GODAN
Global Open Data
for Agriculture & Nutrition

Ownership of Open Data: Governance Options for Agriculture and Nutrition

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ACKNOWLEDGEMENTS: Jeremy Baarbé and Meghan Blom provided research and editorial assistance. Tim Davies, Martin Parr, and Ben Schaap offered strategic direction and support.

Key informants who provided factual information and/or feedback include Dean Allemang, Hanse-Christophe Eiden, Elizabeth Fischer, Shaun Hobbs, Ednah Karamagi, Johannes Keizer, Ajit Maru, Fernando Perini, Zara Rahman, Stefan Stegemann, Jeni Tennison, and others.

DESIGN: Anja Pircher Design (anjapircher.com).

DISCLOSURE: This research was funded by GODAN, with additional support from the International Development Research Centre (IDRC) and Social Sciences and Humanities Research Council (SSHRC) via the Open African Innovation Research (Open AIR) network. The opinions expressed herein are those of the author alone, and may or may not reflect the opinions of key informants, research funders, or other organizations.

ANALYSIS HIGHLIGHTS

- Ownership rights, or the lack thereof, are a major factor in the power dynamics of open data for agriculture and nutrition.
- The discussion of open data ownership must move beyond licensing to address underlying rights and governance systems.
- Relevant ownership rights include copyrights and also database rights, technical measures, trade secrets, patents and plant breeders' rights and traditional knowledge.
- Most ownership rights accrue to the intermediaries that invest in databases, not persons who provide or use data.
- Options for governance include an interorganizational open data charter, national model laws and policies, a social certification scheme for open data, and an international treaty.
- GODAN and others in the open data community must identify their roles in raising awareness and building capacity to resolve open data ownership challenges.

EXECUTIVE SUMMARY

Ownership rights are a major factor in access and use of open data, distinct from yet as important as the availability of education, skills, technology, infrastructure, and finances. There are real deficits in law, understanding, and frameworks for governing open data ownership. These challenges must be addressed to achieve meaningful and equitable open data as default.

The chief policy lesson from this paper is that moving to a model where data is open as default requires change in legal, social and technological norms, which all influence ownership of agriculture and nutrition data. Copyrights are not the only, nor even most important, legal rights establishing ownership of data. Relevant legal rights that facilitate access to and use of data at the international, national and subnational level include copyrights, database rights, technical protection measures, trade secrets, and patents and plant breeders' rights, privacy and even tangible property rights. The open data community must broaden its engagement in all these areas to address emerging challenges.

Open data is often achieved by persuading data owners to voluntarily licence their rights on open terms. Open licensing contracts are important to transfer legal rights between parties, but licences do not create new rights that would bind all stakeholders or change overarching data governance structures. Most legal rights to data are owned by intermediaries that invest in the selection of data, arrangement of databases, safeguarding of confidential information, or similar activities. The lack of enforceable data rights owned by certain communities, particularly smallholder farmers, contributes to inequality and marginalization. The line between data and traditional knowledge is blurred in indigenous knowledge systems. Ethically, informed consent to use such data should be sought, although legally, rights are just starting to be recognized in international law.

The current contract-based model for ownership of open data leaves many stakeholders vulnerable to the whims of entities that own data, without addressing more systemic challenges and opportunities for open data governance. Meanwhile, expanding ownership rights to protect individual or community data providers could cause significant complications for the intermediaries that practice and promote open data. Several real-world case stories demonstrate the challenges of open data ownership for farmers and grassroots community groups, non/inter-governmental organizations, and multinational commercial entities.

There are four possible governance strategies for ownership of open agricultural and nutrition data. First, interinstitutional cooperation can help build understanding and consensus about the terms and conditions of ownership of open data. Second, model frameworks adopted at the local, national or regional level can offer a governance example other jurisdictions might emulate. Third, a social certification scheme can leverage the power of ethical consumerism and market pressures to promote best open data practices. Fourth, stakeholders can work toward an international agreement on ownership of open data.

The task for GODAN and others in the open data community is to engage with the challenges outlined in this paper, in order to facilitate more inclusive sharing of the benefits of open data.

