Research Trends Issue 35: Developing Research in Developing Countries

This issue contains five articles that provide a bibliometric view of scientifically developing countries from different angles. First, Sarah Huggett reveals how these countries are scientifically maturing, while Ylann Schlemm discusses how the availability of scientific literature has a positive effect on this development. Gali Halevi shows how developing countries participate in international research networks and in a second piece, how approaches originating from them have had and still have a great impact on modern science. Finally, Daphne van Weijen explains how authors from developing countries may overcome language obstacles to publication.

From a bibliometric point of view, the pieces illustrate the potential usefulness of publication trend analysis for the identification of emerging scientific institutions, of co-authorship relationships for the study of international collaboration networks, and of keyword analysis in large publication databases to identify cognitive influences from one field upon the other.

This issue also contains a sixth article, by Mike Taylor, on the development and use of new types of metrics denoted as altmetrics, an entity which is fast maturing into a new scientific (sub) discipline. This discussion paper is a prelude for a special issue of Research Trends dedicated to this topic next year.

We hope you enjoy reading this issue. Please share your thoughts and feedback with us! You can do this in the comments section following each article on our website or by sending us an email (researchtrends@elsevier.com).

Kind regards,

Dr. Henk F. Moed
Editor-in-Chief
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**The bibliometrics of the developing world**
Sarah Huggett touches upon the difficulty of defining 'developing countries' and then discusses their development in bibliometric terms. For example, has research output from developing countries changed in different subject fields in recent years?

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**Migration and co-authorship networks in Mexico, Turkey and India**
In this article, Dr. Gali Halevi describes the co-authorship networks and researchers’ migration trends for three scientifically developing countries: Mexico, India and Turkey.

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**Africa doubles research output over past decade, moves towards a knowledge-based economy**
In this contribution Ylann Schemm discusses some of the factors contributing to the increase in research output from sub-Saharan Africa, including increased funding, the rise of open access and Research4Life.

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**Ancient medicine in modern times**
Dr. Gali Halevi investigates the extent to which “Complementary” or “Alternative” medicine (CAM) has penetrated modern practices by means of a bibliometric study that looks at journals, articles and citations of alternative medicine in mainstream medical research.

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**How to overcome common obstacles to publishing in English**
For this issue on Research in Developing countries, Dr. Daphne van Weijen takes a closer look at the challenges researchers from developing and/or non-English speaking countries face when trying to get their work published, and suggests what they can do to overcome them.

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**Towards a common model of citation: some thoughts on merging altmetrics and bibliometrics**
In this contribution, Mike Taylor stresses the need for a theoretical basis for the nascent field of alternative metrics, on which any methodological decisions need to rely.

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**Did you know?**
…about developing countries’ position in university rankings?
What is a “developing country”? According to the Oxford English Dictionary, the developing world consists of “those countries of the world which are poor and not fully industrialized, but are seeking to become more economically and technologically advanced” (1). There is some controversy around the use of the term (2), as it may be perceived to imply inferiority of a “developing” versus a “developed” country, and also because it assumes a trend towards development along the traditional Western model that may not occur by choice or circumstance. Nevertheless, the term is broadly accepted, and in this article used only to define those countries that may perhaps have historically had fewer resources to devote to research and scholarly communications than others. For the purpose of this analysis, the list of countries used was derived from the International Monetary Fund World Economic Outlook April 2013 (3). Whole counting of publications was used, so that each co-authorship equates to an article count. This means that co-publications between the developing world and the developed world are counted towards the developing world’s output, and vice-versa.
Recent bibliometrics developments for the developing world

In 2011, the developing world published over 830,000 scholarly papers, representing just under 40% of the world’s scholarly output. These countries have indeed been developing in both absolute and relative terms, as demonstrated by their increasing share of global scholarly papers (see Figure 1). The output of the developing world grew at 15% Compound Annual Growth Rate (CAGR) from 2002 to 2011, compared to 6% CAGR globally.

Looking at a historical overview of the developing world’s scholarly publications by region reveals that most of the growth is concentrated in Asia (see Figure 2). A large proportion of the rise is due to China, which grew from an already large 17.3% of the developing world’s scholarly papers in 1996 to a very prominent 43.9% in 2011, with an impressive 15% 2002-2011 CAGR. The three next most prolific developing countries are the other BRIC countries, but their shares of the developing world’s output in 2011 are far behind China’s with 9.9% for India with a strong 14% 2002-2011 CAGR, 5.7% for Brazil with a high 13% 2002-2011 CAGR, and 4.5% for Russia with a very low 2% 2002-2011 CAGR. The only other developing country with more than 4% of the developing world’s 2011 output is Iran at 4.2%, with a tremendous 33% 2002-2011 CAGR.

And the developing world’s scholarly output has not only been growing in quantity, but in citability as well, as demonstrated by a historical overview of its five year field weighted relative impact, a measure of citation impact relative to global citation impact. For 2011, this is calculated as a ratio of 2007-2011 citations to 2007-2011 scholarly papers, divided by number of 2007-2011 scholarly papers, then normalized to expected impact worldwide, accounting for different citation patterns in different fields. Although this measure is still under the world average of 1 at 0.70 in 2011, it has grown both absolutely and relatively from 0.52 in 2000 (see Figure 3). To put it in a nutshell, the developing world has grown from about half as impactful as the global average, to more than two thirds as impactful as the global average. This increase may be partly due to increased international collaboration between developing and developed countries over the years.

