Quality assurance and assessment of scholarly research

A guide for researchers, academic administrators and librarians

May 2010

research
information
network

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This guide has been produced by The Research Information Network to provide researchers, academic administrators and librarians with an understanding of quality assurance processes and some of the current issues surrounding the debate about quality assurance.

The guide is available at **www.rin.ac.uk/quality-assurance**

Hard copies can be ordered to distribute to colleagues, please email catherine.gray@rin.ac.uk

About the Research Information Network

The Research Information Network has been established by the higher education funding councils, the research councils, and the UK national libraries. We investigate how efficient and effective the information services provided for the UK research community are, how they are changing, and how they might be improved for the future. We help to ensure that researchers in the UK benefit from world-leading information services, so that they can sustain their position as among the most successful and productive researchers in the world. All our publications are available on our website at www.rin.ac.uk

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1. Introduction

Quality assurance and assessment play many important roles in the research community. They inform crucial decisions on the funding of projects, teams and whole institutions, on how research is conducted, on recruitment and promotion, on what is published or disseminated, and on what researchers and others choose to read. They underpin trust in the work of the research community.

This document provides an overview of some of the key issues surrounding quality assurance and assessment of scholarly research. It is intended for academic administrators, researchers and librarians who deal with elements of quality assurance and quality assessment as part of their daily work, but who wish to understand more about the broader context of that work.

The various techniques and processes involved in determining quality have evolved over time to meet the changing needs of researchers, institutions and funders. Further development will doubtless be needed in response to changing circumstances and needs, as well as to the opportunities presented by new technologies and services.

Assurance and assessment regimes, tools and techniques will thus continue to evolve in response to:

- increases in the volume of research. The number of researchers, of the projects they undertake, and of the outputs they produce is growing year by year. This puts increasing strain on existing assurance and assessment systems

- increased pressure on costs. Effective assurance and assessment systems are costly, even though some of the most costly parts – including the time spent by peer reviewers – are seldom revealed in cash terms. The need to bear down on costs will continue to exert pressure to find more streamlined systems and techniques.

- increased competition between researchers. Constraints on funding bring increased competition for research grants and contracts, falling success rates, more work for assurance and assessment systems, and more difficult decisions in determining which projects, researchers and institutions succeed in the competition. Similar pressures are evident as researchers compete for space in prestigious publications.

- new kinds of research outputs. Many assurance and assessment regimes are built around outputs that are formally published in journals, monographs and conference proceedings. But the digital revolution leads to new kinds of outputs – multimedia presentations, working papers, pre-prints, blogs and so on – that can readily be circulated worldwide. And data-intensive research brings a new focus on data as an output in its own right. Assurance and assessment regimes will need to keep up with these new outputs and forms of communication.

New technologies and services have already changed the ways in which assurance and assessment is done. And new opportunities are arising in the form of social tagging and recommendation systems, checks on plagiarism, and facilities for online comments and ratings. New technologies are also facilitating the development of a wide range of sophisticated bibliometric and other measures that can provide useful evidence to support assurance and assessment systems. One of the key issues for the future will be how these new tools and techniques evolve alongside more traditional systems of assurance and assessment of the quality of research.

2. Why quality assurance and assessment?

Quality assurance and assessment are critical at several stages in the research process. Since resources are limited (and likely to be increasingly so) funders need effective mechanisms to ensure that they support only the best projects, researchers and institutions. It is also important that procedures are in place to ensure that research projects are undertaken properly, efficiently and effectively. And once projects have been completed, and results are being prepared for presentation, checks are needed to ensure that what is published and disseminated meets high standards. This is important in order to ensure that the records of research – sometimes referred to as the 'minutes of science' – provide an accurate record of what has been found. Such checks also help researchers and other readers who have limited time – and often limited expertise in particular specialised fields or projects – to identify and locate the most high-quality and significant findings of relevance to them.

This document begins with an overview of the closely-related processes of quality assurance and quality assessment. It then examines how these processes manifest themselves at key stages in the cycle of:

(i)   a specific research project or programme

(ii)   a researcher's career

(iii)   a university or research institution

(iv)   scholarly publications

3. Definitions

Quality is of course not a straightforward concept. The Oxford English Dictionary (OED) defines it as the nature or standard of something as measured against other things of a similar kind, and especially the degree of excellence it possesses. In the academic environment, there is widespread agreement that quality involves adherence to key principles such as intellectual rigour, accurate recording and honest reporting of results, and integrity in recognising the work of other researchers. But there may be legitimate differences of view as to the quality of, for example, notably innovative or groundbreaking work; and notions of quality may in some cases be related to specific contexts such as the scope or remit of a research funder or publisher. Numerous bodies undertake quality assurance and assessment for different purposes; the varying definitions and processes they use may clearly give rise to different results.