1 Liz Carolan, Fiona Smith, Vassilis Protonotarios, Ben Schaap, Ellen Broad, Jack Hardingest, and William Gerry, How Can We Improve Agriculture, Food, and Nutrition with Open Data (London, UK: Open Data Institute, 2015) http://theodi.org/how-improve-agriculture-food-nutrition-open-data; Chris Addison, Isolina Boto, Ana Brandusescu, Hugo Besemer, Jerven Morten, Ben Schaap, and Isaura Lopes Ramos, Data Revolution for Agriculture (Wageningen, NL: Technical Centre for Agricultural and Rural Cooperation (CTA), 2015) http://www.godan.info/documents/data-revolution-agriculture; Open Data for Development, Open Data for Development: Building an Inclusive Data Revolution (Annual Report), (Ottawa, CA: Open Data for Development, 2015) http://od4d.com/wp-content/uploads/2016/06/OD4D_annual_report_2015.pdf

2 For an example of how this is being done, see Valeria Pesce, Ajit Maru, and Johannes Keizer, "The CIARD RING, an Infrastructure for Interoperability of Agricultural Research Information Services," AgInfo Worldwide 4, no. 1 (2011) http://journals.sfu.ca/iaald/index.php/aginfo/article/view/213/170. See also Holly Jane Wright, Willis Ochilo, Aislinn Pearson, Cambria Finegold, MaryLucy Oronje, James Wanjohi, Rose Kamau, Timothy Holmes, and Abigail Rumsey, "Using ICT to Strengthen Agricultural Extension Systems for Plant Health," Journal of Agricultural & Food Information 17, no. 1 (2016): 23 http://www.tandfonline.com/doi/full/10.1080/10496505.2015.1120214; and Peter Ballantyne, Ajit Maru, and Enrica M. Porcari, "Information and Communication Technologies—Opportunities to Mobilize Agricultural Science for Development," Crop Science Digital Library 50, no. S-63–S-69 (2010) http://dx.doi.org/10.2135/cropsci2009.09.0527.

THE OPPORTUNITY OF OPEN DATA

Agriculture and nutrition issues are interwoven with global challenges including food insecurity, health crises, climate change, poverty and more. Open agriculture and nutrition data can play a role in solving these challenges[1]. Numerous advantages of open data have been identified. Open data can facilitate collaboration for faster and better innovation. It can be a platform for entrepreneurship and new economic activity. And it can increase transparency, accountability and efficiency across organizations.

If open data is to yield any of these benefits, however, certain challenges must be addressed. One challenge is technical. We must design standards, platforms and other infrastructure to facilitate efficient and appropriate access to data[2]. Open data also raises social and ethical issues. We must define responsibilities to respect the rights of all those affected by the release and use of open data. Members of the open agriculture and nutrition data community are working actively on these issues[3]. Another one of the many challenges — the specific focus of this think piece — is determining how ownership of open data is and could be governed.

Terms and Conditions Apply

There already exists a basic understanding of what "open data" is: data that anyone can access, use or share[4]. Open data may be understood on a spectrum, from closed to shared to open[5]. In contrast to open data, closed data is not accessible to anyone outside of the organization that controls it. Shared data is data that is shared amongst specific groups of people for specific purposes, but not fully open to the general public.

The nature of "data" may also vary: it is shaped by organizational and cultural norms of its producers, as well as the available technology[6]. Data can take many forms, including 'big data' such as primary data (i.e. census data) and real-time data (i.e. traffic or weather patterns), as well as qualitative data such as text, maps, satellite photographs, pictures, and paintings[7]. There is some consensus that data should be standardized. Standardized data is interoperable and traceable, so users can work with and trust it[8].

It is understood that absent express permissions regarding access and use, data cannot be considered open[9]. Why not? When one speaks about permissions, or licensing, it usually points to a more fundamental issue: ownership. If data could not be owned, permission to access, use and share it would not be needed.

True, permission requirements are not always attributable to ownership. Sometimes permission is required for safety or security reasons that have little to do with ownership. But if the reason for requiring permission is confidentiality or commercial sensitivity, that typically signals someone else owns the data.

It is tempting to avoid the language of ownership, because data isn't like other objects that can only be used by one person at a time. (Physical things are "rivalrous"; data is not.) But the legal and practical reality is that data is treated like property. As a result, it is difficult to promote data "openness" unless one fully understands data "ownership".

What does it mean to "own" data? It means that someone — an individual, a group, a business, an organization — has a proprietary interest. Speaking of ownership necessarily implies the existence of property rights. The most basic element of property ownership is the exclusive right to control the terms and conditions of access to a resource.

