Journal of Scientometric Research, 2025; 14(2):548-558.
https://www.jscires.org

Research Article

Mapping Anthropomorphism through Bibliometrics and TCCM Approach

Avanti Chinmulgund*, Sanjeev Kadam, Poornima Tapas

Symbiosis Institute of Business Management-Pune, Symbiosis International (Deemed University), Lavale, Pune, INDIA.

ABSTRACT

This research study focuses on appraising the relevant studies in anthropomorphism, i.e., humanizing the non-human entities. Firstly, research data points from 2,316 publications were retrieved using the Scopus database as of December 2024. Secondly, the finest literature was reviewed using Theory-Context-Characteristics-Methods (TCCM) to understand the insights and prospects of anthropomorphism studies and find the gaps. Thirdly, quantitative analysis was conducted using multiple bibliometric data points consisting of prominent authors, keywords, subject areas, source titles, institutional and country affiliations, and citations until data retrieval. Finally, an attempt was made to showcase the interconnectedness among authors, author keywords, and affiliated countries using network analysis. Anthropomorphism studies took a great leap during the last five years, publishing approximately 60% of research studies. As a country, the United States of America (USA) emerged as a solitary leader with almost 30% of anthropomorphism research. The anthropomorphism studies were deliberated in different contexts apart from its origin in psychology, such as human-technology interaction, sociology, consumer behavior, and organizational behavior.

Keywords: Anthropomorphism, Bibliometrics, Non-human, Psychology, Sociology, TCCM.

Correspondence:
Avanti Chinmulgund
Symbiosis Institute of Business Management-Pune, Symbiosis International (Deemed University), Lavale, Pune, INDIA.
Email: avantichinmulgund@sibmpune.edu.in

Received: 25-04-2025;
Revised: 13-06-2025;
Accepted: 01-08-2025.

INTRODUCTION

The emergence of anthropomorphic thinking can be argued to have started about 40,000 years ago.[1] The term' anthropomorphism' was mentioned in research on comparative psychology concerning the discussion on animal mentality.[2] Anthropomorphism enables a "default schema" to help the sense-making process even if it is altered in case of inconsistent information.[3] People often refer to restaurants as "cool," the stock market as it is "climbing" or "falling," and oceans as "angry" or “calm." In human interactions, we frequently witness non-human objects getting attributed by human adjectives. This psychology of calling, perceiving, and imagining non-human objects as if they are humans is called anthropomorphism. Thus, anthropomorphism is "attributing human qualities or behaviors to non-human entities, objects, and events".[4]

In business and management, the anthropomorphism of non-human agents is also found in consumers, who name their cars or treat their computers as their friends.[5] Thus, the manufacturers and firms are highly focused on providing consumers with products and services that exhibit anthropomorphism characteristics in consumer and organizational behavior. It led to the development of innovative products such as AI-enabled Amazon's Alexa, Apple's Siri, or Roomba's vacuum cleaner that can process human voice commands and perform tasks accordingly.[6] Human characteristics in the context of anthropomorphism might contain "emotional states",[7] "physical appearance",[8] and "inner mental motivations and states".[9] The non-human agents in this context can be imaginary or real, such as natural forces, non-human animals, religious deities, nations, electrical and mechanical devices, or electronic gadgets.[10] These non-human agents can act or be imagined to be acting from an anthropomorphic vision. This anthropomorphic vision is responsible for determining how humans behave towards non-human agents.

This study uses the TCCM framework, which Paul and Rosado-Serrano developed, as a literature review tool to extend the insights of anthropomorphism studies.[11] Thus, the complex nature of anthropomorphism stimulates new-age researchers to conduct a structured review of the available relevant information on this topic through bibliometric analysis.[12] The bibliometric analysis facilitates tracking down the evolution and characteristics of a topic within a given field of study using a quantitative assessment of data on publication records.[13] The research patterns of authors, journals, institutes, and countries were evaluated using bibliometric tools to identify and assess patterns of collaboration between them.[14] Significant theoretical

OPEN ACCESS

Manuscript TECHNOMEDIA

DOI: 10.5530/jscires.20251309

Publishing Partner : Manuscript Technomedia. [www.mstechnomedia.com]

revelations, contexts, characteristics, and methods have also been offered to suggest future research avenues in anthropomorphism. Thus, the primary goal of this study is to conduct a systematic review to clarify the state of the art in anthropomorphism.

In this study, authors have attempted to draw inferences from the publication data in many ways by answering the following research questions:

- How has anthropomorphism literature evolved considering its Theories, Context, Characteristics, and Methodologies (TCCM)?
- What are anthropomorphism studies' geographical area, subject area, keyword, author, journal, and affiliation trends?
- How is anthropomorphism research work being recognized by the research fraternity?
- How do the authors, publications, sources, keywords, and their affiliations network with one another?

This research paper is organized as follows. A systematic literature review of significant articles using the TCCM methodology has been deliberated in the following section. Thereafter, the materials and methods adopted in this study have been declared. In the next section, bibliometric analysis, citation analysis, and network analysis are conducted and showcased using the quantitative data points until data retrieval. Finally, the paper has been concluded with research conclusion and future research directions.

LITERATURE REVIEW

This research work integrates TCCM methodology to deepen the understanding of anthropomorphism studies' theories, contexts, characteristics, and methods.

Theory

Fundamentally, anthropomorphism is a human response that is naturally mindless but consciously denied by individuals who actively exercise it, especially in the case of computers, robots, and chatbots. Based on the theory of mindfulness and mindlessness,[15] humans mindlessly apply social cues and make sense when interacting with non-human entities but deny this when they are mindful. Based on three key psychological determinants of anthropomorphism, "the accessibility and applicability of egocentric or homocentric knowledge" (elicited agent knowledge), “the motivation to be effective social agents" (effectance motivation) and "the motivation for social connection” (Sociality motivation), people anthropomorphize and when they do not.[4] According to the Schema Congruity theory, anthropomorphism was evaluated by congruity affected by schemas-based processing.[16] The paradoxical research of anthropomorphism can be solved by the cognitive theory of cultural representations, wherein if the representations have both "inferential potential" and salience, then such representations become steady and extensive.[17] The theory of mind from developmental psychology underpins humans' capacity to observe human intentions in non-human inducements.[18] Social theories include social identity theory,[19] social learning theory,[20] social agency theory,[21] social exchange theory,[22] and social response theory.[23]

Psychology theories have been widely used in anthropomorphism studies, followed by social theories and theories related to human-technology interfaces. The review of these theories reveals that the groundwork of anthropomorphism can be attributed to theories comprising psychological factors. These studies then progress into social needs and technology-related theories, extending into consumer and organizational behavior theories.