Looking at a historical overview of the developing world’s five year field weighted relative impact by region reveals that growth in impact is not tied to growth in output (see Figure 4). Indeed, two groups emerge, with developing countries in Africa and the Americas showing relatively high field weighted relative impact at around 0.8 in 2011, while developing countries in Europe and Asia have a lower field weighted relative impact of respectively 0.65 and 0.68 in 2011. However the trends for developing countries in these two regions differ: Asia has shown faster growth, so that while Asia’s field weighted relative impact was notably inferior to Europe in 2000, it caught up with Europe in 2010 and outpaced it in 2011. Developing countries in Oceania have the highest field weighted relative impact and reach above world average at 1.01 in 2011, but their output is relatively small with only 334 scholarly papers published in 2011.
Subject trends for the developing world

The scholarly output of the developing world has been quite stable in its composition of various subject areas over time (see Figure 5). Over half (53.7%) of the papers published in 2011 by authors from developing countries are in the Physical Sciences. The rest of the papers are mostly divided between Life Sciences (21.5%) and Health Sciences (17.9%), accounting together for nearly 40% of the developing world’s 2011 scholarly output. By contrast, the developing world is not very prolific in the Social Sciences (5.3% of its 2011 scholarly papers).

A comparison of developed versus developing world scholarly output by main field reveals some interesting patterns. Overall, the developed world’s output follows a similar distribution pattern as the developing world, but appears less unequally distributed across main fields. Even if for both worlds, Physical Sciences is the most prolific area, it represents less than half (43.9%) of the developed world’s output. A larger proportion of the developed world’s output is in the Life Sciences (28.0%) or Health Sciences (31.4%), accounting for nearly 60% of the developed world’s 2011 scholarly output. And while Social Sciences (13.6%) is still the least prolific area, it represents more than double the proportion of scholarly output for the developed world than for the developing world.

Given the vast differences in number of papers published by different regions, the developing world aggregate is skewed by the dominating output from Asia. Looking at the distribution of 2011 scholarly publications by main field for developing countries in each region reveals a more diverse picture (see Figure 6). Developing countries in Europe and Asia show a similar pattern to the aggregate, which they influence heavily due to the large number of papers they publish relative to total developing world scholarly output. In these regions, the scholarly output of developing countries is heavily geared towards the Physical Sciences (~60%), followed by Life Sciences (~20%) and Health Sciences (16%), with a much lower share for Social Sciences (~5%). Developing countries in other regions show a more balanced distribution: although Physical Sciences is still the most prolific field for developing countries in North America, Africa, and South America, these papers represent 32-38% of each region’s output, leaving larger shares to Life Sciences (~30%) and Health Sciences (25-29%). Developing countries in these regions also show a higher proportion of Social Sciences papers (~8%).

This distribution of 2011 scholarly publications by main field for developed countries in each region again shows similar but more balanced patterns (see Figure 7). North America displays the fewest divergences between developing and developed countries amongst regions with enough data for robust results. A third of the scholarly output of developed countries in North America is in the Physical Sciences (~5 percentile points compared to developing countries), a quarter in the Life Sciences (~4 percentile points compared to developing countries), 28% in the Health Sciences (~3 percentile points compared to developing countries), and 14% in the Social Sciences (~6 percentile points compared to developing countries). While the output of developed countries in Asia is still predominantly in the Physical Sciences, this represents just under half of their scholarly output (~11 percentile points compared to developing countries). The share of Life Sciences and Social Sciences scholarly papers in this region is similar to those in developing countries at respectively 22% and 6% (2 percentile points higher than developed countries each). However, developed countries in Asia publish proportionally more in the Health Sciences (23%) than developing countries (16%). The differences are even more blatant for Europe: Physical Sciences account for 38% of scholarly papers (21 fewer percentile points than in developing countries in this region), allowing for higher shares in Life Sciences (24% (+5 percentile points compared to developing countries), Health Sciences (27% (+11 percentile points compared to developing countries), and Social Sciences (11% (+5 percentile points compared to developing countries)).

![Figure 5: Historical overview of the distribution of the developed and developing worlds’ scholarly output by main field. Source: Scopus](image)
Future development for the developing world

In bibliometric terms, the developing world has indeed seen some development over the past few years, both in absolute and relative terms. Although the developing world is still heavily dominated by the BRIC countries in terms of quantity of scholarly papers published, it achieves higher impact with research published from Africa and the Americas. Regional differences also occur in terms of the distribution of content published by main field, with Europe and Asia showing a marked prominence in the Physical Sciences.

The developing world appears to be a combination of varied entities with different specifications when it comes to scholarly output, and its recent growth trends for both quantity and impact bode well for its future, although the distribution of future successes may be unequal between different developing countries.

References:
1. http://www.oed.com/view/Entry/51432?redirectedFrom=%22developing+country%22#eid6852973
Section 2:
Country Trends

Migration and co-authorship networks in Mexico, Turkey and India

Dr. Gali Halevi

Scientific networks, collaboration and exchange have been discussed in Research Trends before (1, 2, 3). The main reason for the continuing interest in these topics has been the premise that these types of exchanges benefit scientific progress in that they foster innovation, and enhance and enable the flow of ideas between scientists in different institutions. In addition to the ability to track and sketch scientific collaborations between institutions, the availability of author profiles and their affiliation information in Scopus has also made possible the tracking of scientific migration from country to country. Research migration or mobility, although related to the formation of networks and collaboration, has unique characteristics and far reaching implications that go beyond the development of collaborative scientific activities. In a migration scenario, collaboration is achieved through the physical move of a scientist from one country to another. In addition to its impact on immigration rates, economy and culture, scientific migration has professional implications as well. Potential outcomes of research migration include: enhanced scientific contributions to the receiving country, the enrichment of its scientific strength, the flow of new ideas and perspectives in different areas of research as well as its potential to develop new products and technologies.

This article describes the co-authorship networks and researchers’ migration trends for three scientifically developing countries. It presents case studies on three countries from different world regions: Mexico from Latin America; India from Asia; and Turkey from Europe. It analyzes scientific migration from each of these three source countries to a set of 17 destination countries from all over the world, including both scientifically developing and big, developed countries, including the USA, China, the UK, Japan and Germany. A full list of destination countries is given in Table 1. In addition, it looks at co-authorship patterns between Mexico, India and Turkey and the 17 selected countries and describes the similarities and differences between these two phenomena. The result is an examination of the unique patterns that both these lines of investigation offer and the ways in which each can be used to shed some light on the development of scientific excellence in different areas of the world.