An owner's proprietary control over data creates an apparent paradox: can data be both open and owned? If data is owned, then is openness merely whatever access a data owner chooses to permit? Do data users have just those rights an owner offers through a licensing contract? Or is there more to openness than that? Are there positive rights to access another owner's data, or share the benefits

3 Kara Kaminski-Killany, Tom Walker, Zara Rahman, and Lindsay Ferris. "Responsibly Opening Agriculture Data," The Engine Room, June 8, 2016 https://www.theengineroom.org/responsibly-opening-agriculture-data/.

4 "The Open Definition," Open Knowledge International, accessed July 14, 2016 http://opendefinition.org.

5 "The Data Spectrum: The Data Spectrum helps you understand the language of data," Open Data Institute, accessed July 14, 2016 https://theodi.org/data-spectrum.

6 Tim Davies, Open Data in Developing Countries: Emerging Insights from Phase I, Open Data in Developing Countries Working Papers, (Berlin: The World Wide Web Foundation, 2014) http://www.opendataresearch.org/content/2014/704/open-data-developing-countries-emerging-insights-phase-i.

7 Mohammad Alamgir Hossain, Yogesh K. Dwivedi, and Nripendra P. Rana, "State-of-the-art in Open Data Research: Insights from Existing Literature and a Research Agenda," Journal of Organizational Computing and Electronic Commerce 26, no. 1-2 (2015) at 15 http://www.tandfonline.com/doi/full/10.1080/10919392.2015.1124007.

8 + 9 "The Data Spectrum," Open Data Institute, (n. 5).

of its exploitation? Can communities own data, or just individuals and companies?

A Matter of Perspective

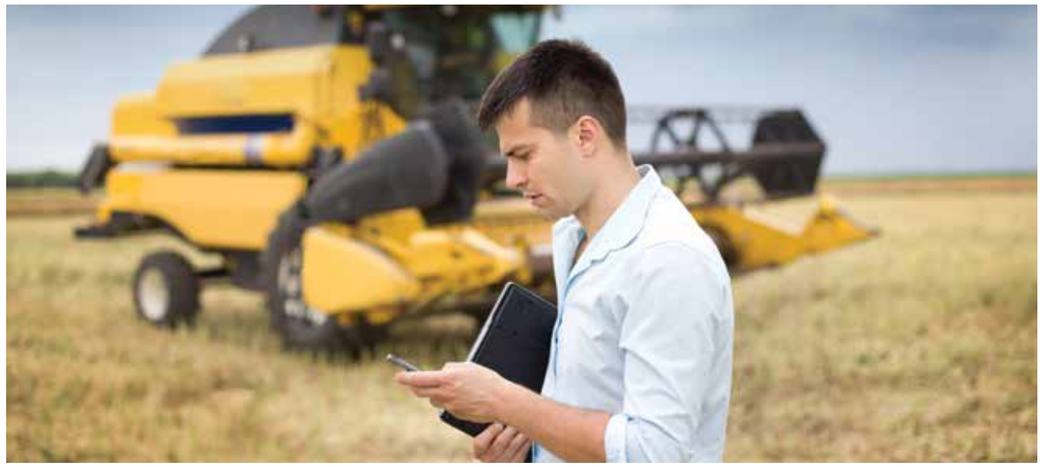
There is sometimes an implicit (or even explicit) assumption that making data open will invariably lead to positive outcomes for everyone. Yet it is evident that access and usage is heavily influenced by the availability of resources, including education and skills, infrastructure, and finances. In respect to open government data, for example, some countries expect that data be available in convenient and modifiable form, preferably available over the Internet[10]. However, studies such as the Open Data Barometer have found that with regard to developing countries, key datasets such as company and land registries are simply not held in digital form, due to capacity or other limitations[11]. Such studies highlight a dichotomy between the developed and developing country context related to open data.

Accessibility concerns are magnified by the fact that the international legal system tends to favor the geopolitically and economically powerful nations that shape the dominant norms. As a result, a global debate over what, where, and how priorities are set has become a prominent issue in the discourse of open data. Inequality persists between those who have access and can exploit open data, and those who cannot. Those already empowered with financial resources and skills to use open data may do so in self-interested and exploitative ways[12].

Removing the rose-coloured glasses through which open data is often viewed shows us that equitable and accessible use of open data requires a concomitant investment in capacity building.

A Structured Analysis of Open Data Ownership

This paper "opens" the debate on open data ownership. It offers an introduction and framework for addressing complex and difficult issues surrounding the ownership and governance of open data. The paper begins by first describing the technical, social, and legal aspects of open data ownership. Next, it describes the experiences of open data stakeholders through three case stories that illustrate ownership and governance issues. On that basis, the paper offers four possible strategies for advancing discussions of open data ownership. Finally, the paper concludes by highlighting crucial matters of practice and principle that may shape debates about ownership and governance of open data, and next steps for the open data community.



