African Researcher 2.0: Using New Technologies to Join Global Academic Conversations[1]

Miriam Conteh-Morgan
Ohio State University

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Abstract
Researchers in Africa have typically been regarded as consumers, not producers, of academic information. Recently, Open Access publishing has been advanced as a way of making research from Africa more easily and widely available, but more changes need to be made. This article discusses how researchers in Africa can join global academic conversations through a rethinking of their research workflows, and how they can strategically position themselves and their research in knowledge streams for rippling effects.

Keywords
Knowledge dissemination; Research impact; Disruptive change; Web 2.0 tools and practices

Miriam Conteh-Morgan is Associate Professor and Librarian for African Studies at Ohio State University, 1858 Neil Avenue Mall, Columbus, OH 43210. Email: conteh-morgan.2@osu.edu .

In the mid-1990s, the US weekly *The Chronicle of Higher Education* published a cartoon that depicted two small girls engaged in a playground-slanging match. One of the girls, hands on hips, shouted at the other, "My mother's website gets more hits than your mother's!" The 1990s, of course, was a time when the personal website was just gaining acceptance as a way for academics to present their professional profiles to others outside their immediate networks. In those early days, this was considered cutting edge, and even shameless self-promotion; today, when even cats can have an online following, personal websites are considered an essential form of online self-

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presentation, and an important way in the academy of showcasing one's teaching, research, and publication profile. How did we get here?

For about 500 years, since Gutenberg's invention of the modern printing machine in the 1430s, the printed word has held sway as the most durable and effective mode of producing and transmitting information, ideas, and knowledge. This model was fundamentally altered when, by the last decade of the twentieth century, the Internet revolution offered multiple ways of knowledge production and dissemination to the general public. What these new modes also offer are an accelerated production pace and opportunities for pre- and post-publication communication with a much expanded research community. The new modes and their possibilities have up-ended the slow, unidirectional flow of knowledge (from author to reader), hitherto mediated by gatekeeping publishers, editors, and librarians. The pervasive and enabling culture in which one can easily create and disseminate a product has created certain expectations among participants in the global information society, the expectation that content on the Web has the potential to be noticed and viewed by at least one person, even a world away.

In the reformulated research environment, individuals can position themselves upstream in the research creation-to-dissemination cycle; can influence the production, dissemination, and reception of their intellectual output; can enhance their professional profiles; and can take a more active role in shaping knowledge ecologies. They can insert themselves into, and become participants in, global networks and new invisible colleges in ways unimaginable even just five years ago. The explosion of possibilities for increased global interactions may, by some accounts, be seen as a flattening of the world (Friedman, 2005). But can one really talk about a flattening when the resources needed for it to occur are not readily available to, or evenly distributed among and within, all geographic regions of the world? Scholars such as Mark Warschauer (2003) have argued that inequities and exclusions still persist in technology-driven environments because the infrastructures and literacies needed for information border crossings and for engaging with new knowledge – some of the very tools that should flatten the world – have ended up creating more divides. Indeed, much of sub-Saharan Africa and the academic knowledge created there stand on the periphery of many global exchanges, mainly because researchers there have not yet taken full advantage of the new possibilities that exist for effective participation in global academic communities.

According to South Africa's Minister of Higher Education, Blade Nzimande, scholars in African universities "are essentially consumers of knowledge produced in developed countries" (Gray, 2010, slide 6), rather than producers. Consumption of scientific literature in Africa has, in the past decade, been accelerated by information philanthropy initiatives spearheaded by, for example, the World Health Organization, the Food and Agriculture Organization, and Western universities and foundations, but the overall usefulness and sustainability of these initiatives are sometimes questioned (Contreras, 2012). When they do produce, much of African science researchers' output ends up as "lost science" because it either remains unpublished or when it is, it has "very low international reach" (Mackay, 2011, p. 25). William Lyakunwa, Executive Director of the African Economic Research Consortium, noted in an interview with

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Global Development Network (GDNet) posted on YouTube, that some of the challenges South-based researchers face can be overcome by interacting with other researchers and tapping into resource persons outside of the region (GDNet, 2012).

Some initiatives are being pursued to ensure that more scholars in Africa become knowledge producers and effective participants in knowledge exchange with global communities of scholars. In 2005, the African Union rolled out the continent's Science and Technology Consolidated Plan of Action (African Union, 2005) and endorsed a target of 1% of member countries' Gross Domestic Product (GDP) to be spent on research and development. Individual member countries such as Madagascar are meeting this target by launching online research networks to "boost science, technology and education in the country, as well as internationalise (sic) its science" (Razasifon, 2012), and the Network of African Science Academies (NASAC) launched a project in 2011 to determine innovative ways for better dissemination of research by their emerging scientists (http://www.interacademies.net/Activities/Projects/15273.aspx).

