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Review

Beyond Bibliometrics: Harnessing Multidimensional Indicators of Scholarly Impact, Edited by Blaise Cronin & Cassidy R. Sugimoto, Cambridge, MA: MIT Press, 2014, 466 pp. $35.00 (pbk), ISBN: 978-0262525510 (pbk), 978-0262026796 (hardcover), 9780262323277 (e-book)

During the last 10–15 years bibliometrics has enjoyed a resurgence, in part due to the increasing availability of digital bibliographic data. Bibliometric methods have been used in research libraries for decades, and scholars who study science have also been using bibliometric methods at least since the 1960s. Nowadays, research assessment and evaluation have become more important to governments and other research finance organizations, and bibliometrics has become a tool for science policy authorities. *Beyond Bibliometrics* analyzes the concepts, history, and use of bibliometrics from diverse viewpoints. Divided into five parts, the book includes 21 articles written by esteemed European and U.S. authorities who have backgrounds in the sciences and social sciences, scientific research and libraries, research evaluation, and scientific publishing. The chapters together provide insights into the history, present state, and future of bibliometrics.

Part 1 deals with history, starting with medieval Europe and formal and informal scientific communication, and bridging to the present and future. This introduction also covers criticisms of bibliometrics and recent developments in altmetrics. Nicola De Bellis, in her chapter, makes the point that "bibliometrics is not just applied mathematics but a social science" (p. 24). This section on the history of bibliometrics is well worth reading on its own.

Part 2, "Critiques," includes an overview by Paul Wouters of citation analysis from the 1950s to the present. The inequality between different fields of sciences and disciplines due to their publication and citation culture is discussed. Ronald Day focuses on the social sciences, and asks what the metrics of citation analyses represent. Part 2 also contains chapters on the ethics of evaluative bibliometrics (Jonathan Furner), and a review of criteria for evaluating indicators (Yves Gingras).

Part 3, "Methods and Tools," includes seven articles that explore new perspectives. The coverage of the network approach to scholarly evaluation, by Levin D. West and Daril A. Vilhena, is interesting, although interpretation of the results of network analyses (like co-word or co-citation or co-authorship analysis) needs deeper knowledge and understanding of the scientific field in question. Results of citation analysis can be explained technically or even from a science policy viewpoint. Network analyses are more methods of the science of science. Science visualization and mapping are connected to network analysis; Loet Leydesdorff points out that "visualization and animation in sciences constitute an active research front in the development of the information sciences and bibliometrics" (p. 181). This is intriguing, as explicit figures and graphical representations based on bibliometric analysis can tell more (or a different story) about a discipline than can words. However, such interpretations also need understanding of the discipline under study. When they examine scientific problems that cross disciplines, research evaluators question how they can measure interdisciplinarity. Vencent Larivière and Yves Gingras present an overview of measuring interdisciplinarity, demonstrating how interdisciplinary research has increased over the past century.

Criticism of traditional research evaluation and especially of citation analysis has encouraged the development of altmetrics. Part 4 deals with alternative metrics that are used to gauge the impact and visibility of research in both publications and in social media. Where traditional citation analysis considers published results (i.e., the end product), altmetric approaches tries to indicate what is happening in the moment, how a research community has reacted to scientific discussion in social media, and whether or not there are "likes," "favs," "retweets," in Facebook, Twitter, and the like. These issues are connected to changing research cultures, especially when younger researchers are more engaged in social media. The last chapter in Part 4, by Cassidy R. Sugimoto, deals with intellectual heritage in science. This chapter reviews types of academic genealogy (honorific, egotistical, historical, paradigmatic and analytic) and examines the state of existing research.

Part 5 offers different perspectives on bibliometrics, including one from the world of publishing. The last chapter examines science policy about science metrics, highlighting the need to advance science policymakers' understanding of science metrics and their use. It also reminds us that understanding the scientific culture of different disciplines and changes in scholarly communication is key to using bibliometric methods and interpreting the results.

Interest in bibliometrics has been growing globally, along with the volume of research using bibliometric methods, and has been a theme in many conferences in many countries. *Beyond Bibliometrics* is an invaluable collection and guide for librarians involved in research evaluation and students and researchers in the fields of information science, science studies, and scientometrics.

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