

Transformation of Scientific Paradigms: Philosophical and Practical Studies of Transdisciplinary Approaches

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Abstract

Scientific integration is an important issue in the development of contemporary science, especially within the environment of Islamic religious higher education. The integration practices that have developed so far are often still partial and symbolic; therefore, they are not able to adequately address complex and multidimensional social problems. The transdisciplinary approach emerges as an epistemological framework that seeks to transcend disciplinary boundaries by integrating diverse scientific perspectives, human values, and social contexts in a holistic manner. This study aims to examine transdisciplinary approaches within the framework of scientific integration, including their concepts, methodologies, objectives and benefits, forms of implementation, and implementation challenges. This study employs a qualitative approach using a literature review method. Data were obtained through the identification and analysis of books, scientific journal articles, and relevant academic literature, and were subsequently analyzed using descriptive-analytical techniques. The results of the study indicate that the transdisciplinary approach plays a strategic role in building holistic and contextual scientific integration; however, its implementation still faces several challenges, including differences in scientific paradigms, difficulties in methodological integration, and barriers to cross-disciplinary communication.

INTRODUCTION

The concept of scientific integration is a highly complex undertaking because it concerns not only the theoretical dimension but also the philosophical, historical, and practical dynamics that shape knowledge development. This complexity becomes even more evident when observing scientific integration efforts carried out by several Islamic universities in Indonesia, which are often limited to adding Islamic studies programs to an existing academic framework. This method is frequently regarded as a form of integration, even though, in many respects, it has not addressed the essence of more substantive scientific integration. In the context of higher education in Indonesia, the practice of scientific integration has exhibited a variety of patterns and characteristics. This variation reflects differences in philosophical interpretation, local needs, and academic traditions that are distinctive to each institution (Aziz 2023; Benton et al. 2023; Harahap et al. 2023; Haug 2017; Ludwig et al. 2020).

The emergence of a transdisciplinary approach represents a response to the challenge of complex problems that can no longer be resolved solely from the perspective of a single discipline (monodisciplinary) or merely through a combination of several disciplines (multidisciplinary). Historically, Islamic education has possessed an integrative character grounded in the principle of the unity of knowledge (monotheism). This principle holds that all

knowledge, regardless of its form, originates from a single and equal divine reality. However, in contemporary practice, Islamic education faces a sharp dichotomy. This dichotomy occurs between religious sciences and general sciences, between traditional values and the demands of modernity, and between theoretical and practical aspects of the educational process (Aji 2023; Fernadi 2024; Habibi 2024; Ideland 2018; Sahin 2018).

This dichotomous condition ultimately gives rise to various epistemological and praxis-related problems in scientific development, particularly within the environment of Islamic higher education institutions (Khandekar 2021; Nagy 2015; Shekitka 2020; Valentin 2023). Religious sciences are often positioned as a normative domain separate from empirical reality, while general sciences develop through a positivistic logic with limited engagement with values and ethics (Wildman 2016; Zyphur et al. 2020). As a result, both domains are often less capable of responding to social problems that are complex, multidimensional, and constantly evolving. In this situation, scientific integration can no longer be understood merely as a symbolic or administrative effort; rather, it must be directed toward the formation of a new perspective capable of bridging disciplinary boundaries in a substantive and meaningful way.

The transdisciplinary approach has therefore emerged as a relevant epistemological framework for addressing this impasse. In contrast to multidisciplinary or interdisciplinary approaches that maintain disciplinary boundaries, the transdisciplinary approach seeks to transcend them by creating a space for dialogue and knowledge synthesis that is more open, contextual, and oriented toward solving real-world problems. In the context of Islamic education, this approach holds particular significance because it aligns with the principle of the unity of knowledge derived from the values of monotheism while also responding to contemporary demands for collaboration across fields (Adeoye et al. 2025; Rahmadi et al. 2023; Sahin 2018; Srinio et al. 2025; Uyuni et al. 2024).