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Table 1: 17 set of selected destination countries
We collected the research output of 17 countries among which 10 are considered “growing” or “developing” countries (noted in italic) and 7 are considered as “established” from different regions in the world (see Table 1). For this study, each country’s research output for 2000-2012 was collected. In order to trace the movement of researchers from one country to another we used the unique Author ID offered by Scopus as a way to identify individual authors. The affiliations associated with an author ID as they appear on their publications are kept and become part of the unique author profile constructed within Scopus. This allows for an analysis of migration as one can identify from which institution and country an author published research articles in the course of his or her scientific career. Moreover, the fact that the affiliation is tracked per author allows for a comparison between international migration and co-authorship and enables the distinction between the two as separate indicators of mobility and collaboration, respectively.

**Mexico co-authorships**

Over 15,000 documents were analyzed in order to track the patterns of co-authorship between Mexico and the 17 selected countries. Figure 1 shows the countries Mexico collaborates with as well as the strength of the co-authorship network. The thickness of the lines and the numbers indicated on the map demonstrate the most frequently co-authored countries, which are Brazil in the first place, Pakistan in the second place and the USA in the third place. Other countries Mexican researchers frequently collaborate with are India, Portugal and Egypt.

The collaborative scientific output between Mexico, Brazil, Pakistan and the United States focuses on the areas of Agriculture, Biology, Medicine and Social Sciences.

**Migration from Mexico**

The migration of researchers from Mexico to the 17 destination countries studied shows a somewhat different pattern compared to co-authorship (see Figure 2). Brazil, the United States and Portugal are the leading destination countries of Mexican researchers. High co-authorship and migration exchange between Mexico and Brazil could be attributed to the fact that both countries are not only the most populated nations in Latin America but also have the largest global emerging economies and are considered to have high regional powers. In addition, both countries focus on common research issues, especially those related to climate change and the environment.

![Figure 1: Mexico's co-authorship network (2000-2012)](image)

![Figure 2: Migration from Mexico (2000-2012)](image)
India co-authorships

India's co-authorship network, as can be seen in Figure 3, is led by Malaysia, Pakistan and Iran followed by Thailand, the United States and Japan. Collaborative research between India, Malaysia and Iran coincides with the close economic relationships between these countries, especially relating to Oil trade. The collaborative scientific output between these countries falls in the areas of Physics, Chemistry and Medicine as well as Materials Sciences.

Migration from India

The migration patterns (see Figure 4) from India show Pakistan and Malaysia as leading destinations followed by the United States, which is somewhat different from the co-authorship patterns of India. Both geographic proximity and close economic ties seem to be the drivers of co-authorships and migration. The migration to the USA might be the result of specialized programs and funding such as the Indo-US Joint Research Programs that received over 200 billion dollars in grants and fellowships in the past year (4).

Turkey co-authorships

Turkey's co-authorship network (see Figure 5) shows strong ties to Pakistan, Iran and Romania and is in areas of Physics, Chemistry and Engineering. The strong ties between Turkey and Pakistan could be the result of the diplomatic efforts to strengthen the economic, educational and technological relationships between the two countries through the High Level Strategic Cooperation Council (HLSCC). Among other topics promoted by the council is the “interaction between universities and academic institutions” (5).

Migration from Turkey

However, the migration from Turkey as depicted in Figure 6 shows a somewhat different pattern. The leading destination country is the United States, followed by the Netherlands and Iran. The high migration to the United States could be attributed to the relatively high number of US National Science Foundation (NSF) funded projects with Turkey. The purpose of these projects is “to promote inclusion of junior researchers in collaborations to stimulate long-term research partnerships.” (6). Turkish migration to the Netherlands has historical roots which date back to 1964 when the Dutch government initiated a “recruitment agreement” with Turkey for the purpose of attracting Turkish workers, mainly low skilled laborers, to migrate to the Netherlands. This agreement lasted for 10 years and created a peak in migration from Turkey to the Netherlands in that period.
Summary

Co-authorship and migration patterns can differ, although both are stimulated by economic and diplomatic factors. Grants, fellowships and joint technological projects on national levels drive scientific collaborations, which in turn result in co-authored papers. Migration can sometimes display similar patterns, but is also driven by personal factors such as career opportunities. Although one can see these patterns through the scientific affiliations of published papers, explaining them can only be done by looking at special agreements and diplomatic developments between countries in the preceding years. Language similarity and geographic vicinity are probably some of the factors affecting co-authorships and migration, and though we might not be able to show that through publications since most are published in English, the co-authorship networks could imply that. For migration, however, economic stimuli and opportunities could also be a driving cause, as researchers look to further develop their careers.

References:
There is no doubt that economic growth across sub-Saharan Africa has been stellar in recent years, illustrated by GDP growth expected to be 5.3% in 2014 (1). Coverage of Africa has increasingly focused on this growth, seeing the encouraging future prospects for many countries and the improved life chances for the younger generation as a result. However, to date, there has been little focus on the flourishing academic and scientific success on the continent as countries move beyond agriculture-dominated economies towards a research and knowledge-based future.

One of the most positive signs for Africa has been the recent increase in scientific research being conducted by local African scientists. From 1996 to 2012, the number of research papers published in scientific journals with at least one African author more than quadrupled (from about 12,500 to over 52,000). During the same time the share of the world’s articles with African authors almost doubled from 1.2% to around 2.3%.

Looking at Africa’s outputs overall and as a share of total articles globally, we see clearly that the continent is starting to emerge scientifically onto the world stage. Admittedly starting from a relatively low base, this still reflects more than 52,000 research outputs in 2012 featuring at least one African author. Clearly, this also has important implications for the entire developing world, given the potential for “South-South” information transfer. Through published research, what is learned in one region/country can be the basis for improvements in other developing-world regions and countries.