10 "Open Data 101," Government of Canada, last modified November 5, 2014, accessed July 14, 2016 http://open.canada.ca/en/open-data-principles.

11 Davies, Open Data, at 12, (n. 6).

12 Mike Gurstein, "Open Data: Empowering the Empowered or Effective Data Use for Everyone?" First Monday 16 no. 2 (2011) http://dx.doi.org/10.5210/fm.v16i2.3316. See also Tim Davies and Duncan Edwards, "Emerging Implications of Open and Linked Data for Knowledge Sharing in Development," Institute of Development Studies Bulletin 43, no. 5 (2012): 117 http://dx.doi.org/10.1111/j.1759-5436.2012.00372.x.

DATA: OWNED BY DEFAULT?

Given that property rights are such an important piece of the data governance puzzle, they deserve detailed discussion. This section of the paper explains the basics of data ownership. Moving to a model where data is "open by default" invites changes in legal, social and technological norms. The status quo, like it or not, is that data is normally owned by default. Currently, openness is achieved primarily by persuading (or, rarely, requiring) data owners to licence their rights on open terms. Is that the best model for the open agriculture and data community? What "rights" do data owners, providers, users, intermediaries and others really have?

Tangible and Intangible Data Assets

Data is normally accessed, used and shared through physical objects and places like paper files, hard drives, mobile phones, server rooms or library archives. The ordinary laws of property govern ownership of and access to those things. Data is inaccessible, and so not open, if one cannot get access to the places where it is stored. Data is unusable when one may not use devices needed to do something with it. The lesson here is that the physicality of data-related systems cannot be ignored when considering ownership issues.

When the value of a resource is mostly intangible, as with data, ownership issues are governed by intellectual property rights. Though copyright is the right most commonly discussed by advocates of openness (including data, software, educational resources and more), the intellectual property landscape that governs data ownership is actually far more complex. We can start to simplify how data becomes and remains open by better understanding the technological, social, and especially legal mechanisms that enable ownership.

Technological and Social Mechanisms Governing Data Ownership:

Technological measures work along with legal measures to facilitate or frustrate access to data. All data has some technical component to it. Data may exist in digital or paper format. It may be accessible on certain computer platforms but not others. It may or may not comply with one or more standards. Even the language in which data data exists can be considered a technical barrier to accessibility (especially with non-numerical data). Insofar as data must be "machine readable" to be considered open[13], technical aspects of data ownership are extremely important.

Data ownership also depends heavily on social and cultural norms. In many communities, the key rules governing data are those set and enforced by the community itself. This is particularly true for indigenous and local communities, where understandings of openness, and even of data, may be different. Social values are also essential to acknowledge in rural settings, where informality characterizes much if not most agricultural industrial activity. In these

Technical	Social	Legal
Standards, platforms, languages, formats	Relationships, trust, communities, culture	Laws, regulatory schemes, policies, licensing practices

Table 1: Dimensions of Data Ownership

13 "The Open Definition," Open Knowledge International, (n. 4).

environments, core principles like trust, honour, and integrity may be more important than the formal legal conditions that govern open data licensing in Western urban settings.

Formal legal frameworks become most important, however, when open data initiatives are scaled up. Scalability is the fulcrum on which the balance between formal and informal governance of open data pivots. Once data sharing goes beyond close-knit communities, inter-personal trust or cultural values no longer govern the terms and conditions of access. Clear legal rules then become integral to delineate the scope of data ownership and promotion of openness.

Legal Ownership of Data

Legal mechanisms can take many different forms, from international treaties to national legislation to licensing practices. Laws may operate at an international, national or subnational level. Internationally, legal instruments may be open to all or most countries of the world to join, such as treaties of the United Nations and agreements of the World Trade Organization. Or instruments may be regionally or topically based, like agreements on political integration or free trade. In some countries, international law is directly binding at the national level. In other countries, international law must be ratified and implemented at the national level before it becomes binding domestically. National laws, including statutes and regulations as well as case law, may or may not always be consistent with international law.

This jurisdictional layering can make ownership of data very complex. On a practical level, when it comes to ownership and governance of data, national laws matter most. That is because national laws are most clearly and easily enforceable, through the real threat of sanctions ranging from criminal punishment to civil liability for legal violations. On a conceptual level, however, because of the variability in national laws it is simpler to introduce the mechanisms that enable data ownership in terms that are globally generalizable.