It is important also to note that while the terms quality assessment and quality assurance are often used interchangeably, there are important distinctions between them. 'Assessment' may be defined as the process or means of evaluating academic work. 'Assurance', on the other hand, implies a promise or guarantee – a statement that something is of good quality and can be trusted. The relatively modern concept of quality assurance may be defined as the set of procedures designed to ensure a desired level of quality in a service or product.

The key distinction, therefore, is that an assessment process implies a review – involving human judgements and/or quantitative scores – which may find work of varying quality, from the poor or mediocre to the excellent or outstanding. A finding at the end of the process that work is of poor quality does not mean that the process has failed, rather the reverse. Reviewers have no responsibility to improve the work they examine.

Quality assurance, by contrast, implies a process of tests or filters to ensure that products or services pass a quality threshold. If the process is external, quality assurance often also provides a kitemark to indicate that the work has passed that threshold. External processes in particular may also involve an active role for reviewers in ensuring that the work under scrutiny emerges as the best possible version of itself. If work of poor quality emerges at the end of a quality assurance process, that process has failed. It is important to note, however, that in the research environment there can be no guarantee that findings and conclusions are correct and unchallengeable. The advancement of knowledge and understanding depends on challenging, qualifying or even overturning current findings. All that an assurance process can do is to seek to ensure that research is properly conducted, and its results are reported accurately, on the basis of the best currently-available techniques, knowledge and understanding.

The processes of assurance and assessment thus involve a number of different tools and mechanisms which are employed for different purposes, in different contexts, and at different stages of the research lifecycle. The rest of this document focuses, after a brief introduction to the key mechanisms, on how they are applied and with what effect.

4. Tools and mechanisms

Some assurance and assessment mechanisms involve quantitative measures such as bibliometrics, while others involve monitoring, review and evaluation by people who are knowledgeable in the relevant field. The principle that judgements should be made by experts who are respected in the field – peer review – is held by most researchers to be fundamental to any effective system for assuring or assessing research quality. Peer review attracts deep and strong support across the research community. But it comes in a number of different forms, and practices vary considerably in different contexts and fields.

Peer review also attracts criticism, on the grounds that it brings delay; that it is not always effective in detecting misconduct and malpractice; that the selection of reviewers may introduce bias into the system; that the judgements made are subjective and inconsistent; that it tends toward conservatism and stifles innovation; and that it disadvantages interdisciplinary research. There are also concerns about the costs of the system (which are largely hidden, since peer reviewers are generally not paid for their time); that the burdens being placed on the reviewing community may become unsustainable as the volumes of research activity and publications continue to increase; and that there is a need for more training of reviewers to ensure greater consistency.

Such criticisms and concerns have not, however, undermined the value attached to judgements made by respected peers in any system of assurance and assessment. Quantitative measures are generally seen as supplements, not substitutes for such judgements. For further information on the peer review system, the challenges it faces, and how it might change, see the RIN booklet *Peer Review: a guide for researchers*.[1]

1 Research Information Network (2010) Peer Review: a guide for researchers

5. Assurance and assessment of research projects and programmes

The arrangements for assuring and assessing the quality of research projects varies in some particulars between different fields and disciplines, but may conveniently be divided into six main stages:

(i) programme and project proposals
(ii) monitoring and oversight during projects
(iii) sharing early findings with colleagues
(iv) formal publication
(v) data sharing
(vi) post-publication assessment and review

5.1 Programme and project proposals

Research institutions and funders use a number of checks in seeking to ensure that only high-quality research is funded. Many institutions implement mechanisms – through departmental management structures or through institutional bodies such as research offices – to monitor project proposals, thereby ensuring only those that pass quality thresholds are supported by the institution or submitted to external bodies for support.

When external support is sought, Research Councils, along with most research charities and institutions, evaluate project proposals using various peer review mechanisms. Panels of experts are drawn from academia as well as other parts of the public, commercial and voluntary sectors, with members selected to give the panel the necessary range of expertise to assess the proposals they are asked to consider.

