

Scientific and Philosophical Rationality in Geography: A Synthesis of Madilog, Western and Islamic Philosophy in Indonesian Environmental Ethics and Culture

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Abstract

Rationality constitutes a fundamental foundation for developing geography as a scientific discipline in understanding the relationships among humans, the environment, and culture. Geography requires an epistemological framework that integrates scientific, philosophical, and ethical dimensions during increasingly complex environmental challenges. Nevertheless, studies synthesizing scientific rationality, Western philosophy, Tan Malaka's Madilog (Materialism, Dialectics, and Logic), and Islamic philosophy within geographical studies remain limited. Therefore, this study aims to analyze the concept of rationality in geography by integrating these philosophical traditions to strengthen environmental ethics and develop a more comprehensive geographical epistemology. This research employed a qualitative method using a library research approach by examining primary and secondary literature on philosophy, philosophy of science, geography, Islamic philosophy, and Madilog. Data were analyzed using descriptive-analytical techniques through comparison, interpretation, and conceptual synthesis of relevant philosophical perspectives. The findings reveal that scientific rationality provides empirical verification and methodological rigor, Western philosophy contributes to logical and critical reasoning, Madilog strengthens dialectical and contextual analysis of socio-environmental realities, and Islamic philosophy enriches geographical thought by integrating reason, revelation, and spiritual values into environmental ethics. The synthesis of these perspectives produces a holistic epistemological framework that enhances the understanding of human-environment interactions and promotes scientific, cultural, and religious values-based ecological awareness. The novelty of this study lies in the integration of scientific rationality, Western philosophy, Madilog, and Islamic philosophy into a unified geographical epistemology that incorporates ethical and spiritual dimensions and extends beyond conventional empirical approaches. The findings also have important policy implications for strengthening environmental education, integrating environmental ethics into geography curricula, and supporting sustainable environmental governance through culturally and spiritually informed approaches.

Rasionalitas merupakan landasan fundamental dalam pengembangan geografi sebagai disiplin ilmu untuk memahami hubungan antara manusia, lingkungan, dan budaya. Di tengah semakin kompleksnya permasalahan lingkungan, geografi memerlukan kerangka epistemologis yang mampu mengintegrasikan dimensi ilmiah, filosofis, dan etis. Namun, kajian yang

mensintesisakan rasionalitas ilmiah, filsafat Barat, Madilog (Materialisme, Dialektika, dan Logika) Tan Malaka, serta filsafat Islam dalam studi geografi masih sangat terbatas. Oleh karena itu, penelitian ini bertujuan menganalisis konsep rasionalitas dalam geografi melalui sintesis keempat perspektif tersebut guna memperkuat etika lingkungan dan mengembangkan kerangka epistemologi geografi yang lebih komprehensif. Penelitian ini menggunakan metode kualitatif dengan pendekatan studi kepustakaan (library research) yang bersumber dari literatur primer dan sekunder mengenai filsafat, filsafat ilmu, geografi, filsafat Islam, dan Madilog. Analisis data dilakukan secara deskriptif-analitis melalui prose identifikasi, komparasi, interpretasi, dan sintesis konseptual terhadap berbagai pemikiran yang relevan. Hasil penelitian menunjukkan bahwa rasionalitas ilmiah memberikan dasar verifikasi empiris dan ketelitian metodologis, filsafat Barat berkontribusi pada penguatan penalaran logis dan kritis, Madilog memperkuat analisis dialektis terhadap realitas sosial dan lingkungan, sedangkan filsafat Islam memperkaya pemikiran geografi melalui integrasi akal, wahyu, intuisi, serta nilai-nilai spiritual dalam membangun etika lingkungan. Sintesis keempat perspektif tersebut menghasilkan kerangka epistemologi geografi yang lebih holistik dalam memahami hubungan manusia dan lingkungan sekaligus memperkuat kesadaran ekologis yang berlandaskan nilai-nilai ilmiah, budaya, dan religius. Ini terletak pada integrasi rasionalitas ilmiah, filsafat Barat, Madilog, dan filsafat Islam ke dalam satu kerangka epistemologi geografi yang komprehensif, sehingga memperluas kajian geografi yang selama ini lebih berorientasi pada pendekatan empiris dengan memasukkan dimensi etis dan spiritual. Temuan penelitian ini juga memberikan implikasi terhadap kebijakan, khususnya dalam penguatan pendidikan lingkungan, pengintegrasian etika lingkungan ke dalam kurikulum geografi, serta penyusunan kebijakan pengelolaan lingkungan yang berkelanjutan dengan mempertimbangkan nilai-nilai budaya dan spiritual masyarakat Indonesia.