So what are the factors contributing to this promising trend? They are many: increased funding, significant policy changes within countries, improved research infrastructure, both human and physical, ICT resources, open, free and low cost access to peer reviewed literature, and research capacity building training have all contributed to the positive, upward trend in African research output.

One key contributor to increased research access is Research4Life, a public-private, UN-publisher partnership that provides scientists in developing countries with free or low-cost access to articles from leading scientific journals. Altogether, more than 35,000 peer-reviewed resources are available to researchers in the developing world and 6,000 institutions from more than 100 developing countries have signed up to use Research4Life programs. A 2010
The rapid growth of open access also represents a significant contributor to African research output. David Tempest, Director of Access Relations at Elsevier, hosted an “Open Access in Africa” workshop in Kenya in April 2013 in cooperation with the African Academy of Sciences to explore the African access experience and how publishers can assist in the process of enhancing access to African research. “Africa has some outstanding researchers, and the quality of their work is improving, but there needs to be a concerted effort to work together and create excellence on a local level. […] At Elsevier, we’re happy to work with these organizations to run author workshops to help researchers understand how to publish in journals, the ethical dimensions of publishing, and the emergence of new publishing possibilities, such as open access.” (7).

As a follow on, Elsevier is supporting the National Research Foundation’s National Postdoctoral Forum, which will take place in Cape Town in early December 2013. He noted, “This is an opportunity to work with young researchers in Africa to illustrate how the scholarly communication system is changing and to answer any questions on how young researchers can publish in our journals.”

While African authors have nearly doubled their article share over the past decade, the returns could be many times greater over the next decade if awareness, usage and research capacity are tackled in a collaborative and integrated manner by African institutions, access programs and publishers.

Research4Life user experience review revealed that more respondents (24%) cite HINARI as a source for life-science and medical research than cite any other source, while more respondents (32%) cite HINARI as the source they use most frequently. For agricultural research, AGORA similarly tops the list of resources used, with equivalent figures of 27% and 54% respectively (3).

However, as Richard Gedye, Director of Outreach Programs for the International Association of Scientific, Technical & Medical Publishers (STM), who serves as Research4Life’s key publisher representative, recently pointed out, demonstrating real research output impact is not a straightforward undertaking (4). “Through our booklet, Making a Difference, we’ve been able to build up a convincing collection of case studies: more robust research agendas, stronger grant applications, better teaching and improved health outcomes have been achieved (5). A strong bibliometric analysis, however, remains problematic due to a lack of basic information about registered institutions and other important viable, co-existing access programs such as the International Network for the Availability of Scientific Publications (INASP) and open access. Instead, we’ve decided to plan a comprehensive survey in 2014 of the impact of Research4Life access with African researchers, research funders, research administrators, physicians, trainers and librarians.”

But there’s no room for complacency. In the November 2010 report on “Growing knowledge: Access to research in east and southern African universities” from the Association of Commonwealth Universities, Jonathan Harle, now INASP’s Senior Programme Manager, Research Access and Availability, clarifies that increased access and bandwidth won’t solve the problem (6). Skills development and awareness of free and low cost access to peer reviewed research need to receive much more attention if research output is to grow substantially. INASP is another critical contributor to African research output growth with a focus going far beyond access to support the full cycle of research capacity building across 22 countries. They provide a range of services including developing deeply discounted consortial arrangements, training librarians in managing digital resources, mentoring researchers in academic literacy and authorship skills and supporting the process of local online journal development and hosting.

The Association of Commonwealth Universities, Available at: http://www.arcadiafund.org.uk/sites/default/files/arc_pub_africanconnectivity_thesarcssofcommonwealthuniversities_0.pdf

2. Scopus data analysis by Dr. Andrew Plume, Director of Scientometrics & Market Analysis, Elsevier.


5. Gaible, E., (2013) “Making a Difference: Stories from the Field: How access to scientific literature is improving the livelihoods of communities around the world.” Research4Life, Available at: http://www.elsevierfoundation.org


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• Q&A: Kimberly Parker, HINARI Programme Manager at the World Health Organization
• Measuring the impact of research access in the developing world

Research4Life is a public-private partnership of over 200 international scientific publishers, the International Association of Scientific, Technical and Medical Publishers (STM); Cornell and Yale universities in collaboration with WHO, FAO, UNEP, WIPO and technology partner Microsoft. Since 2001, the four programs – Access to Research in Health (HINARI), Access to Global Online Research in Agriculture (AGORA), Online Access to Research in the Environment (OARE) and Access to Research for Development and Innovation (ARDI) – have grown and developed to the point where they now give researchers at more than 6,000 institutions in over 100 developing-world countries and territories free or low-cost online access to over 35,000 peer-reviewed international scientific journals, books and databases provided by leading scientific publishers.

In November 2012, Research4Life partners announced their commitment to the program through 2020.

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One of the interesting contributions to science made by countries in regions that are considered “developing”, is what is labeled as “Alternative” or “Complementary” medicine (CAM) which stems from practices carried through thousands of years into modern times. Methods of healing using local herbs and plants or physical and spiritual elements penetrated Western medicine through the years, becoming an integral part of medical procedures in many countries around the world.

In this article, we sought to find out the extent to which CAM has penetrated modern practices by means of a bibliometric study that looks at journals, articles and citations of alternative medicine in mainstream medical research.

The diversity and sheer number of journals dedicated to Alternative or Complimentary Medicine (CAM) and the countries from which they originate is an interesting phenomenon. According to Ulrich’s Global Serials Directory (http://ulrichsweb.serialssolutions.com) there are 358 active scientific journals categorized as CAM journals. Figure 1 visualizes the top publishing countries in the area of CAM. Perhaps not surprisingly, China is a leader in CAM journal publications. Many popular alternative medicine methods originated from China and carried through thousands of years making their way into Western medicine and culture. The same goes for India. It is interesting, though, to see leading Western countries such as the United States and Canada in North America and the United Kingdom, Germany, and France in Europe taking a leading role in the publication of CAM journals. This could be interpreted as an indicator of the high penetration rate of alternative medicine in the Western world.

