

# Exact formula now available for measuring scientific success

February 1 2016

---



Credit: Petr Kratochvil/Public Domain

Scientometrics research is the science of evaluating scientific performance. Physics methods designed to predict growth based on a scale-free network have rarely been applied to this field. Now, scientists in Poland have developed an analytical method using a previously developed agent-based model to predict the h-index, probably the most popular citation-based scientific measurement, using bibliometric data.

They are the very first to succeed in developing an exact formula to calculate the number of external citations and self-citations for each paper written by an author.

These findings have just been published in the *European Physics Journal B* by Barbara Żogała-Siudem from the Systems Research Institute, Polish Academy of Sciences, Warsaw, and colleagues. It opens the door to applying this growth analysis to social network users or citations from different scientific fields.

Knowing an author's overall number of papers and total number of citations helps compute an approximated value of their h-index, which was named after the American physicist J.E. Hirsch in 2005 and measures the overall number of a scientist's publications as well as their quality and number of citations.

In this study, the authors relied on rate equations, a complex systems physics tool. To establish the equations governing the growth of citation networks, they incorporated a rule called the preferential attachment rule. Although this rule has been known for over 50 years, it remained unclear until now how and why such rules matter to the growth of the h-index. The explanation came from incorporating the rule into agent-based models representing citation networks, otherwise known as the Ionescu-Chopard (IC) model.

This led to exact h-index predictions—just like with the IC model alone—and enabled the authors to explain some underlying bibliometric phenomena. For example, they showed that the h-index can be further investigated using the aggregation theory. Lastly, they verified their results with data from real authors as well as numerical simulations.

**More information:** Barbara Żogała-Siudem et al. Agent-based model for the h-index – exact solution, *The European Physical Journal B*

(2016). [DOI: 10.1140/epjb/e2015-60757-1](https://doi.org/10.1140/epjb/e2015-60757-1)

Provided by SciencePOD

Citation: Exact formula now available for measuring scientific success (2016, February 1)  
retrieved 27 April 2024 from

<https://phys.org/news/2016-02-exact-formula-scientific-success.html>

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.