Context

Context-based classification studies offer various facets of any concept under study.[24] Anthropomorphism studies are deliberated in different contexts apart from its origin in psychology, like human-technology interaction, sociology, consumer behavior, and organizational behavior. The extant research base is so disjointed and diverse that few definitive assumptions lead to the challenge of using anthropomorphic processes in different contexts. The studies extensively covered the contexts of psychology, sociology, and technology, followed by consumer behavior domains. However, it is still nascent in the context of organizational behavior.[25]

Characteristics

Extensive literature has concentrated its focus on the most significant characteristic of anthropomorphism, which is humanization. The attributes of anthropomorphism make authors think about humanizing non-humans, which is the crux of anthropomorphism. The most relevant keywords are "human",[26] "human factor",[27] "humanness",[28] and "human likeness".[29] The characteristics of anthropomorphism can also be highlighted, including its antecedents and consequences. These studies have reached distant growth, yet the consolidation of such studies remains a challenge.

Antecedents

A body of anthropomorphism research has been dedicated to identifying its antecedents. However, these studies deal mainly with the domains of psychology and technology. There are excellent prospects for studying the antecedents in other available domains. When the construct of anthropomorphism is examined in detail to check its antecedents, it is found that psychological motives make humans anthropomorphize. The motives of sociality motivation and effectance motivation are the predictors or antecedents of anthropomorphism.[30] When elaborated in organizational scenarios, these motives emerge as humans' sense-making and social connection needs.[31] Verbal speech

quality and psychological features like autonomy, sociability and personality trigger the anthropomorphic schemas.[32] Elicited agent knowledge, effectance motivation, and sociality motivation are the three key determinants of anthropomorphism.[33] Technological factors like identity cues and communication performance, individual factors like personality traits and competence, and environmental factors like task characteristics and social influence form the antecedents of anthropomorphism in AI-enabled technologies.[34] Self-esteem and intrinsic religiosity decide anthropomorphism regarding superstitious belief.[35]

Outcomes

The research work on outcomes of anthropomorphism focuses majorly on efficacy, social connection, and belief systems, yet very few studies consolidate the findings. The significant outcomes of the anthropomorphism process can be evoking interpersonal behaviors, social and personal identification, and psychological contract.[31] The process of anthropomorphism positively affects self-efficacy and social connection.[32] Human-technology relationships, perceptions, attitudes, emotional engagement and motivation in terms of overall appraisal, intentions, and active responses and usage behavior form the consequences of AI-enabled technology anthropomorphism.[34] Anthropomorphism regarding superstitious belief results in horoscope importance and behavioral superstitious beliefs.[35]

Methods

Studies related to anthropomorphism majorly focus on theory extension. As an abstract concept, anthropomorphism needs theory backing, and its advancement must contribute to theory building. Studies, particularly from the consumer behavior domain, were found to be contributing to model testing.[36] Scale development was extensively carried out in consumer behavior and technology-human interaction studies. Statistical analyses majorly include regression analysis,[37] factor analysis,[38] structural equation modeling,[39] correlation analysis,[40] and variance analysis.[41] The studies involving antecedents and consequences employed statistical analysis.

Table 1 depicts the research methods employed in the case of various anthropomorphism study areas, as observed in the literature review and bibliometrics.

It was observed that anthropomorphism studies in the context of psychology and sociology employ conceptual analysis and mixed methods over statistical and mathematical analyses. Anthropomorphism in technology and management domains employs statistical and mathematical analyses and mixed methods.

Research Gap

Post-TCCM analysis found that there is no satisfactory and sufficient integration of interdisciplinary perspectives on anthropomorphism as a concept. There are high-stake domains like autonomous driving, environmental conservation, education, and healthcare therapy, which are underexplored with limited research on anthropomorphism's acts and impacts having contextual specificity. Additionally, TCCM analysis reveals demographic and cultural gaps with heavy coverage of Western perspectives and neglect of non-Western focus with some exceptions.[42] Existing literature neglects the adverse outcomes of anthropomorphism, discussing anthropomorphism's potential risks. To the best of the researchers' knowledge, none of the studies offer an integrative examination of this topic so far. Hence, to support these revelations of TCCM analysis, a bibliometric analysis is carried out in the following section to further extend the understanding of anthropomorphism.

METHODOLOGY

In this research, authors implemented a 3-stage approach. Firstly, we retrieved relevant data from the Scopus database and refined it for further analysis. Secondly, we conducted a systematic literature review using the TCCM methodology to comprehend the many facets of anthropomorphism research studies. Thirdly, using quantitative information, bibliometric analysis was performed with the help of research data points, citations, and network analysis.

Table 1: Area Method matrix.

Methods Studies	Statistical Analysis	Mathematical Analysis	Qualitative Analysis	Conceptual Analysis	Mixed Method Analysis
Sociology studies			✓	✓	✓
Psychology studies	✓		✓	✓	✓
Technology-Human interaction studies	✓	✓			✓
Consumer Behaviour studies	✓	✓	✓	✓	✓
Organizational Behaviour studies	✓		✓	✓	✓

Data retrieval and refinement

Systematic literature review process has different steps according to different researchers.[43,44] Various review methodologies are shaped through these systematic literature review studies based on the research objectives. A systematic literature review is a recurring procedure intended to answer the pre-defined research questions that assist in concluding past results.[45] Likewise, this article draws references from previous literature on anthropomorphism.

We retrieved relevant research data from the Scopus database until December 2024. SCOPUS was the primary choice for the database as it includes 20% more articles in the various categories than Web of Science.[46,47] Authors executed the search query using the keyword 'anthropomorphism' through the 'abstract, title, and keywords' search in the Scopus database. Initially, the authors retrieved 3,787 research datasets. Later, the data were filtered considering the type of documents as articles, conference papers, and review papers) totalling 3,378 datasets. Thereafter, authors considered only journal papers as a source type for research, further limiting the use of 2565 publication datasets. Furthermore, the authors preferred the publication language to be 'English,' compressing publication datasets to 2,369. Finally, the research datasets of 2,316 research studies published until 2024 were considered for further bibliometric analysis.

The publication dataset consists of various data points such as authors, year of publications, source titles, citation counts, author's affiliations, keywords, number of publications by authors, subject areas, document type, source type, affiliation, and country concerning each publication was stored in dot CSV files for further bibliometric and network analysis study using free opensource visualization software 'VOSviewer' and 'GPS visualizer.'

Table 2: Top ten bibliometric trends in anthropomorphism studies.