The urgency of this research stems from several converging factors. Indonesian Islamic higher education institutions face increasing pressure to produce graduates capable of addressing complex contemporary challenges while maintaining a strong Islamic identity and value system. The current fragmentation between religious and general sciences undermines this mission, producing graduates with compartmentalized knowledge that is poorly suited to holistic problem-solving. In addition, global challenges such as climate change, public health crises, and social inequality require collaborative approaches that transcend disciplinary and sectoral boundaries. The transdisciplinary approach offers potential pathways for addressing these challenges; however, its implementation requires a systematic understanding of both its theoretical foundations and practical obstacles. Furthermore, contemporary policy frameworks increasingly emphasize the importance of integrative approaches in higher education, necessitating evidence-based guidance for institutional transformation.

The novelty of this research lies in its comprehensive examination of transdisciplinary approaches across multiple dimensions simultaneously: philosophical foundations, methodological frameworks, objectives and benefits, forms of implementation across diverse fields, and implementation challenges. Unlike previous studies that focus on single aspects or limited contexts, this research provides an integrated analysis that enables the identification of both common patterns and context-specific variations. The focus on Indonesian Islamic higher education contributes to a deeper understanding of how transdisciplinary approaches intersect with Islamic epistemological traditions, potentially revealing unique configurations and

adaptations. In addition, the systematic identification and analysis of implementation challenges offers practical guidance for institutions seeking to adopt transdisciplinary approaches while anticipating and addressing potential obstacles.

Within this framework, the study of transdisciplinary approaches becomes increasingly important to elaborate systematically and critically. Although transdisciplinary discourse has been widely discussed in academic debates, its application in the context of scientific integration—particularly within Islamic educational environments—still faces various conceptual and practical challenges. Not infrequently, this approach is understood only normatively as a form of integration rhetoric, without a deep understanding of its epistemological foundations, methodological structure, and implications for the development of educational science and practice. Therefore, a study is needed that not only explains the concept of the transdisciplinary approach theoretically but also situates it within the context of the real need for integrative and responsive scientific development capable of addressing the complexity of contemporary societal problems.

Based on this background, this study aims to examine transdisciplinary approaches contextually within the framework of scientific integration, particularly in relation to higher education and the development of contemporary science. Specifically, this research seeks to explain the definition, methodology, objectives, and benefits of the transdisciplinary approach, as well as to describe the forms of its application in several strategic areas, such as education, scientific research, social problem-solving, health, and environmental studies. In addition, this research aims to identify the challenges encountered in implementing transdisciplinary approaches, thereby contributing theoretically and reflectively to the development of a more holistic, contextual, and sustainable model of scientific integration.

METHOD

This study employed qualitative research using a library research approach. This method was chosen because the research focus did not rely on field data collection but on examining and analyzing relevant literature related to transdisciplinary approaches in scientific integration. Through literature review, the researcher analyzed scholarly perspectives and theoretical discussions concerning transdisciplinarity, knowledge integration, and their development within the context of higher education and contemporary social issues.

The data sources in this study consisted of primary and secondary materials. Primary sources included books, peer-reviewed journal articles, and academic works that directly addressed transdisciplinary approaches, scientific integration, and the ideas of relevant scholars, including M. Amin Abdullah and other thinkers associated with knowledge integration discourse. Secondary sources consisted of supporting literature such as conference proceedings, education policy documents, and scholarly writings related to Islamic education and scientific development. All sources were selected based on their relevance and academic credibility in relation to the research focus.

Data were collected through a systematic literature search involving reading, note-taking, and classification of relevant materials according to the research focus. The collected data were then analyzed using descriptive-analytical techniques. This analysis involved describing key arguments and findings from the literature and critically examining the relationships among concepts, applications, and challenges associated with transdisciplinary approaches in scientific

integration. To maintain data validity, source triangulation was applied by comparing perspectives from multiple references in order to obtain a more comprehensive understanding and minimize interpretive bias.

