accordingly, algorithms are considered co-authors in the epistemic choreography of research, mediating how data, theory, and interpretation intra-act within posthuman inquiry. Comparable reflexive approaches appear in recent work by Prihadi and Lahbar (2025), who used bibliometric mapping to visualise the diffusion of posthuman concepts in marine ecotourism, reinforcing the methodological convergence between posthuman ethics and data-driven inquiry.

Data Source, Retrieval, and Selection Criteria

All bibliographic records were extracted exclusively from Scopus on 20 August 2025. Scopus

was selected for its comprehensive multidisciplinary coverage, rigorous indexing criteria, and compatibility with bibliometric software environments. Its capacity for exporting structured metadata ensures seamless integration with R/Bibliometrix and VOSviewer. Compared with alternative databases, Scopus provides a balanced combination of breadth, data quality, and interoperability—features that render it particularly suited to constructing a reflexive cartography of posthuman innovation studies.

The search strategy was designed to ensure both conceptual inclusivity and epistemic coherence. Rather than relying on generic keyword retrieval, Boolean logic was iteratively refined to capture intersections between posthuman theory, innovation discourse, and research commercialisation. This approach ensured that the resulting corpus embodied the ontological and methodological hybridity characteristic of posthuman inquiry, where technology, agency, and knowledge systems co-evolve.

Scopus Boolean Query:

TITLE-ABS-KEY("posthuman" OR "posthumanism" OR "more-than-human" OR "nonhuman agency" OR "actor-network" OR "new materialism" OR "sociomaterial" OR "material agency")
AND TITLE-ABS-KEY("innovation" OR "entrepreneurship" OR "research commercialization" OR "research commercialisation" OR "technology transfer" OR "innovation ecosystem" OR "innovation policy" OR "academic entrepreneurship")
AND PUBYEAR > 2019 AND PUBYEAR < 2026
AND (LIMIT-TO (LANGUAGE, "English"))
AND (LIMIT-TO (DOCTYPE, "ar") OR LIMIT-TO (DOCTYPE, "re"))

The initial query yielded 161 records. Through iterative refinement—adding keywords such as “research translation”, “innovation management”, “knowledge economy”, and “creative industries”—a total of 448 unique Scopus documents (articles and reviews) were retained, covering 2020–2025. This six-year span captures the intensification of applied posthuman discourse, particularly the rise of AI-driven and ecological innovation studies.

Publications were included if they (i) were indexed in Scopus, (ii) appeared between 2020 and 2025, (iii) were written in English, and (iv) explicitly engaged with posthumanism, innovation, commercialisation, or related ethical-philosophical dimensions of technology. Records were excluded if they (i) were non-scholarly materials such as proceedings or editorials, (ii) discussed innovation or HCI without philosophical framing, or (iii) were duplicates or outside the timeframe. After screening, 448 publications were confirmed for analysis. Metadata were exported in CSV and BibTeX formats containing title, abstract, author(s), source title, year, keywords, DOI, and citations, following Scopus metadata standards for compatibility.

Data Cleaning and Harmonisation

Data cleaning was conducted in three iterative stages to ensure accuracy, reproducibility, and semantic coherence. First, the Scopus export was screened for incomplete fields, inconsistent author names, and non-standard keyword formats. Second, keyword normalisation was executed using a thesaurus-based merge list in VOSviewer, aligning variant spellings (e.g. commercialisation/commercialization; posthuman/posthumanism). Third, DOI-based deduplication confirmed that all 448 records were unique. The final metadata were standardised to include authors, title, abstract, journal, keywords, year, document type, and DOI. The cleaned dataset was exported in .csv format and archived in Zenodo (DOI: 10.5281/zenodo.17406980),

which is currently under review and will be made publicly available after verification.

Analytical Procedure

The bibliometric analysis integrated quantitative mapping with qualitative interpretation across four stages:
Step 1 – Descriptive Bibliometric Analysis: Publication trends, authorship, and citation averages were computed in Biblioshiny. Indicators such as annual output, country productivity, and citation impact provided a descriptive baseline of posthuman innovation scholarship between 2020 and 2025 (Donthu et al., 2021).
Step 2 – Keyword Co-occurrence and Network Clustering: Using VOSviewer 1.6.20, keyword co-occurrence analysis (fractional counting, minimum of 5 occurrences) produced five thematic clusters: (1) philosophical-ethical foundations; (2) new materialism and relational ontology; (3) gender and feminist innovation; (4) ecological and decolonial technologies; and (5) research commercialisation and entrepreneurship. Each cluster was interpreted hermeneutically as a manifestation of conceptual entanglement rather than statistical co-presence.
Step 3 – Thematic Evolution (Temporal Overlay): Overlay visualisations traced conceptual migration across the dataset, revealing a temporal shift from theoretical ethics (2020–2022) toward applied innovation and entrepreneurship (2023–2025), empirically confirming the transition toward posthuman innovation ecologies.
Step 4 – Conceptual Structure Mapping (MCA): Multiple Correspondence Analysis in Bibliometrix created a two-dimensional conceptual map revealing proximities among terms such as posthumanism, innovation, ethics, and commercialisation. Rather than treating it as taxonomy, the map was read as an epistemic cartography—a spatial enactment of thought.
All parameter choices (e.g. threshold = 5, minimum cluster size = 3) were documented to ensure transparency and reproducibility.

Reflexivity, Ethics, and Reproducibility

Following Barad (2007) and Haraway (2016), the analytical process was approached as an intra-action among researcher, dataset, and software. Each methodological decision—how to clean data, merge keywords, or visualise networks—constituted an entanglement of human intention and algorithmic affordance rather than a neutral operation. Algorithms were treated as epistemic collaborators that shape what can be seen, counted, and known (Leonelli, 2016). Reflexive notes documented how parameter adjustments influenced network topology, acknowledging the situated and partial nature of every visualisation. Recognising algorithmic agency transforms bibliometric mapping into a form of situated co-production where meaning emerges through the interplay of researcher, code, and data. This resonates with posthuman ethics as response-ability (Haraway, 2016), requiring attentiveness to how methodological choices configure inclusion and exclusion within knowledge ecologies.
Ethically, the study adheres to open-data principles: all metadata are publicly accessible via Scopus, and no personal data were involved. However, epistemic justice necessitates recognising that Scopus privileges English-language and Western publications, potentially marginalising alternative epistemologies (Birch et al., 2020). Addressing this limitation is integral to maintaining posthuman responsibility and accountability within more-than-human entanglements of knowledge.