Subject Area	Authors	Keywords (author/ index)	Affiliation	Country	Source Title
Social Sciences (817)	Waytz, A. (12)	Anthropomorphism (1249)	Sungkyunkwan University (24)	United States (715)	Computers in Human Behavior (60)
Arts and Humanities (682)	Epley, N. (10)	Human/s (543)	The University of Chicago (23)	United Kingdom (293)	International Journal of Social Robotics (54)
Computer Science (553)	Spatola, N. (10)	Artificial Intelligence (212)	Monash University (18)	China (259)	Frontiers in Psychology (39)
Business, Management and Accounting (541)	You, C. (10)	Male (188)	University of Oxford (18)	Germany (165)	International Journal of Human Computer Interaction (34)
Psychology (521)	Ishiguro, H. (9)	Female (187)	The Hong Kong Polytechnic University (17)	Australia (129)	Journal of Business Research (32)
Engineering (211)	Kim, S. (9)	Adult (158)	Technische Universität Berlin (16)	Canada (114)	Anthrozoos (31)
Agricultural and Biological Sciences (174)	Nowak, K.L. (9)	Robotics (114)	Stanford University (16)	South Korea (102)	Psychology and Marketing (31)
Veterinary (113)	Onnasch, L. (9)	Perception (109)	Indiana University Bloomington (16)	India (96)	Society and Animals (30)
Medicine (101)	Roesler, E. (9)	Human Experiment (103)	Pennsylvania State University (15)	Italy (86)	Journal of Retailing and Consumer Services (22)
Neuroscience (98)	Atherton, G. (8)	Animals (99)	Zhejiang University (15)	Netherlands (73)	Technological Forecasting and Social Change (19)

Source: Author compilation (Number in the bracket indicates number of publications).

RESULTS

Bibliometric Analysis

The bibliometric analysis aims to analyze available literature to obtain transparent and systematic insights into a concept under study. Bibliometric analysis is a great aid when the research objective is to evaluate the considerable body of literature.[48] It is a method to evaluate the bibliographic data quantitatively.[49] The graphics created by bibliometric analysis led to an understanding of the advancement of the topic under study.[50] The chronological publication patterns resulting from bibliometric analysis help to understand the sources, authors, countries, institutions, and other important parameters of an area of study.[51]

This section of the study elucidates the analyses of the bibliometric study of anthropomorphism. The retrieved data showcase the demography of each publication in anthropomorphism research. In bibliometric analysis, quantitative data related to the publications is used to understand the direction of the research interest.

Annual publication trends in anthropomorphism studies

In 1900, Thorndike mentioned the term 'anthropomorphism' in the context of comparative psychology concerning animal mentality. Thereafter, it took almost a hundred years to accelerate the studies concerning anthropomorphism. Figure 1 exhibits the annual trends of publications indicating growth in anthropomorphism studies. Until 2000, merely five percent of publications were published in anthropomorphism studies. During 2001-2010, it saw slow growth in publishing only 194 (8.38%) publications. Anthropomorphism studies took a great leap from 2011 to 2020, publishing 766 (33.07%) of total publications. In the last five years (2020-2024), the anthropomorphism studies boosted with 1,232 (53.20%) publications until data retrieval.

Mapping top ten bibliometric trends in anthropomorphism studies

In this section, we attempted to highlight the most influential bibliometric data points in anthropomorphism studies. Table 2 presents the top ten trends in this field, considering subject areas, authors, keywords, affiliations, associated countries, and source titles in anthropomorphism-related research. The publications might fall under more than one category of the subject areas. Social science was the preferred subject area, followed by arts and humanities, computer science, business, management, accounting, and psychology. Waytz and Epley were the leading authors in anthropomorphism studies, with 12 and 10 publications each. It was obvious that anthropomorphism (with 53.93% occurrences) is the leading keyword espoused by researchers in anthropomorphism studies. The researcher's fraternity commonly used human-oriented keywords. A few of them from the list of top ten were human/s (23.45%), male (8.17%), female (8.07%), and adult (6.82%). The most affiliated organizations in anthropomorphism studies were 'Sungkyunkwan University' with 24 publications in anthropomorphism, followed by 'The

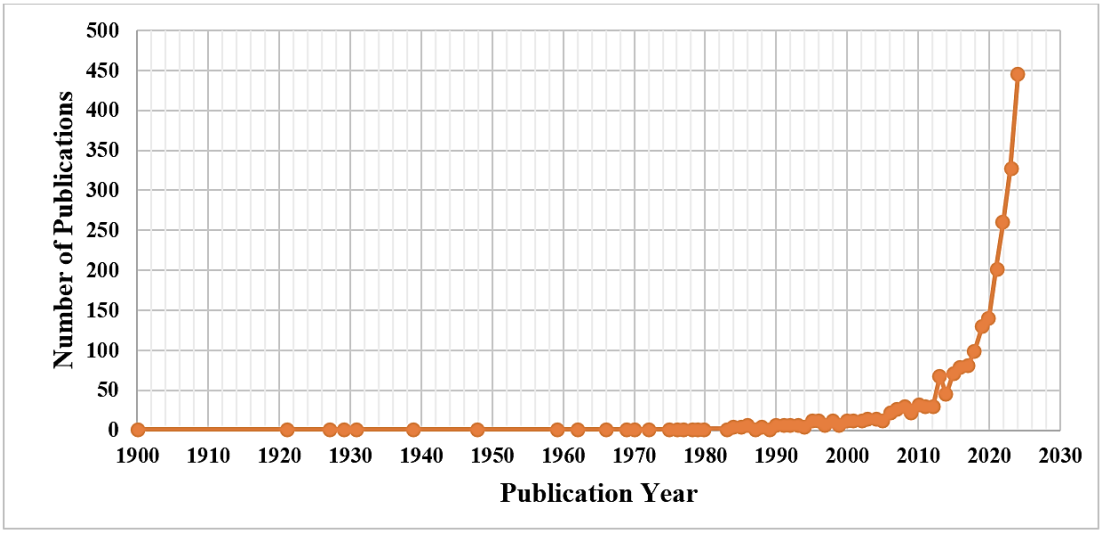

Figure 1: Annual trends of publication in anthropomorphism studies. Source: Author compilation.

Table 3: Yearly citation trends in anthropomorphism studies until 2024.

Year	<2015	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	Total Citations
Number of citations	7513	1646	1900	2240	2790	3397	4667	7269	9947	14072	21661	77102

Source: Author compilation.

Table 4: Top 10 journals-Citations wise in anthropomorphism studies.