This article discusses strategies that will help researchers in sub-Saharan Africa better leverage new technologies for scholarly purposes and join global academic conversations as networked individuals in what Rainie and Wellman (2012) refer to, in the subtitle of their book, as the "new social operating system." It will provide examples of how these researchers can rethink their research workflows, and how they can strategically drop pebbles in knowledge streams for wider impact. Among the topics to be explored are newer Web 2.0-based models of collaboration, such as self-organizing networks, and emerging innovative ways of sharing research and related news. These will be framed in the context of what John Hagel III, John Seely Brown, and Lang Davison (2010) call "levels of pull" and Caroline Wagner's (2008) "five forces" that drive the shifts in research. The article will also briefly list online tools that can further research collaboration, enhance knowledge production and dissemination, and provide alternative measures of scholarly impact. It must be emphasized that the arguments presented here do not seek to lead scholars away from established resources and practices (libraries, librarians, and traditional publication routes and outlets), which still remain relevant; instead, the discussion is meant to introduce scholars in Africa to alternative yet complementary avenues that ensure faster and wider recognition for both self and research.

Defining parameters

It is first worth defining the geographic and conceptual contours of the arguments offered in this article, as well as the rationale that underpins the choice of region and target audience. The descriptors "Africa(n)" in this article refer to sub-Saharan Africa (SSA). Some of the points made may well apply to researchers in other parts of the world who have not adopted new media for research purposes, but the author has chosen to limit the scope to this region only.

Why premise the main argument on Internet technologies, when Africa as a continent had only 6% of the world's Internet users as of 2011 (Internet World Stats, 2012)? However, it is also true that the situation is poised to improve as more fibre networks open the region up for wider Internet use. For example, between June 2011 and July 2012, with the roll-out of more terrestrial networks, an estimated 4% more of Africa's

population were within reach 50 km of an operational fibre node, with another 6%, mostly in West Africa, also coming within that range by the end of 2012 when new fibre networks would have been completed (Hamilton Research, 2012). What this potentially means is cheaper and faster access to the Internet, making Internet usage and the uptake of Web 2.0 platforms and services more feasible. So the ideas presented here should not necessarily be out of the reach of Africa-based researchers. The article can be viewed as a preparedness plan, at the very least.

And what is this Web 2.0 that is seen as a boost for research practice and dissemination? The term still remains a slippery one to define, even though the concept began to be more widely used after a 2004 conference brainstorming session by technology gurus Tim O'Reilly and Dale Dougherty (O'Reilly, 2005). The inventor of the World Wide Web, Sir Tim Berners-Lee, thinks the term is redundant because the original idea of the Web was to connect people (cited in Anderson, 2007; the article also provides excellent background information about Web 2.0 and its implications for education).

In 2008, O'Reilly clarified it further to mean:

> [The] design of systems that harness network effects to get better the more people use them, or more colloquially, as 'harnessing collective intelligence.' This includes explicit network-enabled collaboration, to be sure, but it should encompass every way that people connected to a network create synergistic effects. (para. 5)

It is this definition that undergirds the use of the term in the context of this article. When researchers in sub-Saharan Africa form academic networks and collaborations, harness collective intelligence, and build new synergies with peers in and outside the region, I would argue that the essentials of Web 2.0 will help transform them into "researchers 2.0."

The allure of the commons and Open Access

Conventional wisdom has it that scholarship from Africa has been marginal or non-visible globally because its researchers have typically produced papers mostly for local realities, conference papers that go unpublished, and working papers – grey literature, in short – and that much of what does get published receives limited circulation, even within the continent itself. Eve Gray, for example, has written extensively on and argued cogently for rethinking publication of research (especially in South Africa) by taking advantage of Open Access initiatives like institutional repositories. With regard to its global competitiveness, she declares that "[w]hat is certain is that African research publication has fared badly in terms of the conventional measures of competitive, global publication performance" (Gray, 2009/2010, p. 6) because, as she notes in another paper published in 2010, publications that issue from development-focused research – pretty substantial in Africa – have been slighted by what she terms the "highly competitive and exclusionary" system of measuring impact (Gray, 2010, slide 11). Indeed, multiple studies, which show how poorly African content is indexed in benchmarking citation indexes such as the Institute for Scientific Information (ISI) and Scopus (see for example, Nwagwu, 2005, 2010; Tijssen, 2007), back her assertion.

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In the last two decades or so, a new thinking about expanding conceptions of "private" and "public" ownership of information – or intellectual property rights in the information age – began to emerge among legal scholars such as James Boyle (1992). There is a general move to re-inscribe a "commons thinking" in many areas of society today. Historically, the idea of a commons in pre-industrialized societies meant collectively used spaces and natural resources like fields and grazing land (Hess & Ostrom, 2007). In the academic world, commons thinking has led to a push toward Open Access (OA) and the knowledge commons movement. This movement calls for opening up access to information and knowledge, and distributing them freely, even across geographic divides. Conceptually, it is the blending of an old tradition – of scholars' willingness to publish and share their research with colleagues – with new information and communication technologies (Budapest Open Access Initiative, 2002), which make dissemination and collaboration easier and faster, thus creating a shift in the knowledge production-to-use cycle. This philosophical turn toward the commons rests on the basic premise that sharing resources is ultimately for the public good. I would argue that although this may seem like a novel idea for industrialized countries that are a couple of centuries removed from such ideas and practices, for many countries of the Global South, still largely rural-based, this hardly represents a radical shift in thinking; rather, it is an overlay of new technologies on old values and ideas. Put differently, it is a continuation of an old practice, but with new resources that are now to be shared, and through enhanced methods.