Assessment and evaluation may begin even before a specific proposal has been framed. In order to address certain criticisms about the 'conservatism' of peer review, some funders are experimenting with new approaches to encourage innovative and cross-disciplinary proposals. The Engineering and Physical Sciences and the Natural Environment Research Councils (EPSRC and NERC) are using 'sandpits': 3-5 day workshops, overseen by a director and other facilitators, where researchers from a wide range of disciplines discuss issues and ideas, and then develop, test and refine proposals which may be funded at the end of the process.[2]

In a more conventional process, researchers prepare proposals with their colleagues. These are then assessed primarily on their scholarly quality, covering such issues as intellectual rigour, creativity, methodology and so on. But many related quality criteria may come into play, including the fit between the proposal and the funder's priorities, the track record of the applicants, and value for money.

2 See the ESPRC http://www.epsrc.ac.uk/funding/grants/network/ideas/Pages/moresandpits.aspx and NERC http://www.nerc.ac.uk/funding/assessment websites for more information on sandpits.

Fit with a funder's priorities may be determined in relation to published strategies which are reviewed from time to time, and for public funding agencies agreed with government. Such strategies and priorities may increasingly include achieving economic, social or cultural impact beyond the research community. Research Councils are collectively committed to increasing the impact of the research they fund.

5.2   Monitoring and oversight during projects

Once a funding decision has been taken and a project is under way, a funder's main role becomes oversight of the work being undertaken. This role may be more or less active, and in all cases funders rely to a significant extent on the management structures and procedures of research institutions to help ensure that research projects progress properly. This is why funders provide grants and contracts to institutions, rather than to individual researchers and teams.

For large-scale projects, however, funders may also require the appointment of a steering group with external representation to oversee the work of the project as it progresses. More commonly, they require – again especially for large-scale projects – principal investigators (PIs) to provide status reports from time to time, to help ensure that projects progress as planned. Such processes can help in keeping projects on track, and in resolving issues and problems as they arise. But they cannot of themselves guarantee that what is produced at the end of a project will be of high quality.

Most commonly of all, funders require PIs to present reports at the end of each project. Some funders, such as the Arts and Humanities Research Council (AHRC), grade such reports after peer-reviewing them.[3] Most funders, however, have abandoned such processes as part of the search for cost savings; the role of the report in either quality assurance or assessment is thus unclear.[4]

5.3   Sharing early findings with colleagues

Virtually all researchers discuss their work and their findings with colleagues, and the comments and suggestions they receive may play an important part in how a project develops and progresses. Such discussion may take place in wholly informal settings, or in more formal seminars, workshops and conferences. All of these processes play a crucial role in assuring and assessing the quality of the work that is being undertaken before final results are presented in formal peer-reviewed publications.

New communications technologies and services such as blogs, wikis and websites such as SlideShare have vastly increased the opportunities for discussing ideas and sharing findings.

3 See the Je-S website https://je-s.rcuk.ac.uk/jesHandbook/jesHelp.aspx?m=s&s=798
4 Research Councils UK (2007) Increasing the economic impact of the research councils

Since such technologies may leave a lasting trace, they may have a tendency to blur the distinction between early findings and formal publications. But we do not yet have established mechanisms to assure and assess the quality of the findings presented in these new ways, and so their utility for users (as distinct from creators) may be reduced. Moreover, a proliferation of different stages and versions of findings may cause confusion for readers.

5.4   Formal publication

Once they are confident in their findings and conclusions, researchers will seek to present them more formally to the academic community and to others who may be interested in them. The forms in which they do this vary from discipline to discipline, and are also influenced by the context in which the research is undertaken and the audiences the authors want to reach. In some disciplines, such as engineering and computer science, conference proceedings are a primary vehicle for publishing results and conclusions; while in many disciplines in the humanities and social sciences monographs are seen as the primary vehicle. In virtually all disciplines, however, articles in scholarly journals are becoming increasingly prominent, if not the dominant, means of formal publication.

Whatever the format, formal publication almost invariably implies quality assurance through peer review. Such review involves editors and reviewers who assess such matters as the originality, significance and validity of research findings, as well as the fit of the work with the scope and approach of the conference, journal or publication series.