To ensure reproducibility, all bibliometric analyses employed consistent parameters across Bibliometrix (R v4.2.1) and VOSviewer (v1.6.20). Table 1 summarises the key configuration settings, enabling methodological transparency and reflexive replication.

Table 1. Summary of Parameter Settings for Reflexive Bibliometric Mapping

Parameter	Specification/Setting
Software / Environment	R (Bibliometrix v4.2.1); VOSviewer v1.6.20
Counting Method	Fractional counting (recommended for conceptual balance)
Minimum Keyword Occurrences	5
Minimum Cluster Size	3 nodes
Clustering Resolution	1.00 (default VOSviewer modularity)
Link Strength Normalisation	Association strength
Temporal Overlay Parameter	Year of publication (2020–2025 gradient)
MCA (Conceptual Structure Mapping)	Two-dimensional solution; k-means = 5
Threshold Adjustments	Iteratively tested (min = 3; max = 7) to preserve conceptual density
Data Cleaning Log	DOI-based deduplication; keyword stemming and synonym merging; manual harmonisation of source titles
Reproducibility Materials	Cleaned dataset (Scopus, n = 448) and R scripts archived in Zenodo (DOI: 10.5281/zenodo.17406980; currently under review).

Source: Author's configuration based on Scopus, 2025

RESULTS AND DISCUSSION

Descriptive Overview

The bibliometric dataset (n = 448) captures scholarly intersections between posthumanism, innovation, and research commercialisation from 2020 to 2025. The overall trend reveals an upward trajectory beginning in 2021, with annual publications increasing by 42% between 2021 and 2024. This growth reflects how posthuman and new materialist discourses are gradually diffusing into domains once confined to managerial and economic logics (Donthu et al., 2021; Ferrando, 2023). Philosophical venues such as Journal of Posthumanism, Theory, Culture & Society, and Philosophy & Technology coexist with applied outlets like Research Policy and Journal of Responsible Technology, signalling an epistemic convergence between critical humanities and innovation management (Braidotti, 2022; Kitchin, 2017; Crawford & Joler, 2018).

Geographically, the leading contributors are the United States (n = 76), United Kingdom (n = 74), and Australia (n = 40), followed by Canada (n = 28), China (n = 26), and several European and Global South countries including South Africa, Germany, India, the Netherlands, and Sweden. This distribution reflects the enduring Euro-Atlantic philosophical traditions of posthumanism while revealing emerging centres of theoretical and applied innovation in Asia and the Global South (Leonelli, 2016; AlShehhi et al., 2022; Connell, 2007).

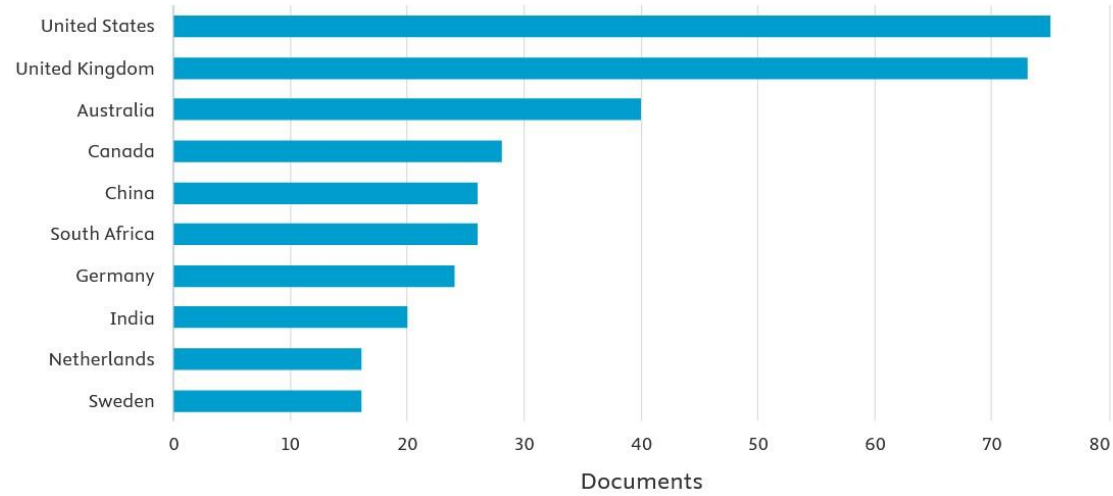

Figure 1. Top 10 Countries contributing to posthumanism and innovation research (Source: Scopus 2020–2025, processed by author, 2025)

The figure visualises this geographic distribution, showing that the United States and United Kingdom continue to dominate the field, followed by Australia, Canada, and China. Yet the trend also indicates an epistemic shift: traditional Euro-American dominance now coexists with growing Global South participation, marking the pluralisation of posthuman innovation ecologies.

From a posthuman perspective, this distribution is performative; it enacts and reproduces geopolitical asymmetries embedded in academic infrastructures. The prominence of Anglophone and Western European scholarship mirrors the linguistic, institutional, and algorithmic biases of databases such as Scopus (Birch et al., 2020). Hence, bibliometric visualisation is not a neutral representation but a co-constitutive agent in shaping epistemic geographies (Braidotti, 2022).

Table 2. Descriptive Overview of the Dataset (Scopus 2020–2025)

Indicator	Description	Value
Data Source	Scopus (Elsevier)	2020–2025
Document Types	Articles, Reviews	448
Average Citations per Document	6.4	
Authors	987 unique	
Journals Represented	233	
Leading Journals	Journal of Posthumanism, Research Policy, Theory, Culture & Society	
Keywords (cleaned)	2,186	
Most Frequent Terms	posthumanism, ethics, innovation, entrepreneurship, sustainability, research commercialisation	

Source: Scopus, 2025

Conceptual Network

The keyword co-occurrence network generated in VOSviewer (Figure 2) visualises 102

significant keywords (minimum threshold = 5 occurrences) drawn from the Scopus dataset. The resulting configuration delineates five major clusters that collectively compose the evolving research ecology of posthuman innovation.