The Budapest Initiative, together with the Bethesda Statement on Open Access Publishing (2003) and the Berlin Declaration on Open Access in the Sciences and Humanities (2003), passed in June and October 2003 respectively, were all essentially aimed at opening up research through the use of "the Internet as a functional instrument for a global scientific knowledge base and human reflection and to specify measures which research policy makers, research institutions, funding agencies, libraries, archives, and museums need to consider" (para. 3). Many analyses and critiques have suggested that Open Access publishing is beneficial to African research production capabilities, scholars' reputations, and their institutions. Ahmed (2007) emphatically states that:

> OA would want to eliminate *all* the factors that inhibit the flow of knowledge from the South to the North and vice versa. If embraced, the movement would probably expose the true level of scientific activities going on in Africa and other developing regions as well as give them access to those sources that have been hitherto restrictive to them. (p. 340, author's emphasis)

While it was clearly ambitious on Ahmed's part to think that all fences guarding access to knowledge would be completely broken down, it is true that Open Access has helped to remove some of these barriers and offered researchers the opportunity to transform the scholarly publication landscape. The time lapse between writing, publishing, and diffusion of an Open Access article, for example, is greatly reduced because of the shortcuts, facilitated by technology, now built into the cycle. When indexed by free search engines, discoverability of Open Access content from the Global South is greatly enhanced, which in turn may lead to works being cited by other researchers, as suggested by Alma Swan (2010) in her meta-study of 35 studies on the link between

Open Access and increased citation. This also means visibility for the author, the institution, and the new knowledge contained in the publication itself. Additionally, this exposure could foster new collaborations along Global South-North and South-South lines. In other words, freely available work accessed by scholars across the world can serve as a crucial node in establishing potentially new research networks.

But it should also be noted that there has to be a deliberate attempt to make a work visible. Unfortunately, one of the main directories of Open Access repositories shows that repositories in sub-Saharan Africa only make up 2.6% of its global listing (Directory of Open Access Repositories [OpenDoar], 2012); and of the twelve countries registered with the Directory of Open Access Journals, South Africa and Nigeria have 47 and 24 publications, respectively, with the remaining 10 countries each show showing six or fewer publications (Directory of Open Access Journals, 2012). Additionally, Francis Nyamnjoh (2009/2010) believes Open Access may not necessarily be such a leveller after all. He argues that:

> It is common in discussions of open access to limit the issue to publication and dissemination. This conflates accessibility with recognition and representation, and supposes that competing and conflicting knowledge systems and ideas would be equally available and affordable if room were created for multiple channels of accessibility. (p. 67)

These discussions, he goes on to say, do not "adequately account for the prevalent power relations that structure knowledge production into interconnecting hierarchies at local and global levels" (p. 67). It is true, as mentioned earlier, that the utopian dream of a flattening of hierarchies, of equal recognition, may never be reached. While the stranglehold of commercial publishers may have been somewhat loosened by Open Access initiatives, digital scholarship in general is yet to be widely accepted in many academic reward systems where "[p]rint is still the gold standard" (Cheverie, Boettcher, & Buschman, 2009, p. 220). But even if acceptance of Open Access publishing is slow, it is pushing against the ramparts and forcing conversations between all those involved in the scholarly enterprise to rethink those "conventional measures of competitiveness" that Gray (2009/2010) talks about.

So while the commons thinking and multiple new technologies have provided the impetus for content production, dissemination, and use and are helping bring African scholarship and perspectives to new audiences in the global knowledge space, a related question that begs for an answer is whether there should be "non-conventional measures" to evaluate the visibility and impact of scholarship from Africa. This author does not believe that there needs to be a two-tiered system that will lay out different measures of competitiveness; such a move will not serve African scholars and their output well. What is needed is the opening up of current citation indexes that will broaden the types of documents included, thereby giving greater visibility to scholarly output other than just monographs and refereed journal articles. What the ISI indices and Scopus currently provide need not be interrupted, but they could widen their scope to be more inclusive. More importantly, scholars and researchers in Africa can make better use of the tools and technologies available today to speed up the production and dissemination of their ideas and findings and help them become more

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embedded in the global knowledge enterprise. This requires radical new thinking about what constitutes scholarly communication. In short, what is needed is disruptive change in scholarly communication.

New ways of thinking and doing

Given that the research process is embedded in disciplinary and sometimes cultural norms, innovations in the process will either face skepticism, slow buy-in, late adoption, or outright rejection. Moreover, one cannot effectively discuss new ways of disseminating research if scholars themselves do not recognize at the outset that using new technologies will also engender radical and transformative shifts in practice. Or as Brian Matthews (2012) playfully puts it, "Don't think about better vacuum cleaners, think about cleaner floors" (p. 1).

