Post-print of Research on the Foundations and Structural Construction of an Integrated Five-ology Discipline

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Abstract

[Purpose/Significance] In response to the integrated development trend of the "Five-Metrology", this study explores the fundamental issues concerning the foundation and structural construction of an integrated informetrics discipline. [Method/Process] Based on the basic information circulation process and an analysis of the dialectical relationship among discipline, object, and researcher, this paper employs the literature research method to analyze and examine the process, trends, current status, and problems of the integrated development of the "Five-Metrology"; utilizes the tree structure analogy method for knowledge systems to discuss the disciplinary foundation construction of the "Five-Metrology" integration; and applies the genetic approach to address the construction of content structure and formal structure in the integrated "Five-Metrology" discipline. [Results/Conclusion] The foundation and structural construction of the integrated "Five-Metrology" discipline is to establish an informetrics discipline system that takes "information" as its logical starting point, the "basic information circulation process" and the "information phenomena" therein as its research objects, follows the principle of "dual-normativity" characterized by the dialectical unity of heteronomy and autonomy, adheres to the core value of "metrological research", and possesses a three-level structure of "phenomenology-metatheory-methodology", a three-dimensional structure of "theory-method-application", a synchronic-diachronic warp-weft network structure, and a tripartite unity of "content-structure-form".

Full Text

Preamble

Research on the Foundation and Structure Construction of the Integrated Discipline of "Five Metrics"

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Abstract:
[Objective/Significance] In response to the holistic development trend of "Five Metrics," this paper explores fundamental issues in constructing the foundation and structure of an integrated informetrics discipline. [Methods/Process] Based on the basic information circulation process and an analysis of the dialectical relationship among discipline, object, and researcher, this study employs literature research methods to analyze the developmental process, trends, current status, and challenges of "Five Metrics" integration. Using the tree structure analogy for knowledge systems, it discusses foundational disciplinary construction issues. Through genetic examination methods, it addresses content structure and formal structure construction. [Results/Conclusion] The construction of an integrated "Five Metrics" disciplinary foundation and structure aims to establish an informetrics system that takes "information" as its logical starting point, the "basic information circulation process" and its "information phenomena" as research objects, follows the dialectical unity of heteronomy and autonomy ("dual-law principle"), adheres to "quantitative research" as core values, and possesses a three-level structure of "phenomenology-meta-methodology," a three-dimensional structure of "theory-method-application," a "synchronic-diachronic" network structure, and a "content-structure-form" tripartite unity.

Keywords: Five Metrics; Integration; Informetrics
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2 Research Ideas and Methods

This study draws upon the foundational contributions of key informetrics scholars including L. Egghe, R. Rousseau, P. Ingwersen, J. Tague-Sutcliffe, and C. Brookes. The methodological framework integrates literature analysis, structural analogy, and genetic examination to investigate the theoretical unification of bibliometrics, scientometrics, informetrics, webometrics, and altmetrics.

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3 Research on Disciplinary Foundation Construction

3.1 Logical Starting Point

The logical starting point for the integrated discipline is established as "information," representing the fundamental conceptual unit from which the entire

theoretical framework derives. This starting point reflects the essential nature of information phenomena across all five metrics domains.

3.2 Disciplinary Object

The research object encompasses "information phenomena" occurring within the basic information circulation process. This includes the generation, dissemination, utilization, and transformation of information across scholarly communication networks, as represented in the information cycle model.

The Relationship Among Discipline, Object, and Researcher

3.3 Genesis and Development

The developmental trajectory of the integrated discipline follows a genetic progression from theoretical foundations to methodological innovations and practical applications. This evolution reflects the dialectical relationship between disciplinary autonomy and external determinants (the "dual-law principle") in the formation of a unified informetrics framework.

[Figure 1: see original paper] Basic Information Cycle Diagram

The information cycle illustrates the fundamental process where the objective world (W) interacts with knowledge structures (K) and information sources (S), producing information increments (ΔI) through cognitive processing. This cyclical model, building upon Brookes' information equation, provides the conceptual foundation for integrating the five metrics disciplines.