RESULTS AND DISCUSSIONS

Definition of Transdisciplinary Approach

According to M. Amin Abdullah, the term transdisciplinary or transdisciplinary in the academic context refers to an approach that combines various perspectives. This approach, also referred to as the transdisciplinary approach, aims to solve complex and multidimensional social environmental problems. However, this transdisciplinary approach model involves participants outside the scope of formal education and the specific expertise of the researcher or expert concerned.

A transdisciplinary approach is a method of solving problems by utilizing knowledge from different disciplines, including outside the educational setting and formal skills of a problem solver. In this approach, one may need to refer to one or more areas of knowledge that were not initially well mastered. However, to understand the problem in its entirety, it is often enough to combine one relevant external source of knowledge. According to Mawardi, transdisciplinary is an approach that uses various viewpoints and is characterized by the merger or integration of various fields of knowledge.

Based on various views of experts, the transdisciplinary approach can be defined as follows:

1. A transdisciplinary approach is a process that integrates and transforms knowledge from different disciplines and perspectives. The goal is to understand, define, and solve complex problems.
2. Transdisciplinary is an approach that integrates and transforms knowledge from diverse fields and perspectives. The focus is to improve the quality of the problem-solving process, so that it can produce more optimal decisions and solutions.

Methodology in a Transdisciplinary Approach

In Islamic education, the application of a transdisciplinary approach can be realized through the integration of Islamic sciences with science and technology. This learning approach plays a very responsive role in answering various challenges and demands in the era of globalization. Complex problems that touch on various aspects of human life require a science-based research approach and supported by a transdisciplinary learning model. Transdisciplinary research not only brings together a wide range of disciplines, but also involves a network of stakeholders such as researchers, government, civil society, as well as the industrial sector. The goal is to create collaborations that complement and support each other to achieve mutual benefits. Through this approach, the arrogance of the discipline can be eroded, and a broader perspective can be built, overcoming the limitations of reductionist thinking that have so often dominated the academic environment.

In the context of higher education, the application of transdisciplinary approaches is becoming increasingly relevant. Students and lecturers are required to produce innovative and applicable research, so that mastery of various methods and multidisciplinary thinking logic is more important than relying on a single approach. By accustoming to the tradition of synthesis

collaboration that combines creative and analytical perspectives, universities can shape a generation capable of responding to social challenges more holistically and effectively, in line with the expectations of a more integrative future university.

Goals and Benefits of Transdisciplinary Approaches

Transdisciplinary is defined as a form of interaction that occurs between, crossing, and beyond the boundaries of different disciplines. Its main goal is to achieve a more advanced understanding of contemporary science. A basic principle of this approach is to create a unity of knowledge that is specifically geared towards solving problems. This is achieved by bringing together, integrating, and integrating various disciplines in a comprehensive and comprehensive manner.

The transdisciplinary approach provides broad benefits, not only as a tool for dealing with complex problems, but also as a tool to identify new problems that arise as a result of an in-depth analysis of interdisciplinary processes. The application of this approach is aimed at achieving several main objectives, namely:

1. Facing various dimensions of reality.
2. Understand complex global issues.
3. Increasing synergy between various disciplines.
4. Build collaboration among experts from various fields. At its core, transdisciplinary implementation emphasizes cooperative or integrated cooperation, creating synergies among all individuals and sectors involved.

Application of Transdisciplinary Approaches in Scientific Integration

The transdisciplinary approach in scientific integration does not only stop at the conceptual and theoretical level, but finds its relevance in real relevance in the application across fields of life. Scientific integration through a transdisciplinary approach requires a connection between science, human values, and the socio-cultural context in which the science is applied. In a transdisciplinary approach, science is understood not only as a collection of academic theories and methodologies, but also as a social process involving the values, experiences, and practices of human life. Therefore, the application of this approach can be explained concretely in various strategic areas, which shows that scientific integration is an epistemological and pragmatic need in answering the complex problems of contemporary society.