The writings of Clayton Christensen have been influential in helping business, industry, and academia, to name a few areas where his impact has been felt, realize the value and risk of disruptive change or innovation. In a book published in 1997, he makes the distinction between "sustaining technological change" – that which would tweak processes without fundamentally changing the accepted practice – and "disruptive technological change," which up-ends the status quo and rattles the established orthodoxy.

Understanding the changing environment and finding ways of domesticating the unfamiliar are key to innovation. With respect to disruptive change in the academic world, especially in research and publication, insights from Christensen cannot be more a propos. Established practice has privileged monographs and articles in peer-reviewed journals, leading to the publish-or-perish model of distinction and success. A different package of attributes would call for new measures of competitiveness and novel approaches to creating value for one's research. In other words, there have to be new ways of documenting the scholarly record, new metrics for evaluating quality and impact, and new rubrics for rewarding effort. This does not mean completely abandoning the tried and tested measures, but in the context of technological advances, it would mean creating more pathways to academic competitiveness. This is something that researchers themselves can shape.

For a moment, let us reflect on email and how it enhanced the ease and speed of communication and disrupted the practice of establishing new professional contacts. Through this technology-driven mode of communication, how many researchers have not either emailed or been emailed by a peer from around the world requesting a copy of an article, inviting them to participate in conferences, or to contribute a chapter to an edited book, and how many have not jumped at the idea because it brings with it recognition and validation? Or how many scholars have not learned about calls for proposals on electronic discussion boards, responded to them, and boosted their publication profile as a result of that call? Though these scenarios are now standard ways of operating, they also are examples that show positive effects of forming and benefiting from a virtual scholarly community, or an invisible college.

As Wagner (2008) discusses in her book *The New Invisible College: Science for Development*, there has been an invisible college of science since the 1600s (when the

Irish scientist Robert Boyle first used the term), before scientific research became nationalized through government funding and oversight (as in the National Institutes of Health in the United States, or research centres like the *Centre national de la recherche scientifique* in France). Then, independent science researchers freely shared information and ideas as part of a common search for knowledge. Wagner (2008) posits that today, the new invisible college shaping science is being driven by five forces, though it can be argued that these forces are not just limited to science because even the Humanities have become increasingly collaborative. The first of these forces is "networks," which she says are "forged through meetings and common interests ... and across geographic distances" (p. 4). "Emergence" is the second force Wagner lists, and it feeds off networks. She puts it very succinctly thus: "New ideas emerge from the combination and recombination of people and knowledge" (p. 4). In other words, when people meet, ideas collide, and new knowledges emerge. None of this is new, but in the new invisible college, technologies now make it easier for people, ideas, information, and knowledge to all circulate (the third force) beyond proscribed geographic borders.

Wagner herself is quick to point out that although there could be constant circulation in the virtual environment, physical locations still matter, especially when they are the established loci of resources and talent. So conferences, universities, and research institutions form magnets, bringing together talent and resources for doing research (e.g., equipment, funding, academic stars). This fourth force she terms "stickiness." Hagel et al. (2010) call these places "spikes," or "places where talented people cluster around shared interests and passions" (p. 22). Wagner's fifth force is "distribution," in this case, of researchers, research locations, and the research workload itself. Now that collaboration is easier to do, disruptive change means the onus need not be on one institute or a lone researcher trying to crack a code all by herself. When tasks are shared among researchers and locations, based on recognized strengths, collaboration becomes less resisted or painful. When many minds are working on different aspects of a problem, resources are diffused and solutions may come sooner. A notable example of this phenomenon is the crowdsourced project FoldIt, that encourages individuals – non-scientists as well – to "contribute to important scientific research" to unlock the science of protein folding by playing a specifically designed computer game (http://fold.it/portal/info/science).

These forces, especially the first three, dovetail beautifully with the ideas put forward by Hagel et al. (2010) in *The Power of Pull: How Small Moves, Smartly Made, Can Set Big Things in Motion*. They argue that "pull" is built on three A's: first is "access," defined as the ability "to fluidly find and get to the people and resources" so as to participate in relevant knowledge flows (p. 10); second is the ability to "attract" potentially valuable people and resources (found in geographic, and now virtual, areas of knowledge concentration); both of these, they argue, will help one "achieve" new levels of performance and influence.

A common theme in both books is the importance of finding and making good use of the interaction with peer scholars. In the Internet age, such networking happens when a scholar has access to homophilic groups (in the social science sense) in online environments where they can attract the attention of, and engage in conversations with, numerous potential colleagues (many-to-many), or even just eavesdrop on them.

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Additionally, the potential for recognizing "competence awareness" within the community is heightened when one discovers personally known colleagues (and I would add highly regarded scholars in a field) participating in that online community (Matzat, 2004, p. 211). But Hagel et al. (2010) also advocate for leveraging pull by expanding and engaging the "edges" of one's social networks. In other words, scholars can learn not just from the "stars" in their core networks, but from those perceived as "weak" ties – graduate students, junior faculty, researchers in other disciplines – some of whom could potentially migrate to the core network. They stress self-agency on the part of researchers in actively seeking to make connections with peers, and accessorily, in opening up access to themselves as a resource for others.