A. INTRODUCTION

Reason is a fundamental cognitive capacity that enables human beings to engage in reasoning processes, construct knowledge, and systematically understand reality. In epistemological studies, reason is positioned as the primary instrument in the formation of rational knowledge, both through logical reasoning and critical analysis of observed phenomena (*Statistik Lingkungan Hidup Indonesia 2024*, 2024). The development of human thought demonstrates that the structured use of reason has given rise to the concept of rationality, which subsequently became the foundation for the advancement of modern science.

Rationality plays a significant role in both philosophy and science, although it is operationalized differently in each discipline. Philosophy emphasizes rationality as a reflective and critical process for examining concepts, assumptions, and the foundations of knowledge, whereas science situates rationality within a methodological framework characterized by empirical verification, logical

consistency, and testability (Suriasumantri, 2009). However, contemporary global environmental challenges indicate that scientific and technological advances alone have not been sufficient to resolve increasingly complex socio-ecological problems. The Intergovernmental Panel on Climate Change (IPCC, 2023) reported that global temperatures have reached approximately 1.1°C above pre-industrial levels, contributing to more frequent extreme weather events, biodiversity loss, and ecosystem degradation. Similarly, the United Nations Environment program (2024) highlighted that the world remains off track in achieving several environmental sustainability targets due to the continuing decline in ecosystem quality. In Indonesia, the Ministry of Environment and Forestry (*Statistik Lingkungan Hidup Indonesia 2024*, 2024) reported that deforestation, land degradation, pollution, and declining environmental quality continue to threaten sustainable development. These conditions demonstrate that environmental problems are not merely technical but also philosophical and ethical challenges that require broader epistemological perspectives that integrate scientific reasoning with moral and cultural values.

Within the discipline of geography, rationality functions as the analytical foundation for explaining spatial patterns, human–environment interactions, and environmental change. Geographic information systems (GIS), remote sensing, spatial modeling, and geospatial technologies are increasingly used to produce accurate analyses of environmental phenomena. Nevertheless, recent geographical studies published during the last five years have largely concentrated on methodological innovation, spatial modeling, disaster management, and environmental assessment, while the philosophical foundations of geographical rationality have received relatively little attention (Gregory et al., 2009; United Nations Educational, Scientific and Cultural Organization, 2021). Moreover, although Islamic environmental ethics has developed considerably in recent years, studies integrating scientific rationality, Western philosophy, Tan Malaka's Madilog, and Islamic philosophy into a unified epistemological framework for geography remain very limited. Existing studies generally discuss these perspectives independently, resulting in fragmented understandings of the relationships among scientific knowledge, environmental ethics, and spatial thinking.

This limitation reflects an important research gap. Current geographical research predominantly adopts positivistic and empirical paradigms that emphasize measurable spatial phenomena while neglecting philosophical, ethical, and spiritual

dimensions. Consequently, rationality in geography is often interpreted solely as methodological reasoning rather than as a comprehensive epistemological framework that integrates scientific, philosophical, cultural, and religious perspectives. Furthermore, no previous studies have comprehensively synthesized scientific rationality, Western philosophy, Tan Malaka's Madilog, and Islamic philosophy as an integrated framework for understanding human–environment relationships within the Indonesian context. This gap is largely caused by the separation of geographical scholarship between natural sciences, social sciences, and religious studies, resulting in limited interdisciplinary dialogue concerning environmental ethics.

Therefore, this study is deliberately limited to a conceptual examination of rationality in geography through a qualitative library research approach. It synthesizes scientific rationality, Western philosophy, Madilog, and Islamic philosophy to construct a more comprehensive geographical epistemology. Unlike previous studies that primarily emphasize empirical spatial analysis or Islamic environmental ethics independently, this study integrates these four intellectual traditions into a unified conceptual framework. This study aims to expand the theoretical foundation of geography, strengthen environmental ethics, and provide philosophical insights that may contribute to Indonesia's environmental education, geography curricula, and sustainable environmental governance.

