Open Science, open issues

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What is open and collaborative science and what roles could it play in development?

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INTRODUCTION

This chapter provides the contexts and rationale for the development of the Open and Collaborative Science in Development Network (OCSDNet), a three-year research and practice project co-funded by the International Development Research Centre in Canada and the Department of International Development, UK.

Launched in July 2014, the network is jointly coordinated by iHub - Nairobi’s Innovation Hub based in Nairobi, Kenya, and the Centre for Critical Development Studies at the University of Toronto Scarborough, Canada, while supported by an international team of expert advisors who are well-known practitioners of open science and policy researchers. This chapter further describes the organizational framework of the OCSDNet and how it intends to mobilize and support researchers and practitioners from the Global South through a multi-stage network-building process to support the overarching goal of the project, which is to investigate whether, and the conditions under which, a set of open research practices could lead to new thinking and practices about development and their outcomes.
We further outline the strategies being undertaken by the OCSDNet team in realizing the more specific objectives of the project, which are to frame a series of research questions about the nature and assumptions of open science, and to support a community of open science practitioners in the Global South whose research and practices would deepen our understanding of the principles and impacts of open research and knowledge co-creation.

It is common in the literature to characterize open science as processes that involve sharing of research plans, data and publications, participatory citizen science, distributed “crowdsourced” forms of data collection (RIN/NESTA 2010, THE ROYAL SOCIETY, 2011; FRANZONI; SAUERMANN, 2014), and new forms of international scientific collaborations, enabled by networked technologies and peer-to-peer production (NELSON 2011; KOCAREV; IN, 2010; BARTLING; FRIESEKE, 2013). Common examples include the Human Genome Project, in which open and rapid sharing of gene and protein sequence data over the Internet greatly facilitated the completion of this mega-project in record time with multiple downstream impact (WADMAN, 2013). Similarly, crowdsourcing has been used to monitor deforestation in Brazil and Indonesia\(^1\), political violence in Kenya, natural disasters in Haiti and Pakistan, and gender violence in Egypt\(^2\).

However, how these mechanisms challenge and enrich traditional research systems and how new network-enabled collaborations and institutions could lead to more equitable and inclusive change in knowledge production and sharing in the Global South, is still poorly understood. The intention of OCSDNet is to

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critically examine some common assumptions about open science and its purported impact on development, and to begin to gather evidence on both the positive and unintended effects of network enabled knowledge making practices. In the longer term, the project intends to generate a richer conceptual framework about the complex interactions of open science in diverse institutional contexts, and to stimulate dialogues on policy thinking and formulation in support of emerging practices documented by the research projects within the network.

BACKGROUND AND RATIONALE

CONVERGENCE OF OPENNESS

The hallmark of science is that the results of scientific research are meant to be made “public” in order to enable future knowledge building. Indeed progress of science is dependent on access to prior understanding and contributions of scientists to a common pool of knowledge. In the Gutenberg era, making science public was primarily through the publication of research articles in scholarly journals. However, as the scientific publishing enterprise began to be dominated by commercial interests because of the high profit they could extract, the fruits of science became less and less public, and became enjoyable only to those organizations and individuals who were privileged enough to afford the increasingly high cost of access (CHAN; COSTA, 2005, CHAN et al. 2011).

The Internet has profoundly changed the public and open nature of scientific communication. Thus, the “Budapest Open Access Initiative” (2002) began with the statement that: “An old tradition and a new technology have converged to make possible an unprecedented public good.” The old tradition refers to the

willingness of scholars and scientists to share the fruits of their research without payment for the sake of inquiry and knowledge building for the public good. The new technology is of course the Web, with its peer-to-peer architecture and the foundation of open technology. Over the last decade, open source tools and open networks have enabled the flourishing of “openness” movements across different domains, from Open Access to Open Educational Resources, from Open Data to Open Government, and from Open Innovation to Open Development initiatives around the world.\(^4\)

While drawing on open source and peer production principles, these open initiatives also share the common historical trajectory of starting out as grass-root movements in localized context, but growing worldwide with increasingly diverse stakeholders and participants, and increasingly supported and indeed advocated by funders and policy makers at both the local and international level.\(^5\)