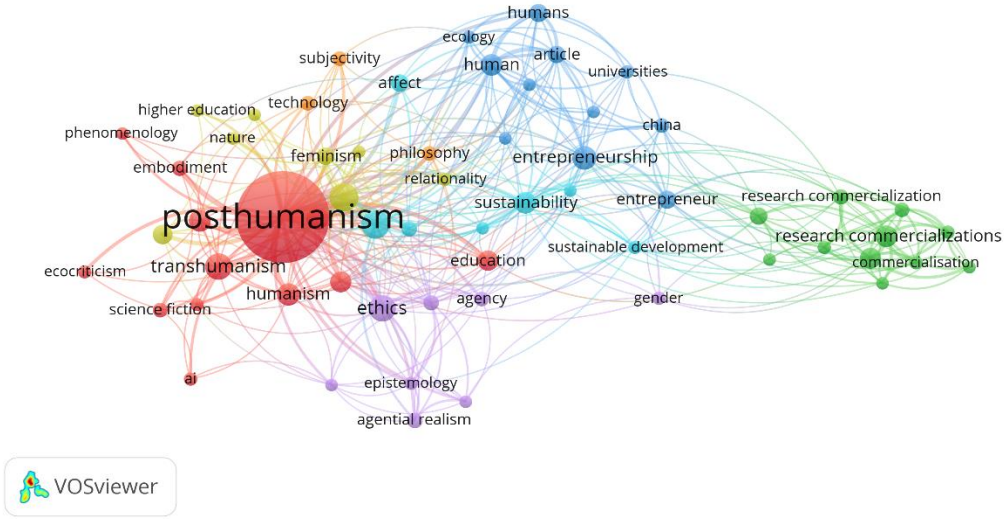

Figure 2. Keyword co-occurrence network of posthumanism and innovation (VOSviewer, 2020–2025). Source: Scopus Data Processed by Author, 2025

The network illustrates five conceptual clusters derived from keyword co-occurrence analysis. The size of each node represents keyword frequency, while proximity indicates conceptual affinity. Beyond their visual appeal, these clusters can be read as distinct yet entangled trajectories of thought—spanning philosophical foundations, relational ontologies, ethical materialism, and applied innovation practices. Rather than treating them as static categories, the clusters trace ongoing negotiations between theory and application, revealing how posthumanism continually rearticulates innovation across epistemic and disciplinary boundaries.

Table 3. Thematic Clusters of Posthuman Innovation Ecologies (2020–2025)

Cluster	Dominant Keywords (simplified)	Representative Focus	Interpretive Dimension	Key References (selected)
Cluster 1: Philosophical–Ethical Core	posthumanism, ethics, agential realism, epistemology, subjectivity	Foundations of posthuman thought, ethics of becoming, relational ontology	Establishes moral and ontological basis for rethinking human agency	Barad (2007, 2014); Braidotti (2019, 2022); Haraway (2016); Ferrando (2023); Bennett (2010)
Cluster 2: New Materialism & Relational Ontology	new materialism, affect, embodiment, agency, ecology	Distributed vitality, material agency, multispecies entanglement	Reconceives innovation as an emergent co-production among matter, bodies, and	Alaimo (2016); Gabrys (2016); Tsing (2015); Hui (2020)

			technologies	
Cluster 3: Gender & Feminist Innovation	feminism, gender, relationality, affect, higher education	Feminist ethics, embodied cognition, creative economies	Frames innovation as affective, inclusive, and care-oriented practice	Ferrando (2023); Åsberg (2010); Braidotti (2022); Barad (2014)
Cluster 4: Ecological & Decolonial Technoscience	sustainability, ecology, decolonial, nature, environment	Planetary ethics, decolonial AI, ecological infrastructures	Expands innovation beyond human progress to multispecies coexistence	Bratton (2021); Mbembe (2021); Crawford & Joler (2018)
Cluster 5: Research Commercialisation & Entrepreneurial Systems	entrepreneurship, innovation, research commercialisation, university, sustainable development	Academic capitalism, distributed innovation, digital entrepreneurship	Applies posthuman theory to innovation ecosystems and market translation	Etzkowitz & Leydesdorff (2000); Shane (2004); Kitchin (2017)

Source: Author's configuration based on Scopus and VOSviewer, 2025

Density and Temporal Shifts

The density visualisation highlights conceptual concentrations around posthumanism, ethics, new materialism, and AI. Denser regions (in yellow) indicate areas of sustained discursive intensity, suggesting a stable philosophical nucleus that anchors the field. High-density zones denote persistent conceptual attention, while the gradual movement from abstract to applied terms reflects a temporal drift toward praxis and situated experimentation.

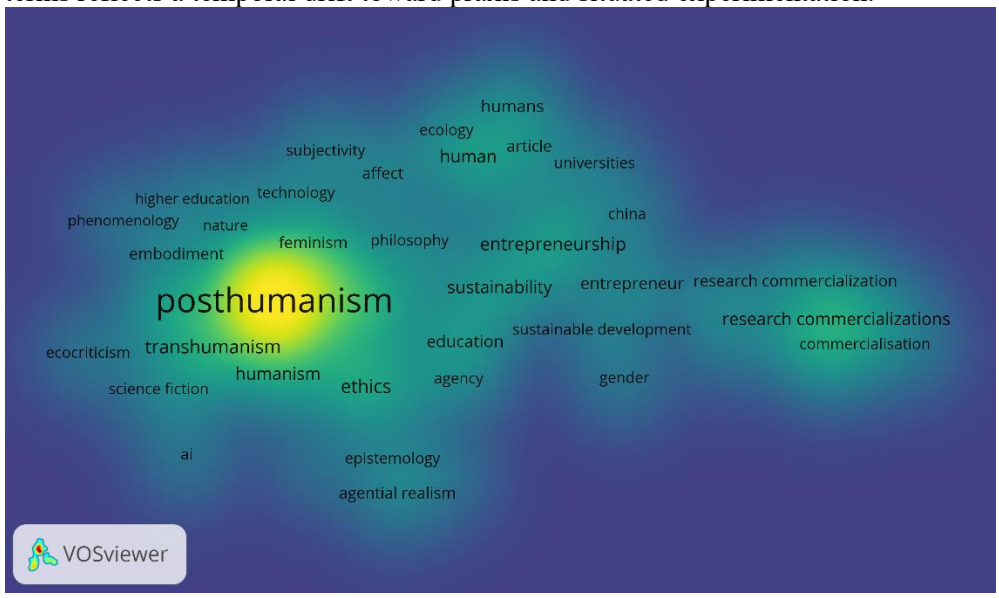

Figure 3. Density Visualisation of Conceptual Concentrations (Source: Data Processed by