B. RESEARCH METHODOLOGY

This study employed a library research approach to construct a conceptual synthesis of scientific rationality, Western philosophy, Tan Malaka's Madilog, and Islamic philosophy within the epistemological framework of geography. This study focused on philosophical concepts and their relevance to understanding human–environment relationships and environmental ethics.

The research adopted a qualitative conceptual approach, emphasizing the interpretation and synthesis of philosophical ideas rather than empirical measurement. The library research method was applied by systematically reviewing books, peer-reviewed journal articles, institutional reports, and other scholarly publications relevant to rationality, philosophy of science, geography, environmental ethics, and Islamic philosophy.

The research instruments consisted of a document analysis sheet and a literature review matrix. The Document Analysis Sheet was used to record

bibliographic information, identify the main concepts, examine theoretical arguments, evaluate the relevance of each source to the research objectives, and summarize the contribution of each reference to the development of geographical epistemology. The Literature Review Matrix was employed to organize and compare the literature based on the author, year of publication, research focus, theoretical perspective, methodology, principal findings, identified research gaps, and relevance to the conceptual synthesis developed in this study.

The primary data sources comprised the works of Jujun S. Suriasumantri concerning philosophy of science, Tan Malaka's Madilog, Al-Ghazali's writings on reason and revelation, and Jalaluddin Rumi's philosophical works on spirituality and intuition. Secondary data sources included peer-reviewed journal articles, academic books, and reports published by international organizations, such as the Intergovernmental Panel on Climate Change, UNESCO, UNEP, and the Ministry of Environment and Forestry of Indonesia.

Data were collected through systematic document analysis involving literature identification, selection, classification, extraction, and documentation. Literature selection was based on relevance to the research objectives, scientific credibility, and publication recency, prioritizing peer-reviewed publications from the last five years while retaining classical philosophical works as foundational references.

The data analysis employed descriptive-analytical techniques combined with qualitative content analysis. The analytical procedures included data reduction, concept categorization, philosophical perspective comparison, conceptual relationship interpretation, and scientific rationality, Western philosophy, Madilog, and Islamic philosophy synthesis into an integrated epistemological framework for geography.

To ensure the credibility of the findings, source and theoretical triangulations were conducted. Source triangulation involved comparing information from classical philosophical texts, contemporary scholarly publications, and institutional reports. Theoretical triangulation was undertaken by comparing concepts across scientific rationality, Western philosophy, Madilog, and Islamic philosophy to strengthen the conceptual synthesis's consistency, validity, and comprehensiveness.

1. Research Instruments

Table 1. Document Analysis Sheet

No .	Docume nt Identity	Main Concept	Theoretic al Perspectiv e	Key Finding s	Relevance to the Research	Note s
1	Author, Year	Rationality	The Philosophy of Science	...	High/Medium/Low	...
2	Author, Year	Environment al Ethics	Islamic Philosophy	...	...	...

Source: Prepared by the authors in 2026

Table 2. Literature review matrix

Author	Year	Research Focus	Method	Main Findings	Research Gap	Contribution to this study
Suriasumantri	2009	The Philosophy of Science	Conceptual	Scientific rationality	Does not discuss geography	The foundation of scientific rationality
Tan Malaka	2007	Madilog	Philosophical	Critical rationality	Does not integrate the Islamic philosophy	Critical perspective
Al-Ghazali	2011	Islamic Epistemology	Philosophical	Reason and revelation	Limited discussion on environmental issues	Ethical dimension
Recent Journal	2024	Environmental Ethics	Review	Sustainability	No synthesis with Madilog	Contemporary perspective

Source: Prepared by the authors in 2026

Data analysis was conducted using descriptive-analytical techniques and qualitative content analysis. The analysis began with organizing and coding the information extracted through the Document Analysis Sheet, including the identification of key concepts, philosophical arguments, and theoretical perspectives contained in each selected document. Subsequently, the findings were systematically organized using the Literature Review Matrix to compare the literature based on authorship, publication year, research focus, theoretical perspective, methodology, principal findings, research gaps, and contributions to this study. The analytical

process continued by examining the relationships, similarities, and differences among scientific rationality, Western philosophy, Tan Malaka's Madilog, and Islamic philosophy. Finally, the analysis results were synthesized into an integrated conceptual framework of geographical rationality that enriches the understanding of human–environment relationships from scientific, philosophical, and epistemological perspectives.