Copyrights

Copyright is one way in which data can be owned. But data is not always or even normally copyright protected by default. Facts—for example statistics, formulas, geo-information and news—are not copyrightable. Much data falls into that category. Databases are a different matter, however. Original compilations of data are protected for an extremely long period of time; in many cases well over a century[14].

All of the World Trade Organization's 162 member countries have agreed to this provision of the Agreement on Trade-Related Aspects of Intellectual Property, known as TRIPS:

> "Compilations of data or other material, whether in machine readable or other form, which by reason of the selection or arrangement of their contents constitute intellectual creations shall be protected as such. Such protection, which shall not extend to the data or material itself, shall be without prejudice to any copyright subsisting in the data or material itself."[15]

In plain language this means that countries must offer copyright protection to databases with a sufficient amount of intellectual creativity. And while the copyright in the database as a whole does not cover the data in it, that data may be separately protected by its own distinct copyrights.

The WIPO Copyright Treaty of 1996, administered by the UN Agency responsible for intellectual property rights, contains a nearly identical provision[16]. The foundational Berne Convention of 1886 is generally understood to require the same protection, though using less explicit language[17].

The bottom line: certain databases can be copyright-protected worldwide, but the standard of eligibility for protection can vary from country to country. The United States protects databases that demonstrate "a modicum of creativity"; Australia requires only an investment of labour, known as "sweat of the brow"; in Kenya, "sufficient effort" gives work an original character; Canada offers protection if enough "skill and judgment" has gone into the selection and arrangement of data.

Sui Generis Database Rights

The European Union, its member states, and Mexico are notable places that offer distinct database rights in addition to copyright protection. The European Parliament's 1996 Database Directive establishes *sui generis*, i.e. unique, rights in databases that fall short of the standard of an intellectual creation required by copyright law[18]. These non-innovative or unoriginal databases are protected if there has been qualitatively or quantitatively a substantial investment in either the obtaining, verifying, or presenting the contents. Database "manufacturers", as they are known in the EU, have the right, valid for 15 years, to prohibit the extraction and/or reuse of substantial parts of their databases by third parties.

While the EU had hoped this extra protection would attract investment in database creation, believing it was necessary to promote the "Information Society", the EU's own 10-year evaluation concluded: "the new instrument has had no proven impact on the production of databases."[19] The EU also believed its database law would become a global example for others, but in the 20 years since its enactment, this model has not been widely adopted[20].

Technological Protection Measures

Data is increasingly becoming digital. Indeed, "open data" must, according to the leading definition, be machine readable. This means that data is typically protected not only by legal mechanisms but by technological measures too. Technological protection measures, or TPMs for short, may include digital tools that protect access to and/or copying of databases. Username and password combinations, geo-blocking restrictions and software that limit usability of certain features like copying or pasting are all examples of TPMs.

TPMs can affect data by restricting access and use, even if data is not protected by copyright or *sui generis* database rights. If a database is copyright-protected, however, then at least two layers of legal restrictions exist: copyright protection for the data and/or database, plus legal protection for the technologies that protect the copyright. The legal prohibition on circumventing TPMs or tampering with information related to rights management is enshrined in the WIPO Copyright Treaty to which many countries are (or are becoming) signatories[21].

Technological and legal mechanisms, therefore, work in tandem to reinforce the proprietary rights of data and database owners. TPMs should be a matter of serious interest to the open data community.

Patents and Plant Breeders' Rights

Patents and plant breeders' rights do not protect data directly, but can nonetheless limit the ability to use data related to innovations in agriculture and nutrition. For example, it is possible to obtain patents on products and/or processes derived from data, such as genetically modified plants and the methods to produce them. Plant breeders' rights protect new, distinctive and stable varieties of plants. Therefore, even if copyright, database, confidentiality or other laws do not prohibit third parties from accessing or using the underlying data, the ability to make certain uses of the data could be limited.

In other respects, however, patents and plant breeders' rights are themselves sources of valuable data about innovations in agriculture or nutrition. Patents provide an important incentive to disclose information related to an invention instead of keeping it secret. While there is usually no obligation to release all of the data and related information an inventor has regarding an invention, some data may be disclosed to the public in the patent application. Furthermore, data regarding patents or plant breeders' rights may be useful in analysis of technological, economic and other trends in agriculture and nutrition industries. While such data is not yet routinely made open by most intellectual property offices worldwide, steps

14 Copyright protection lasts for the life of the author plus at least 50 more years, and in some countries up to 100 more years. The life of the author plus at least 70 more years of protection is common in much of the world.