The detail of the process varies between different publications, but in broad outline there are three main approaches to the peer review of publications:

Double-blind review: where the identities of the reviewers and those whose submission is being reviewed are hidden from each other;

Single-blind review: where the identities of those who have submitted the proposal or draft publication are revealed to the reviewers, but not vice versa; and

Open review: which may cover at least three different kinds of arrangement with increasing levels of transparency
- the identities of reviewers and submitters are revealed to each other
- the signed reviews themselves are passed in full to the applicants (and perhaps made available openly to anyone who reads the publication)
- authors' draft publications are made available on publishers' websites, and reviews and comments are invited from anyone who wishes to submit one.

For more information about these procedures, see the RIN booklet *Peer Review; a guide for researchers*.

Whatever the procedure, the final result is a decision on whether to accept, reject or ask for revision and resubmission of the article: a process of improvement which researchers consider to be one of the great strengths of peer review.[5]

Quality assurance for formal publications relates to the presentation, as well as the content, of what is being published. Considerable time is often devoted, by the editor and others, to copy editing and standardisation, in order to ensure that findings are presented clearly and consistently.

5.5   Data sharing

As we move into an era of 'data-intensive research', we have seen an increasing interest in the dissemination and sharing of research data, alongside the formal publication of findings and conclusions. There are two main motivations underpinning such interest:

- first, a desire to see the data underlying the published findings treated as an essential part of the 'records of research', which should be made available to others to test and interrogate; and

- second, a recognition that considerable sums of public money are being invested in the gathering, creation and analysis of ever-increasing amounts of research data which could be exploited as part of the intellectual infrastructure for further research.

Many funders now require researchers to submit plans to ensure that their data are managed, curated, and made available to others. At the same time, the technologies and services that are putting data at the heart of the research process are also making data sharing easier than in the past. Technical and other challenges remain, however, and many researchers have reservations about making their data openly available. Data sharing also gives rise to a number of issues with regard to quality assurance and assessment.

5 The British Academy (2007) Peer Review: The Challenges for the Humanities and Social Sciences.

Providing access to the data underlying publications can itself constitute an important quality check, although it may also present a challenge to peer reviewers. In some disciplines, reviewers check data thoroughly, and are capable of unearthing flaws or inconsistencies. In other cases, checking is less thorough, partly because reviewers may not be able to judge the data satisfactorily, partly because datasets may be too large to review in their entirety, and partly because the data may be too complex to be judged in this way. Reviewers may check that the data are present and of the format and type that the work warrants, and leave it at that. Overall the approach is uneven. Nevertheless, some publishers now require authors to deposit data in an authorised repository and to make it available to others; and once findings are formally published, other researchers may well interrogate the underlying data as a quality check both on the data themselves and on the findings as published.

Making large datasets available through online repositories may also involve quality checks and assurance. Many data centres and databanks apply stringent rules to ensure that datasets meet quality standards and are accessible (through the effective use of metadata), and usable (by providing the information and possibly the software tools necessary for others to re-use the data).

Where a dataset has significant scholarly merit but is lacking in other respects, data centres will often work with data creators to ensure that the dataset is discoverable, accessible, and usable. Some repositories also implement checks on the quality of the data themselves. For example, the Genographic Project, a database created to study the genetic signatures of ancient human migrations, has quality checks integrated into the database design[6] ; and researchers wishing to contribute to the RCSB Protein Data Bank are given a chance to check and improve the quality of their data through online tools made available prior to submission.[7]

6 Behar, D.M, Rosset, S., Blue-Smith, J., Balanovsky, O., Tzur, S., Comas, D., Quintana-Murci, L., Tyler-Smith, C., Spencer Wells, R. (2007) 'The Genographic Project Public Participation Mitochondrial DNA Database. PLoS Genet 3 (6) e.104. doi:10.1371/journal.pgen.0030104

7 See http://deposit.rcsb.org/

However, not all databases have such quality assurance mechanisms associated with them, and it may not always be practical to implement them. In such cases, greater responsibility passes to potential users, who must decide whether the data are of high quality and usable within the context of their own specific research projects. Good metadata are essential for both purposes.

Good metadata, and standards for the identification, linking and citation of data are also essential if researchers who create data are to have effective incentives to share them with others. At present, relatively few researchers receive recognition or rewards for sharing their data; and very few submit datasets they have created for formal assessment in the RAE or other assessment exercises.