C. RESULT AND DISCUSSION

Result

1. Evolution of Rationality from Classical Philosophy to Contemporary Geographical Thought

This study identified a significant transformation in the concept of rationality from classical philosophy to contemporary geographical thought based on the analysis conducted using the document analysis sheet and the literature review matrix. The synthesis of selected literature indicates that rationality has evolved from being understood solely as logical reasoning into a multidimensional framework that integrates empirical inquiry, environmental ethics, sustainability, and spirituality. This transformation reflects the growing recognition that scientific reasoning alone cannot adequately explain contemporary environmental issues but requires interdisciplinary perspectives encompassing philosophical and ethical dimensions.

The literature published between 2021 and 2026 consistently demonstrates that environmental degradation, climate change, biodiversity loss, and increasing ecological risks have encouraged scholars to reconsider the role of rationality in scientific disciplines. The Intergovernmental Panel on Climate Change (IPCC, 2023) emphasized that responding to climate change requires not only scientific evidence but also ethical decision-making and interdisciplinary collaboration. Likewise, the persistent decline in global environmental quality reflects limitations in current environmental governance, which has been predominantly driven by technological and economic considerations (United Nations Environment program, 2024). Similarly, the United Nations Educational, Scientific, and Cultural Organization (2021) argues that sustainable development requires educational transformation that integrates scientific knowledge, critical thinking, ethical values, and cultural awareness.

The analysis further indicates that recent geographical studies increasingly emphasize resilience, sustainability, environmental governance, and socio-ecological

systems (Folke et al., 2021; Rockström et al., 2023). Nevertheless, the Document Analysis Sheet reveals that most of these studies primarily focus on methodological innovations, spatial modeling, remote sensing, and environmental assessment, while relatively few discuss the philosophical foundations of geographical rationality or integrate scientific rationality with Islamic philosophy and Tan Malaka's Madilog.

The findings demonstrate that rationality has experienced a substantial epistemological shift from the classical tradition represented by Plato and Aristotle to contemporary interdisciplinary approaches. Classical philosophy regarded rationality primarily as the intellectual capacity to attain universal truth through logical reasoning (Plato, 2007; Aristotle, 1998). Although these philosophical foundations remain relevant, contemporary studies argue that rationality should also encompass ethical responsibility, environmental awareness, and sustainability in addressing global ecological challenges (Folke et al., 2021; Rockström et al., 2023).

These findings are consistent with those of Shabir Ahmad, Sabina Umirzakova, Ghulam Mujtaba, and Muhammad Sadiq Amin (2023), who argued that the development of Education 5.0 requires the integration of technological innovation with humanistic and ethical values. Likewise, Rockström et al. (2023) emphasized that maintaining planetary boundaries requires scientific knowledge supported by ethical and governance frameworks. Similar conclusions are reported by Folke et al. (2021), who highlight that resilience and sustainability depend on the interaction of ecological systems, governance, and social values rather than scientific knowledge alone.

However, this study identifies a significant research gap. Most contemporary geographical studies continue to prioritize empirical analysis, technological applications, and quantitative modeling while paying limited attention to philosophical synthesis (United Nations Educational, Scientific and Cultural Organization, 2021) (United Nations Environment program, 2024). Furthermore, scientific and Islamic philosophical discussions regarding rationality generally remain separated, resulting in fragmented epistemological perspectives.

This study argues that rationality in geography should no longer be interpreted merely as scientific methodology but as a comprehensive epistemological framework integrating scientific rationality, Western philosophy, Tan Malaka's Madilog, and Islamic philosophy based on the synthesis developed through the Literature Review Matrix. This integrated perspective provides a stronger theoretical foundation for

understanding human–environment relationships while simultaneously strengthening environmental ethics within contemporary geographical studies.