In the case of Open Access, support by national and multilateral funders and policy makers are predicated on emerging evidence that opening up the results of funded research greatly enhances the return on research investment, not only in economic terms (HoUToN et al. 2009; HoUToN; swaN, 2013), but also in the creation of new forms of social and political impact (JOSEPH, 2013). These may include new opportunities for entrepreneurship, citizen participation in political processes, and novel forms of

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\(^5\) For a succinct history of the growth and convergence of the various grass-root open commons movements, see Bollier (2008). At the regional and national level, policies on Open Science are now being actively formulated by the European Commission as part of the Digital Agenda for Europe <http://ec.europa.eu/commission_2010-2014/kroes/en/blog/open-science>, the National Science Foundation in the US has a long history of supporting data sharing of publicly funded research <http://www.nsf.gov/bfa/dias/policy/dmp.jsp>. Access on: June 19, 2015.
inclusive collaboration, all are potential benefits beyond the original funding targets.

In a similar vein, across some low- and middle-income countries (LMICs), the rapid adoption and deep penetration of mobile technologies are providing access to banking, health services, learning resources, and important platforms for information sharing. These opportunities have the potential to empower citizens who did not previously enjoy such forms of access and participation (Fuchs; Elder, 2013).

“Open Development”

Across these open initiatives, there is also growing consensus that traditional intellectual property (IP) regimes of maximum restriction and protection not only stifle innovation, but also restrict and limit participation from those with limited means and political power (De Beer et. al. 2014). A number of scholars (e.g. Boyle 2009; Drahos; Braithwaite, 2002; Shaver, 2015; Kirchschlager, 2013) suggest that “the right to science and culture” requires a public goods approach to knowledge innovation and diffusion rather than the current practice of IP protection, thus reframing the access to knowledge agenda as a demand for fulfillment of fundamental rights (Donders, 2011).

Excluding individuals from enjoying the fruits and benefits of scientific inquiry is also understood as a social justice issue, as it violates the fundamental rights of the individual as stated in the 1948 Universal Declaration of Human Rights⁶ and the International Covenant on Economic, Social and Cultural Rights, adopted by the UN General Assembly in 1966⁷. Understanding access to scientific

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knowledge and participation in science as a human right counters the tendency to view science and development primarily through a macro-economic lens and provides an important alternative to the econocentric paradigm of development with exclusive focus on economic growth of the past few decades (ESCOBAR, 1995; STIGLITZ et. al. 2010; STIGLITZ, 2012).

The growing discontent with the traditional development paradigm, coupled with the emerging observation that access to open technologies and equitable participation in knowledge production could improve the quality of lives and well-being of people in marginalized regions, has given rise to a new school of thinking known as “Open Development” (SMITH et. al. 2011; SMITH; REILLY, 2014).

“Open Development” is a broad proposition that open models and peer-based production, enabled by pervasive network technologies, non-market based incentive structures and alternative licensing regimes (such as Creative Commons licenses), can result in greater participation, access and collaboration across different social and economic sectors.

These interactions may in turn create new social benefits in areas as diverse as education, health, science and innovation, governance and citizen participation and small and medium enterprises.

A key understanding of “Open Development” is that while technologies are not the sole driver of social change, they are deeply embedded in our social, economic and political fabric. We therefore need to understand ‘openness’ within the context of a complex socio-technical framework and power structure (BUSKENS, 2014). This understanding about the need to understand the power dynamics of institutional structure and how individuals are often constraint by existing practices is central to the development of the conceptual framework that guides the development of OCSDNet.
DEFINING OPEN SCIENCE

Across the various open initiatives, we are also seeing boundaries of what can be made open being pushed further and further. This trend is most apparent in the emerging area of open science.

According to Michael Nielsen, author of Reinventing Discovery (Nielsen, 2011), “Open science is the idea that scientific knowledge of all kinds should be openly shared as early as is practical in the discovery process.” The British Research Information Network defined open science as “science carried out and communicated in a manner which allows others to contribute, collaborate and add to the research effort, with all kinds of data, results and protocols made freely available at different stages of the research process.” (RIN / NESTA, 2010).

In the traditional research process, publications were only made publicly available as an end product, and not necessarily in an open fashion. On the other hand, in open science, not only are research articles openly accessible, but access is extended to other research objects such as data, software codes, protocols and workflows, such that people are free to use, re-use and distribute without legal, technological or social restrictions. In some cases, open science also entails the opening up of the entire research process from agenda-setting, data generation and data analysis, to dissemination and use with the aid of various emerging social platforms and tools (O’HARA; HALL, 2013).