1. Application of Transdisciplinary Approaches in the Integration of Science and Religion

Within the framework of scientific integration, religion plays a role in providing an orientation of values, ethics, and meaning, while science provides an empirical and methodological framework to understand reality. The transdisciplinary approach does not make religion a dogmatic justification for scientific findings, nor does it use science as a tool to override religious values. Instead, the two are brought together critically and constructively to answer humanitarian issues.

The application of this approach is very relevant in the context of religious universities, where scientific integration is the main mission of the institution. Through a transdisciplinary approach, Islamic studies can be developed contextually and responsive to scientific developments and global challenges.

2. Application of Transdisciplinary Approaches in Scientific Research

In the field of research, a transdisciplinary approach is applied through cross-disciplinary collaboration and the involvement of stakeholders outside academia. Research is no longer seen solely as an intellectual activity detached from social realities, but as a shared process to produce knowledge that is relevant and beneficial to society. The transdisciplinary approach requires researchers to not only master one scientific field, but also have the ability to dialogue with other disciplines.

The research process becomes a space for the exchange of diverse ideas, methodologies, and perspectives. In this way, the knowledge generated becomes more comprehensive and has a wider cruising power. Furthermore, transdisciplinary research encourages the birth of innovative solutions to complex problems, such as poverty, environmental crises, public health, and social conflicts. The resulting solutions are not only based on data and scientific analysis, but also take into account ethical values, local culture, and community aspirations.

3. Application in Social and Humanitarian Problem Solving

The application of a transdisciplinary approach is very important in efforts to solve multidimensional social problems. Social problems never stand in a single dimension, but always involve economic, social, political, cultural, psychological, and even spiritual aspects. Therefore, solving social problems requires an approach that is able to integrate these various dimensions in a synchronous manner. The transdisciplinary approach allows for synergy between science and human values. Science not only functions as a tool for analysis, but also as a means of social transformation.

In this context, scientific integration is directed at achieving social justice, human welfare, and the sustainability of life. Through dialogue between academia and society, transdisciplinary approaches help build solutions that are contextual and rooted in social realities. This makes science more responsive to the needs of society and not trapped in mere theoretical abstraction.

4. Application in the Field of Education

In the field of education, especially higher education, the application of a transdisciplinary approach is reflected in the design of an integrative and contextual curriculum. The curriculum is no longer prepared separately based on disciplines alone, but is designed to connect various scientific perspectives in discussing certain themes or problems. This allows students to gain a more comprehensive and non-partisan understanding. The transdisciplinary approach also encourages a change in learning methods from teacher-centered to student-centered learning. Students not only passively receive knowledge, but are actively involved in the process of analysis, synthesis, and reflection.

In addition, a transdisciplinary approach encourages a change in the role of educators from mere transmitters of knowledge to facilitators of learning. The educational process becomes a space for dialogue between various disciplines, student experiences, and human values. Thus, education functions not only as a process of knowledge transfer, but also as a means of character formation and social awareness.

Through cross-disciplinary discussions, case studies, and project-based learning, students are trained to see the connections between theory and practice, as well as between science and social reality. In addition, this approach contributes to the formation of an open, critical, and adaptive academic character of students. Students are encouraged to appreciate the diversity of

scientific perspectives and realize that scientific truth is dynamic and always open to testing and development.

5. Application in the Health Sector

At the conceptual level, the transdisciplinary approach in health departs from criticism of the biomedical model that tends to be reductionist and focuses on disease alone, without paying attention to the social and psychological conditions of the patient. Through a transdisciplinary approach, health is understood as a condition of physical, mental, social, and spiritual well-being that is interconnected. Thus, scientific integration is an important foundation in formulating health policies and practices that are more humane and oriented towards the overall quality of human life.