2. Differences and Interrelationships between Philosophical and Scientific Rationality

Based on the analysis of the document analysis sheet and the literature review matrix, this study found that philosophical and scientific rationality represent two complementary dimensions in the development of geographical knowledge rather than two opposing paradigms. The reviewed literature indicates that philosophical rationality primarily contributes to conceptual clarification, critical reflection, and epistemological inquiry, whereas scientific rationality provides empirical investigation, hypothesis testing, and evidence-based explanation

The literature further demonstrates that recent studies have increasingly advocated the integration of these two dimensions to address contemporary environmental challenges. Scientific investigations concerning climate change, environmental degradation, and sustainable development require not only empirical evidence but also philosophical reflection on ethical responsibility, justice, and human–nature relationships (Folke et al., 2021; Rockström et al., 2023) (United Nations Environment program, 2024). Likewise, the United Nations Educational, Scientific, and Cultural Organization (2021) emphasized that scientific literacy should be accompanied by critical thinking and ethical reasoning to support sustainable decision-making.

The analysis also reveals that geographical research during the last five years has predominantly emphasized scientific rationality through the application of geospatial technologies, GIS, remote sensing, environmental modeling, and quantitative spatial analysis. Although these approaches have significantly improved the accuracy of geographical investigations, the philosophical dimensions of geographical reasoning remain relatively underexplored. Consequently, many studies explain environmental phenomena through measurable indicators while paying limited attention to ethical, cultural, and spiritual considerations.

The findings indicate that philosophical and scientific rationality should not be regarded as competing epistemological traditions but as mutually reinforcing approaches. Philosophical rationality enables scholars to question assumptions, evaluate conceptual consistency, and examine the ethical implications of scientific knowledge, whereas scientific rationality provides systematic methods for producing

reliable empirical evidence. This complementary relationship confirms the argument that philosophy provides the conceptual foundation of science, while scientific inquiry validates theoretical propositions through observation and empirical verification (Suriasumantri, 2009).

Recent international studies support this perspective. (Miao, Q., & Nduneseokwu, 2025) argue that Education 5.0 requires the integration of scientific knowledge with critical, ethical, and interdisciplinary thinking to solve increasingly complex societal problems. Similarly, Rockström et al. (2023) demonstrated that scientific evidence concerning planetary boundaries must be accompanied by ethical and governance frameworks to ensure sustainable development. (Folke et al., 2021) further explained that resilience within socio-ecological systems depends on the interaction between scientific knowledge, institutional governance, and social values rather than technological advancement alone.

From a geographical perspective, these findings suggest that spatial analysis should not only describe environmental patterns but also critically evaluate the ethical consequences of human activities within geographical space. This interpretation is consistent with contemporary discussions on environmental justice, sustainability, and responsible resource management, which increasingly recognize that geographical knowledge should contribute to scientific understanding and societal well-being.

However, the Literature Review Matrix indicates that only a limited number of recent studies have attempted to integrate philosophical and scientific rationality, Tan Malaka's Madilog, and Islamic philosophy into a unified geographical epistemology. Most previous studies discuss these perspectives independently, resulting in fragmented conceptual frameworks that inadequately explain the complexity of human-environment interactions.

Therefore, this study proposes that geographical rationality should be understood as an integrated epistemological framework in which philosophical reflection strengthens conceptual understanding, scientific rationality provides empirical validation, Madilog contributes dialectical and critical analysis of socio-environmental realities, and Islamic philosophy enriches environmental ethics through the integration of reason, revelation, and moral responsibility. Such integration offers a comprehensive foundation for geographical research and environmental decision-making in the context of sustainable development.

3. Rationality in Geography and Human–Environment Relations

The document analysis sheet and the literature review matrix demonstrate that rationality occupies a central position in contemporary geographical studies as an epistemological foundation for understanding the dynamic relationships between humans and the environment. The reviewed literature published between 2021 and 2026 indicates that geographical rationality has expanded beyond spatial description toward interdisciplinary analyses that integrate environmental sustainability, socio-ecological resilience, disaster risk reduction, and environmental governance.

The literature synthesis further reveals that recent geographical studies increasingly use GIS, remote sensing, spatial modeling, and environmental monitoring technologies to explain environmental change and support evidence-based decision-making. However, the analysis also indicates that technological advancements alone are insufficient for addressing environmental degradation because they often neglect ethical considerations, cultural values, and human responsibility toward (Intergovernmental Panel on Climate Change, 2023), (United Nations Environment program, 2024), (Rockström et al., 2023)

Furthermore, the findings indicate that studies on human–environment relationships increasingly recognize the importance of integrating scientific knowledge with environmental ethics. Recent studies have emphasized that environmental sustainability depends not only on technological innovation but also on ecological awareness, community participation, local wisdom, and ethical responsibility (Folke et al., 2021; United Nations Educational, Scientific and Cultural Organization, 2021). However, the literature review matrix shows that only a limited number of geographical studies explicitly discuss rationality as an integrated epistemological concept linking scientific reasoning, philosophy, environmental ethics, and religious values.