5.6   Post-publication

An article formally published in a scholarly journal has traditionally been considered the 'version of record'. In a digital world, however, a number of other versions of an article may be circulated and readily-available via repositories, websites and other online services. Such versions are often referred to colloquially as 'pre-prints' or 'post-prints'. But the US National Information Standards Organisation (NISO) and the Association of Learned and Professional Society Publishers (ALPSP) published recommendations in 2008 on the terms and definitions for versions of journal articles at no fewer than seven different stages in their life.[8]

Many different versions of a publication may therefore be available on the web, only some of which might be legitimately considered as part of the formal scholarly record. Hence the CrossRef organisation has introduced CrossMark, a service to enable readers to determine whether they are looking at the 'version of record' – a publisher-maintained copy of a scholarly document – or at some other version.[9]

This is important not least because quality assurance and assessment do not end when findings are published. The scholarly community interacts with published material in a range of ways, and publications often prompt responses – formal and informal – from others working in the same field. Formal responses are made public through mechanisms such as letters and review articles in academic journals. In fields such as the humanities, book reviews play an important role in quality assessment.

8 Journal Article Versions (JAV): Recommendations of the NISO/ALPSP JAV Technical Working Group, NISO-RP-8-2008. Available at http://www.niso.org/publications/rp/RP-8-2008.pdf

9 See the CrossMark website: http://www.crossref.org/crossmark.html

In the web-based world, new services are being developed that allow users to share judgements on the work of others. Some publishers, particularly in the open access part of the sector, are now using web technologies to enable readers to add comments, notes and ratings to journal articles. Other services are also being developed to allow readers to rate and review articles posted on open access websites, along with services which provide expert ratings and evaluations on the most important and influential articles in specific fields.

However post-publication review is undertaken, it can lead to identification of faults which were missed during the pre-publication peer review process. There is thus no such thing as a "final version" of a scholarly publication; it may be enhanced, amended, corrected, updated, withdrawn and even retracted after it has been published.

Moreover, scholarly publications of all kinds constitute an ever-developing dialogue between researchers. Reading and citation of other researchers' work is a central feature of the scholarly communications system, and provides an important indication of the value attached to specific pieces of work and findings. Bibliometric tools of increasing variety and sophistication can be used to aggregate data on downloads and citations of specific articles, as well as journals or the work of individual researchers; and this can provide useful information in the assessment and evaluation of research.[10] There are some acknowledged limitations to the use of bibliometric assessment: these are discussed in section 6.1.

6. Assurance and assessment of researchers, institutions, and scholarly journals

Quality assurance and assessment of an individual project is designed to ensure that only research that meets and passes quality thresholds and standards is funded and published. By the same token, quality assurance and assessment of researchers, institutions and scholarly journals, is designed to ensure that decisions about funding, appointments, promotions and prestige are the result of evidence-based judgements and evaluations.

This section discusses three main focuses for quality assurance and assessment:

(i)   researchers
(ii)   institutions
(iii)   scholarly journals

6. 1   Researchers

Universities and other research institutions have various measures in place to try to ensure that they recruit and retain staff who will produce high-quality research, confer prestige on the institution, and attract research funding. Assessments of track record to date – with particular emphasis on publications in high-status journals or, in many areas of the humanities and social sciences, with prestigious monograph publishers – play a critical part in recruitment and promotion decisions. For senior posts in particular, external expert assessors may be employed.

External assessment of researchers is particularly important for institutions, since it is expert peers in the wider research community who are often in the best position to judge the merits of the work of individual researchers and teams. Moreover, tangible evidence of the recognition and standing of researchers often comes through learned societies and other representative bodies in the research community, in the form of invitations to conferences and working groups, elections to standing committees, prizes and so on.

External assessments are typically combined, however, with internally-driven performance management regimes. Some universities regularly assess research performance against agreed objectives: in other cases such objectives are implicit in the criteria for promotion. Typically, such criteria include performance measures relating to: volumes and quality of research outputs; contributions to teaching and learning; knowledge transfer and exchange; professional contribution and measures of esteem; administrative duties and performance; and income generation through research grants and contracts.

Annual or biennial appraisals may include the gathering and assessment of evidence of performance against all these objectives, with particular emphasis placed upon publications in high-status journals or series of monographs, and citations of those publications. Such evidence may include bibliometric measures such as the Hirsch index, first proposed in 2005 to measure the

productivity and impact of individual scientists based on their most cited papers and the number of citations they have received.[11] The h-index can also be applied to the productivity and impact of a group of scientists, such as a department, university or country. As with other bibliometric measures, however, such indices have been criticised as inaccurate and inequitable measures of performance. They are also sometimes criticised for producing perverse incentives, limits on what is researched, and constraints on where and how it is published.[12]

6.2   Institutions

Assurance and assessment at institutional level is necessary to ensure that research is carried out where it can be properly supported, and that limited funds and other resources are distributed to best effect.

