

Book Review

Beyond Bibliometrics: Harnessing Multidimensional Indicators of Scholarly Intent. Blaise Cronin and Cassidy R. Sugimoto. Cambridge, MA: MIT Press, 2014. 466 pp. \$37.00. (Paperback). (ISBN: 9780262525510)

Blaise Cronin begins the first chapter in this remarkably comprehensive work on the evaluation of scholarly impact with a Latin phrase “est modus in rebus,” that there is a proper measure in all things. Yet no one really likes to get evaluated unless they know they are headed for a hall of fame. Scholarly contributions can be diced up by person, by publishing outlet, by institution, by field, and by many different variables associated with each of these. The very metrics created to assess scholarly impact can place the threat of post-hoc evaluation as a deterrent that inhibits the creativity and courage needed to make substantive advances in scholarship.

Each of the 21 chapters by 37 contributors advises that the advantages of measuring scholarly output needs to be counterbalanced by attention to the problems that might be associated with the variables and metrics used in this enterprise. To their credit, and with the obvious attention of Cronin and Sugimoto, who produced a unified, well-edited work, the authors of the chapters provide an excellent roundup of five major areas of bibliometrics as it morphs into a new era fueled by the dynamic availability of data about the artifacts of scholarship in the online provision of scholarly information. New measures and new dashboards are being created because they *can* be created with an ease not known in the early days of Eugene Garfield’s monumental collection of data to produce the *Science Citation Index* and *Journal Citation Reports*.

Cronin’s opening chapter presents a powerfully written overview of the history of the philosophy, measures, and metrics associated with evaluating science and crediting impact. He makes it clear that the movement under way is to go from citation analyses to a more total view of usage statistics. Cronin unsettles the reader by introducing new social media measures and then asks if and how their impact might assume the weight of more authoritative sources. Just as this thorny issue is addressed, he then comments that this might perpetuate criticisms of citation analysis that they were control mechanisms to discipline scholarly discourse. The issues raised in this short but well documented chapter—and the open questions presented to the reader—could be used with this text as a platform to structure a graduate course on this topic.

Nicola de Bellis’ chapter reaches back several centuries to identify the foundation for how scholarship was communicated through peer review and how this process produces a path to a continuing process of evaluating scholarly impact at the individual or journal level. The concomitant advances of mathematics and related statistical methods provided a convenience for creating bibliometric measures. de Bellis offers extensive documentation on traditional measures that fall prey to the rank-order methods that produce similar hyperbolic distributions; surprisingly, he omitted the important contributions of Anatol Rapoport in evaluating such distributions. This cogent chapter addresses the probability problem, where quantity of output is correlated with what are proposed as quality measures. This theme is mentioned in a number of other chapters in this text and it is doubtful that this controversial issue will soon be resolved.

Four chapters are included in a section labeled “Critiques,” and these provide notable depth in analyzing the ultimate purposes of assessing scholarly contributions while addressing how such assessment might relate to knowledge creation. It includes how the very mechanisms to evaluate scholarship might, themselves, be evaluated. Paul Wouters offers a theoretical framework that has the potential to uncover the complex environment of knowledge creation. He precedes this with a concern that current measures are widely accepted and watched and that performance-funding models may be influencing problem definition and career trajectories.

Ronald E. Day provides a philosophical analysis of citation research and methods by asking if epistemological and ontological analyses have shown that anything real has been accomplished. In this era of evaluation it is possible that the assessments are being done as an end in themselves and that they may be working backwards to produce behavioral conformity. Day provides an astute and startling assessment of the economics of citation assessments and he produces a lucid view of how value enters into this enterprise to include that such a system may encourage its own gaming aspects.

Jonathan Furner sheds new light on the ethics of bibliometric and related systems by producing several very detailed outlines of core topics and issues that need to be addressed if such methods are to continue to prevail in what is basically a human enterprise with social values. He suggests that different subdisciplines have vastly diverse practices in publication and citation rates, making universal indicators inappropriate. This is a noble but probably not practical observation, given that citation methods are, themselves, data reductionist metrics applied to information that is already data reduced, such as journal articles. It is far

easier to advance general, unified methods than to produce separate measures specific to each subdiscipline.

The debate above can be illustrated by an experience of mine at a faculty tenure hearing in the sciences. A biology professor complained that a tenure candidate had low productivity, noting that his area of biology expected young researchers to be on an author list of a published paper every month. Another professor said that his advisor produced about one major paper per year and another review or short contribution that year. Yet he noted that his advisor was the holder of not one Nobel Prize but two (the advisor was Frederick Sanger). The counter-response by the first professor was that the Nobel advisor would probably not be funded today.

A remarkable contribution in the Cronin and Sugimoto text is the chapter by Yves Gingras on “Criteria for Evaluating Indicators.” This is an age when universities look to peer and aspirant rankings to determine where they are situated discipline-by-discipline on a radar or star chart. Gingras digs into the meaning behind each of the major criteria and proposes how those measures might be evaluated as measures. The irony is that Gingras is a very productive author who asks for a separation of meaning between impact and quality, which are now encompassed in such single measures as citation rate. He also provides concise and clear caveats regarding ranking philosophies for universities as well as such popular and fashionable indicators as the h-index. Importantly, he spends several pages on validity issues, with attention to international comparisons.