According to Matzat (2004), the degree to which a researcher is socially embedded in an online community can be a good measure of how active that researcher is in participating in the "give-and-receive help" dynamics in the community. This classic "commons" practice – simultaneously benefiting from and contributing to the collective – is also evident in the practice of some researchers at a U.S. university (Donovan, 2011).

The norms for creating a successful, helpful, and sharing environment within the online network will emerge when there is a high degree of embeddedness in the network and buy-in for the process. In such environments, one must not be shy about brazenly sharing thoughts and ideas, asking questions, and inviting engagement with one's ideas or feedback on drafts. There is definitely a lot to be gained from tapping into both explicit knowledge about the field, as held by practitioners, and tacit knowledge (about, for example, lab processes or workarounds for knotty issues) held by those at the core and edges.

Brown (2011), however, found that very few researchers (9.4% in development academia in sub-Saharan Africa) report adopting Web 2.0 tools for their academic work. This is, however, not exceptional, as using social media for research purposes may still be going against the practice of scholarship as undertaken by many researchers, even in countries with easy access to these tools. In a study of academics in the U.K., Collins and Hide (2010) found that only 13% of respondents (mostly PhD students) were frequent users of Web 2.0 tools for information sharing, while 39% had never used them for that purpose. This lack of adoption, it can be argued, may be because certain received norms and academic practice have enculturated scholars everywhere to believe that their publication should speak for itself, leading to a "publish-it-and-they-will-flock-to-you" mindset. Another argument can equally be made that researchers in sub-Saharan Africa who, as discussed earlier, have difficulties publishing in journals in the North, or whose works are not indexed by North-centric citation databases, could stand to benefit from the information sharing and networking advantages offered by social media.

The discussion and works cited so far suggest that information and communication technologies (ICTs), especially those that invite virtual interaction, offer new opportunities for sharing work and ideas, and can improve knowledge flows between a researcher and (un)targeted audiences. The services built on ICT platforms make it much simpler to create or expand personal networks and to be part of multiple

networks. By proactively pursuing opportunities for meaningful participation in research networks and by inserting themselves into existing groups, scholars in Africa can consciously refashion their research practice. Also, by strategically depositing citations of and links to their own works in venues where they will get greater visibility from other researchers, scholars can complement what publishers and libraries already do. Becoming directly involved in the dissemination of their research and academic record is certainly a good strategy for profile and possibly career enhancement.

Some Africa-based researchers might feel that doing all of this is too time-consuming, or feel that there are too many technology constraints to make it worth their while. But they must also think about the "ROA" (return on attention) they will accrue from engaging in networked scholarship. Hagel et al. (2010) define it as "the value we get for the time and effort we invest in focusing on someone or something" (pp. 23–24). They go on to say that although search tools greatly enhance this value, it is the "serendipity tools" that are even more useful as they lead to connections between previously unknown people and resources. In short, scholars should embrace the practice of deliberate and structured serendipity.

Selected tools for practicing the "power of pull"

There is a raft of technologies and free tools available that make scaling up "creative conversation[s]" possible, where hitherto only "fortuitous serendipity" was required (Nielsen, 2012, p. 2). To ensure that these new modes of scholarly practice get rewarded in the academy, efforts are afoot to develop new metrics for academic reward systems that take into account scholars' impact in online environments. This approach, dubbed "altmetrics" (shorthand for alternative metrics) aims to track and measure how often, for example, a scholar's work is blogged about, tweeted, or socially bookmarked.

The discussion will now turn to giving examples of a few Web 2.0 tools and services and descriptions of how they are being used for research purposes. The section must be seen as a guide. Where possible, studies about their impact on academic use are cited; but given that these are relatively new tools, one should expect that there are more product reviews and informal analyses. These are easy to obtain via Internet searches.

Academic search engines/Discovery tools

It is now a cliché to talk about fractured information in the digital environment, but as search engines become more sophisticated, and powerful enough to crawl for different types of data and come back with more targeted results, researchers are finding it easier to discover works that greatly enrich their own scholarship. Examples of popular academic search engines are given below.

Google may be the most widely-used search engine for general searching, but using Google Scholar (http://scholar.google.com) limits a regular Google search to a universe of academic works – articles, monographs, theses, and abstracts. Another limiting option that Google offers is Google Books (http://www.google.com/googlebooks/about.html), which is a database of digitized versions of public domain books and snippets of still copyrighted materials.

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Microsoft Academic Search (http://academic.research.microsoft.com) allows one to search for authors, publications, organizations, conferences, or journals by discipline. With its strong visualization tools, one can create graphs of paper citations, academic genealogies and co-authors, or spatially map researchers and their institutions. Unlike the previous examples, which cover multiple disciplines, Scirus (http://www.scirus.com) is a science-specific search engine that pulls results from 460 million science webpages (as of June 12, 2012).