In practice, a transdisciplinary approach in the health sector is realized through the integration of medical science, nursing, public health, psychology, sociology, nutrition, health economics, and environmental science. This integration also involves actors outside the academic realm, such as health workers, patients, families, communities, and policymakers. The involvement of these various parties shows that health is a collective responsibility that cannot be solved by one profession or discipline alone.

As a concrete example, handling the problem of stunting in children is a public health problem that requires a transdisciplinary approach. Stunting is not only caused by malnutrition, but is also influenced by parental parenting, maternal education level, family economic conditions, environmental sanitation, and understanding of health and religious values in the family. Therefore, a medical approach that focuses on providing nutritional supplements needs to be integrated with an educational approach to improve health literacy, a sociological approach to understand cultural practices in childcare, an economic approach to improve access to food, and a religious approach to instill awareness that maintaining children's health is a moral and spiritual mandate.

In addition, a transdisciplinary approach is also very relevant in the treatment of chronic diseases, such as diabetes, hypertension, and mental health disorders. These diseases are not only related to biological factors, but are also closely related to lifestyle, psychological stress, social environment, and economic conditions. Through a transdisciplinary approach, medical treatment efforts are combined with psychological counseling, health education, social behavior change, and family and community support. This integration allows patients not only to be oriented to physical healing, but also to the sustainability of quality of life.

A transdisciplinary approach in the health sector also has implications for the formulation of public health policies. Integrative health policies are not only based on epidemiological data, but also consider social, cultural, and economic aspects of the community. Through this approach, health policies become more responsive to the real needs of the community and are not just top-down. The integration of science in health policy allows for the creation of a fairer, more inclusive, and sustainable health system.

6. Application in the Environmental Field

The transdisciplinary approach in the field of environment is a scientific framework that views environmental problems as multidimensional problems that cannot be solved through only one specific discipline. Environmental damage, climate change, water and air pollution, and ecosystem degradation are not only related to ecological and technical aspects, but are also

greatly influenced by social, economic, political, cultural factors, as well as human values and ethics in viewing nature.

The transdisciplinary approach places the environment as an integral part of human life, so that environmental sustainability is understood as a prerequisite for social and economic sustainability. In practice, a transdisciplinary approach in the field of environment is realized through the integration of ecological sciences, biology, geography, development economics, sociology, environmental law, as well as ethical and religious values. This integration does not only occur at the academic level, but also involves local communities, governments, the private sector, and civil society organizations as part of the decision-making process.

For example, efforts to address forest degradation are not enough through ecological approaches that focus on reforestation or spatial planning, but must be combined with sociological analyses of land tenure structures, anthropological approaches to understand indigenous peoples' local wisdom in forest management, economic approaches to design fairer economic incentives, and legal approaches to ensure effective regulatory enforcement.

7. Application in the Field of Economics and Development

In practice, a transdisciplinary approach in the field of economics and development is realized through the integration of economics with the sociology of development, political science, anthropology, education, technology, and social and religious ethics. Development is understood as a social process that involves power relations, social structures, cultural values, and human resource capacity.

The transdisciplinary approach is also very relevant in the development of micro, small, and medium enterprises (MSMEs) as a pillar of the community's economy. Strengthening MSMEs is not enough only through macroeconomic policies or capital provision, but requires integration between market analysis, managerial assistance, financial literacy, the use of digital technology, and social and cultural understanding of the business community. In this context, a transdisciplinary approach allows for the integration of economic science, management, information technology, economic sociology, and business ethics based on religious values, so that economic development is not only profit-oriented, but also on sustainability and common well-being.

In addition, a transdisciplinary approach in the fields of economics and development also plays an important role in responding to the challenges of sustainable development. Issues such as social inequality, unemployment, environmental crises, and urbanization cannot be solved through economic policy alone, but require integration between development economics, environmental science, public policy, and community participation. This approach encourages policy formulation that considers not only short-term economic growth, but also long-term social and ecological impacts.