4 Research on the Content Structure Construction of the Discipline

4.1 Heteronomous Analysis

[The original text in this section was severely corrupted during PDF extraction and cannot be reliably reconstructed. The section appears to discuss the heteronomous (externally-determined) characteristics of the discipline's development and its theoretical foundations.]

4.2 Content Structure Construction

This section presents a mathematical model for the content structure of the integrated discipline of "Five Bibliometrics." Building on Brookes' foundational work, the model describes the dynamic relationships between core components of the discipline.

The basic structure can be represented as:

$$K(S) \rightarrow K'(S')$$

Where K represents the knowledge structure, S represents the source structure, I represents information/items, and Δ denotes change or transformation.

The model illustrates the transformation process:

1. Initial state: $K(S)$
2. With information input: $K(S) + \Delta I$
3. After transformation: $K'(S')$

The equations demonstrate that as new information (ΔI) enters the system, both the knowledge structure and source structure undergo corresponding changes (ΔS), leading to a new equilibrium state. The model further elaborates on this relationship through several key transformations:

$$K(S) + \Delta I = K'(S + \Delta S)$$

This core equation shows that the input of new information leads to an expansion of the source structure, which in turn transforms the overall knowledge structure. The complete model includes multiple stages:

$$K(S) \xrightarrow{+\Delta I} K'(S + \Delta S) \rightarrow K''(S'')$$

The text references the work of B.C. Brookes and applies it to the context of "Five Bibliometrics" (encompassing bibliometrics, scientometrics, informetrics, webometrics, and altmetrics), suggesting that the discipline's content structure evolves through continuous interaction between knowledge bases, information sources, and information items. The model suggests that quantitative changes in information items lead to qualitative transformations in the disciplinary structure, following regular patterns that can be mathematically modeled.

[FIGURE:N] and [TABLE:N] markers would appear here to illustrate the model structure and parameter relationships.

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5 Research on the Formal Structure Construction of the Discipline

5.1 Analysis of "Autonomy"

5.2 Research on Formal Structure Construction

5.2.1 Three-layer Structure of "Phenomenology-Meta-methodology-Methodology"

5.2.2 "Synchronic-Diachronic" Warp-Weft Structure of "Five Metrics"

5.2.3 Three-dimensional Structure of "Theory-Method-Application" of "Five Metrics"

References

1. Nacke, O. (1979). Informetrie: Ein neuer Name für eine neue Disziplin. *Nachrichten für Dokumentation*, 30(6), 219–226.
2. Brookes, B. C. (1989). Biblio-sciento-informetrics: What are we talking about? In L. Egghe & R. Rousseau (Eds.), *Informetrics 89/90: Selection of papers submitted for the Second International Conference on Bibliometrics, Scientometrics and Informetrics* (pp. 1–3). Amsterdam: Elsevier.
3. Egghe, L., & Rousseau, R. (1990). *Introduction to informetrics: Quantitative methods in library, documentation and information science*. Amsterdam: Elsevier.
4. Tague-Sutcliffe, J. (1992). An introduction to informetrics. *Information Processing & Management*, 28(1), 1–3.
5. [Reference corrupted - content unreadable]
6. Björneborn, L., & Ingwersen, P. (2004). Toward a basic framework for webometrics. *Journal of the American Society for Information Science and Technology*, 55(14), 1216–1227.
7. [Reference corrupted - content unreadable]
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Author Contributions:
Wang Hongxin: Proposed the research topic, outline, ideas, and methods; wrote and revised the paper.
Huang Lijun: Wrote the third section; handled English translation.
Liu Yang: Wrote the fourth section; compiled reference materials.
Lin Kejia: Wrote the fifth section; conducted literature retrieval.
Qiu Junping: Provided research guidance and reviewed/revised the paper.

Note: Figure translations are in progress. See original paper for figures.