Academic social networking sites

Social networking sites (SNSs) have been defined as "web-based services that allow individuals to 1) construct a public or semi-public profile within a bounded system, 2) articulate a list of other users with whom they share a connection, and 3) view and traverse their list of connections and those made by others within the system" (Boyd & Ellison, 2007). Sites such as MySpace and Facebook that are popular with teenagers and college-aged users may have helped shape the notion that SNSs are only about "friending" and "liking" photos or banal posts. But Facebook does have options for creating (open or closed) groups that can be leveraged for academic networking.

Networking sites for researchers have begun to appear, but it may be too soon to evaluate their uptake. In a preliminary study of academics from 215 countries (including a handful from sub-Saharan Africa) who actively use social media in their research workflows, Nicholas and Rowlands (2011) found that SNSs were ranked fourth in usage, at 27%, behind collaborative authoring (62.7%), conferencing (48.3%), and meeting scheduling (41%). In Africa, about 4.7% of development researchers in Africa use social media sites such as Facebook, LinkedIn (a networking site for professionals), and Academia.edu professionally (Brown, 2011).

Academia.edu (http://academia.edu) is a platform where scholars themselves can upload their research (citations and even the full text of their articles, subject to a copyright agreement signed with the publisher), keep up with research in their areas of interest, and follow the work of chosen researchers. A great feature of this tool is that a member gets email alerts whenever someone searches for them by name or discovers their work through a search engine. The information passed on by the alert includes what search engine and keywords were used and in what country the search was conducted. It would be harder to confirm if the work ultimately becomes cited by the searcher, but Kelly and Delasalle (2012) suggest that links to articles in Academia.edu and LinkedIn may have been responsible for high downloads of those articles in the institutional repositories in some U.K. universities.

According to their website, Nature Network (http://network.nature.com) is "the professional networking website for scientists around the world" and an online meeting place where they can "gather, share and discuss ideas, and keep in touch [and] … consult the community for answers to scientific questions or offer your expertise to help others." The idea for a similar product, ResearchGate (http://www.researchgate.net), sprang from the difficulties two researchers on different sides of the globe encountered as they tried to collaborate. It markets itself to researchers in the scientific community as a "hub for … research … expertise [and] … contacts," and "a place to get answers." According to a study referenced by Nentwich (2010), one third of ResearchGate users

go there to find new research partners, another third to find information, while 12% use it for "concrete research cooperation" (p. 68).

Social bookmarking/Information management

These tools allow researchers to bookmark websites and citations and assign tags to them; the program creates "bundles" of similar tags, thus enabling users to search bookmarks by tags. Users can also share their bookmarked sites with other researchers; it is also possible to see others who have bookmarked a site, making it possible to potentially discover useful Web documents and grow one's own library of bookmarks. Some tools also allow users to highlight text and create marginalia on the saved site. Examples of tools include: Connotea (http://www.connotea.org), Delicious (http://www.delicious.com), CiteULike (http://www.citeulike.com), Zotero (http://www.zotero.org), BibSonomy (http://bibsonomy.org), and Diigo (http://diigo.com).

Scholars can also organize and create searchable personal databases and libraries of PDF files downloaded from other sources. Articles can be highlighted and annotated as well, and items from the personal database can be exported to word processing documents such as Microsoft Word. Tools in this category include ReadCube (http://www.readcube.com), Papers (http://www.mekentosj.com/papers), and Peaya Paper (http://peaya.com/peayapaper). Evernote (http://evernote.com) allows one to clip and save webpages (not just links to them). Mendeley (http://www.mendeley.com) can also be used offline as a desktop program, an attractive feature for when the Internet cannot be accessed.

Writing collaboration

There are a number of Web-based software tools that offer researchers opportunities to work collaboratively on a project in a restrictive or open environment, locally or globally. These spaces are sometimes referred to as "collaboratories." The best example of a global collaborative project is Wikipedia, based on the wiki tool. Wiki websites can provide each scholar with individual workspaces within the project, or allow multiple scholars to work on the same document while keeping track of individual contributions and the change history. Good examples include Wikispaces (http://www.wikispaces.com) and Zoho (https://www.zoho.com), which is free for up to three users. For those who may already have a Google account, Google Docs can be seamlessly integrated into their suite of tools. Like the others mentioned, it shows updates, edits, and deletions made to a document. The new Google Drive brings together search engines, email, and documents, creating efficiencies in work and collaboration.

Disseminating research

Digital or institutional repositories could be university based (e.g., Kwame Nkrumah University of Science and Technology in Ghana [KNUST] and the University of Nigeria, Nsukka), or hosted by research institutes (examples in SSA include Rift Valley Institute in Kenya and the Council for Scientific and Industrial Research in South Africa). Repositories are typically archives of full text articles, data sets, working papers, or research reports that showcase an individual researcher's scholarly output as well as their institution's position as a research hub. Items in digital repositories are

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discoverable globally through free search engines, so they also offer higher visibility of researchers and their publications. However, preliminary findings of this author's own ongoing research on institutional repositories in sub-Saharan Africa suggest that quite a few institutions have not registered their sites with the directories of global repositories, thereby making their content less easy to find. Sample searches for works on selected topics authored by scholars at KNUST, for example, an institution that registered its repository, were among the top hits in a Google results page. By contrast, authors from institutions not registered were buried deeper in the results list – often found on the third and fourth pages. Although an intrepid searcher may ultimately get to them, the general rule of thumb is that people hardly go beyond the third page for useful information; they give up and launch a new search.