Journal Title	No of publications (Citations Received/ Total)	<2015	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	Total Citations
Computers in Human Behavior	59/60	399	117	82	91	131	171	252	508	721	1137	1836	5445
International Journal of Social Robotics	50/52	139	81	104	155	180	215	345	472	599	684	908	3882
Journal of Consumer Research	17/17	138	64	69	105	146	187	344	421	445	581	648	3148
Journal of Social Issues	2/2	575	91	86	91	95	142	175	222	277	308	379	2441
Psychological Review	7/7	274	69	83	91	106	149	190	246	276	363	465	2312
Journal of Business Research	31/32	28	7	9	14	17	22	45	115	258	429	699	1643
Frontiers in Psychology	37/37	0	15	28	35	49	85	128	161	212	271	366	1350
Trends in Cognitive Sciences	1/1	118	53	58	69	79	82	129	165	174	161	178	1266
Journal of Experimental Social Psychology	8/8	13	28	32	58	57	106	114	181	145	197	284	1215
Robotics and Autonomous Systems	6/6	240	41	53	59	52	70	94	124	145	141	161	1180

Source: Author compilation.

University of Chicago (23)', 'The University of Oxford (18)' and 'Monash University (18)'. Among the source titles, ' Computers in Human Behavior' with 60 publications, was the most sought-after journal by the researcher fraternity in anthropomorphism studies, followed by 'International Journal of Social Robotics' (54) and 'Frontiers in Psychology' (39) until data retrieval.

Using the free, open-source software 'gpsvisuliser.com,' the geographical dispersal of the authors/organizations in anthropomorphism studies has been exhibited in Figure 2. The red-coloured node displayed on the map depicts countries associated with the publications in anthropomorphism. The size of each node correlates with the number of publications from that particular country. The USA emerged as the leader in anthropomorphism research, boasting 715 publications (30.87%), followed by the UK (12.65%), China (11.18%), Germany (7.12%), and Australia (5.57%) until the data retrieval.

Citation analysis of publications in anthropomorphism studies

The researchers' work in the research fraternity is recognized by citing their related publications as a reference. Citations indicate the impact of the researcher's work value on other researchers' ability to pursue their research interests. Table 3 presents the annual citation counts for studies on anthropomorphism up until the data retrieval date of this study. Of 2,316 publications examined in this research, 1,901(88.99%) had been cited at least once. It depicts a rising citation trend annually, signifying the importance of the research on anthropomorphism studies. The total citations received until data retrieval were 77,102 counts. Notably, 69,589 (90.26%) of these citations occurred in the last ten years, from 2015 to 2024. The peak annual citation count was in 2024, with 21,661 (28.09%) citations, indicating significant advancements in recent research on anthropomorphism.

Based on citations received by the total publications in the source titles considered in this study, Table 4 portrays the top ten journals in anthropomorphism studies. The topmost journal 'Computers in Human Behavior' was able to fetch 5,445 (7.06%) citations from 59 publications, followed by 'The International Journal of Social Robotics' with 3,882 (5.04%) citations, and 'Journal of Consumer Research' with 3,148 (4.08%) citations until data retrieval. Interestingly, 'Trends in Cognitive Sciences' and 'Journal of Social Issues' with only one and two publications received 1,266 (1.64%) and 2,441 (3.17%) citations, respectively.

Out of 2,316 publications considered in this research, 1,901 (82.08%) were cited at least once, amounting to 77,102 citations until data retrieval. There were 415 (17.92%) publications, primarily published during the last five years, that had not received any citations until data retrieval. Five publications have received more than 1,000 citations, and 166 have fetched at least 100 citations. Table 5 exhibits the top ten publications in anthropomorphism studies. Almost all top ten publications indicate rising trends of citations annually.

Table 5: Top 10 publication-Citations wise in anthropomorphism studies.

Publication Title (Published Year)	<2015	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	Total Citations
On Seeing Human: A Three-Factor Theory of Anthropomorphism (2007).	265	68	82	90	105	149	189	243	276	363	463	2293
Machines and mindlessness: Social responses to computers (2000).	498	78	79	81	86	135	166	208	266	295	368	2260
Measurement instruments for the anthropomorphism, animacy, likeability, perceived intelligence, and perceived safety of robots (2009).	124	62	76	108	100	135	202	237	275	300	393	2012
Perceived social isolation and cognition (2009).	118	53	58	69	79	82	129	165	174	161	178	1266
Anthropomorphism and the social robot (2003).	194	41	50	58	52	68	88	118	133	125	146	1073
Human trust in artificial intelligence: Review of empirical research (2020).	0	0	0	0	0	1	6	69	154	246	424	900
The mind in the machine: Anthropomorphism increases trust in an autonomous vehicle (2014).	2	10	18	32	41	80	81	126	96	134	188	808
The Effect of the Agency and Anthropomorphism on users' Sense of Telepresence, Copresence, and Social Presence in Virtual Environments (2003).	193	32	34	33	57	56	65	89	66	73	105	803
Who sees human? The stability and importance of individual differences in anthropomorphism (2010).	66	23	35	38	39	53	69	86	99	109	133	750
Is that car smiling at me? Schema congruity as a basis for evaluating anthropomorphized products (2007).	98	25	26	36	41	49	68	81	86	92	113	715

Source: Author compilation.

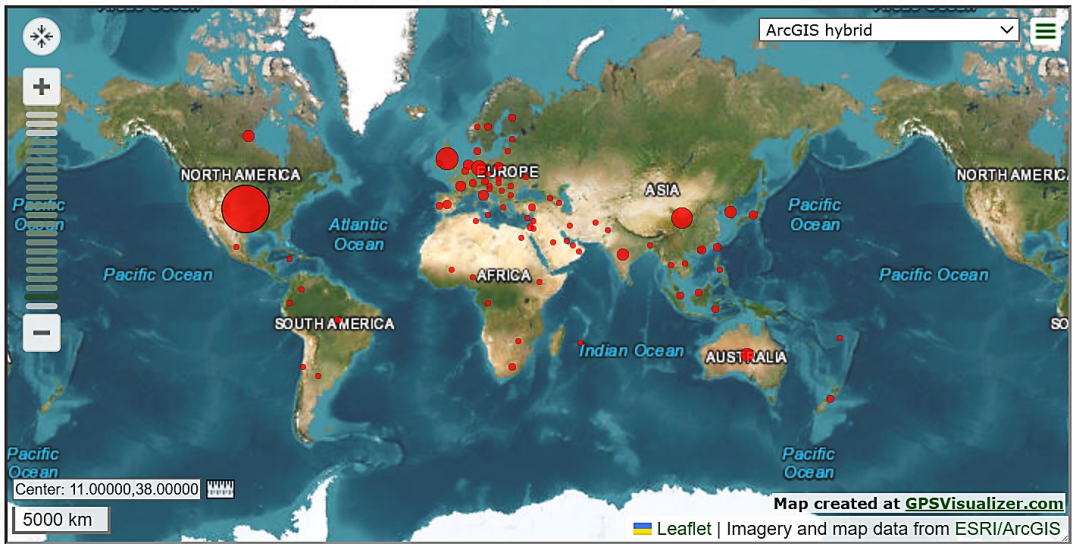

Figure 2: Geographical distribution of research in anthropomorphism studies. Source: gpsvisuliser.com.