Katherine McCain has the lead chapter in the section on “Methods and Tools.” She has credible roots in dealing with the reasons behind why a work is cited and she offers a concise summary of the research in this area. McCain gets to the heart of why one individual might cite another. She hints at what meanings might emerge from cocitations and bibliographic coupling, but keeps her focus on direct and indirect citations while addressing Merton’s palimpsestic syndrome where credit is given to the person who communicates information and not necessarily to the one who discovered it.

Underlying the respectable notion of science is that individuals stand on the shoulders of giants and that incremental advances are important. This position has been discounted in research on Nobel laureates and other award winners, whose contributions provoke enormous advances and even change the trajectory of scientific research. Both of these competing avenues of research on scholarly impact are covered in several chapters of this text.

Jevin D. West and Daril A. Vilhena offer a concise and technical chapter on the use of network analyses to evaluate scholarship. They note that such an application was first suggested about a half-century ago but that the necessary analytic tools to accomplish this have only recently become available. The authors clarify what a network approach offers over non-network methods by comparing a network Eigenfactor score with a traditional impact factor score. They add a distinction between the unweighted and

directional links of paper-level citation compared to the weighted and reciprocal links of a coauthorship network. Whereas journal links have direction and weight, article citations rarely have weight. Examples in this chapter are depicted within a matrix algebra approach, with accompanying graphic displays of citation and Eigenfactor centralities. This renders the real importance of this network method to be complex enough that it might not get the universal attention it deserves. It may need yet another layer of reduction to gain a wider audience.

Methods to provide a visualization of scientific development are effectively summarized by Loet Leydesdorff. He presents the concept of an intellectual space of science and notes that it might be mapped in a multitude of ways with links among such entities as words, images, citations, authors, institutions, etc., which contribute to discursive knowledge. Leydesdorff provides a depiction of journals most cited by authors of the *Journal of the American Society for Information Science and Technology* (JASIST) with visualizations that include node size, color, and edge width across frequency distances. This provides a powerful method to communicate intra- and interdisciplinary connections as knowledge builds in similar areas and wanes in others. He then provides a cosine-normalized map of frequent words in several years of JASIST titles that again give a meaningful picture of links and centralities. His co-occurrence map is also remarkable in giving a different perspective from the cosine-normalized map. The visualization of such vector spaces culminates in a multidimensional depiction that could rotate to show fluid three-dimensional views of coauthors and words. This work has tremendous promise in creating a wider understanding between semantic maps and social networks that can depict sociocognitive interactions among people and texts.

The chapter on “Measuring Interdisciplinarity” by Vincent Larivière and Yves Gingras actually reports on Web of Science papers, using the truncated version of the term *interdisciplinary* as an indicator of such work. They critique their method, noting its shortcomings, but also provide some validation from a historical assessment of when such references and papers occurred over the 20th century. This includes patterns in different disciplines and specialties. It was surprising that interdisciplinary work did not rise in some fields and was actually at the same levels at the end of the century as it had been over 60 years earlier.

The evaluation of research institutes is examined by Lutz Bornmann, Benjamin F. Bowman, Johann Bauer, Werner Marx, Hermann Schier, and Margit Palzenberger, who view bibliometrics as a subtopic in scientometrics, although other authors used these terms in parallel fashion. Six research institutes were compared on the number of publications and citations by year. The findings provide reinforcement for points expressed in three other chapters in this book. It was refreshing that the authors could modify their chapters based on the chapters of other authors. Although many of the findings were at a descriptive statistical level, it was uncovered that the institutes had a greater publication and citation

impact than the fields they represented. This chapter suggests that such methods could be used to reinforce the value of providing institutes as centers for productive research.

Kevin W. Boyack and Richard Klavans provide a different perspective by examining research strengths using market segmentation methodology. They make the distinction that this method can be used for document clusters but that it will need additional conversions to create market clusters. Metrics can be produced to show which institutions are reference leaders compared to others and that it is likely that these may represent centers of productive scholarship. Ranks for various institutions are then compared to those produced using Scopus, with the results showing different findings using such variables as the number of articles produced and citations received. The authors note that this new method is not as stable as traditional measures but this still holds promise in providing a different perspective on research productivity and impact. This chapter provides additional value in presenting different graphic displays and tables to visualize research strengths.

Michael J. Kurtz and Edwin A. Henneken discuss recommender reference systems, giving an overview of various tools to find scholarly articles on particular topics and of particular quality. They key on the time for the system to query the database. Of importance in this area would be the development of a method to compare the quality of the output through some external validity methodology. Such systems can alert scholars to new research and it would be important to compare systems for queries that are oversaturated with those that emphasize high recall. The authors provide details on the many query options of operational systems and it is likely that as response times decrease these algorithms may someday improve searches when implemented in a large number of proprietary databases. Of value in such recommender systems is capturing what others are viewing within your subject query of interest. Also, the provision of alternative display outputs adds additional value to these reference systems.