The number of new CAM journals launched in the past few decades tells a lot about the increasing scientific interest in Alternative Medicine. The largest growth in the number of journals published on the topic is seen from the 1960s to the 1980s and from the 1990s to the 2000s (see Figure 2).

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**Figure 1:** CAM journals publication by country. Source: Ulrich’s Global Serial Directory
The growth of scientific journals focusing on CAM can be attributed to the direct funding of CAM research received in the 1990s. In 1998, for example, the United States congress established the National Center for Complementary and Alternative Medicine (NCCAM) at the National Institutes of Health. The NCCAM funds university-based centers for research on CAM. This funding stimulated researchers to apply for grants and conduct research in this area, the results of which are published in an ever growing number of dedicated scientific journals. There is similar funding in Europe, where research funded nationally and by the European Commission is conducted by over 50 different foundations, universities and research centers (1). The availability of monetary means to support such research has a direct impact on publication growth.

Based on Ulrich's Global Serial Directory, English is the leading publication language in CAM journals publications as can be seen in Figure 3. As such, CAM can be seen as a part of the global scientific discourse, as English is no doubt the most common language published in science.

In addition to the trends in growth of journals published in this area, we also examined the citations characteristics of this topic and especially the growth of cited references to CAM journals, the top cited CAM journals and the top citing journals from disciplines other than CAM. The purpose of this analysis was to try and establish how this topic evolved in terms of its scientific activity and the manner of exchange between CAM research and other disciplines.

In the first step in our analysis we conducted a Scopus search of all CAM journals indexed by Ulrich's Global Serial Directory. We then retrieved all the cited references to the CAM journals found. The cited references analyzed here include all publications regardless of their coverage in Scopus. Since Scopus displays all references listed in each publication it indexes, whether their source is indexed in the database or not, it is possible to analyze them in a complete manner. It is important to note here that this analysis depends on database coverage and might result in different numbers of references if a different database is used.
As can be seen in Figure 4, there is an evident and significant growth in the number of cited references to CAM journals and articles through the years. This could indicate a growing research agenda and scientific network around topics and issues related to CAM. Although these numbers do not differentiate between cited references appearing in articles in journals focusing on CAM to those appearing in other disciplines, the mere growth of cited references exchange points to the increased activity in this area of research.

In addition, we examined the most cited CAM journals. Figure 5 shows the top 10 most cited journals in this area which include Evidence Based Complementary and Alternative Medicine, Journal of Alternative and Complementary Medicine and the American Journal of Chinese Medicine as leading journals.

Finally we examined the top 50 most cited articles in CAM journals and looked at the top journals that cite them. As can be seen from Figure 6, PLOS One has the most citations to CAM articles. However, it must be noted here that PLOS One is an exception as it publishes thousands of articles every year compared to other journals that have more moderate rates of publications. This by itself could be a factor in its prominent place in the top citing journals. The inclusion of PLOS One in our analysis stems from the fact that it is a mainstream Medical journal and thus fits the criteria of our analysis. CAM articles cited in PLOS One were mainly in the areas of Agricultural and Biological Biochemistry, Genetics and Molecular Biology and general Medicine. Other journals citing CAM articles include journals focusing on Chemistry and Pharmacology such as the Journal of Ethnopharmacology and the Journal of Agricultural and Food Chemistry. In addition, journals focusing on internal medicine, pain management and cardiology are also seen to be citing CAM articles.

Summary
According to the 2009 "National Health Statistics Report" published by the the US Department of Health and Human Services, the American public spent over 33 billion dollars on CAM practitioners and purchases of CAM products, classes, and materials (2). As awareness of nutrition and general well-being as well as a holistic approach to health is gaining more momentum, more and more people seek self-care CAM therapies such as homeopathic products, yoga, and natural products.

Moreover, Alternative Medicine and complimentary health services are becoming an integral part of mainstream medical practices and are in many countries sponsored by governments’ health systems. Practices that could have been considered esoteric or exotic a couple of decades ago, are now to be found almost everywhere in the world. These originated from regions and countries that are or were considered ‘developing’ and managed to penetrate and influence science, medicine and human well-being for years to come.

References:
Figure 5: Cited References to CAM journals and articles. Source: Scopus

Figure 6: Journals most frequently citing CAM periodicals. Source: Scopus
Obstacles to overcome
A review of multilingual scholars’ participation in global academic communities revealed a number of problems that researchers face when trying to publish their work in international, English language journals (2). The most obvious obstacles are related to language issues. For example, writing in English is cognitively more demanding for non-native speakers than for native speakers, which can make the process of writing far more time consuming. Second, the presence of linguistic errors in a manuscript, or the use of a rhetorical or regional style that does not match the style of the English language research community, can negatively influence the outcome of the peer review process (3), particularly if the research being described is of mediocre rather than outstanding quality. Furthermore, non-native speakers can have difficulties paraphrasing the work of others, which means they run the risk of unintentionally plagiarizing the work of others (4). Finally, non-native speakers are sometimes less familiar with rhetorical styles favored by the English language research community.

Other potential obstacles include a lack of connections to key members of the disciplinary community, potential bias towards manuscript submission by non-English speaking authors (see also 5), scarcity of funding to conduct research, and a general focus on ‘local’ research and collaboration with neighboring countries rather than on wider international collaboration (2).

