

A BRIEF CONTRIBUTION TO THE THEORY OF EXPLANATORY VALUE WITH REFERENCE TO REGIONAL DEVELOPMENT

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Abstract

The objective of this study is to examine how the concept of “explanatory value” is defined and applied across the natural sciences, social sciences, and humanities. A systematic literature review was conducted using the SPIDER framework, with searches in the Web of Science Core Collection and explicit inclusion and exclusion criteria applied (English language, review articles, last five years; additionally, the year 2025). Titles, abstracts, and full texts were subjected to a screening process. The initial query yielded five pertinent studies, frequently employing the concept of “explanatory power.” A supplementary query generated eleven records from 2025, resulting in nine unique studies after duplicates were removed. The findings confirm the disciplinary heterogeneity of the concept and highlight its role as an evaluative criterion. Explanatory value emerges as a multidimensional and context-dependent concept that combines logical, empirical, and pragmatic aspects. In the context of regional development, explanatory value provides a key measure for assessing the adequacy of socioeconomic models and their applicability in regional policy design.

Keywords: Explanatory Value, Theory, Regional Development, Systematic Literature Review

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Introduction

The theory of explanatory value (also referred to as explanatory power, adequacy, or strength) deals with the ability of a particular statement, claim, or linguistic expression to provide relevant, interpretable, and truth-evaluable information. Explanatory value is not only a matter of linguistic form, but above all the ability of a statement to reflect reality, contribute to knowledge, and enable communication with a certain degree of accuracy. At its core, it concerns the connection between language and reality: a statement has explanatory value if it says something about the state of the world and can be assessed in terms of truthfulness or at least relevance. In contrast to explanatory value, which tells us why something is the case, one may distinguish the purely informative aspect of a statement, which only tells us that something is the case (Hempel and Oppenheim, 1948).

The roots of this concept lie in logic and analytical philosophy of language. Aristotle (1984) already understood a statement as a bearer of truth or falsehood. The modern concept was developed by Frege (1892) and Wittgenstein (1922). Logical positivism linked the truth value of statements to the possibility of empirical verification. However, it turned out that an approach focused purely on verification is problematic because it would exclude several theoretical claims that are nevertheless meaningful.

Therefore, alternatives emerged, notably Popper's theory of falsification, which considers a statement valuable if it is potentially refutable. Tarski's semantic theory of truth shows that the relationship between language and reality can be captured by defining truth as the correspondence of a statement with the situation. In addition, pragmatic and discursive approaches emphasize the role of context and the function of statements in communication (Popper, 1959).

The basic criteria for explanatory value are usually considered to be referentiality, i.e. the ability of a statement to refer to status quo, the possibility of truth evaluation, empirical or logical verifiability, and finally relevance. A statement makes sense when it carries information that is not trivial. On the other hand, purely emotional or metaphorical expressions may be effective in communication, but their explanatory value in a strictly logical sense is limited (Ylikoski and Kuorikoski, 2010).

In a scientific context, explanatory value is a key criterion in the formulation of theories and hypotheses. Scientific claims must be unambiguous, relate to reality, and be testable. The statement “this substance increases blood pressure” has high explanatory value because it is measurable and refutable, while vague statements such as “everything is connected to everything else” lack the necessary strength.

In law, the term is used primarily in the evaluation of evidence and witness testimony (Twining, 2006). Here, not only truthfulness is assessed, but also credibility, consistency, and relevance to the case under consideration. In the social sciences and humanities, the situation is more complex. Statements may not be directly verifiable by experiment, yet they may still have explanatory value in the interpretation of social phenomena.

The concept itself has its limitations. It is not absolute and depends on context, method, and language. A strictly logical approach, for example, would exclude a large part of humanities discourse (Dilthey, 1989). Empirical verifiability is sometimes limited, and language is inevitably vague. Therefore, current theories often combine logical, empirical, and pragmatic aspects (Habermas, 1988).

Currently, explanatory value is understood as a multidimensional concept. Scientific discourse assesses it according to falsifiability, accuracy, and relevance. In legal practice, emphasis is placed on the credibility and accuracy of testimony. In linguistics, the focus is on communicative function, pragmatic use, and semantic context. Overall, it can be said that the theory of explanatory value combines logic, philosophy, science, and law. Its significance lies in its ability to distinguish meaningful statements from meaningless ones, relevant ones from irrelevant ones, and useful ones from trivial ones (Wojtowicz and DeDeo, 2020).