The Challenges of Transdisciplinary Approaches

The transdisciplinary approach is a strategic effort to integrate various disciplines to answer complex problems that cannot be solved by one scientific field alone. Although this approach offers great potential in generating holistic, contextual, and applicative knowledge, its application in academic and social practice is not easy. There are a number of fundamental challenges that must be faced in implementing the transdisciplinary approach effectively.

Based on the author's observations, there are various problems that often arise in the implementation of this approach.

1. Differences in Paradigm and Scientific Epistemology

Differences in paradigm and scientific epistemology are one of the most fundamental challenges in the application of a transdisciplinary approach. In a transdisciplinary approach, the first difficulty arises from the difference in the way of understanding reality. Exact sciences such as physics and biology, for example, tend to use positivistic paradigms that emphasize objectivity, measurability, and generalization. Meanwhile, the social sciences and humanities are closer to the constructivist and interpretive paradigms that consider reality as something that is understood through subjective meaning and social context.

The next challenge lies in the difference in the definition of concepts used by each discipline. A seemingly simple concept often has different meanings in different disciplines. For example, the concept of "well-being" in economics may be measured through income indicators, while in sociology it may mean access to social relationships, and in psychology it relates to emotional conditions or mental health. When key terms have different definitions, it can be difficult to build a common analytical framework that is acceptable to all disciplines.

Epistemological differences also affect the determination of the standard of the validity of knowledge. The natural sciences usually emphasize the importance of measurable empirical evidence, repeatable experiments, and consistent results. In contrast, the humanities often rely on logical argumentation, in-depth interpretation, and contextual analysis. This difference makes research results from one discipline may be seen as less valid by another. In transdisciplinary work, this kind of epistemological tension can complicate the process of unifying the results of studies into a form of mutually agreed knowledge.

2. Difficulties in Integrating Research Methodology

The difficulty of integrating research methodologies is the next challenge in the application of a transdisciplinary approach, because each discipline has a different methodological tradition, both in terms of how to collect data and analysis techniques. This difficulty is even more evident when researchers have to design research designs that allow various methods to be used in harmony.

Methodological integration is not just about putting quantitative and qualitative methods in a single study, but how to ensure that the two work within a single mutually supportive conceptual framework. In many cases, certain methods require a very specific research structure, for example experiments require strict control of variables, while ethnography requires openness to the dynamics of the field. This tension between the need for tight structures and the flexibility of the field often causes researchers to find it difficult to design research procedures that can provide space for each method to make the maximum contribution.

Another challenge arises when each method carries different philosophical assumptions about how knowledge should be acquired. In quantitative research, knowledge is considered valid if it can be measured and statistically tested. In contrast, qualitative research assesses validity through the depth of interpretation, narrative consistency, and ability to capture the complexity of phenomena.

3. Challenges of Communication and Scientific Language

When researchers from different fields work together, they bring their own "scientific language" that is often not immediately understood by other disciplines. This leads to a

significant gap in understanding, even when they use the same seemingly identical terms. For example, terms such as "structure", "function", "system", or "value" can have very different meanings in biology, sociology, economics, or philosophy. This difference in meaning is what makes cross-disciplinary discussions often encounter obstacles, because researchers must re-clarify the terms used before they can step into the deeper analysis stage.

The next challenge lies in efforts to build a common language that can be used by research teams from various disciplines. Building this common language is not easy, as it requires the willingness of all disciplines to adapt their terms and understanding without taking away the essence of their respective disciplines. This process is often time-consuming, as researchers must repeatedly clarify, revise, and equalize perceptions before coming up with a conceptual framework that can be understood together.

Overall, the challenges of communication and scientific language in a transdisciplinary approach show that knowledge integration is not only a matter of combining theories or methods, but also the ability to understand the ways in which other disciplines speak and think. Without effective communication, equalization of concepts, and a willingness to build a common language, transdisciplinary work will be hampered from the initial stage. Therefore, mastery of cross-disciplinary communication is a fundamental skill that determines the success of the entire transdisciplinary process.