15 TRIPS: Agreement on Trade-Related Aspects of Intellectual Property Rights, April 15, 1994, Marrakesh Agreement Establishing the World Trade Organization, Annex 1C, THE LEGAL TEXTS: THE RESULTS OF THE URUGUAY ROUND OF MULTILATERAL TRADE NEGOTIATIONS 320 (1999), 1869 UNTS 299, 33 ILM 1197 (1994) https://www.wto.org/english/docs_e/legal_e/27-trips.pdf.

16 WIPO Copyright Treaty (WCT), December 20, 1996, S. Treaty Doc. No. 105-17 (1997), 36 ILM 65 (1997), at art 5 http://www.wipo.int/treaties/en/ip/wct/.

17 The Berne Convention for the Protection of Literary and Artistic Works, September 9, 1886, Can TS 1948 No 22, 828 UNTS 221, revised most recently by Paris Act relating to the Berne Convention, July 24, 1971, and amended September 28, 1979, 1161 UNTS 3 http://www.wipo.int/treaties/en/ip/berne/.

18 Directive 96/9/EC of the European Parliament and of the Council of 11 March 1996 on the Legal Protection of Databases, 1996 OJ L 77/20 http://data.europa.eu/eli/dir/1996/9/oj

19 Commission of the European Communities, First Evaluation of Directive 96/9/EC on the Legal Protection of Databases (Brussels: Commission of the European Communities, 2005) http://ec.europa.eu/internal_market/copyright/docs/databases/evaluation_report_en.pdf.

20 Mexico also included a sui generis right in databases as part of a 1996 overhaul of copyright law. In addition to copyright based protections, databases that are not original ("no sean originales") are protected for five years. "Ley Federal Del Derecho De Autor (LFDA)," titulo IV, art 108, D.O., 24 de diciembre de 1996, art 108 http://www.indautor.gob.mx/documentos_normas/leyfederal.pdf. See further Eduardo e la Parra Trujillo, "The Sui Generis Right on Databases in Mexico and the European Union," Comparative Media Law Journal, 3 (2004) http://www.juridicas.unam.mx/publica/rev/indice.htm?r=comlawj&n=3.

21 WIPO Copyright Treaty (WCT), at art 10-12, (n. 16).

are being taken to leverage the power of open data for better intellectual property analytics[22].

Trade Secrets and Confidential Information

One of the most important but often overlooked aspects of data governance is trade secrecy, sometimes known as confidential information. There is ongoing debate about whether confidential information can or should be owned as property, like works protected by copyright or other intellectual property rights. As a practical matter, international agreements establish an ownership-like interest in confidential information. Trade secrecy has major impacts on agriculture and nutrition, especially with agrochemical, pharmaceutical, and nutriceutical data.

According to the WTO's TRIPS Agreement: "Natural and legal persons shall have the possibility of preventing information lawfully within their control from being disclosed to, acquired by, or used by others without their consent in a manner contrary to honest commercial practices"[23]. Translating the Agreement's legal jargon into simple terms, countries must provide the right to control data that is: (a) secret, (b) valuable and (c) safeguarded. Trade secrecy law at the national or subnational (i.e. state or provincial) level is widely used to protect against unfair competition between private sector actors.

Laws regarding confidential information are also used widely around the world to restrict access to government-held data about pharmaceutical and agricultural chemical products. As a condition of regulatory approval assuring the safety and efficacy of new chemical entities, governments typically require undisclosed test or other data to be submitted before a product may be marketed. TRIPS protects the pharmaceutical and agrochemical companies that expend considerable resources to collect this data against disclosure, except where necessary to protect the public, or unless steps are taken to ensure that the data are protected against unfair commercial use.

Data protection is increasingly a key part of bilateral trade agreements or economic partnerships, such as the Trans Pacific Partnership (TPP). For example, the TPP mandates that its signatories, including 12 Pacific Rim countries representing 40% of global economic output, extend exclusive rights in agriculture-related data for at least 10 years from the date of marketing approval[24]. Similar provisions may be found or contemplated in bilateral and regional agreements worldwide.