Six chapters are included in the Alternative Metrics section of the book and each tries to establish its own territory in this growing area of interest. Social media are usually thought of as vehicles to see which research is receiving a current “buzz” and some have proffered that this may be subject to even more manipulation than traditional measures. One concern often heard is that much research, especially patent-based work, is competitive, proprietary, potentially important, and that it would not be likely to offer itself up for popular consumption. Jason Priem contends that the footprints of ideas do leave good tracks and that new methods are needed to augment citation studies by following tweets, blogs, and other media output. He summarizes many different methods to capture such information and lists a variety of ways to capture altmetrics. Priem offers convincing arguments on the value of such data while noting its current limitations, including the charge that manipulation or gaming the system will skew findings.

Kayvan Kousha and Mike Thelwall cover web impact measures, noting the number of URLs cited in scholarly research. This chapter includes how hyperlinks from one research article to other URLs represent the spread and impact of research. Course syllabi, online presentations, download counts, and social web impact are included as research assessment indicators of scholarly influence. Following this chapter is the work of Judit Bar-Ilan, Hadas Shema, and Mike Thelwall, who explore how social media platforms such as Facebook and blogs can operate as indicators of links among scholars where ideas are tracked while they are being developed and later used to infuse new work. The bibliographic references in these works become interesting, as they assume a presence that could augment traditional uses of citation data while having the advantages of being more current and easily available to wider audiences of scholars.

Readership metrics can now be captured as more and more content is available online. Stefanie Haustein emphasizes the importance of readership data, since it could be a driving factor in which journals get subscribed to and which ideas receive widespread dissemination. Electronic downloads available on dashboards also provide a moving picture of the centrality and long tail of certain publications and, by implication, particular disciplines. This has economic implications that impact the future of scholarship in subdisciplines where the readership metrics can help determine which journals survive and which ones are not cost-effective. Just as albums moved to songs, journals are moving to articles that can be isolated on a cost-per-piece basis. If libraries extend patron-driven acquisition systems to articles, then the readership metrics take on new importance. Haustein covers the impact of social tagging on access since this type of crowd sourcing becomes its own predictor of access and impact.

Peter Hook covers the use of citation systems using court documents and extends this to assessments of the influence of judges. These systems date back 140 years, where they focused on legal precedence. Now new methods can be used to map relationship indicators to show how Supreme Court judges might be clustered on different dimensions. This chapter is ripe for legal scholars to extend the ken of their methodologies to understand how judges work with particular cases and how they work with each other in common or individual ways.

Cassidy Sugimoto explores “Academic Genealogy,” which has the promise to show the connections among individuals and, concomitantly, their links to the development of knowledge. This method has had an interesting past but has not been exploited for its importance. Sugimoto covers the different approaches used in this area to include those that are honorific, egotistic, historical, and paradigmatic. Then the emerging online analytic methods are explained that provide metrics to assess scholarly contributions while revealing academic genealogical information. She covers the range of ways to visualize such results, while noting how this links to other chapters in this book such as the one by

West and Vilhena that network and other approaches offer new perspectives on academic links among scholars and institutions.

Beyond Bibliometrics concludes with two chapters offering a publishing perspective and a science policy view. Judith Kamalski, Andrew Plume, and Mayur Amin focus on why publishers should take an interest in bibliometric data, using visualizations to improve their publications and to map how emerging knowledge changes their subject areas.

The final chapter on science policy by Julia Lane, Mark Largent, and Rebecca Rosen offers dire warnings that bibliometrics are not good indicators of scientific performance and that they create “the wrong incentives and foster bad science.” This chapter references the National Science Foundation’s Science of Science and Innovation Policy (SciSIP) and concludes that citation measures do not capture how science contributes to social well-being or economic growth that underlies the critical decision criteria for funded research. Lane, Largent, and Rosen then propose a theoretical framework and a new approach to data collection so that information about scientific progress and impact can be measured in more meaningful ways. They cover specific debilitating flaws in the current system, such as name disambiguation, and address how new social media platforms and open access to data might contribute to furthering our understanding of scholarly impact that contributes to

meaningful growth in knowledge. This chapter is a sobering conclusion in a forward-looking text on how scholarly impact is measured and valued. This final chapter concludes with an outline of what scientific metrics should cover if the SciSIP objectives are to be reached for the advancement of social and economic gains.

Cronin and Sugimoto’s *Beyond Bibliometrics* is a dynamic *tour de force*, offering a roundup of numerous approaches to measure scholarly contributions and progress at a multitude of levels. It includes clear prescriptions for methods that are productive while offering appropriate caveats for those that may mislead. It addresses how scholarship might be measured through the contribution of individuals, disciplines, institutions, and even countries. This tightly edited, logically organized, and comprehensively indexed book embodies the content and spirit of its challenging subtitle: “Harnessing Multidimensional Indicators of Scholarly Impact.”

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