Open science utilizes the prevalence of the Internet and associated digital tools to enable greater local and global research collaboration. Such collaboration need not be limited to traditional research communities but could also include the participation of citizen scientists, both in partnership with traditional research institutions as well as those in non-traditional research locations, often using open software, hardware and other open technologies (WOELFLE et al. 2011; BARTLING; FRIESIKE, 2014).

Fecher and Friesike (2013) surveyed the current landscape of open science and attempted a typology of the various activities
under this broad umbrella. Not surprisingly, what they found was a diversity of activities involving different actors (though they often overlap), different actions and strategies, but most importantly, these activities are guided by different motivations, incentives, assumptions and end goals (Table 1).

**Table 1** A simplified chart showing the different activities (involving different motivations and actors) that have been grouped under the term Open Science

<table>
<thead>
<tr>
<th>Assumption</th>
<th>Pragmatic</th>
<th>e-Infrastructure</th>
<th>Public Engagement</th>
<th>Value System</th>
</tr>
</thead>
<tbody>
<tr>
<td>Access to knowledge is highly inequitable</td>
<td>Open Collaboration is more efficient for knowledge creation and discovery</td>
<td>Network Infrastructure and tools are essential for open collaboration</td>
<td>Science is a public enterprise and should be made publicly accessible</td>
<td>There is a need to create new metrics and incentive</td>
</tr>
<tr>
<td>Actions</td>
<td>Making scholarly knowledge freely available to everyone</td>
<td>Opening up the process of knowledge discovery as early as possible</td>
<td>Creating open platforms, tools and services for scientists</td>
<td>Engaging citizens in design and conducting research</td>
</tr>
<tr>
<td>Actors</td>
<td>Scientists, policy makers, funders, citizens</td>
<td>Scientists, tool developers</td>
<td>Scientists, platform designers and providers</td>
<td>Citizens, Scientists, Non-government Organizations</td>
</tr>
<tr>
<td>Tools and Strategies</td>
<td>Open Access, Open License, Open Data, Open Source</td>
<td>Open Data, Open Source, Crowdsourcing, Open Access, Open License</td>
<td>Defining Standards and Interoperable protocols for knowledge exchanges</td>
<td>Social media platforms (Facebook, Twitter, blogs, etc.), Crowdsourcing</td>
</tr>
</tbody>
</table>

Source: Modified from Fecher and Friesike, 2013

In trying to understand open science, it is important to go beyond the mechanisms of access and reuse, such as the statement that open science is “scientific knowledge that people are free to use, re-use and
What is open and collaborative science

If we take as a starting assumption that open science entails collaboration and participation of diverse actors in a wide variety of institutional contexts, with wide ranging motivations, values and intentions, then we must view open science as a conditional process, not a binary condition, operating within a highly complex socio-technical system that span the local and the global (HALFORD et. al. 2012).

Thus, understanding the principles and dynamics of collaboration and participation is central to the OCSD network activities as openness is more than simply about access (CHAN; GRAY, 2014). We therefore adopted “Open and Collaborative Science” (OCS) as an operating term for the research network to remind us of the central nature of network collaboration and participation (SHRUM et. al. 2007).

Open Science and Development

The OCSDNet is particularly timely given the increasing awareness of the integral role of science, technology and innovation (STI) in development activities on the one hand (WAGNER, 2009), and the growing interest in the role of openness in science as a transformative framework for both development thinking and practices on the other (CRIBB; HARTOMO, 2010).

In the book The New Invisible College: Science for Development, Caroline Wagner posits that:

Like many parts of the knowledge system, the organization of scientific research is changing in fundamental ways. Self-organizing networks that span the globe are the most notable feature of science today. These networks constitute an invisible college of researchers: scientists who collaborate not because they are told to but because they want to, not because they work in the same laboratory or even in the same field but

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because they have complementary insight, data, or skills. Networks can take on the role of institutions in some parts of the world that do not have a long history of building scientific infrastructure. (WAGNER, 2009, p. 2)

By mapping the emergence of global science networks and tracing the dynamics driving their growth, Wagner argues that the shift from “big science” to global networks creates unprecedented opportunities for developing countries to harness science and the potential of innovation. Rather than wasting resources in mimicking scientific establishments and policies of the pre-digital age, policy makers in developing countries should leverage networks by creating incentives for scientists to focus on research that addresses their concerns, and by finding ways to tie knowledge to local problem solving (WOLKOVICH et al. 2012).