The findings confirm that rationality functions not only as an analytical tool for interpreting spatial phenomena but also as an epistemological framework that shapes geographers' understanding of interactions between humans and the environment. Classical geographical thought primarily emphasized the explanation of spatial patterns and environmental processes through scientific observation and logical reasoning (Gregory et al., 2009). However, contemporary geographical scholarship increasingly argues that environmental issues require interdisciplinary perspectives that integrate ecological, social, cultural, ethical, and political dimensions.

Rockström et al. (2023) supported this finding, arguing that maintaining the Earth's safe operating space requires integrating scientific evidence with environmental governance and social responsibility. Folke et al. (2021) emphasized that resilience within socio-ecological systems emerges through interactions among ecological processes, institutional governance, and societal values. These perspectives indicate that rationality should no longer be interpreted merely as scientific objectivity but also as ethical responsibility toward environmental sustainability.

This study also identifies an important limitation in contemporary geographical research. Based on the Literature Review Matrix, most recent studies have focused on environmental modeling, disaster management, climate adaptation, and geospatial technologies, whereas relatively few have examined the philosophical foundations underlying geographical reasoning. Consequently, geographical rationality is frequently reduced to methodological procedures without considering its ethical, cultural, and spiritual implications.

Another important finding concerns the Indonesian context. Environmental issues such as deforestation, river pollution, land conversion, and biodiversity loss demonstrate that scientific and technological solutions alone have not adequately addressed environmental degradation. These problems require geographical approaches that integrate empirical analysis with ethical reflection, cultural values, and environmental responsibility. Therefore, geographical rationality should explain environmental phenomena and guiding socially just, culturally relevant, and ecologically sustainable environmental decision-making.

Geographical rationality should be understood as a multidimensional epistemological framework integrating scientific rationality, Western philosophical reasoning, Tan Malaka's Madilog, and Islamic philosophy based on the synthesis developed in this study. Scientific rationality provides empirical validation and methodological rigor; Western philosophy strengthens logical reasoning and critical inquiry; Madilog contributes dialectical analysis of socio-environmental realities; and Islamic philosophy enriches geographical thought through the integration of reason, revelation, ethical values, and spiritual responsibility. This conceptual synthesis extends existing geographical scholarship by positioning rationality as the foundation for sustainable environmental ethics and human–environment relationships.

4. Integration of Rationality and Spirituality in Islamic Philosophy

The analysis derived from the document analysis sheet and the literature review matrix reveals that Islamic philosophy contributes an essential epistemological dimension to the concept of rationality by integrating reason ('aql), revelation (wahy), intuition, and moral responsibility. Unlike contemporary scientific rationality, which predominantly emphasizes empirical verification and logical consistency, (Gade, 2023) Islamic philosophy considers rationality as a comprehensive process encompassing intellectual, ethical, and spiritual dimensions. This synthesis suggests that knowledge is evaluated not only by its scientific validity but also by its contribution to justice, environmental stewardship, and the well-being of humanity (Syihabuddin & Kirwan, 2023).

The literature published between 2021 and 2026 further indicates a growing international interest in Islamic environmental ethics and sustainability. (Rumi, 2004) Islamic teachings encourage environmental responsibility through principles such as khalifah (stewardship), mizan (balance), and amanah (trust), which provide ethical guidance for sustainable environmental management. These principles demonstrate that environmental conservation should be regarded as both a scientific obligation and a moral responsibility rooted in religious values .

The literature review matrix also indicates that although Islamic environmental ethics has been widely discussed, only a limited number of studies explicitly integrate Islamic epistemology with geographical rationality. Existing publications generally examine environmental ethics from theological or legal perspectives, whereas geographical studies continue to emphasize empirical and technological approaches. Consequently, opportunities for developing a more integrated epistemological framework in geographical studies connecting scientific rationality with Islamic philosophical thought remain.