The combination of two factors — the proliferation of data protection requirements in economic partnership agreements and the extension of exclusive data protection rights into the domain of agriculture — raises important ownership issues for those interested in open data for agriculture and nutrition. When the phrase "data protection" is used in international legal negotiations, it does not normally refer to the privacy safeguards that come to mind for many in the open data community. Data protection is more commonly used to describe the exclusive rights that data owners have to use the data in regulatory and commercial contexts.

Privacy

While privacy rights are not the same as property rights, parallels can be drawn between the nature of control over information that both rights might provide[26]. In both cases, a person (the individual to whom personally identifiable information pertains, or the owner of the data) has certain rights of control over access to and use of information.

The key difference between a privacy model and a property model for data, however, is in marketability. While privacy can in some respects be bargained away in exchange for money, services or conveniences, there is no market for privacy *per se*. There certainly is a market for personal information, but the rights exchanged amongst third parties are based not on privacy law. This data is bought and sold through licences based on the legal rights discussed elsewhere in this section: copyrights, sui generis database rights, confidential information, as well as contracts for physical or technological control over the data.

Privacy and property rights intersect in a number of situations related to agriculture and nutrition data. One example is the collection of data by satellites, drones, or even digitally connected tractors. While farmers might think they have property rights that would prevent this kind of data gathering, in most cases they have no legal recourse. Farmers are typically asked to, and do, accept certain data collection as a condition of sale associated with digitally connected equipment. Insofar as others' surveillance equipment is concerned, satellites fly well above any height a farmer may claim to own (although the law pertaining to low-flying drones has yet to be tested)[27]. As to the data that may be collected by such surveillors, farmers almost certainly have no enforceable, proprietary claim to ownership[28]. Whether a legal action for invasion of privacy is plausible may depend on the personal or sensitive nature of the data gathered; a farmer normally cannot control data that does not personally identify an individual or her actions.

Notably, the law on all these kinds of matters varies greatly from one jurisdiction to another. There is no international instrument that governs. The point here is that global governance solutions based on privacy principles may address part of the open data puzzle, but a small part. Other, proprietary rights discussed above are much more relevant to the ownership of open data, especially by intermediaries. Licensing practices are also essential to understand.

Data Licensing Contracts

Contracts are the legal mechanisms that create much of the open data we have in the world. Indeed, open licensing practices are embedded explicitly or implicitly into some of the basic definitions of open data[29]. Open data licenses are inspired by the contracts that establish terms and conditions governing open source software, such as the GNU General Public license, or creative content, like the Creative Commons suite of licenses.

Two points about contracts are essential to understand within the open agriculture and nutrition data community. The first is that these licenses to do not create data ownership rights; they merely transfer rights from one party to another. The underlying rights are created through the legal mechanisms described in this paper, and these underlying rights are ambiguous, contentious, and dynamic. The adequacy or inadequacy of ownership rights in data should not be taken as immutable. Rather, the underlying norms that govern data ownership should be constantly interrogated and improved.

Point two is that the standard licences developed for software and creative content were not originally developed to govern open data. While adjustments have been made to deal with data[30], in updated Creative Commons licences for example[31], open data licensing may not be as straightforward as

22 WIPO's Global Dissemination of IP Data Initiative aims to make IP data publically available through the WIPO website and national IP offices. See "Intellectual Property Statistics," World Intellectual Property Organization, accessed July 14, 2016 http://www.wipo.int/ipstats/en/. Australia's national IP office, for example has been a world leader in open intellectual property data. See Bradley Man, Overview of the Intellectual Property Government Open Data, Economic Research Paper 2 (Philip, AUS: IP Australia, 2014) https://www.ipaustralia.gov.au/sites/g/files/net856/f/reports_publications/ip_government_open_data_paper_-_final.pdf; "Intellectual Property Government Open Data 2016," (Dataset) IP Australia, last modified July 8, 2016, accessed July 14, 2016 https://data.gov.au/dataset/intellectual-property-government-open-data-2016.

23 TRIPS Agreement, at art 39, (n. 15).

24 Trans-Pacific Partnership (TPP), at art 18.47, accessed July 14, 2016 https://ustr.gov/trade-agreements/free-trade-agreements/trans-pacific-partnership/tpp-full-text.

25 One recent work indicated that less than half of developing countries had a dedicated data protection law in place, illustrating that issues of privacy are not on radar of most open data projects in such developing countries: Davies, Open Data, (n. 6).