This approach is highly appropriate because many of the “grand” challenges facing humanities today, such as climate change, environmental degradation, emerging infectious diseases, inadequate access to clean drinking water and food insecurity, are global in nature but are disproportionately harmful to developing economies. Meeting these challenges requires not only appropriate local solutions but also requires rapid and sustainable deployment of new tools and approaches that draw from the global scientific and knowledge commons.

The dramatically falling cost of computing and the increasing access to the Internet as well as associated digital networks by researchers around the world hold great promises for solving some of these development challenges through open sharing of data, methods, infrastructure and other open approaches to knowledge discovery and problem solving (SMITH et al., 2011; SMITH; REILLY, 2014). The emerging practice of Open Source Drug Discovery for neglected diseases (MASUM; HARRIS, 2011; WOELFLE, 2011; ROBERTSON et al. 2014); the incorporation of citizen science in a wide variety of environmental monitoring and climate change
related research (VITOS et. al. 2013; SUZUKI, 2014; SEE et al. 2013), and the increasing use of social networks for scientific collaboration among scientists in the Global South (e.g. GUERRERO-MEDINA et al. 2013) are but the tip of the iceberg.

In addition to addressing these Global level problems, which require long term interventions, OCS also promises to increase visibility and impact of research at the local level, facilitate participation of researchers in local and international collaborations, encourage public engagement with science through activities such as citizen science, and promote the culture of knowledge sharing and new thinking on social innovations. These are considered to be short term outcomes that have direct development benefits and could contribute to the strengthening of local research capacity through education and participation.

In the longer term, these results will potentially lead to more equitable participation of researchers from the Global South, who are often marginalized in the traditional research competition process driven by Northern agendas (YNALVEZ; SHRUM, 2011; DUQUE et. al. 2012).

This has the further potential of leading to expanded and more inclusive ways of knowing, and is in keeping with our assumption that ‘collaboration’ entails equitable contribution in both the framing and the search for solutions to relevant problems, and not simply about following the norms set by those in power or in charge of resources (HAVERKORT et. al. 2012).

In this regard, openness is not simply about gaining access to knowledge, but also about the right to participate in the knowledge production process, driven by issues that are of local relevance, rather than research agendas set elsewhere or from the top down.

However, while open science is lauded by many as a goal to stride for, the practice is far from universal in the Global North (GRUBB; EASTERBROOK, 2011; PIWOWAR 2011; WHYTE; PRYOR, 2011) and
awareness of its benefits and practices are even less prominent in the Global South. Indeed many researchers in established organizations are actively resisting the disruptive changes brought on by open practices, as they simultaneously call into question long held notions of scientific authority, trust, quality, recognition as well as incentives (Masum; Tovey, 2011; Priem et al. 2012; Bernal, 2013).

And while many of the purported development benefits of Open and Collaborative Science (some of which were outlined earlier) are highly attractive, there is little empirical evidence at the moment to support or refute these claims.

Indeed, as discussed above, the notion of OCS is an umbrella term that encompasses a diversity of activities, actors, assumptions, motivations, and institutional contexts and the outcomes of these complex interactions are often uncertain. Such outcomes may also turn out to be negative in nature, and could further exacerbate problems of inequitable participation, gender disparity, and further exclusion of researchers who do not have the capacity to take advantage of the network tools and resources (Powell et. al. 2012).

Questions have also been raised about potential conflict between open approaches to science and the interests of privacy, safety and security of citizens (Chandramohan et al., 2008; Church et al., 2009; Pisani; Abou Zahr, 2010).

In short, we have very limited understanding of the social, political and institutional contexts and the value and incentive framework within which open approaches to science take place (Delfanti 2013), and equally little about the mechanisms (causal and others) that link open science practices with potential development outcomes. The OCSDNet research program and network is designed to address these gaps in our understanding through a multi-stage data collection and theory building process.
GOALS AND SPECIFIC OBJECTIVES OF OCSDNET

To tackle the rather broad and ambitious goal of OCSDNet described above, there needs to be a set of more specific objectives and strategies to guide the generation of observations, data gathering, and theory building. At the same time, we need to construct a “Theory of Change” (ToC) to guide the design and implementation of the research problems. The ToC is intended to make explicit the assumptions of the problem situation, potential mechanisms of change, the institutional contexts and the actors of OCS, the short and long-term outcomes, and the processes that need to take place in order for the desired changes to occur.