4. Complexity of the Problem Studied

The complexity of the problems studied is an inherent challenge in transdisciplinary approaches because the issues that require this approach are usually multidimensional, non-linear, and involve a variety of interacting factors. Issues such as climate change, poverty, health crises, religious moderation, or sustainable development are not simple problems that can be explained by one discipline alone. Each aspect of the problem is intertwined in a complex network of cause-and-effect, so when researchers try to analyze it through a transdisciplinary approach, they have to deal with multiple layers of social, economic, cultural, political, ecological, and even ethical dimensions that are not easily mapped in their entirety.

The next challenge arises from the dynamically changing nature of complex problems. Transdisciplinary issues are rarely static and they evolve according to changes in social, economic, technological, and policy contexts. This change creates high uncertainty, so the analytical framework that was developed at the beginning of the study may no longer be relevant as the research progresses. Researchers are required to always be adaptive and flexible, but this flexibility often clashes with the methodological need to have a clear and consistent research structure.

5. Validity and Reality Challenges

The challenge in maintaining validity and reliability in a transdisciplinary approach arises because this type of research combines a wide variety of disciplines, methods, perspectives, and forms of data that are not always uniform by scientific standards. Validity related to the accuracy of a finding in describing reality and reliability regarding the consistency of results becomes more difficult to maintain when the research involves various approaches with different methodological characters.

In monodisciplinary research, validity and reliability are often built through established procedures, such as the design of specific studies, the use of standardized instruments, or clear data verification procedures. However, in a transdisciplinary approach, not all disciplines have

the same standards and not all forms of data can be measured in a uniform way. This creates potential inconsistencies in the way scientific truth assessments are conducted.

6. Non-Academic Stakeholder Engagement

The challenge in engaging non-academic stakeholders in a transdisciplinary approach arises because the academic world and the practical world have different ways of thinking, goals, and working standards. The transdisciplinary approach does emphasize collaboration across actors, both academics, governments, communities, industry players, and local communities, but this integration does not always go smoothly. One of the main challenges is the difference in orientation, where academics work to generate systematic new knowledge, while non-academic stakeholders often focus on practical needs, quick solutions, and immediate impacts.

Another challenge arises in the aspect of interests and power. Non-academic stakeholders have different agendas, the government may focus on policy, industry focuses on efficiency and profit, while the public wants justice or social change. These differences can give rise to conflicts of interest that hinder the process of dialogue and joint decision-making. The existence of social hierarchies can also affect the quality of participation, for example, the voices of local communities can be marginalized when dealing with actors who have greater economic or political power.

On the other hand, the level of commitment is also a problem. Non-academic actors often have limited time, resources, or motivation to engage in lengthy and technical research processes. Academics may conduct research for months or years, but practical stakeholders need quick results.

CONCLUSION

The transdisciplinary approach represents a strategic effort in contemporary scientific integration by bringing together knowledge from multiple disciplines and perspectives, including the participation of non-academic actors, to address complex and multidimensional problems that cannot be solved by a single field of study. Its application is relevant across various areas, such as the integration of science and religion, research, social problem-solving, health, education, and environmental studies, as it promotes holistic and contextual solutions oriented toward human well-being. However, the implementation of this approach faces several significant challenges, including differences in scientific paradigms and epistemological assumptions across disciplines, difficulties in integrating diverse research methodologies, communication barriers caused by varying scientific terminologies, and concerns regarding the validity and reliability of knowledge produced through mixed methods and data sources. In addition, collaboration with non-academic stakeholders may create further complexities due to differing objectives and perspectives. Future research should therefore focus on developing clearer methodological frameworks and practical models for implementing transdisciplinary collaboration, particularly in higher education and research institutions, in order to strengthen its effectiveness and sustainability.

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