Author, 2025)

The overlay visualisation (2020–2025) traces a chronological transformation. Earlier studies (2020–2022) concentrated on theoretical ethics and ontology, whereas more recent works (2023–2025) have gravitated toward applied themes, particularly entrepreneurship, ecological innovation, and algorithmic agency. This temporal shift aligns with what Crawford and Joler (2018) call planetary intelligence: the entanglement of algorithmic infrastructures, extractive data economies, and ecological materialities that collectively contour the horizon of posthuman innovation. Such movement exemplifies epistemic migration (Leonelli, 2016), the relocation of ideas across material and institutional infrastructures, and resonates with Barad's (2014) notion of diffraction, where methodological entanglements bend, scatter, and transform theoretical trajectories.

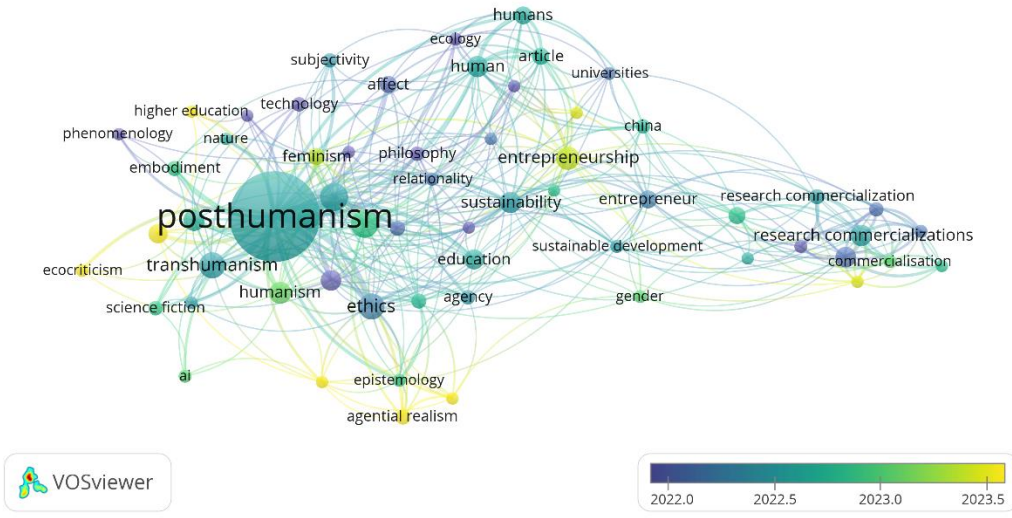

Figure 4. Overlay Visualisation (Source: Data Processed by Author, 2025)

Colour scale indicates publication year (blue = early; yellow = recent). The gradient confirms an epistemic migration from philosophical foundations to applied innovation.
These empirical cartographies together affirm the emergence of posthuman innovation ecologies, distributed and relational systems where innovation, ethics, and ecology coalesce into shared processes of invention.

Interpreting Thematic Clusters

The five clusters delineated above compose a relational topology of posthuman innovation ecologies. Their interplay reveals that innovation is no longer a human-led enterprise but a distributed co-becoming among human, technological, and ecological actors (Braidotti, 2022; Bennett, 2010).

Clusters 1–2, the philosophical-ethical and materialist cores—constitute the field's ontological foundation. They articulate shared agency between subjects, machines, and matter, challenging the liberal-humanist notion of creativity as individual property (Barad, 2007; Ferrando, 2023). Clusters 3–4 extend this movement into feminist and ecological technoscience, where ethics becomes affective and planetary, aligning with Haraway's (2016) "response-ability" and Floridi's (2023) "ecological digital ethics." Illustrative examples on decolonising technoscience and Crawford & Joler (2018) on the planetary costs of AI. Cluster 5 translates theory into practice, reframing entrepreneurship and commercialisation as ethical ecologies of production (Etzkowitz & Leydesdorff, 2000).

This distributed understanding of innovation also resonates with Piacente's (2022) conception of philosophical posthumanism and intentionality, which reframes intention not as an exclusively human cognitive act but as an emergent property of relational material processes. In this view, intentionality itself becomes distributed across human, technological, and ecological assemblages that co-generate thought, perception, and invention. Such an account deepens the ontological shift observed in posthuman innovation ecologies—where thinking, creating, and acting are no longer bound to individual consciousness but unfold within the collective dynamics of matter, code, and affect. By situating intentionality within these entangled processes, Piacente's argument bridges the philosophical and empirical dimensions of this study, illustrating how innovation operates as a field of shared becoming rather than human mastery.

Conceptually, these clusters converge around three theoretical pillars: ontology, method, and ethics. The philosophical and materialist clusters correspond to ontological inquiry; the feminist and ecological ones enact the ethical turn; and the commercialisation cluster bridges ontology and method, translating posthuman principles into empirical practice. Collectively, they reveal posthuman innovation as an interwoven process of knowing, doing, and caring.

Innovation thus appears as a philosophical-economic interface in which distributed intelligences, human, digital, and ecological, generate new value formations. This dynamic confirms what Ferrando (2023) terms affirmative posthumanism: a framework that moves beyond critique toward creative coexistence among multiple ontologies.

The Triadic Framework of Posthuman Innovation

The triadic model in Figure 5 synthesises the ontological (distributed agency), methodological (algorithmic collaboration), and ethical (ecological coexistence) pillars of posthuman innovation. It reframes research commercialisation not as a transactional process but as a living ecology of relational entanglement.