Network analysis of publications in anthropomorphism studies

Network analysis is a visual graphical representation of data points using a set of relationships between entities represented by the nodes. Edges act as a linkage between the related nodes. This study used the open-source visualization software 'VOSviewer' to draw network diagrams.

Networks of authors keywords

The data revealed 6,018 author keywords associated with the anthropomorphism research. The leading keyword, 'anthropomorphism,' has been considered by 1,249 research studies and has a total link strength of 5,839 in the network. It was followed by 'human or humans' and 'artificial intelligence.' However, the keyword 'human or humans' had been considered

with many other keywords. Notably, "human" has been linked with many other related keywords, such as animal-human, dog-human, human brand, human-agent interaction, human-automation interaction, human-robot interaction, and human-computer interaction. From the font size in the network diagram exhibited in Figure 3, it was obvious that the keyword 'anthropomorphism' was the most prominent among the authors in anthropomorphism studies.

Network of authors linked by co-publication

This network has considered 5,246 authors associated with the research area. It was evident from the node size that Waytz (5,754 citations), Epley (5,743 citations), and Cacioppo (4853 citations) were the leading authors in anthropomorphism research, as exhibited in Figure 4. However, we noticed from the top 10 cited authors that 'Moon and Nass and 'Croft, Kulić, and Zoghbi,' with a single publication, received 2,299 and 2,036 citations, respectively, to position themselves in the top category.

Network of countries

The network of countries can be detected considering the interconnectedness of co-authorship among authors from various affiliated organizations worldwide. Currently, 105 countries are associated with research on anthropomorphism. As exhibited in Figure 5 in this research, authors and organizations from the USA had been far ahead of all other countries with the help of

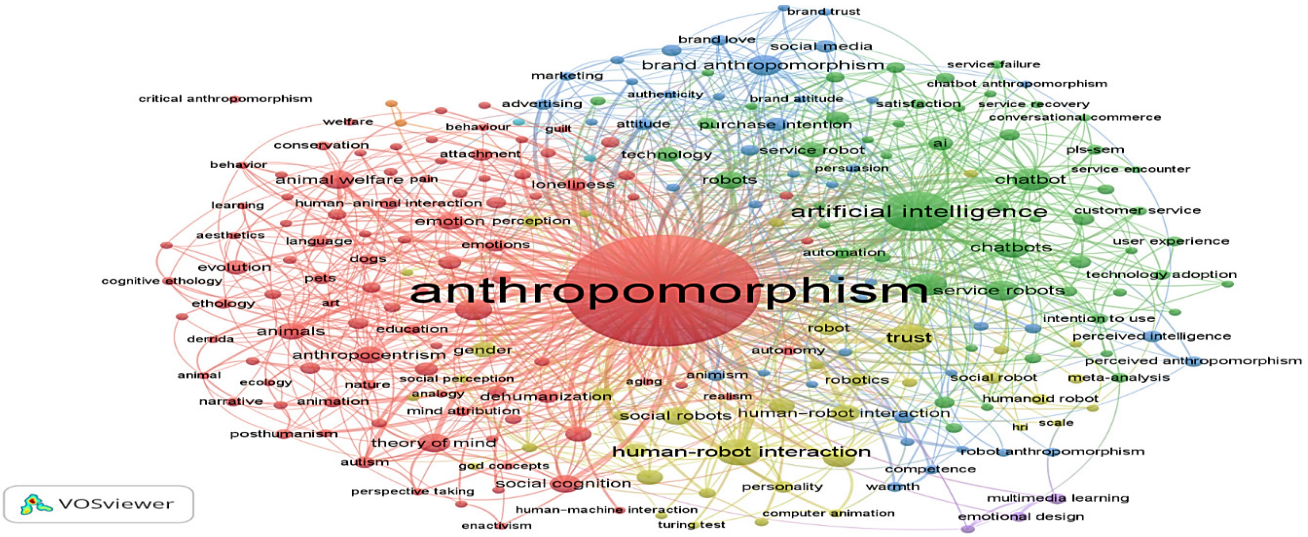

Figure 3: Network of author keywords. Source: Author compilation.

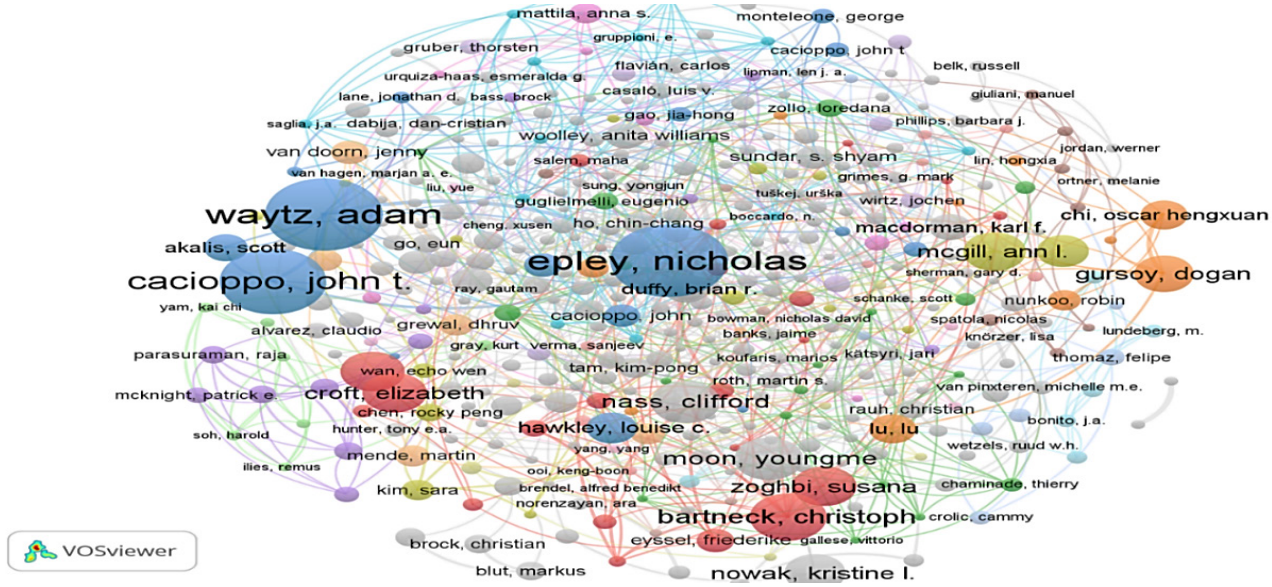

Figure 4: Network of authors linked by co-publication (Screenshot). Source: Author compilation.