Another study focusing specifically on challenges related to scholarly publishing in sub-Saharan Africa revealed that: “Scholarly publishing in sub-Saharan Africa faces numerous challenges, including technological, socio-political, and economic challenges as well as an environment that does not favor scholarly publishing” (6). Specific obstacles raised in this study include the lack of participation in scholarly conferences, brain drain and technological challenges. For example, lack of Internet access makes it very difficult for scholars in the region to submit their work electronically, to access electronic journal content online, or to act as reviewers using electronic submission systems. As a result of these, and other potential obstacles: “Very few articles published by scholars from sub-Saharan Africa may become citation classics or even find a place in the list of key papers on the emerging research fronts” (6).

Possible solutions
There are clearly many potential obstacles that researchers from developing countries and/or non-English speaking countries face when trying to get their work published. But what can they do to try to overcome them?

Recommendations for researchers to increase their chances for publication success include:

- **Be patient and persistent:** do not give up too quickly. If your paper is rejected, use the Editors’ and reviewers’ comments and feedback to further improve the quality of your paper. If at first you don’t succeed, try again (2).

- **Collaborate with other researchers:** make contact with other, more experienced, researchers whenever possible, and look for potential areas of collaboration (7).

- **Imitate the style of others:** read papers in your field of research by prominent researchers and try to mirror their rhetorical styles (2, 7). However beware of committing
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plagiarism. For information on publishing ethics, see the Ethics Toolkit.

• Adhere to journal guidelines: make sure you read the journal’s guidelines carefully and comply with them before submitting your paper (7, 8).

• Linguistic editing: “The importance of good English language usage cannot be over-emphasized. (...) Should one do a full language check before sending in an article? Although it is expensive and time consuming, the answer is YES” (9). So when in doubt, ask someone to review your manuscript before submitting it. But opinions differ on whether this should be a professional corrector, a local editor, a language service provider, a convenience editor (e.g. English speaking colleague), or a literacy broker (10, 11).

• Find the right outlet for your work: Some journals are more open to publishing work by non-native English researchers than others. Investing some time in finding the right journal, by checking journal websites, and reviewing work they’ve already published can also help increase your chance of publication success.

• Increase the visibility of your work: help increase the visibility of your research findings by maintaining a website for your research team, blogging about your results, using social media, and consider submitting your paper to a more visible (Open Access) journal.

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Section 6: Expert Opinion

Towards a common model of citation: some thoughts on merging altmetrics and bibliometrics

Mike Taylor

The increasing visibility of scholarly communication and discussion has led to a dramatic increase in the complexity of understanding its academic impact and social reach.

Although the nature of the communication has many different forms, with radically different attributes, it is generally treated as a singular entity: that of altmetrics.

In fact, it is arguable that the creation of altmetrics as a singular entity was technocratic (driven by what is technically possible) and thus pragmatic (built from what is available), rather than rooted in a theoretical discipline, and, had the different sources emerged at different times, or been accessed via different technical solutions, they would have been kept discrete.

The fundamental differences are readily apparent. For example, when one tweets a reference to a paper, it can be observed that the communication is necessarily brief, and is unlikely to have taken much time or thought. Frequently it is in the form of a ‘retweet’ and can be classified as the mere repetition of a message through personal networks.

The effort taken to tweet a link or reference may be contrasted to a blog post, where the intended recipient may well be the original research team, as well as others interested in this academic area. Other forms of scholarly blogs link to papers when attempting to précis the content for a non-academic audience (http://realclimate.org), or engage misleading and mendacious uses of research to promote commercial and political aims - a less scholarly endeavor that nonetheless still contains links and discussion.

Nevertheless, both blogs and tweets can be said to have the explicit intention of being public: this can be contrasted with anonymous data that can be harvested and interpreted from many other sites. Of course, formal citation in a peer-reviewed article is also a public act, and this serves to introduce two other important criteria: that of context and immediacy. A tweet may have virtually no context (being only a reference to a paper), whereas a blog post may be several thousand words long. Similarly, a tweet may be an immediate act of impetuosity, whereas a citation in a peer-reviewed paper will necessarily take a longer period.

However, focusing on the issue of privacy: reading or downloading of articles may be considered as a private act in a study room, but user activity counts (and other demographic information) aggregating such acts and provided by tools such as Mendeley, Citeulike, GitHub and DataDryad are often included in publicly available altmetric data, as can be article-level-usage figures from publisher sites.

With the exception of people who are trying deliberately to distort data (for example, by repeatedly downloading an article – a practice which publishers work hard to counter), little is known of how mindful people are of the public nature or use of their activity and how this affects their behavior.

Therefore altmetrics consists of a wide variety of data with different characteristics, linked by a common set of tools. Data is typically accessed via an API (application programming interface), papers referenced by DOIs (digital object identifiers), and the platforms from which the data is gathered are social: this defines the set of data, rather than provides a theoretical foundation.

It is not surprising, therefore, that little is known about the intentional, motivational or experiential motives of the users.

Reporting back

This article is based on presentations that Mike Taylor gave at the PLoS article level metrics workshop in San Francisco and at the World Social Science Forum (WSSF) in Montreal, both in October 2013.

Nevertheless, both blogs and tweets can be said to have the explicit intention of being public: this can be contrasted with anonymous data that can be harvested and interpreted from many other sites. Of course, formal citation in a peer-reviewed article is also a public act, and this serves to introduce two other important criteria: that of context and immediacy. A tweet may have virtually no context (being only a reference to a paper), whereas a blog post may be several thousand words long. Similarly, a tweet may be an immediate act of impetuosity, whereas a citation in a peer-reviewed paper will necessarily take a longer period.

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When a user posts a paper on Mendeley, we can hypothesize various motives including (but not limited to) the following:

- Other people might be interested in this paper.
- I might read this paper in the future.
- I have read this paper and want it to be easily findable.
- I want other people to think I have read this paper.
- It is my paper, and I maintain my own library.
- It is my paper, and I want people to read it.
- It is my paper, and I want people to see that I wrote it.
- I might skim read this paper in the future because I suspect it might back up an argument I’m thinking about making and it looks like it would make a useful citation.