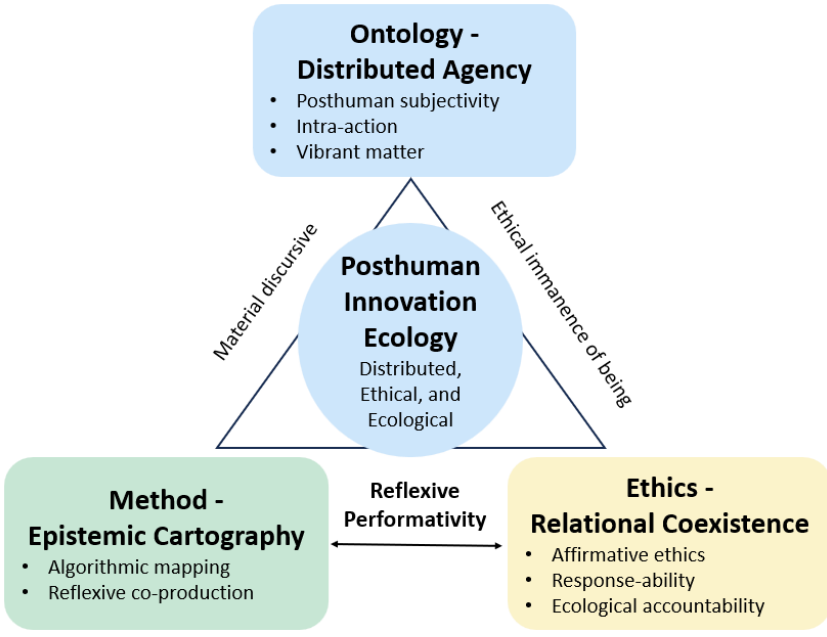

Figure 5. Conceptual Triadic Framework of Posthuman Innovation Ecologies (Source: Author's synthesis based on Barad (2007), Bennett (2010), Haraway (2016), Braidotti (2019, 2022), Floridi (2023), and Hui (2019))

This diagram integrates ontology, method, and ethics to demonstrate how human and nonhuman agencies co-produce innovation. The framework aligns empirical mapping with philosophical reflection, transforming bibliometric analysis itself into a posthuman practice.
By weaving empirical visualisation with philosophical reasoning, the framework affirms the epistemic legitimacy of hybrid methods. Bibliometric mapping, far from being a detached metric, becomes an epistemic artefact, a site where algorithms, scholars, and data collectively think. This enactment of thinking-with-machines transforms scientometrics into a form of philosophical experimentation (Leonelli, 2016; Beer, 2019).

Philosophical Reflection: From Data to Thought

The findings collectively materialise the philosophical proposition that knowledge is relational, performative, and embodied. The posthuman condition redefines innovation as an ecology of co-production, where commercialisation processes are as much ethical and epistemic as they are economic (Braidotti, 2022; Haraway, 2016). Thus, the bibliometric visualisations in this study do more than represent scholarly trends, they perform the posthuman. Algorithms and researchers together enact agential cuts (Barad, 2007), shaping what becomes visible as "knowledge." Such reflexive recognition turns the act of mapping itself into an ethical praxis of accountability within the knowledge economy. Comparable insights can be found in recent bibliometric analyses of posthuman education and AI integration (Rasdiana et al., 2025; Gunawan & Indrawan, 2025), which reveal how algorithmic visualisation practices actively participate in producing situated, reflexive knowledge rather than merely describing it.

Posthuman Knowledge Economies and Cosmotechnics

As knowledge infrastructures become algorithmic, commercialisation becomes a planetary question of cosmotechnics (Hui, 2020). Diverse epistemic systems—academic, technological, ecological, interact as plural rationalities of innovation. Posthuman commercialisation therefore demands epistemic pluralism, valuing multiple ways of knowing beyond Western industrial paradigms (de Sousa Santos, 2018; Mbembe, 2021). This epistemic pluralism echoes the call for decolonising science education and integrating Indigenous knowledge systems within posthuman frameworks (Gunawan & Indrawan, 2025), demonstrating how cosmotechnical diversity strengthens global knowledge justice.

Bibliometric evidence of cross-disciplinary linkages among posthumanism, ecology, and entrepreneurship reflects this pluralisation of technics and a turn toward situated, care-based innovation. Such diversity is essential for confronting planetary crises of knowledge inequality and ecological precarity (Crawford, 2021; Birch et al., 2020). Parallel patterns are identified in posthuman sustainability research (Dedeoğlu & Zampaki, 2023), which conceptualises ecological innovation as an ethics of care and regenerative coexistence across human–nonhuman relations.

This study also underscores that bibliometric mapping is a posthuman practice of thinking-with algorithms. Researcher and software intra-act to co-produce the epistemic artefact called "knowledge." Each methodological choice, including threshold, cluster, and colour, constitutes an ethical cut shaping what worlds become visible. Following Haraway's (1988) situated knowledges, the results are partial yet accountable. To map is to intervene; to visualise is to perform the world into being. Hence, this cartography of posthuman innovation is both a map and an event—a living assemblage embodying the philosophy it theorises. These methodological insights align with Castañeda et al. (2025), whose analysis of AI-driven forensics similarly reframes algorithmic processes as active epistemic participants rather than neutral analytical tools.

Posthuman innovation ecologies disrupt the linear, anthropocentric assumptions of conventional commercialisation models. Frameworks such as the Triple Helix (Etzkowitz & Leydesdorff, 2000) and its Quadruple or Quintuple extensions still centre human institutions and intentional agency. A posthuman perspective instead reconfigures commercialisation as an emergent, multi-agential process distributed across human and nonhuman entities such as algorithms, materials, infrastructures, and ecosystems that co-produce epistemic and economic value. Innovation thus unfolds not through fixed institutional channels but through intra-active processes where knowledge, matter, and technology continuously remake one another. This shift moves from management and control toward participation and care, reframing commercialisation as a relational ethics of co-creation within planetary knowledge networks.

Recent developments in generative and affective AI further illuminate these dynamics. Dwi (2025) argues that responsible and inclusive innovation requires recognising the ethical and psychological entanglements of human and algorithmic agencies, positioning care and accountability as central to posthuman knowledge economies. Hu et al. (2025) extend this by demonstrating that entrepreneurial competence itself becomes a posthuman capacity distributed across human–technological ecosystems, reinforcing innovation as a collective process of co-becoming.

Furthermore, posthuman innovation ecologies invite a decolonial re-reading of posthumanism. Scholars such as Wynter (2003) and Mignolo (2018) remind us that "the human" is historically

shaped by colonial hierarchies of knowledge and power. Their perspectives situate innovation within pluriversal epistemologies where Southern and Indigenous cosmotechnics participate as equal agents in shaping futures of innovation. This ensures posthumanism remains a living, responsive ethics of co-creation. Recent bibliometric evidence by Garcés-Giraldo et al. (2025) reinforces this pluriversal turn, showing how open science practices and global collaboration infrastructures operationalise decolonial posthumanism through inclusive epistemic participation.