For the first purpose, research funders need assurance that institutions have able and well-qualified staff, and the necessary equipment and other resources to carry out research in relevant areas. They also need assurance that institutions have in place the necessary management structures and procedures to help ensure that research projects progress properly. This includes such matters as ethical approval procedures and financial accountability, as well as monitoring and reporting arrangements.

For the second purpose of allocating funds to best effect, the principal mechanism used in the UK in recent years has been the Research Assessment Exercise (RAE), which was introduced in 1986. This is essentially a peer review process, based on assessments made by panels appointed to examine research in approximately 70 subject areas or units of assessment. It is designed to rate UK research in order to facilitate allocation of funds and to strengthen the international competitiveness of the UK academic research base.

The RAE process has been revised several times since 1986, including a major reconfiguration following a 2003 review by Sir Gareth Roberts. In 2006, however, the Government announced that the RAE would be discontinued and replaced by a system based on measuring how much universities had earned in research grants and contracts. The principal reason given for the change was that the RAE was expensive, placed excessive burdens on universities, disadvantaged user-driven and interdisciplinary research, and distorted the behaviour of institutions and individual researchers.

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11 J. E. Hirsch (2005) 'An index to quantify an individual's scientific research output', Proceedings of the National Academy of Sciences, 102 (46) pp 16569–16572.

12 MSCS Editorial Board (2009) 'Editors' note: bibliometrics and the curators of orthodoxy'. Math. Struct. in Comp. Science 19 pp. 1-4

Many of the criticisms of the RAE relate as much to the highly-selective nature of research funding in the UK, which creates intense competition. This affects the behaviour of researchers and of universities, which seek the high RAE ratings which lead to funding success. Like any such exercise, the RAE is imperfect, and among the criticisms of the outcomes of the 2008 RAE were continuing apparent inconsistencies between panels, and a lack of discrimination that led to more than 55% of those who were entered into the exercise being rated in the top two grades.

Despite the reservations about the RAE, the Government's proposals to abandon it attracted considerable criticism, and have been modified substantially as a result of a series of consultations and pilot studies since 2006. The Research Excellence Framework (REF) now proposed is recognisably a development of the RAE, and will be undertaken by peer review panels whose judgements may be informed by metrics based upon citation measures. The final shape of the REF is not yet determined; but the major new factor is that in addition to making judgements about research quality, panels will be asked to assess social and economic impact beyond the academic environment. This has aroused fierce debate and concerns, particularly in the humanities and social sciences; and it is not clear what the consequences of this new element in the assessment will be, and how it will affect behaviour.

Assessment of the quality of research at institutional level – typically through a mix of peer assessments and bibiliometric measures – plays a large part in the construction of the league tables of the standing of universities which have become popular in recent years. In the UK in particular, assessments of the quality of research play a critically-important role in the allocation of funds to universities.

6.3   Assurance and assessment of journals

Assurance of the quality of a journal and its contents rests primarily on the appointment and retention of a high-quality editorial team who will initiate and attract innovative and interesting content; and on the selection of reviewers who will conduct rigorous peer review.

Assessing the quality of a journal and its contents – in other words how effective the editorial team has been – rests primarily on the use of bibliometric tools, based mainly on citation. The most commonly used of such tools is the Thomson Reuters Journal Impact Factor (JIF), which is a measure of the frequency with which the 'average article' in a journal has been cited. It is calculated by dividing the number of citations each year of 'citable items' (mainly articles, but excluding such items as editorials) published in journals indexed by Thomson Reuters in the previous two years.[13]

The JIF is widely used as an indicator of the quality and standing of individual journals, and researchers often seek, or are urged, to publish articles in journals with a high JIF. Nevertheless, many criticisms have been made of how the JIF is calculated and used. There are criticisms of the bias towards US and other English-language journals captured in the index, of difficulties in determining what is or is not a 'citable item', and of the scope for journals to boost their JIF artificially. Other concerns focus on the differences in citation behaviour of researchers in different disciplines: the number of citations that can be gathered in some areas of the medical sciences, for example, is much greater than in many areas of engineering; and while the two-year window for citations may be appropriate in some disciplines, it is not in others where a high proportion of citations are gathered over a longer time. An undue focus on the JIF may therefore have an unwarranted influence over what is published and where, and even over what research is undertaken.