If repositories offer researchers a way of archiving and disseminating the full text of their publications, blogs are an excellent way of sharing information *about* their research and engaging different publics in what Gregg (2006) calls "conversational scholarship" (p. 147). Blog entries are not lengthy pieces, so one can use them to synthesize the main findings of research or to reproduce executive summaries, for example. The key is to provide good metadata so that the blog article can be picked up in an online search. The power of blogs is that once a story is picked up, other bloggers can link to it, increasing the chance of search engine optimization and consequently, wider dissemination of the research results. However, Brown (2011) notes that many researchers in Africa reported in a GDNet survey that they were unaware of online social networks and blogs. The more aware they become of these online tools as research aids, the greater the possibility of their uptake and use. Blog entries can generate conversations on other platforms such as microblogs (described below), amplify one's impact on the social media landscape, and promote professional engagement, as Quinnell (2011) testifies. One good aggregator of blogs is Research Blogging (http://researchblogging.org), which has been analyzed in an article by Shema, Bar-Ilan, and Thelwall (2012). It might also be helpful for researchers in Africa to know that some publishers blog about, for example, how to "navigate academic publishing" (Sage Connection, http://sageconnection.wordpress.com/about), or share news about new publication offers (Cambridge Journals, http://blog.journals.cambridge.org).

Microblogging, as the name suggests, is a brief, character-defined (140 for Twitter) method of blogging. Microblogs have found their niche in giving almost real-time updates on unfolding events, or in broadcasting short news items. They can be pressed into service to announce new publications, to share breaking news about interesting research or talks at conferences, or simply to re-broadcast news pertinent to one's own circle of followers. The most popular microblogging tools are Twitter (http://www.twitter.com), Plurk (http://www.plurk.com), and Tumblr (http://www.tumbler.com). Microblogs may seem too informal and playful when compared to traditional publication venues, but their missions are different. Just as email discussion boards were, and still continue to be, used as research news outlets, so too can microblogs.

Increasingly, academics and academic institutions are making digital records of lectures and discussions in video and audio formats and archiving them online for free viewing or listening. There are many free multimedia repositories where individuals

can post video, audio, photos, and conference presentation slides. For videos, the most known website is YouTube (http://www.youtube.com). While it is indeed full of amateurish videos, YouTube is also populated with videos of formal presentations, lectures, and demonstrations by world-renowned scholars. This author, for example, teaches a course on the global information society that relies heavily on the scholarly videos found there. Also, many universities and organizations have their own channels where they may showcase presentations, lectures, talks about research activities, and breakthroughs pioneered by their faculty. By posting either short five-minute videos about one's research, or an hour-long one discussing the results, a scholar can find this a worthwhile way to join a global academic conversation. As of July 2012, there were four million videos on YouTube (not all academic) with Creative Commons Attribution licenses, wherein the content creators have given some level of permission for others' use of their work (Harmon, 2012). Additionally, slides of presentations where a researcher has discussed her work can also be added to sites such as Slideshare (http://www.slideshare.net) or Scribd (http://www.scribd.com).

In disciplines that make heavy use of images, scholars in the field may, over the years, have built large collections. These can be uploaded to photo repositories, not just for the sake of sharing, but also as a way of preserving the physical pictures. Scholars can protect their efforts in building the collection if the images in such repositories are put under some form of a Creative Commons license (http://creativecommons.org/licenses/). But a really exciting opportunity to advance research may lie in inviting the global scholarly community and knowledgeable members of the public to classify and analyze the images, if that has not already been done. Such collaborative, or crowdsourced, ventures can produce very rewarding outcomes because everyone will benefit from the shared images, and the original owner has had help in making it more usable for their own research. A good and successful example of a crowdsourced project is Galaxy Zoo (http://www.galaxyzoo.org), in which a team of scientists ask citizen astronomers to help them classify galaxies from pictures taken by the Hubble Space Telescope. For more examples of crowdsourcing projects, see the list compiled in Wikipedia (http://en.wikipedia.org/wiki/List_of_crowdsourcing_projects).

Alternative measures of impact

As has been mentioned earlier, scholarly production is no longer confined to books and articles. If researchers were to use the strategies, services, and tools discussed in this article, then there ought to be new ways through which they can keep track of their contribution to and measure their impact in their academic field. Until, perhaps, the traditional citation indexes such as ISI start including these metrics, the tools listed below are attempts at putting value on a researcher's total scholarly effort and output.