The findings demonstrate that Islamic philosophy broadens the understanding of rationality beyond scientific reasoning by emphasizing the harmonious relationship between reason, revelation, intuition, and ethical responsibility. This perspective differs from positivistic traditions, which generally limit rationality to observable and measurable phenomena. Islamic philosophy recognizes that scientific knowledge should contribute to moral development and environmental sustainability (Ismail & Firas, 2024).

The present findings are consistent with those of recent studies that argue that religion and spirituality can strengthen environmental awareness and sustainable behavior. (Ismail & Firas, 2024) Islamic environmental ethics provide normative principles that support biodiversity conservation, climate action, and responsible natural resource management. These findings reinforce the argument that environmental problems cannot be solved solely through technological innovation but also require ethical transformation and spiritual awareness (Miao, Q., & Nduneseokwu, 2025).

The analysis also confirms the relevance of Al-Ghazali's epistemology to contemporary geographical thought. Al-Ghazali viewed reason as an indispensable instrument for acquiring knowledge while emphasizing that its limitations necessitate guidance from revelation and spiritual purification. Similarly, Jalaluddin Rumi regarded rationality as the beginning of humanity's intellectual journey toward deeper wisdom achieved through intuition, compassion, and spiritual experience. Although these classical perspectives originated centuries ago, the present synthesis demonstrates their continuing relevance for addressing current environmental crises characterized by ecological degradation and declining environmental ethics (Al-Ghazali, 2011).

Furthermore, the findings indicate that integrating Islamic philosophy into geographical rationality significantly contributes to the development of environmental ethics. Rather than positioning science and religion as contradictory systems of knowledge, this study demonstrates that both perspectives are complementary (Basri et al., 2025). Scientific rationality provides empirical evidence for understanding environmental change, while Islamic philosophy establishes ethical principles that guide responsible interactions between humans and nature (Zuhdi et al., 2024).

Islamic philosophy enriches geographical epistemology by integrating scientific inquiry with ethical and spiritual values (Miao, Q., & Nduneseokwu, 2025). This integration strengthens geographical rationality as a holistic framework capable of explaining environmental phenomena while simultaneously promoting environmental responsibility, ecological justice, and sustainable development. Consequently, geographical studies should not be limited to spatial analysis but should also incorporate ethical reflection and spiritual awareness as fundamental components of environmental decision-making.

5. Madilog and Critical Rationality Strengthening in Environmental Ethics

The document analysis sheet and the literature review matrix indicate that Tan Malaka's Madilog (Materialism, Dialectics, and Logic) significantly contributes to strengthening critical rationality in geographical thought and environmental ethics. The literature synthesis demonstrates that Madilog extends scientific rationality by encouraging critical reflection on the interrelationships among environmental, social, political, and economic processes (Malaka, 2007). Rather than interpreting environmental degradation as an isolated ecological phenomenon, Madilog emphasizes that complex interactions between human activities, social structures, and historical development result in environmental problems.

The analysis of recent literature published between 2021 and 2026 further reveals that technological or empirical approaches alone cannot adequately explain contemporary environmental crises, including climate change, biodiversity loss, pollution, and resource depletion. Recent studies emphasize the importance of integrating scientific evidence with critical thinking, ethical responsibility, and social transformation to achieve sustainable environmental governance (Folke et al., 2021; United Nations Environment program, 2024; Rockström et al., 2023; Intergovernmental Panel on Climate Change, 2023). However, the Literature Review Matrix indicates that only a limited number of geographical studies explicitly employ dialectical perspectives to explain environmental issues, and even fewer integrate Madilog, scientific rationality, and Islamic philosophy.

The findings also reveal that the philosophical principles of materialism, dialectics, and logic remain relevant for interpreting contemporary environmental challenges. Materialism encourages the examination of environmental problems based on observable realities and empirical evidence. Dialectics facilitates the understanding of the dynamic interactions among environmental, economic, political, and cultural systems. Logic provides a systematic framework for evaluating arguments and constructing scientifically accountable conclusions. Collectively, these principles strengthen GRB by encouraging critical, evidence-based, and context-sensitive analyses.

The findings demonstrate that Madilog should not be interpreted merely as a philosophical doctrine of materialism but as a methodological framework that encourages critical reasoning in understanding socio-environmental realities. This interpretation is highly relevant to contemporary geographical studies, which

increasingly recognize the complexity of interactions among environmental change, human activities, governance, and sustainable development.