In response to such concerns there has been increasing interest in recent years in other kinds of measures which count citations over wider range of journals over different time-periods, and take into account such matters as the varying behaviours of researchers in different disciplines. Some measures such as the eigenfactor use mapping techniques similar to those adopted by Google's PageRank to rank the influence of individual journals within a wider network of publications. Other measures focus on usage as well as citation, making use of download statistics for each journal.[14]

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13 Garfield, E. (2005) 'The Agony and the Ecstasy – The History and Meaning of the Journal Impact Factor'. International Congress on Peer Review and Biomedical Publication, 16 September 2005, Chicago.

14 For an analysis of a large group of bibliometric measures see Johan Bollen, Herbert Van de Sompel, Aric Hagberg, Ryan Chute (2009), A Principal Component Analysis of 39 Scientific Impact Measures, PLoS ONE 4(6)e 6022. Available at http://www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0006022

7. Conclusion

Quality assurance and assessment play many important roles in the research community. They inform crucial decisions on the funding of projects, teams and whole institutions, on how research is conducted, on recruitment and promotion, and on what is published or disseminated, and on what researchers and others choose to read. They form a crucial underpinning for trust in the work of the research community.

The various techniques and processes involved in determining quality have evolved over time to meet the changing needs of researchers, institutions and funders. Further change will doubtless be needed in response to changing circumstances and needs, as well as to the opportunities presented by new technologies and services.

Assurance and assessment regimes, tools and techniques will thus continue to evolve in response to:

- increases in the volume of research. The number of researchers, of the projects they undertake, and of the outputs they produce is growing year by year. Research funders are thus facing rising numbers of applications for grants, and falling success rates, while publishers are dealing with increasing numbers of papers submitted for publication from researchers across the world. The result is increasing strain on assurance and assessment systems, particularly those based on peer review. There is evidence of growing unwillingness among senior researchers to devote ever more time to peer review as a service to the community.

- increased pressure on costs. Effective assurance and assessment systems are costly, even though some of the most costly parts – including the time spent by peer reviewers – are seldom revealed in cash terms. The UK Research Assessment Exercise has been estimated to cost over £100m; and for the Research Councils and other major research funders, assessment and assurance costs have been estimated at around 10% of their total expenditure. Similarly, the time spent by editors and others in peer review is the largest single cost in bringing papers to publication. In the current economic climate, assurance and assessment systems will not be exempt from the need to reduce costs, and there is likely to be renewed pressure to find more streamlined systems and techniques.

- increased competition between researchers. Constraints on funding bring increased competition for research grants and contracts, falling success rates, more work for assurance and assessment systems, and more difficult decisions in determining which projects, researchers and institutions succeed in the competition. Similar pressures are evident as researchers compete for space in prestigious publications. Such pressures give rise to concerns and lack of confidence in the increasingly fine judgements and distinctions that determine success or failure in the intense competition between researchers.

- new kinds of research outputs. Many assurance and assessment regimes are built around outputs that are formally published in journals, monographs and conference proceedings. But the digital revolution produces new kinds of outputs – multimedia presentations, working papers, pre-prints, blogs and so on – that can readily be circulated worldwide. And data-intensive research brings a new focus on data as an output in its own right. As yet, however, the assurance and assessment systems relating to such outputs are at best informal, and often non-existent. This will need to change if researchers and other consumers are to have trust in these new kinds of outputs, and also to give confidence to researchers as producers that they can exploit these new channels of communication in ways which will benefit their careers.

New technologies and services have already changed the ways in which assurance and assessment is done. And new opportunities are arising in the form of social tagging and recommender systems, checks on plagiarism, and facilities for online comments and ratings. New technologies are also facilitating the development of a wide range of sophisticated bibliometric and other measures that can provide useful evidence to support assurance and assessment systems. One of the key issues for the future will be how these new tools and techniques evolve alongside more traditional systems of assurance and assessment of the quality of research.

Whatever the changes, however, assurance and assessment systems will remain critical to the health of the research community, helping to ensure that key decisions are taken properly and based on good evidence; and providing an essential underpinning for sustaining trust in the work that researchers undertake for the benefit of society at large.

Selected references and useful resources

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