CitedIn (http://www.citedin.org), managed by the Department of Bioinformatics at Maastricht University, Netherlands, allows bioinformatics researchers to discover where their works have been cited. ScienceCard (http://sciencecard.org), as stated on its website, "is a web service that collects all scientific works published by an author and displays their aggregate work-level metrics. It allows a researcher to create and maintain a researcher profile with minimal effort, and to export and reuse this information elsewhere." While still in its infancy, Total-Impact (http://impactstory.org/) promises to be a whole new approach to determining the impact of a researcher's

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output. It tracks artifact-level metrics on a wide range of outlets, beyond traditional publishing into new media. Altmetric (http://www.altmetric.com) is another similar tool for scientists, but it is subscription based.

All of the above examples of research dissemination strategies and outlets are based on Web 2.0 technologies, whose main advantages are in creating higher visibility for both research and researcher. But this is not to suggest that researchers should not pursue other local and "low-tech" avenues. By discussing their research findings on radio and television forums and relating them to everyday applications, scholars will help foster public conversations, stimulate a culture of engagement and learning, and they may well inspire a new generation of researchers among school children. The same can be said about disseminating research in local newspapers. A 2012 SciDev.Net report notes that African newspapers "carry relatively little about the achievements of African researchers on their own continent" (Clayton & Joubert, 2012, p. 5). However, there are encouraging signs of a commitment by researchers, journalists, and policymakers to dialogue more and disseminate research news; the first African Science Journalism conference was held in Kenya in September 2012 (World Federation of Science Journalists, 2012). Apart from having trained journalists write up research news, scholars themselves can also publish short news pieces about their work, or edit research newspaper columns. And given that a number of these papers have an online presence, word about their research can also cross national borders.

The least low-tech strategy of them all is direct engagement with citizens in conversations about one's research. This is a form of disseminating research information, and it is in the spirit of doing open science. Though hardly innovative in and of itself, who can tell what tacit or indigenous knowledges can be gleaned from the public and incorporated in scholarly research. These types of structured conversations are increasingly happening around the world, Africa included, in the form of science cafés (BMJ Group Blogs, 2010).

Conclusion

Knowledge has become a less stable commodity, flowing fast so that scholars must be aware of the multiple streams into which they can drop pebbles to give greater visibility, accessibility, and impact to themselves and their work. The feedback loop that these streams invite also makes engagement with their work and interactions with peers possible. The era of the lone researcher who is at the mercy of publication and dissemination gatekeepers need not persist. Creating and leveraging meaningful networks, adopting a sharing and receiving outlook, and actively seeking non-traditional outlets for the dissemination of scholarship, while continuing the use of traditional dissemination outlets, will all help get both researcher and research noticed sooner and more widely.

Reliance on the traditional modes of knowledge creation and dissemination alone is no longer an option, especially as even the prestigious journals are under financial stress; many journals are losing their subscription bases because of high prices, so access to them through libraries is being diminished. Academic libraries in the resource-rich North, pioneers in the open scholarly communication debates, acted upon these pressures with institutional repository initiatives, and now some are venturing into

journal publishing (Perry, Bochert, Deliyannides, Kosavic, & Kennison, 2011). That said, they still continue their traditional roles as campus purveyors and custodians of the scholarly record. Likewise, scholars can reinvent themselves to meet the changing publication climate without totally casting aside old practices, because academic administrations have not yet fully caught up with the new directions discussed here. Scholars will continue to use libraries in different ways and expect librarians to provide new types of services to support and mesh with Web 2.0 ways of doing research. This implies, logically, that university libraries must embrace and integrate the use of Web 2.0 technologies and tools to effectively support researchers at their institutions.

There is also beginning to be disruptive change in how funding agencies view dissemination of the knowledge they help create. Major research funding agencies such as BioMed Central (http://www.biomedcentral.com), the World Bank, (http://web.worldbank.org), and the Wellcome Trust (http://www.wellcome.ac.uk), and organizations like the African Union (http://www.au.int) are adopting, requiring, or working toward removing pay walls that bar free access to research they fund. Researchers will have to follow those mandates. Open Access will benefit scholars everywhere, but more so those in the Global South who have been relegated to the margins of networked scholarship.

It will not be a stretch, therefore, to assume that scholars in sub-Saharan Africa can effectively become part of these global networks and conversations and can become embedded in the new invisible college, if more of them adopt the Web 2.0 tools that facilitate these activities. What is crucially needed is a change in the way they do research, and a certain purposefulness with which they practice the power of pull. The arguments proffered here are calling for just that.

Note

1. An earlier version of this article was presented as a paper at the 5th West African Research and Innovation Management (WARIMA) meeting, November 29–December 3, 2011, in Freetown, Sierra Leone.

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Peaya Paper. URL: http://www.peaya.com/peayapaper
Plurk. URL: http://www.plurk.com
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ScienceCard. URL: http://www.sciencecard.org
Scribd. URL: http://www.scribd.com
Slideshare. URL: http://www.slideshare.net
Total-Impact. URL: http://www.impactstory.org
Tumblr. URL: https://www.tumblr.com
Twitter. URL: http://www.twitter.com
Wellcome Trust. URL: http://www.wellcome.ac.uk/About-us/Policy/Spotlight-issues/Open-access/index.htm
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