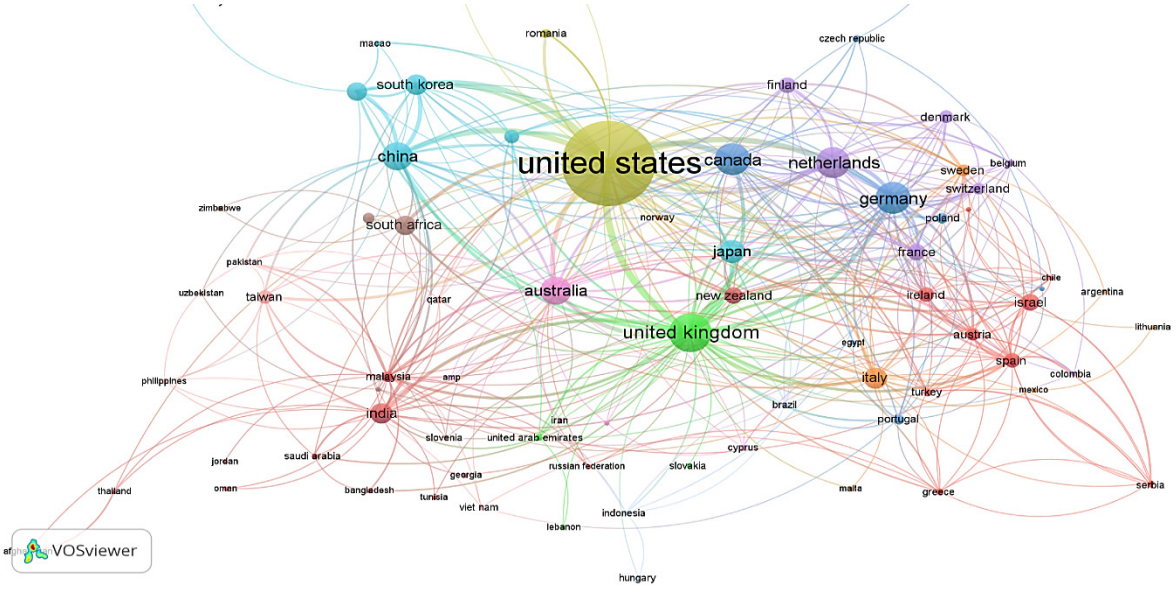

Figure 5: Network of authors and source titles (Screenshot). Source: Author compilation.

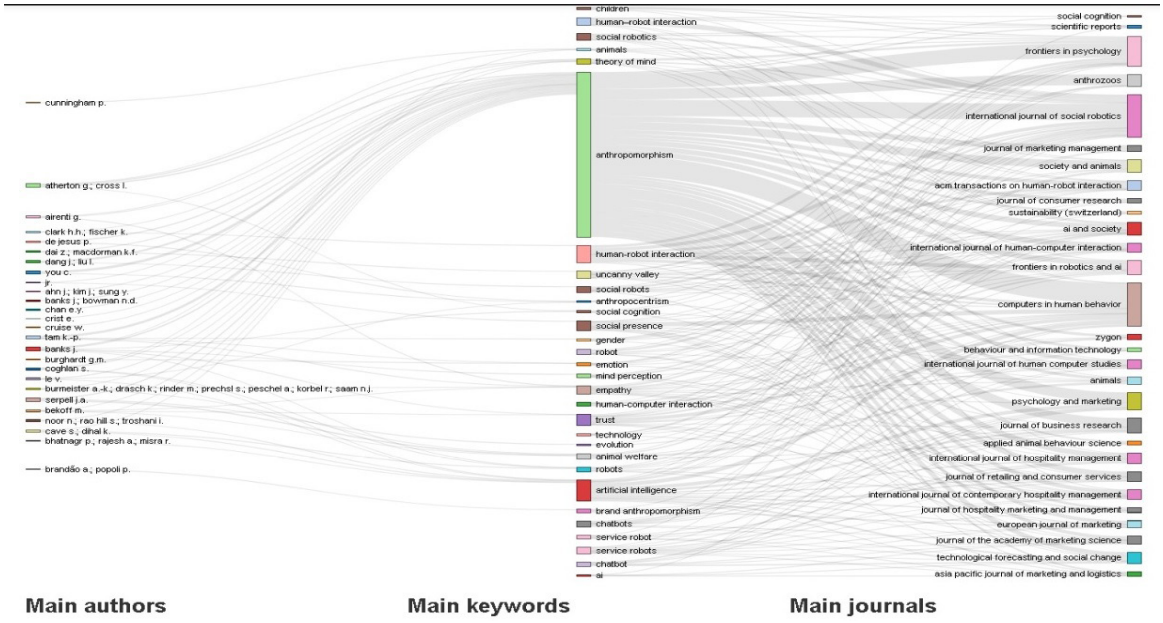

Figure 6: Network of 30 main authors, keywords, and journals. Source: Author compilation.

the highest number of publications (715), citations (40,381), and total link strength (291). Following the USA were authors and organizations affiliated with the UK, China, and Germany.

Network of top thirty authors, journals, and keywords

The interconnectedness among thirty primary authors, thirty leading journals, and thirty main keywords was observed, as illustrated in Figure 6. The length of the vertical bar for each author, journal, and key words indicates the strength of their association. The number of edges indicates an association among the authors, keywords, and journals. It was clear from the length of the vertical bars that authors Waytz, A.,' 'Epley N.' and 'Cacioppo J.T,' keyword 'anthropomorphism' and journals Computers in Human Behavior,' 'International Journal of Social Robotics' and 'Frontiers in Psychology' were the leading authors, keywords and journals respectively in anthropomorphism studies.

CONCLUSION

The research questions posited at the beginning of the study are answered by conducting a review of the burgeoning literature on anthropomorphism. As a result of TCCM analysis, it is observed that the theoretical grounds of anthropomorphism have progressed over the subsequent years. Besides all the theoretical development, there is a need for new the theoretical insights to unearth the unexplained segments of anthropomorphism.

Such unexplained segments can be the human motives like "sense making" and "social connection", in the management and corporate studies. On "context" front, anthropomorphism in terms of psychological motives of organizational behavior is yet to be explored. There is significant scope for filling this gap in the context of organizational behavior. Moreover, geographically, anthropomorphism studies are conducted in advanced Western countries like the USA and European Union nations but less in developing Asia, especially in the South Asian context. The characteristics of anthropomorphism reveal that "humanizing the non-humans" is the crux of the review in terms of its subsequent antecedents and outcomes. Lastly, the methods' review observes that the psychology and sociology studies employ conceptual analysis and mixed methods and technology and management studies employ statistical and mathematical analyses along with mixed methods.