CONCLUSION

The study reimagines research commercialisation through the lens of posthuman innovation ecologies, tracing how posthuman thought permeates the landscape of innovation studies between 2020 and 2025. By integrating bibliometric mapping with posthuman theory, it demonstrates that innovation is not a human-centred act of creation but a distributed ecology of relations among humans, technologies, and materials.

Epistemic Integration

This research integrates empirical bibliometric mapping with posthuman epistemology, advancing a reflexive approach in which algorithms, researchers, and data collaboratively generate knowledge. Bibliometric analysis here becomes a posthuman epistemic practice—a method of thinking-with machines rather than simply using them as analytic tools. This epistemic integration illustrates how digital infrastructures participate in knowledge production as active co-agents.

Ontological Reorientation

The findings reorient innovation ontology from linear, anthropocentric frameworks (e.g., Triple Helix) toward relational, multi-agential ecologies. Innovation unfolds through material and discursive intra-actions across computational, ecological, and institutional domains. By decentring human intentionality, the study situates research commercialisation within an evolving network of algorithmic, environmental, and cognitive agencies that co-constitute value.

Ethical Reconfiguration

The study also reconfigures ethics as an immanent dimension of knowledge production rather than an external regulatory framework. Posthuman ethics foregrounds response-ability—the capacity to act with and through nonhuman others—transforming commercialisation from a system of extraction into a practice of relational care and co-creation. In this sense, innovation becomes an ethical negotiation within planetary ecologies of knowledge.

Collectively, these contributions articulate a posthuman model of research commercialisation grounded in epistemic integration, ontological reorientation, and ethical reconfiguration. They reposition innovation as an emergent process of collaborative world-making, an ongoing co-becoming among human and nonhuman actors. Such a view calls for new forms of institutional reflexivity and policy design that embrace participation, responsibility, and ecological accountability as central to future knowledge economies.

Methodological and Practical Implications

Methodologically, this study demonstrates that algorithmic cartography can function as a

posthuman inquiry, blurring boundaries between data science, philosophy, and ethics. Tools such as VOSviewer and Bibliometrix are not mere analytical instruments but epistemic agents that shape the ontology of knowledge fields. Future researchers are encouraged to treat algorithms as collaborators, document parameter choices reflexively, and publish reproducible workflows that acknowledge algorithmic agency. Beyond methodological rigour, the posthuman turn invites an axiological reflection on the values that orient innovation itself.

Extending the ethical reconfiguration of posthuman innovation, it becomes essential to recognise that innovation is not only an epistemic and ontological process but also an axiological one, shaped by values of care, justice, and regeneration. Puig de la Bellacasa (2017) reminds us that matters of care demand affective and material engagement with the worlds we co-create. Within posthuman innovation ecologies, care functions as both an epistemic and ethical practice: to innovate is to sustain and repair relational networks among human and nonhuman entities rather than to dominate them. Justice, similarly, emerges not as distributive fairness but as situated responsibility—an awareness of how technological and epistemic infrastructures include or exclude particular forms of life and knowledge (Mbembe, 2021). Finally, regeneration reframes the purpose of commercialisation as the renewal of planetary relations rather than their extraction, aligning with Braidotti's (2022) call for an affirmative ethics of coexistence.

Thus, posthuman innovation requires a triadic axiological grounding: care as affective maintenance, justice as relational accountability, and regeneration as planetary continuation. Embedding these values into innovation policy and research evaluation systems can transform commercialisation from a market-driven goal into a planetary ethic of co-creation and endurance, ensuring that posthuman knowledge economies remain life-sustaining rather than exploitative.

Practically, these insights have implications for universities, research funders, and policymakers. Recognising innovation as a distributed ecology calls for a paradigm shift in how impact and commercialisation are evaluated. Instead of measuring outputs solely in economic terms, assessment should account for ethical sustainability, technological inclusivity, and planetary care. Such an approach aligns with responsible innovation frameworks and the ethics of more-than-human coexistence articulated in the UN Sustainable Development Goals.

Limitations and Pathways for Future Research

While comprehensive in scope, this study recognises several limitations. Scopus's bias toward English-language and Global North publications may obscure alternative epistemologies from the Global South. Future research could broaden the corpus through Web of Science, Dimensions, or non-indexed Indigenous archives to reveal pluriversal perspectives on posthuman innovation. Further inquiry is also needed into how posthuman innovation manifests in applied domains such as AI ethics, biotechnology, climate adaptation, and the digital humanities, employing multi-method or post-qualitative designs (St. Pierre, 2021). Bibliometric–ethnographic hybrids could empirically examine how algorithms and humans co-create research value, extending the reflexive potential of this approach.

Future studies might also apply Bibliometrix's thematic evolution tools to trace epistemic shifts over longer temporal spans (e.g., 2000–2030) or integrate topic modelling and AI-assisted discourse analysis to complement human interpretation. These computational futures align with posthumanism's central premise that thinking is distributed, material, and shared among diverse agencies.

Concluding Reflections: Toward a Posthuman Ethos of Innovation

The central argument of this paper is that to innovate posthumanly is to innovate responsibly. Knowledge production must be reimagined as a co-creative, ethical, and ecological enterprise. The challenge is not to make innovation more human, but more than human—open, accountable, and entangled with the planetary networks that sustain life.

By reframing research commercialisation as a posthuman innovation ecology, this study advances an intellectual movement that unites epistemology and ethics, theory and world-making. The algorithmic and conceptual cartographies produced here invite reflection on what it means to know, act, and care in the age of algorithmic technogenesis.

This research contributes to posthuman innovation scholarship in three primary ways. First, it redefines bibliometric analysis as a performative, posthuman methodology that recognises algorithms as co-authors of knowledge. Second, it integrates scientometric techniques with philosophical reflexivity, illustrating how digital infrastructures participate in theory-making. Third, it offers an applied model for studying commercialisation as a distributed ecology of ethical and material entanglements. Together, these contributions position bibliometric mapping as a site of empirical and philosophical co-creation—a posthuman experiment in thinking with machines.

The future of research commercialisation lies not in human mastery over technology but in coexistence with the more-than-human agencies that shape our shared epistemic and ecological futures.