This aspect is particularly important for theories of regional development. Regional science and development studies rely on models and hypotheses whose explanatory value determines their practical usefulness. Classic approaches such as Perroux's theory of growth poles (1955) or Myrdal's cumulative causation theory (1957) emphasize explanatory strength in accounting for uneven development. More recent frameworks, including the learning region concept and sustainable development models, similarly depend on whether they provide robust explanatory value for observed territorial disparities and policy outcomes (Pike *et al.*, 2017; Lundvall and Johnson, 1994). Thus, linking explanatory value to regional development theories highlights its methodological and practical significance in evaluating both traditional and contemporary paradigms.

Methods

A systematic literature review (SLR) was conducted to address the research question: How is explanatory value conceptualized and applied differently in the natural sciences, social sciences, and humanities?

The review was structured using the SPIDER framework. The sample (S) consisted of scholarly literature published in the last 5 years in peer-reviewed journals indexed the Web of Science Core Collection. The phenomenon of interest (PI) was the concept of explanatory value, including its conceptualization, criteria, and applications. The design (D) was defined by journal articles explicitly addressing explanatory value or closely related concepts. The evaluation (E) focused on identifying and comparing definitions, criteria, and disciplinary uses. The research type (R) included qualitative, theoretical, and philosophical contributions, with attention to interdisciplinary perspectives.

Inclusion criteria were: publications explicitly addressing explanatory value (or related terms such as explanatory power or explanatory adequacy), published in English, and indexed in the Web of Science Core Collection. Exclusion criteria ruled out non-academic sources, works only tangentially mentioning explanatory value, texts inaccessible in full, and studies outside the selected database.

The search strategy applied the following query in the Web of Science Core Collection:

Topic search (TS) = (“explanatory value” OR “explanatory power” OR “explanatory adequacy” OR “explanatory strength”) AND TS = (“natural sciences” OR “social sciences” OR humanities OR philosophy OR law)

The first search was filtered by language (English), document types: Review article, and timespan: last 5 years. As a supplementary approach, a broader query without disciplinary terms was considered to capture the widest possible range of relevant studies:

TS = (“explanatory value” OR “explanatory power” OR “explanatory adequacy” OR “explanatory strength”)

The second search was filtered by language (English), document types: Review article, and timespan: 2025. The final selection of journal articles analyzed in the next section involved an initial screening of titles and abstracts, followed by full-text assessment of eligibility.

Results

The search strategy applied in the Web of Science Core Collection successfully identified a set of 5 articles that explicitly or implicitly engage with the notion of explanatory value, often formulated as explanatory power. Overall, the results demonstrate both the strengths and the limitations of the query.

Several articles are directly relevant to the research question. For instance, Guigon (2023) develops a computational theory of motor control and emphasizes how the framework provides explanatory power across diverse movement phenomena. Similarly, Greenberg and Gao (2024) review models of economic

inequality and explicitly discuss the strengths and limitations of their explanatory capacity. Hume (2024) evaluates collegiality as a determinant of judicial behavior, highlighting how explanatory power can be used to assess theoretical accounts within political science. These studies illustrate how explanatory value is applied differently across natural sciences, social sciences, and law, thus aligning with the interdisciplinary scope of the research question.

Other results are only partially relevant. Grossberg (2025) reviews spiking neural networks and refers to gains in explanatory power when comparing modeling approaches, but the focus is mainly technical and neurophysiological. Mangalam (2025) critiques the Bayesian brain hypothesis, noting issues of explanatory power, metaphorical value, and empirical adequacy. Although conceptually pertinent, these articles remain highly specialized, which may limit their usefulness for a broader conceptual comparison.

In summary, the query retrieves a heterogeneous but meaningful set of publications. The key advantage is that it captures concrete disciplinary uses of explanatory value, ranging from neuroscience and computational psychology to economics, political science, and philosophy of mind. The limitation is that the results are scattered and sometimes only tangentially engage with explanatory concepts.

To strengthen the corpus, a complementary search using simplified queries without disciplinary terms was used. This broadened coverage and allowed for a clearer mapping of how explanatory value is conceptualized and applied across the natural sciences, social sciences, and humanities.