Moreover, anthropomorphism's emergence in organizational behavior can focus on developing relationships between organizations and employees, strategy, organizational image, or reputation building. Employees identify their organization through anthropomorphic cues regarding "who" over "what." When employees anthropomorphize the organizations, the relationship between them becomes more visceral. Leaders in an organizational context share a strategic mindset, which partially consists of organizational metaphors. This metaphor drives a leader's feelings, thoughts, and actions toward effective organizational strategy. In organizational image or reputation, anthropomorphism helps the external stakeholders view the organization as a human entity, thereby facilitating its image and reputation building. The present study can be helpful in the organizational behavior domain to strategize HRM policies.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

FUTURE RESEARCH DIRECTIONS

This analysis can be furthered for future research in any domain as anthropomorphism disintegrates the communication dynamics. Communication forms the basis of anthropomorphism, which will help us to deepen our understanding of how we anthropomorphize non-living entities. Exploring anthropomorphism in terms of its antecedents and consequences provides the scope for nomological network for future studies. The present analysis could be extended to the reverse process of anthropomorphism in dehumanization studies. In the organizational context, anthropomorphism can be explored by adopting the case study as a research method in the future. Given the magnitude and multitude of anthropomorphism data through bibliometric and TCCM analysis, a better understanding of this concept is pertinent to enrich the scholarly and practical insights into various domains of study.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available in Scopus database at https://www.scopus.com/. Data until December 2024 was considered for the analysis purpose and was accessed as on January 2025.

REFERENCES

1. Mithen S. The prehistory of the mind: A search for the origins of art, religion and science. Thames & Hudson; 1996.
2. Thorndike E. Comparative psychology. 1900.
3. Caporael LR, Culbertson GH. Verbal response modes of baby talk and other speech at institutions for the aged. Lang Commun. 1986; 6(1-2): 99-112. doi: 10.1016/0271-5309(86)90009-1.
4. Epley N, Waytz A, Cacioppo JT. On seeing human: A three-factor theory of anthropomorphism. Psychol Rev. 2007; 114(4): 864-86. doi: 10.1037/0033-295X.114.4.864, PMID 17907867.
5. Brown S. It's alive inside! A note on the prevalence of personification. Ir Mark Rev. 2011; 21(1-2): 3-11.
6. Chen F, SenGupta J, Adaval R. Does endowing a product with life make one feel more alive? The effect of product anthropomorphism on consumer vitality. J Assoc Con Res. 2018; 3(4): 503-13. doi: 10.1086/698493.
7. Leyens JPh, Cortes BP, Demoulin S, Dovidio JF, Fiske ST, Gaunt R, *et al.* Emotional prejudice, essentialism, and nationalism The 2002 Tajfel lecture. Eur J Soc Psychol. 2003; 33(6): 703-17. doi: 10.1002/ejsp.170.
8. Guthrie SE. Faces in the clouds: A new theory of religion. Oxford University Press; 1993.
9. Gray HM, Gray K, Wegner DM. Dimensions of mind perception. Science. 2007; 315(5812): 619. doi: 10.1126/science.1134475, PMID 17272713.
10. Epley N, Akalis S, Waytz A, Cacioppo JT. Creating social connection through inferential reproduction: loneliness and perceived agency in gadgets, gods, and greyhounds. Psychol Sci. 2008a; 19(2): 114-20. doi: 10.1111/j.1467-9280.2008.02056.x, PMID 18271858.
11. Paul J, Rosado-Serrano A. Gradual Internationalization vs Born-Global/International new venture models: a review and research agenda. Int Mark Rev. 2019; 36(6): 830-58. doi: 10.1108/IMR-10-2018-0280.
12. Donthu N, Kumar S, Mukherjee D, Pandey N, Lim WM. How to conduct a bibliometric analysis: an overview and guidelines. J Bus Res. 2021a;133: 285-96. doi: 10.1016/j.jbusres.2021.04.070.
13. Li J, Hale A. Output distributions and topic maps of safety related journals. Saf Sci. 2016; 82: 236-44. doi: 10.1016/j.ssci.2015.09.004.
14. Li W, Zhao Y. Bibliometric analysis of global environmental assessment research in a 20-year period. Environ Impact Assess Rev. 2015; 50: 158-66. doi: 10.1016/j.eiar.2014.09.012.
15. Langer EJ. Mindfulness. Addison-Wesley; 1989.
16. Mandler G. The structure of value: accounting for taste. In: Clark MS, Fiske ST, editors. Affect and cognition: the 17th Annual Carnegie Symposium. Erlbaum; 1982. p. 3-36.
17. Boyer P. What makes anthropomorphism natural: intuitive ontology and cultural representations. J R Anthropol Inst. 1996; 2(1): 83-97. doi: 10.2307/3034634.
18. Scholl BJ, Tremoulet PD. Perceptual causality and animacy. Trends Cogn Sci. 2000; 4(8): 299-309. doi: 10.1016/s1364-6613(00)01506-0, PMID 10904254.
19. Tajfel H, Turner JC. The social identity theory of intergroup behavior. In: Jost JT, Sidanius J, editors. Political psychology. Psychology Press; 2004. p. 276-93. doi: 10.4324/9780203505984-16.
20. Bandura A. Social learning theory. Prentice Hall; 1977.
21. Mayer RE, Sobko K, Mautone PD. Social cues in multimedia learning: role of speaker's voice. J Educ Psychol. 2003; 95(2): 419-25. doi: 10.1037/0022-0663.95.2.419.
22. Cropanzano R, Mitchell MS. Social exchange theory: an interdisciplinary review. J Manag. 2005; 31(6): 874-900. doi: 10.1177/0149206305279602.
23. Huang JW, Lin CP. To stick or not to stick: the social response theory in the development of continuance intention from organizational cross-level perspective. Comput Hum Behav. 2011; 27(5): 1963-73. doi: 10.1016/j.chb.2011.05.003.
24. Al Kafi A, Banshal SK, Sultana N, Gupta V. Source recommendation system using context-based classification: empirical study on multi-level ensemble methods. J Scientometr Res. 2024; 13(2): 475-84. doi: 10.5530/jscires.13.2.38.
25. Martin F. Organizational virtues and organizational anthropomorphism. J Bus Ethics. 2022; 177(1): 1-17. doi: 10.1007/s10551-020-04725-9.
26. Barrett JL, Keil FC. Conceptualizing a nonnatural entity: anthropomorphism in God concepts. Cogn Psychol. 1996; 31(3): 219-47. doi: 10.1006/cogp.1996.0017, PMID 8975683.
27. Bartneck C, Kulić D, Croft E, Zoghbi S. Measurement instruments for the anthropomorphism, animacy, likeability, perceived intelligence, and perceived safety of robots. Int J Soc Robot. 2009; 1(1): 71-81. doi: 10.1007/s12369-008-0001-3.