Data Availability Statement

All bibliometric data used in this study were obtained from Scopus (Elsevier) and are provided as a cleaned CSV dataset archived in Zenodo (DOI: 10.5281/zenodo.17406980). The dataset is currently under review and will be made publicly accessible upon completion of the verification process. The reproducible R code (Bibliometrix workflow) supporting the analysis is available upon reasonable request from the corresponding author.

Ethical Note

No human or animal subjects were involved. The study adheres to the principles of epistemic justice and situated knowledge, recognising the partial, relational, and performative nature of all scientific inquiry.

References

Abbas, A. F., Jusoh, A., Masod, A., Ali, J., Alsharif, A. H., & Alharthi, R. H. E. (2021). A bibliometric analysis of publications on social media influencers using VOSviewer. Journal of Theoretical and Applied Information Technology, 99(23), 5662–5676. https://www.researchgate.net/publication/357166616

Alaimo, C & Kallinikos, J. (2022) Organizations Decentered: Data Objects, Technology and Knowledge. Organization Science 33(1):19-37. https://doi.org/10.1287/orsc.2021.1552

Alaimo, S. (2016). Exposed: Environmental Politics and Pleasures in Posthuman Times. University of Minnesota Press.

AlShehhi, A. M. A. A., Nasir, B. B. M., Kilani, A., Abuhassna, H., & Awae, F. (2022). Exploring the Role of Diversity on Management and Attitude: A Bibliometric Analysis. International

Journal of Academic Research in Progressive Education and Development, 11(3), 1217-1231. http://dx.doi.org/10.6007/IJARPED/v11-i3/15370

Aria, M., & Cuccurullo, C. (2017). Bibliometrix: An R-tool for comprehensive science mapping analysis. Journal of Informetrics, 11(4), 959–975. https://doi.org/10.1016/j.joi.2017.08.007

Åsberg, C. & Lykke, N. (2010). Feminist Technoscience Studies. European Journal of Women's Studies, 17)4): 299-305. https://doi.org/10.1177/1350506810377692

Atencio, G.S. (2025). The challenges and opportunities for ethics in generative artificial intelligence in the digital age. Revista DYNA, 92(236), 26-35. https://doi.org/10.15446/dyna.v92n236.117144

Barad, K. (2007). Meeting the Universe Halfway: Quantum Physics and the Entanglement of Matter and Meaning. Duke University Press.

Barad, K. (2010). Quantum entanglements and hauntological relations of inheritance: Dis/continuities, spacetime enfoldings, and justice-to-come. Derrida Today, 3(2), 240–268. https://doi.org/10.3366/drt.2010.0206

Barad, K. (2014). Diffracting diffraction: Cutting together-apart. Parallax, 20(3), 168–187. https://doi.org/10.1080/13534645.2014.927623

Beer, D. (2019). The Data Gaze: Capitalism, Power and Perception. Sage.

Bennett, J. (2010). Vibrant Matter: A Political Ecology of Things. Duke University Press.

Birch, K., Cochrane, D., & Ward, C. (2020). Data-driven innovation and posthuman capital. Research Policy, 49(1), 103871. https://doi.org/10.1016/j.respol.2019.103871

Braidotti, R. (2013). The Posthuman. Polity Press.

Braidotti, R. (2019). Posthuman Knowledge. Polity Press.

Braidotti, R. (2022). Posthuman Feminism. Polity Press.

Bratton, B. (2021). The Revenge of the Real: Politics for a Post-Pandemic World. Verso.

Bryant, L. R. (2014). Onto-Cartography: An Ontology of Machines and Media. Edinburgh University Press.

Castañeda R, H., López, B., Ruiz O, J. H., & Pérez P, J. J. (2025). Artificial intelligence and digital forensics: A powerful alliance – A bibliometric review. Journal of Posthumanism, 5(7), Article 2945. https://doi.org/10.63332/joph.v5i7.2945

Connell, R. (2007). Southern Theory: The Global Dynamics of Knowledge in Social Science. Polity Press.

Crawford, K. (2021). Atlas of AI: Power, Politics, and the Planetary Costs of Artificial Intelligence. Yale University Press.

Crawford, K., & Joler, V. (2018). Anatomy of an AI System: The Amazon Echo as an anatomical map of human labor, data and planetary resources. Share Lab And Ai Now Institute. https://anatomyof.ai/img/ai-anatomy-publication.pdf

Dedeoğlu, Ç., & Zampaki, N. (2023). Posthumanism for sustainability: A scoping review. Journal of Posthumanism, 3(1), Article 2761. https://doi.org/10.33182/joph.v3i1.2761

de Sousa Santos, B. (2018). The End of the Cognitive Empire: The Coming of Age of Epistemologies of the South. Duke University Press.

Donthu, N., Kumar, S., Mukherjee, D., Pandey, N., & Lim, W. M. (2021). How to conduct a bibliometric analysis: An overview and guidelines. Journal of Business Research, 133, 285–296. https://doi.org/10.1016/j.jbusres.2021.04.070

Dwi, M. (2025). Ethical and psychological implications of generative AI in digital afterlife technologies: A systematic literature review on responsible inclusive innovation. Journal