To these ends, the key objectives of OCSDNet include:

1) Support (both funding and intellectual) of new sub-projects and activities so as to generate evidence on whether, and if so, under what conditions open approaches to science can enable research that contributes to development goals in the Global South.

2) Build a community of open science practitioners and leaders in different contexts, by nurturing an interactive research network and providing an enabling platform and needed resources.

3) Identify the structural, technical, policy and cultural barriers for individuals and organizations to participate in OCS and determine how these barriers could be addressed. This will be accomplished through a synthesis of the research results generated by the various sub-projects.

4) Contribute to the building of a new and vibrant area of study (OCS for Development), producing guidelines and knowledge synthesis to inform policy and practice.

Objectives 1 and 2 constitute shorter term goals and they require substantial financial input and coordination. While 3 and 4 are
medium and longer term goals. iHub, Nairobi’s innovation space for the technology community, has taken on the role of network coordination, administrating the funding support for the network sub-projects provided by IDRC (International Development Research Centre) and DFID (Department for International Development), and providing network and resource support for researchers within the network. The Centre for Critical Development Studies at the University of Toronto assumed the role of research coordination, responsible for synthesizing the findings from across the sub-projects, and generating a conceptual framework that would guide future debates and research in the area of open science and development.

OCSDNET RESEARCH APPROACH

FUNDING AND SUPPORT OF SUB-PROJECTS

For the first stage of the network project, OCSDNet issued an international call for concept papers on potential research projects. The call targeted case studies that employ innovative open processes in generating knowledge and actions intended to address a range of development challenges in various Global South contexts, and the concept papers must address one or more of the four key themes central to the research objectives of the network. These themes were identified from two IDRC funded scoping workshops that were held prior to the launch of the OCSDNet project. The themes are:

1) Motivations (incentives and ideologies)
2) Infrastructures & Technologies
3) Communities of practice in open and collaborative Science
4) Potential Impacts (positive and negative) of open & collaborative science

Detailed descriptions of each theme and associated research questions, and how these themes fit with the proposed conceptual framework, are provided on http://ocsdnet.org/thematic-areas/.
In addition, we were seeking a mix of projects that include scientific research in different domains aimed at producing new knowledge, as well as critical research on ongoing initiatives, focusing on the behaviours, contexts, challenges and opportunities enabled by OCS.

The call resulted in 91 concept note applications from across the Global South, from which 14 applicants were invited to the full proposal development workshop held in mid-October, 2014 in Nairobi. The selection process was undertaken by the OCSDNet advisors and the coordinating team, as well as appropriate external reviewers. The selection criteria were made known to the applicants through the call, and extensive background materials were provided to the applicants to help with preparation of the concept paper.9

COMMUNITY AND THEORY BUILDING

The workshop was the first step of the community building process, providing a venue for applicants to get to know each other and the OCSDNet team and advisors.

At the workshop, the applicants received detailed feedback on their concept note from the OCSDNet advisors and coordinators, as well as other peer applicants. The workshop provided important face-to-face time and space for the applicants to refine their papers and to ensure that it became a fundable proposal, with a detailed budget that met the funders’ requirements. The workshop also provided opportunities to share common research problems, methodologies, monitoring and evaluation protocols, and more important, to establish how the various projects could contribute to the common goals of open and collaborative science to address diverse development challenges.

The workshop was a clear move toward achieving Objectives 1, 2 & 4 as workshop participants represented a broad range of disciplines, domains and activities, from open hardware in various South East Asia countries to climate change adaptation with indigenous peoples in South Africa, with common elements of using open approaches and collaboration to look at development opportunities and challenges.

The workshop attendees represented 11 Global South countries, with 3 proposed projects from Sub-Saharan Africa, 1 from the Middle East, 1 from the Caribbean, 5 from Latin America, and 4 from South, East and Central Asia. The workshop attendees also represented a diversity of disciplinary background, from environmental scientists to sociologists of science, and from policy studies scholars to citizen science practitioner in open hardware. The attendees had therefore varying experience, knowledge and conception of development, and different perceptions of open and collaborative science, making the event an important opportunity for applicants to share common challenges, and to debate differences in their approaches, priority setting, and ways of knowing.