With Twitter, the poster may choose to call attention to their tweet, to direct people to their response, may address the tweet to the authors, or may add inferences by the arbitrary (or organized) use of hashtags.

Each example of altmetric data has its own set of potential underlying motives, and each example requires different research: tweets may be subject to qualitative research, but are less easily studied by user surveys, for example. It would, of course, be possible (although time-consuming) to monitor tweets and ask the tweeter to complete a survey on their motivations for the individual tweet, but the time taken to survey would probably be disproportionally longer than the time taken to compose and post the original tweet.

To date, altmetric research has focused more on correlation (Priem et al, 1) than on motivation, and has relied upon assumptions rather than empirical evidence to postulate the relative level of engagement with an article (Fenner and Lin, 2).

Fifty years of relevant research

The related field of bibliometrics has – since 1962 – conducted a significant quantity of research in the field of motivation of citation. Amongst the many intellectual assets available for potential re-purpose are theoretical models, methodologies, data sets and references. Bornmann and Daniel’s 2008 article, “What do citation counts measure? A review of studies on citing behavior” (3) reviews the extensive literature and reports the conclusions of this research. However, with the exception of Priem et al’s passing reference to this review, a search on Scopus reveals that of the 162 citations made to this paper, not one of them appears to be related to altmetrics.

The scholarly research into reference and citation attempted to test two potential theories of citation motivation: normative and social constructivist. Broadly speaking, the two camps maybe positioned as:

1. “Scientists give credit to colleagues whose work they use by citing that work” versus
2. “Scientific knowledge is socially constructed through the manipulation of political and financial resources and the use of rhetorical devices” (reported in 3).

After fifty years of research, Cronin was able to summarize the weight of evidence in favor of the normative view:

“The weight of empirical evidence seems to suggest that scientists typically cite the works of their peers in a normatively guided manner and that these signs (citations) perform a mutually intelligible communicative function” (4).

Shortly after the inception of bibliometrics, Eugene Garfield (1962, as reported in 3) listed fifteen possible motivations to cite:

1. Paying homage to pioneers;
2. Giving credit for related work (homage to peers);
3. Identifying methodology, equipment, etc.;
4. Providing background reading;
5. Correcting one’s own work;
6. Correcting the work of others;
7. Criticizing previous work;
8. Substantiating claims;
9. Alerting to forthcoming work;
10. Providing leads to poorly disseminated, poorly indexed, or uncited work;
11. Authenticating data and classes of fact (physical constants, etc.);
12. Identifying original publications in which an idea or concept was discussed;
13. Identifying original publication or other work describing an eponymic concept or term (…);
14. Disclaiming work or ideas of others (negative claims); and
15. Disputing priority claims of others (negative homage).

All of these are as relevant to social citation in 2013 as they were to formal citation in 1962; and the added visibility and speed of activity in social networks only adds to the list, for example:

16. Building a network of related researchers;
17. Building a reputation as a good networker;
18. Paying visible homage to a senior researcher;
19. Seeking the attention of a senior researcher;
20. Demonstrating that one’s reading is up to date; and
21. Intimidating critics with the breadth of one’s reading.

There are many more motivations that can be added to this list.

That there should be general agreement on the nature of formal citation should come as little surprise: learning how to reference, or “show your reading” is a skill that is taught from an early age. Many websites exist to support and develop best citation practice, even going to the length of invoking the law to encourage completion:

“If you do not include your references both in your essay and on a reference sheet at the end of your essay, you could face legal action for being in violation of plagiarism laws.” How to Add Citations in an Essay, Allison Boyer, http://www.ehow.com/how_7472938_add-citations-essay.html

Various Google searches on October 22, 2013 for equivalent guidelines for tweeting scholarly references produced no relevant results, beyond guidance on structuring the actual form of the citation (http://ucarr.edu/blogs/blogcore/postdetail.cfm?postnum=11505). However, there are many resources to support the use of Twitter in the K-12 teaching environment (e.g. http://www.teachhub.com/50-ways-use-twitter-classroom). It seems like a reasonable assumption that people’s first contact with social media will be away from the support of the academic community, and that individual practice will develop in a varied social environment.
Although statistics relating to negative citation are well-known (Bornmann and Daniel report a 5% incidence) there is a distinct contrast when it comes to abusive expression of power relations in social media. Scopus has indexed 30 papers with “cyberbully” in the title or abstract, and Shenk and Fremouw (5) report that 8.6% of college students have been subjected to cyberbullying.

The two observations: that people learn to use social networks away from an academic environment, and that the expression of power relations (at least in Twitter) is common may lead us to conclude that social citation – at least in the sense of public reference – may be less characteristic of normative citation practice.

Developing a methodology
Altmetric data is complex and varied: in order to study it, it is necessary to simplify and normalize the data. For example, the usage figures of social networks vary across time, with networks drifting in and out of fashion, being subject to phases of organic growth and early adopter use, and with operators controlling access to data via their APIs.

Developing the idea of Lin and Fenner’s taxonomy of social citation / usage behavior – albeit with some critical changes and without the idea of developing engagement with the article – it is possible to make sense of types of altmetric behavior. Rather than attributing motivation – or assuming that tweets are a deeper level of engagement than reading the article - I propose classifying activity according to the level of engagement with the behavior, as defined by the user’s choice of platform:

- **Social activity** – characterized by rapid, brief engagement by users on platforms used by the general population – Twitter, Facebook, Delicious, etc.
- **Component re-use** – the re-use of the constituent elements of the research product – data, figures and code.
- **Scholarly commentary** – in-depth engagement by people using scholarly platforms, such as Science Blogs, F1000Prime reviews, etc.
- **Scholarly activity** – indirect measurement of activity by people using scholarly platforms, e.g., Mendeley, Zotero, Citeulike.
- **Mass media coverage** – coverage of research output in the mass media.