of Responsible Technology, 24, 100136. https://doi.org/10.1016/j.jrt.2025.100136
Etzkowitz, H., & Leydesdorff, L. (2000). The dynamics of innovation: From National Systems and Mode 2 to a Triple Helix of university–industry–government relations. Research Policy, 29(2), 109–123. https://doi.org/10.1016/S0048-7333(99)00055-4
Ferrando, F. (2019). Philosophical Posthumanism. Bloomsbury Academic.
Ferrando, F. (2023). Posthuman Affirmations and Ethics of Co-Existence. Bloomsbury Academic.
Floridi, L. (2023). The Ethics of Artificial Intelligence: Principles, Challenges, and Opportunities. Oxford University Press.
Gabrys, J. (2016). Program Earth: Environmental Sensing Technology and the Making of a Computational Planet. University of Minnesota Press.
Garcés G, L. F., Valencia-Arias, A., Suárez-Pizzarello, M., Rodríguez F, E. A., Rodríguez-Correa, P. A., Cardona-Acevedo, S., & Velásquez O, J. A. (2025). Integration of technologies in daily life in smart homes: A bibliometric approach. Journal of Posthumanism, 5(5), Article 1715. https://doi.org/10.63332/joph.v5i5.1715
Guattari, F. (2000). The three ecologies. London & New Brunswick, NJ: The Athlone Press.
Guenduez, A. A., Walker, N., & Demircioglu, M. A. (2025). Digital ethics: Global trends and divergent paths. Government Information Quarterly, 42(1), 102037. https://doi.org/10.1016/j.giq.2025.102050
Gunawan, K. D. H., & Indrawan, I. P. O. (2025). Decolonising science education: A bibliometric analysis of Indigenous knowledge integration in global STEM. Journal of Posthumanism, 5(5), Article 1651. https://doi.org/10.63332/joph.v5i5.1651
Händel, M., Berges, MP., Gläser-Zikuda, M. et al. Who is savvy about digital ethics? Differences between teacher education, law, and computer science students. Educ Inf Technol (2025). https://doi.org/10.1007/s10639-025-13714-2
Haraway, D. (1988). Situated knowledges: The science question in feminism and the privilege of partial perspective. Feminist Studies, 14(3), 575–599. https://doi.org/10.2307/3178066
Haraway, D. (2016). Staying with the Trouble: Making Kin in the Chthulucene. Duke University Press.
Hu, W., Chookhampaeng, C., & Chano, J. (2025). A posthuman perspective on entrepreneurial competence development for vocational college students. Journal of Posthumanism, 5(5), Article 1541. https://doi.org/10.63332/joph.v5i5.1541
Hui, Y. (2019). Recursivity and Contingency. Rowman & Littlefield.
Hui, Y. (2020). Art and Cosmotechnics. University of Minnesota Press.
Jiao, H., Wang, T., Libaers, D., Yang, J., & Hu, L. (2025). The relationship between digital technologies and innovation: A review, critique, and research agenda. Journal of Innovation & Knowledge, 10(1), 100638. https://doi.org/10.1016/j.jik.2024.100638
Kitchin, R. (2017). The Data Revolution: Big Data, Open Data, Data Infrastructures and Their Consequences. Sage.
Latour, B. (2005). Reassembling the Social: An Introduction to Actor–Network Theory. Oxford University Press.
Leonelli, S. (2016). Locating ethics in data science: Responsibility and accountability in global and distributed knowledge production systems. Philosophical Transactions of the Royal Society A, 374(2083), 20160122. https://doi.org/10.1098/rsta.2016.0122
Mbembe, A. (2021). Out of the Dark Night: Essays on Decolonization. Columbia University

Press.
Mignolo, W. D. (2018). On decoloniality: Concepts, analytics, and praxis. In W. D. Mignolo & C. E. Walsh (Eds.), On decoloniality: Concepts, analytics, and praxis. Duke University Press..
Novelli, C., Taddeo, M., & Floridi, L. (2024). Accountability in artificial intelligence: What it is and how it works. AI & Society, 39(5), 1871-1882. https://doi.org/10.1007/s00146-023-01635-y
Piacente, A. (2022). Philosophical posthumanism and intentionality. Journal of Posthumanism, 2(3), 257–268. https://doi.org/10.33182/joph.v2i3.1764
Prihadi, D. J., & Lahbar, G. M. (2025). The rise of posthumanism in marine ecotourism: A comprehensive bibliometric analysis. Journal of Posthumanism, 5(12), 1–16. https://doi.org/10.63332/joph.v5i12.3223
Puig de la Bellacasa, M. (2017). Matters of Care: Speculative Ethics in More than Human Worlds. University of Minnesota Press.
Rasdiana, R., Machrus, M. A., Yatri, D., Purwati, E., Hadi, S., Munawwarah, E., Tefa, M. A. C., Ridwan, A., Leihitu, S. P. M., Rahmawati, A. D., & Mustafidah, F. Z. (2025). Reconceptualizing educational agency: A bibliometric analysis of posthumanist perspectives on artificial intelligence and technology in educational research. Journal of Posthumanism, 5(1), Article 635. https://doi.org/10.63332/joph.v5i1.635
Sahu, O. P., & Karmakar, M. (2024). Disposable culture, posthuman affect, and artificial human in Kazuo Ishiguro's Klara and the Sun (2021). AI & Society, 39(3), 1349-1357. https://doi.org/10.1007/s00146-022-01600-1
Sangadji, S. S., Handriana, T., Iswanto, D., & Rafa'al, M. (2025). The rise of posthumanism in marketing: A comprehensive bibliometric analysis. Journal of Posthumanism, 5(1), Article 3462. https://doi.org/10.33182/joph.v5i1.3462
Shane, S. (2004). Academic Entrepreneurship: University Spinoffs and Wealth Creation. Edward Elgar.
Smith-Nunes, G. (2025). Body as a data artefact: The ontological kaleidoscope framework. Journal of Responsible Technology, 24 (C):100138. https://doi.org/10.1016/j.jrt.2025.100138
St. Pierre, E. A. (2021). Post Qualitative Inquiry: The Critical and the Creative. Routledge.
Stilgoe, J., Owen, R., & Macnaghten, P. (2013). Developing a framework for responsible innovation. Research Policy, 42(9), 1568-1580. https://doi.org/10.1016/j.respol.2013.05.008
Tsing, A. L. (2015). The Mushroom at the End of the World: On the Possibility of Life in Capitalist Ruins. Princeton University Press.
Tutar, H., Nam, S., & Çağıltay, C. G. (2023). Bibliometric analysis and visual mapping of the articles published in the ILEF Journal from the beginning to the present. Kastamonu İletişim Araştırmaları Dergisi, 10, 87-105. https://doi.org/10.56676/kiad.1163603
van Eck, N. J., & Waltman, L. (2010). Software survey: VOSviewer, a computer program for bibliometric mapping. Scientometrics, 84(2), 523–538.
https://doi.org/10.1007/s11192-009-0146-3
Von Schomberg, R. (2013). A Vision of Responsible Research and Innovation. In R. Owen, J. Bessant, & M. Heintz (Eds.), Responsible Innovation (1st ed., pp. 51–74). Wiley. https://doi.org/10.1002/9781118551424.ch3
Wynter, S. (2003). Unsettling the coloniality of being/power/truth/freedom: Towards the human,

after Man, its overrepresentation—An argument. The New Centennial Review, 3(3), 257–337. https://doi.org/10.1353/ncr.2004.0015