The diversity of participants underscore the importance of OCS as a multi and interdisciplinary enterprise, with the need to draw and integrate ideas and research methods and analytical frameworks from disciplines that do not traditionally cross boundaries. This is particularly important for researchers and practitioners from the Global South, who could bring important though often neglected perspectives from diverse institutional settings.

Importantly, one of the key consensus that emerged from the workshop was the need to consider OCS from the perspective of “cognitive justice”, the notion that OCS should seek to empower local actors, including researchers and citizens, by taking into consideration the plurality of knowledge systems and to give priority to development challenges that are of local relevance.
What is open and collaborative science (SANTOS, 1987; VISVANATHAN, 2005; REILLY, 2014; BARRETO, 2014). The assumption is that by supporting capacity development through research participation, local communities are empowered with greater autonomy and ability to create better and more sustainable livelihoods. “Researchers need to work with society and the grassroots because they are the people who are suffering and know what the problems are,” noted OCSDNet Advisor Hebe Vessuri\textsuperscript{10}. This has become an important cross-cutting theme for several of the proposed subprojects, and we anticipate emergence of more cross-cutting themes as the various projects develop and learn from each other.

**CURRENT AND FUTURE ACTIVITIES**

After further online dialogue with the advisors, peer applicants, and external reviewers, the applicants submitted their final proposals in late December 2014. All the proposals were subsequently approved for funding in early January 2015 and all the final proposals are posted on the OCSDNet site\textsuperscript{11}. The projects applicants and the host organizations also went through the due diligent process required by the funders, and all projects were scheduled to begin in February 2015 and last a duration of 24 months.

Through these projects the network expects to be better placed to begin working towards Objective 3 “Identify the structural, technical, policy and cultural barriers for individuals and organizations to participate in OCS and determine how these barriers could be addressed”, and towards building the Theory of Change.


In addition to the development of OCSDNet subprojects, the OCSDNet team has created and launched a network website\(^{12}\). The website includes a blog as well as topical forums, providing space for network participants and interested parties to (1) share and access resources, (2) engage in discussions about issues related to openness and development, and (3) stay informed about the network activities.

The creation of the website is a foundational step towards Objective 2 “Build a Community of Open Science Practitioners and Leaders in different contexts, by nurturing an interactive research network.” In the following months, the OCSDNet team will continue to encourage widespread participation on the website by preparing relevant blog content, stimulating discussions in the various forums, providing resources on networking tools and research approaches, and by increasing the visibility of the OCSDNet’s activities through social media. OCSDNet grant recipients will also be hosting and participating in a variety of conferences and workshops related to OCS and development, and these activities will be reported and shared on the web site to broaden debate and participation.

Each funded projects will also be providing regular updates to the network, and the coordinators will be sharing these widely. These reportings will also form the basis of the ongoing synthesis work that constitutes the theory building phase of the project. At the same time OCSDNet will be engaging in regular monitoring and evaluation exercises with the sub-projects, as well as with the network as a whole. These evaluation outcomes will also be made widely available to interested communities.

FINAL REMARKS

Given the burgeoning and converging interests on “openness” and open science around the world, it is not surprising to see a flourishing of projects designed to investigate the nature and potential impact of “openness” on scientific practices and discourse. The OCSDNet is part of this growing trend, though the network’s focus on the Global South and on development discourse is different from many of the initiatives based in the North. As the network project develops, we also begin to map the diverse actors, agencies and policy dialogues around the world and identify areas of common interests and approaches.

We are also cognizant of the need to be cautious of the strong enthusiasm for open science and its utilitarian claims on efficiencies, return on investment, and economic growth (Mansell; Tremblay, 2013). While cautiously optimistic of the potential of OCS to reshape development practices and discourse, we want to raise critical questions about what real benefits OCS could bring to the Global South, where persistence asymmetries in power structure and deep inequalities in access to resources persist.

Clearly many questions remain open and call for investigation and data gathering. At the same time, as Hebe Vessuri noted (2015, p. 298), there is a strong need to create a “comparative frame that would foster organic interconnections between multiple voices and nourish a diversity of approaches”. Creating rich dialogues between different ways of knowing in a complex networked environment is indeed one of the key challenges for the OCSDNet, and we warmly welcome this challenge.

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