The second search produced a total of 11 studies from 2025. After removing two duplicates already captured in the first search, the refined corpus consists of 9 unique studies published in 2025. These articles cover a wide range of fields including environmental policy, economics, psychology, consumer studies, climate science, environmental engineering, and medicine. Each of them employs the concept of explanatory value—often under the label of explanatory power—though with varying degrees of centrality and relevance to the research question.

Aurenhammer *et al.* (2025) investigate the role of social milieu typologies in forest policy research. The study explicitly evaluates whether such frameworks enhance explanatory value beyond traditional socio-demographic factors. This is highly relevant, as explanatory value is positioned as the central evaluative criterion in applied social science.

Moreno-Foronda *et al.* (2025) compare machine learning and regression models for predicting housing prices. Explanatory power is used as the decisive criterion to assess methodological adequacy, making this article another highly relevant contribution, especially within applied economics and urban studies.

Das *et al.* (2025) apply hybrid dimension reduction and econometric models in transportation research. Explanatory power appears here in a methodological sense, evaluating how well statistical approaches capture determinants of traffic safety and performance. Its relevance is moderate, as explanatory value is mentioned mainly as a measure of technical adequacy.

Wang *et al.* (2025) analyze regional-scale distribution changes in earth science informatics. Explanatory power is invoked to justify the adequacy of predictive models in environmental monitoring. The focus is technical, and the role of explanatory value is peripheral, making this study of limited relevance.

Zheng *et al.* (2025) revisit Vroom's expectancy theory in the context of marketing science. The study highlights explanatory value as a theoretical virtue, positioning it as a benchmark for evaluating whether classical motivational theories remain robust in modern consumer research. This provides a conceptually interesting, moderately relevant example from business studies.

Kirk *et al.* (2025) examine the impact of weather anomalies and climate change on plankton ecology. Explanatory power is used to assess the adequacy of ecological models, providing insights into how explanatory value is applied within the natural sciences. While conceptually less central, the article still demonstrates disciplinary use of the concept.

Koo *et al.* (2025) assess whether social identity theory adequately explains behavior in sports management. Here, explanatory value is invoked explicitly to evaluate the sufficiency of a dominant theoretical framework, offering a moderately relevant case from psychology and organizational studies.

Bivins (2025) discusses the potential role of urine in waste management and resource recovery. Explanatory power is referenced to evaluate competing conceptual models in environmental engineering. The treatment is methodological rather than conceptual, thus of limited relevance.

Li *et al.* (2025) analyze surgical risks for people living with HIV. Explanatory value is mentioned in connection with evaluating epidemiological and medical models. Its relevance to the research question is low, as explanatory power is not a central theme but only a supporting evaluative term.

In summary, the most relevant contributions are Aurenhammer *et al.* (2025) and Moreno-Foronda *et al.* (2025), both of which explicitly place explanatory value at the center of their analysis. Several others (Das *et al.*, 2025; Koo *et al.*, 2025; Zheng *et al.*, 2025) are moderately relevant, demonstrating how explanatory power is used to assess the adequacy of frameworks and models in applied contexts. The remaining works (Bivins, 2025; Kirk *et al.*, 2025; Li *et al.*, 2025; Wang *et al.*, 2025) employ the concept more peripherally, yet they broaden the disciplinary scope and show how explanatory value functions as a cross-cutting evaluative notion.

Discussion and Conclusion

The majority of extant works in the literature addressing explanatory value do not adhere to the structure of a systematic literature review. In the fields of statistics and econometrics, the concept is frequently reduced to the incremental contribution of variables in regression models, an approach typically found in empirical case studies rather than in synthetic reviews. In philosophy of science, contributions by Brössel (2015) and Ylikoski and Kuorikoski (2010) provide valuable conceptual analyses, yet they remain theoretical discussions that fall short of offering a systematic survey of the field. Similar patterns emerge in economics and psychology, where explanatory power is invoked to judge the adequacy of models, but without a comprehensive methodology for comparison across contexts.