28. De Visser EJ, Monfort SS, McKendrick R, Smith MA, McKnight PE, Krueger F, *et al.* Almost human: anthropomorphism increases trust resilience in cognitive agents. J Exp Psychol Appl. 2016; 22(3): 331-49. doi: 10.1037/xap0000092, PMID 27505048.
29. Kätsyri J, Förger K, Mäkäräinen M, Takala T. A review of empirical evidence on different uncanny valley hypotheses: support for perceptual mismatch as one road to the valley of eeriness. Front Psychol. 2015; 6: 390. doi: 10.3389/fpsyg.2015.00390 , PMID 25914661.
30. Epley N, Waytz A, Akalis S, Cacioppo JT. When we need a human: motivational determinants of anthropomorphism. Soc Cogn. 2008b; 26(2): 143-55. doi: 10.1521/soco.2008.26.2.143.
31. Ashforth BE, Schinoff BS, Brickson SL. 'My Company Is Friendly,' "Mine's a rebel": anthropomorphism and shifting organizational identity from "what" to "who". Acad Manag Rev. 2020; 45(1): 29-57. doi: 10.5465/amr.2016.0496.
32. Cao C, Zhao L, Hu Y. Anthropomorphism of intelligent personal assistants (IPAs): antecedents and consequences. In: PACIS. Vol. 187; 2019.
33. Xu L, Yu F, Wu J, Han T, Zhao L. Anthropomorphism: antecedents and consequences. Adv Psychol Sci. 2017; 25(11). doi: 10.3724/SP.J.1042.2017.01942.
34. Li M, Suh A. Anthropomorphism in AI-enabled technology: A literature review. Electron Markets. 2022; 32(4): 2245-75. doi: 10.1007/s12525-022-00591-7.
35. Sierra JJ, Hyman MR, Lee BK, Suh T. Antecedents and consequences of extrinsic superstitious beliefs: A cross-cultural investigation. Asia Pac J Mark Logist. 2015; 27(4): 559-81. doi: 10.1108/APJML-01-2015-0015.
36. Gursoy D, Chi OH, Lu L, Nunkoo R. Consumers acceptance of artificially intelligent (AI) device use in service delivery. Int J Inf Manag. 2019; 49: 157-69. doi: 10.1016/j.ijinfomgt.2019.03.008.
37. Hart PM, Jones SR, Royne MB. The human lens: how anthropomorphic reasoning varies by product complexity and enhances personal value. J Mark Manag. 2013; 29(1-2): 105-21. doi: 10.1080/0267257X.2012.759993.
38. Weiss A, Inoue-Murayama M, King JE, Adams MJ, Matsuzawa T. All too human? Chimpanzee and orangutan personalities are not anthropomorphic projections. Anim Behav. 2012; 83(6): 1355-65. doi: 10.1016/j.anbehav.2012.02.024.
39. Hegner SM, Fenko A, Teravest A. Using the theory of planned behaviour to understand brand love. J Prod Brand Manag. 2017; 26(1): 26-41. doi: 10.1108/JPBM-06-2016-1215.
40. McConnell AR, Paige Lloyd E, Humphrey BT. We are family: viewing pets as family members improves wellbeing. Anthrozoös. 2019; 32(4): 459-70. doi: 10.1080/08927936.2019.1621516.
41. Lu L, Cai R, Gursoy D. Developing and validating a service robot integration willingness scale. Int J Hosp Manag. 2019; 80: 36-51. doi: 10.1016/j.ijhm.2019.01.005.
42. Park DU, Jung T, Chang WS, Kim Y, Rodriguez FS. A diagnostic toolkit for innovation systems in developing countries: an analysis of selected ASEAN countries. J Scientometr Res. 2025; 13(3s):s82-97. doi: 10.5530/jscires.20041209.
43. Gupta S, Modgil S, Gunasekaran A. Big data in lean Six Sigma: a review and further research directions. Int J Prod Res. 2020; 58(3): 947-69. doi: 10.1080/00207543.2019.1598599.
44. Dubey R, Gunasekaran A, Childe SJ, Papadopoulos T, Fosso Wamba SF. World class sustainable supply chain management: critical review and further research directions. Int J Logist Manag. 2017; 28(2): 332-62. doi: 10.1108/IJLM-07-2015-0112.
45. Kitchenham B, Charters S. Guidelines for performing systematic literature reviews in software engineering version 2.3 University of Keele (software engineering group, school of computer science and mathematics) and Durham. Department of Computer Science; 2007.
46. Gusenbauer M. 'Google scholar to overshadow them all? Comparing the sizes of 12 academic search engines and bibliographic databases', Scientometrics, Springer International Publishing. Scientometrics. 2019; 118(1): 177-214. doi: 10.1007/s11192-018-2958-5.
47. Martın-Martın A, Orduna-Malea E, Thelwall M, Delgado López-Cózar ED. Google Scholar, Web of science, and Scopus: A systematic comparison of citations in 252 subject categories. J Inf. 2018; 12(4): 1160-77. doi: 10.1016/j.joi.2018.09.002, Google Scholar.
48. Donthu N, Kumar S, Pattnaik D. Forty-five years of journal of business research: A bibliometric analysis. J Bus Res. 2020; 109: 1-14. doi: 10.1016/j.jbusres.2019.10.039.
49. Varma A, Kumar S, Lim WM, Pandey N. Personnel Review at age 50: A retrospective using bibliometric analysis. Pers Rev, Vol. ahead-of-print No. ahead-of-print. 2023; 52(4): 1291-320. doi: 10.1108/PR-05-2021-0313.
50. Donthu N, Kumar S, Pandey N, Pandey N, Mishra A. Mapping the electronic word-of-mouth (eWOM) research: A systematic review and bibliometric analysis. J Bus Res. 2021c;135: 758-73. doi: 10.1016/j.jbusres.2021.07.015.
51. Singh S, Dhir S. Structured review using TCCM and bibliometric analysis of international cause-related marketing, social marketing, and innovation of the firm. Int Rev Public Nonprofit Mark. 2019; 16(2-4): 335-47. doi: 10.1007/s12208-019-00233-3.

Cite this article: Chinmulgund A, Kadam S, Tapas P. Mapping Anthropomorphism through Bibliometrics and TCCM Approach. J Scientometric Res. 2025;14(2):548-58.