Any well-defined and meaningful collection of data should present two characteristics:

1) the sources that comprise an instance of data (e.g., social activity) should correlate well – for example, if the data is measuring the same class of activity, we should see tight correlation of activities between Twitter, Facebook, Delicious, etc.

2) each class should show discrete phenomena of activity.

Increasing engagement with the article, Fenner and Lin (1 is lowest level of engagement, 5 is maximum):

1. Viewing: the activity of accessing the article online.
2. Saving: storing and referencing of articles (or references) in online tools such as Mendeley or Citeulike.
3. Discussing: ranging from tweeting to blogging.
4. Recommending: formal endorsement of a paper, e.g. F1000Prime.
5. Citating: formal citation of an article in another article.

Both of these are readily testable, and as altmetrics grows to encompass more datasets, it should be able to accommodate further classes of data. For example:

- Social activity surrounding mass media – comments, tweets, etc., linking to mass media coverage of scholarly output.
- References in books and monographs.
- Use of scholarly research in commercial activity, e.g., patents.
- Use of scholarly research in legislation and governmental context.
- Self-promotion, e.g., additional content to support use of research, press releases.

In each case, the legitimacy of the distinctness of the classes and the difference between the classes can be readily tested. In order to validate the uses of the classes to describe motivational behavior and to discover causal patterns between the different types of activity, it is necessary to engage in qualitative research – methods that have been exhaustively researched by the bibliometric researchers reported in Bornmann and Daniel. It is possible that some of this work may be aided by text-mining and entity-recognition techniques, as used in natural language processing research, but any attempt to ascribe motivation to social users will require surveys and interviews.

If the classes of altmetric activity are validated as distinct and internally consistent, then several research steps might follow:

- Identifying statistical trends between the classes.
- Qualitative analysis to understand causation.
- Surveys to acquire evidence of motivation.
- Understanding the likely consequences of ‘gaming’ behavior, e.g. buying tweets, encouraging colleagues to load papers into Mendeley, etc.
- Understanding how behavior changes as a consequence of legitimate promotion.
- Qualifying social citation / social network activity between disciplines, professionals and as the platforms develop.
- Discovering how combinations of classes can contribute to the understanding of potential use cases for altmetric data.
Considering this last point, there are many different issues that might be understood via a properly formulated study of altmetrics and bibliometrics. Given the pragmatic nature of altmetrics, the potential methodologies are varied, and this list is advanced as a discussion point.

1. **Prediction of ultimate citation** – although it has been speculated that some altmetric data might enable a prediction of future citation rates, research has not yet demonstrated a correlation between Twitter counts and citation (Haustein et al 2013) (6). However, disciplines are likely to vary in their adoption of different types of activity; so this work—which may be added to other research that attempts to predict citation rates—will continue to look for correlations in data (7).

2. **Measuring / recognizing component re-use / preparatory work / reproducibility** – a distinctive strand of altmetrics research is focused on measuring re-use of scholarly materials. This is of interest to funders and institutions in its own right; however, making data, code, etc. freely available may lead to increases in reproducibility and reliability. Nevertheless, work would need to be undertaken to understand the extent to which data (etc.) is reused simply because it is available, or well curated, rather than driven by scholarly need.

3. **Hidden impact (impact without citation)** – there has been speculation that some articles may have an impact that is not detected using bibliographic citation analysis. For example, “How to choose a good scientific problem” (8) has only been cited 4 times, according to Scopus, but has been shared on Mendeley nearly 42,000 times as of October 31, 2013.

4. **Real-time filtering / real-time evaluation** of important / impactful articles relies on both a qualitative and quantitative analysis of real-time data. However, it is unknown if there is sufficient data to make this work at a sufficiently fine granularity, whether this is of use to scholars and whether they would trust such a system.

5. **Platform / publisher / institution comparison** – although altmetrics can be used to gauge how effective organizations and authors are at providing social sharing tools, there has been no research on what this data might mean in terms of quality of research, rather than the more obvious values of being a ‘good read’, titivation or scandal.

6. **Measuring social reach / estimating social impact** – evidently a crucial part of communicating research outcomes to society is the ability to communicate, and altmetrics could be used as a starting point to understand the flow of research impact in society – if it expands its remit, issues of privacy remain of low concern and if citation practices outside academia improve [http://www.researchtrends.com/issue-33-june-2013/the-challenges-of-measuring-social-impact-using-altmetrics].

**Conclusion**

The outcome of research in this area should be to align the studies of altmetrics and bibliometrics by developing a common theoretical model that allows for analysis of all forms of accessible reference to scholarly objects: in short, a model of the scholarly network.

Such an ambition would allow for the commonalities between formal citation and altmetric activity, and for understanding the differences. By accepting that different forms of citation or reference take place in environments with different attributes and motivations, we will achieve a richer view of both bibliometric activity and social citation.

**Acknowledgements**

The author is indebted to the many people who are passionate about understanding scholarly communication and always ready to spend time discussing the issues, most notably Dr Stefanie Haustein, Dr Henk Moed, Euan Adie of Altmetric.com, Gregg Gordon of SSRN and many others.

**References:**


**Related presentations:**


Did you know... about developing countries' position in university rankings?

Matthew Richardson

For many years national university rankings have been produced: in many countries they are published annually by national news media as a means for prospective students to make informed decisions about higher education destinations. International university rankings are a more recent phenomenon of growing importance in the academic market. The top ranks in the major international university rankings are dominated by the United States and well-established research nations such as the UK, the Netherlands, Germany and Australia, but developing countries are increasingly represented in the extended rankings.

Following the International Monetary Fund list of developing countries used in the first article of this issue, 30 of the top 400 institutes in the 2013-14 Times Higher Education World University Rankings (1) were from the developing world, while the top 400 ranks of the 2013 Academic Ranking of World Universities (2) and QS World University Rankings (3) include 32 and 52 institutes from developing countries, respectively. China consistently ranks highest of these nations, while India, Turkey, Russia and Brazil also hold strong positions.

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