The articles identified through this review confirm this disciplinary fragmentation. Guigon (2023) employs the concept in computational neuroscience to unify disparate accounts of motor control, while Greenberg and Gao (2024) apply it to economic inequality models, and Hume (2024) highlights its role in evaluating judicial behavior theories. Although these studies illustrate the practical utility of explanatory value within their respective fields, their relevance is circumscribed by disciplinary boundaries. Other works, such as Grossberg (2025) on spiking neural networks and Mangalam (2025) on the Bayesian brain hypothesis, treat explanatory value only as a supplementary or technical criterion rather than as a central evaluative category.

By contrast, the present SLR is distinguished by its explicit methodological rigor and interdisciplinary scope. Through the application of structured search strategies (SPIDER framework, Web of Science queries, inclusion and exclusion criteria) and the synthesis of findings from the natural sciences, social sciences, and humanities, it provides a systematic mapping of how explanatory value is defined and applied. This integrative perspective addresses a significant lacuna in the existing literature by conceptualizing explanatory value as an overarching evaluative concept, rather than an isolated notion confined to disciplinary silos.

Beyond this general contribution, the results also suggest an important connection to regional development theories. In this domain, the adequacy of theoretical models—whether concerned with uneven development, learning regions, or sustainable growth—depends directly on their explanatory capacity (Nevěděl and Horák, 2015). Explanatory value thus offers a methodological lens for assessing why certain regional theories achieve enduring influence, while others remain limited in scope or applicability. This insight aligns with recent reflections on the evolving relationship between formal economic models and regional development theory, which emphasize the need to merge economic laws of growth with territorial relationality to enhance interpretative coherence and practical relevance (Capello, 2019). Recognizing explanatory value as a cross-cutting criterion can therefore enrich not only philosophical debates but also the evaluation of frameworks central to regional development research and policy.

The results of the SLR confirm that explanatory value is conceptualized and applied in diverse ways across disciplines. In the natural sciences, this concept is predominantly linked to notions of falsifiability, accuracy, and predictive adequacy, as evidenced by research findings in neuroscience (Grossberg, 2025; Guigon, 2023) and climate or ecological research (Kirk *et al.*, 2025; Wang *et al.*, 2025). In the social sciences, explanatory value is employed to assess the robustness of theoretical frameworks and the adequacy of models, as seen in studies on economic inequality (Greenberg and Gao, 2024), housing price modeling (Moreno-Foronda *et al.*, 2025), and political science analyses of judicial behavior (Hume, 2024). In psychology and organizational studies, the concept serves to evaluate the adequacy of prevailing theories, such as social identity theory (Koo *et al.*, 2025). In the humanities and applied policy contexts, explanatory value is employed more explicitly as a criterion of interpretive adequacy and relevance, illustrated by research in forest policy (Aurenhammer *et al.*, 2025) and marketing science (Zheng *et al.*, 2025).

Taken together, these findings underscore that explanatory value is a multidimensional evaluative concept, embodying elements of logic, empiricism, and pragmatism. Across academic disciplines, it functions as a metric for assessing methodological adequacy and as a standard for determining the theoretical robustness of concepts and models. The interdisciplinary comparison undertaken in this review demonstrates that explanatory value, though variably defined, serves as a unifying notion enabling scholars to distinguish stronger from weaker accounts, meaningful from trivial statements, and useful from limited explanations.

Whereas many authors address explanatory power in narrower, non-systematic, or discipline-specific ways, this review offers a foundational step toward evaluating and comparing its role across domains. By integrating perspectives from neuroscience, economics, political science, environmental studies, psychology, and related fields, it demonstrates that explanatory value transcends technical or local criteria, representing a generalizable concept with extensive practical applications. At the same time, its interpretation and use remain context-dependent, shaped by disciplinary traditions and methodological

orientations. Future research could therefore build on this mapping to develop comparative frameworks and empirical studies that test how explanatory value operates across domains, thereby contributing to a more coherent understanding of its role in contemporary scholarship.

Beyond its interdisciplinary significance, the findings also highlight the importance of explanatory value for regional development scholarship. As socio-economic disparities and policy challenges persist, the robustness of theoretical frameworks depends on their explanatory capacity. Theories that demonstrate high explanatory value—by effectively linking empirical observations with logical and pragmatic reasoning—are better positioned to inform regional development strategies and policy interventions. Future research may thus profit from explicitly incorporating explanatory value into the evaluation of both established and emerging regional development theories (Pike *et al.*, 2017; Myrdal, 1957; Perroux, 1955).

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