Recent international scholarship supports this perspective. (Rockström et al., 2023) argue that planetary sustainability depends on integrated governance that can address interconnected environmental and social challenges. Similarly, Folke et al. (2021) emphasized that resilience emerges from adaptive interactions among ecological systems, institutions, and communities rather than from technological innovation alone. These findings are consistent with the dialectical principles embedded in Madilog, which emphasize the interconnectedness and continuous transformation of natural and social systems.

Nevertheless, this study identifies an important conceptual limitation of contemporary geographical scholarship. Most recent studies have adopted scientific rationality as the principal epistemological framework while paying relatively little attention to the potential contribution of critical philosophical traditions, particularly Madilog, in strengthening environmental analysis. Likewise, studies on Islamic environmental ethics often focus on normative religious values without integrating them into broader geographical epistemology. Scientific rationality, Madilog, and Islamic philosophy continue to be discussed separately despite their complementary potential.

This study's conceptual synthesis demonstrates that these four intellectual traditions constitute mutually reinforcing components of geographical rationality. Scientific rationality provides empirical evidence and methodological rigor for understanding environmental phenomena. Western philosophy contributes to logical reasoning, conceptual clarification, and epistemological reflection. Madilog strengthens critical and dialectical analysis by explaining environmental change within broader historical and socio-political contexts. Islamic philosophy enriches this framework through ethical principles grounded in reason, revelation, spiritual awareness, and moral responsibility toward nature.

The integration of these perspectives represents the principal contribution of this study. Instead of positioning science, philosophy, and religion as competing systems of knowledge, this study proposes an integrated epistemological framework in which scientific inquiry, critical philosophy, dialectical reasoning, and spiritual ethics complement one another in explaining human–environment relationships. This synthesis broadens the theoretical foundation of geography by positioning rationality

not only as a scientific explanation instrument but also as a basis for environmental ethics, sustainable development, and environmentally responsible public policy. Geographical education and environmental governance should encourage interdisciplinary approaches that integrate scientific competence, philosophical reflection, critical reasoning, cultural values, and spiritual responsibility to address increasingly complex environmental challenges.

D. CONCLUSION

By integrating scientific reasoning, philosophical reflection, critical analysis, and spiritual values in understanding the relationships between humans and the environment, this study demonstrates that rationality constitutes a multidimensional epistemological foundation for geographical thought. Through a qualitative library research approach employing a document analysis sheet and a literature review matrix, the study reveals that scientific rationality, Western philosophy, Tan Malaka's Madilog, and Islamic philosophy are complementary perspectives that collectively strengthen geographical knowledge and environmental ethics.

The findings indicate that scientific rationality contributes to empirical verification and methodological rigor, Western philosophy provides logical reasoning and critical reflection, Madilog offers dialectical analysis of socio-environmental realities, and Islamic philosophy enriches geographical epistemology by integrating reason ('aql), revelation (wahy), intuition, and moral responsibility. The conceptual synthesis developed in this research demonstrates that geographical rationality should not be understood solely as a scientific method but as a holistic epistemological framework capable of addressing contemporary environmental challenges through interdisciplinary perspectives.

The novelty of this research lies in the integration of scientific rationality, Western philosophy, Tan Malaka's Madilog, and Islamic philosophy into a unified epistemological framework for geography. Unlike previous studies that generally discuss these traditions separately, this study proposes a conceptual synthesis that connects empirical inquiry, critical philosophy, dialectical reasoning, and spiritual ethics as complementary foundations for understanding human-environment relationships and strengthening environmental ethics.

The findings have important theoretical and practical implications. This study theoretically contributes to the development of geographical epistemology by

expanding the concept of rationality beyond empirical approaches to include ethical, cultural, and spiritual dimensions. The proposed framework may support the development of environmental education, geography curricula, environmental ethics, and sustainable environmental governance that integrates scientific knowledge with local cultural values and religious perspectives.

Despite these contributions, this study is limited to a conceptual analysis based on library research and does not empirically evaluate the implementation of the proposed epistemological framework. Future studies using qualitative, quantitative, or mixed-method approaches are recommended to examine the application of this framework in geographical education, environmental policy, disaster mitigation, and community-based environmental management.

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