Aims of Science and Peer Review

Károly Takács

MTA TK "Lendület" Research Center for Educational and Network Studies (RECENS), Hungarian Academy of Sciences

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Fundamental question:

Is peer review the appropriate tool for science?

For a proper answer we need to know:

- (i) What are the aims of science;
- (ii) How can we measure whether these aims are fulfilled or not;
- (iii) How efficiently peer review contributes to these aims;
- (iv) Are there better alternatives for the fulfillment of these aims.



What are the aims of science?





Definitions.

✓ Peer review

Science

- Scientia lat knowledge

✓ a *systematic* enterprise



✓ that creates, builds and organizes knowledge
✓ in the form of testable explanations
✓ and predictions about the universe

Discussion:

✓ science is *discovery* as well as *invention* ✓ regularities and laws of nature
 ✓ applied sciences (uses of knowledge, e.g., engineering, medicine)

Aim 1: Creation, building, and organization of knowledge

SZTAKI Szótár I angol - ma...

Includes discovery, development of theories, and observation

Measurement?

Scientific Reports Table of Con... 🗙

Creation of groundbreaking knowledge vs. incremental advancement of knowledge

og Outlook.com - karolytakac... ×

🔁 Zimbra: Inbox (4283

Typically: the number of publications (EC, OECD, NSB/NSF), in SCI, SSCI

Is peer review efficient for this aim?

- Works as a filter
- Raising doubts, critical reading
- Finding problems
- Expert evaluation



nuclear bomb - Google ker...



Larsen and von Ins (2010), Scientometrics, 84(3), See also Bornmann and Mutz (2014) arxiv, follow up of Little Science, Big Science by de Solla Price (1961)

Exponential growth

Continues even after the appearance of new forms: Conference proceedings, open archives, homepages

Aim 1: Creation, building, and organization of knowledge

Includes discovery, development of theories, and observation

Are there better alternatives ?

to publish in peer-reviewed journals



- Publication in books, video, private letters, paintings (no review)
- Dissemination by word of mouth, general newspapers, blogs, wikipedia entries (public debate, no authorship)
 to peer review of submission
- Post-publication selection (impact, Nobel-prize)
- Continuous update (wikipedia) to evaluation of scientists
- Patronage
- Core-funding
- Salaries and promotion based on seniority





Aim 2: Generation of explanations and fundamental theories

Measurement ?

Is peer review efficient for this aim ?

- Influential overarching theories published in non-peer-reviewed form (e.g., books)



Philosophiae Naturalis Principia Mathematica

- Conclusion: rather yes (drop of prestige of books, science books are more for the general public)



Aim 3: Innovations

Measurement: ?

Is peer review efficient for this aim: ?

Are there better alternatives ?

- Patents, copyright benefits (e.g., music)
- R&D teams
 - Market forces behind
 - Hierarchical pressure (state, war)
- Self-disciplined creation
 - Hierarchical pressure (church, state)
 - Crazy individual life-goals
 - Trial and error, creative design



Some most important human innovations of all time



Aim 4: Making human life easier and happier

Measurement?

- GDP, quality of life, human life expectancy Is peer review efficient for this aim: ?



Are there better alternatives?

- Democratic selection: every view and opinion counts equally
 - Pitfall: lack of objectivity, wonderworlds, religions
- Market selection: reactions to needs
 - *Pitfall:* what is produced depends on purchasing power
- Hierarchical selection
 - *Pitfall:* misuse of power, no correction for mistakes



Aim 6:

Measurement: ?

Is peer review efficient for this aim: ?

Are there better alternatives: ?