26 Samuel Warren and Louis Brandeis, "The Right to Privacy," (1890) Harvard Law Review IV, no. 5 http://dx.doi.org/10.2307/1321160; Pamela Samuelson, "Privacy as Intellectual Property?" Stanford Law Review 52, no. 5, (2000): 1125 http://dx.doi.org/10.2307/1229511; Lawrence Lessig, "Privacy as Property," Social Research 69, no. 1 (2002): 247 http://www.jstor.org/stable/40971547.

27 It is well established in law that farmers' rights over airspace above their land is limited to what can be reasonably occupied or used. For example, regarding the law in the United States, see United States v. Causby, 328 US 256 (1946).

28 One case illustrating this principle is the Australian case of Victoria Park Racing and Recreation Grounds v Taylor, [1937] HCA 45, 58 CLR 479.

29 See, for example, "The Open Definition," Open Knowledge International, accessed July 14, 2016 http://opendefinition.org.

30 Michael Mandiberg, "CC and Data[bases]: Huge in 2011, What You Can Do," Creative Commons (blog), February 1, 2011, accessed July 14, 2016 https://creativecommons.org/2011/02/01/cc-and-databases-huge-in-2011-what-you-can-do/.

licensing other content. That is because ownership of data is not as straightforward as ownership of some other content. The issue of open data and traditional knowledge provides an excellent example of the complexity in this area.

Traditional Knowledge

Like the principles of open data generally, the concept of data ownership must be seen in context. In the context of indigenous and local communities (ILCs), cultural and legal norms governing traditional knowledge may have an impact on the ability to access, use and share data. Control over ILCs' traditional knowledge is especially relevant in rural and remote communities where agriculture dominates economic and social life, and nutritional challenges are significant.

While traditional knowledge related to agriculture and nutrition may not meet some formal definitions of open data—it is not normally, for example, machine readable or legally licensed—it is hard to ignore. Indigenous governance systems may not contemplate clear distinctions between data, information and knowledge. Yet as the real-world case stories covered in the next part of this paper show, traditional knowledge is, in fact, being understood and promoted as open data in some contexts. There are certainly local norms governing control over, perhaps more accurately stewardship of, this information. And openness regarding plant genetic resources for food and agriculture is a concept familiar to many ILCs[32].

The norms governing ILC's TK are not only local, however. International law establishes rights in respect of TK that may limit the ability to access, use and share data gathered by or from ILCs. The UN's Food and Agriculture Organization (FAO) has, for example, recognized through the International Treaty on Plant Genetic Resources for Food and Agriculture "the enormous contribution that the local and indigenous communities and farmers of all regions of the world" have made to the conservation and development of plant genetic resources for food and agriculture[33]. "The International Treaty" (as it is unhelpfully known) imposes on member states an obligation to protect traditional knowledge, the right to share benefits from its exploitation, the right to participate in decision-making and more. The Nagoya Protocol to the Convention on Biological Diversity also contains significant provisions on traditional knowledge associated with genetic resources, including obligations upon states to establish mechanisms that facilitate prior informed consent to access knowledge and sharing of benefits from the exploitation of that knowledge[34]. Discussions at WIPO are also ongoing to set the terms of control over traditional knowledge[35].

Because the line between "data" and traditional knowledge is blurred in the context of indigenous knowledge governance systems, and possibly international law, these issues cannot be ignored when analysing ownership of open data.

31 "Data," Creative Commons (wiki), last modified November 26, 2013, accessed July 14, 2016, https://wiki.creativecommons.org/wiki/Data.

32 Chidi Oguamanam, "Open Innovation in Plant Genetic Resources for Food and Agriculture," Chicago Kent Journal of Intellectual Property 13, no. 1, (2013): 11 http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2310635.

33 International Treaty on Plant Genetic Resources for Food and Agriculture, November 3, 2001, 2400 UNTS 303, at art 9 http://www.planttreaty.org/content/article-xiv.

34 Convention on Biological Diversity, June 5, 1994, 1760 UNTS 79, 31 ILM 818, at art 12 https://www.cbd.int/convention/text/.

35 Traditional Knowledge," World Intellectual Property Organization, accessed July 14, 2016 http://www.wipo.int/tk/en/.

Legal right	Protection	Procedure	Duration	Instruments
Copyright	Protects original data and databases against copying. Facts not protected.	Automatic. No application or registration is required, so ownership is hard to track.	Very long. Rights last at least 50 (often 70) years after author's death.	National laws based on the Berne Convention and TRIPS Agreement.
Technological Protection Measures	Circumvention of TPMs to access or use data, and tools to circumvent, are prohibited.	None. Owners of data need only use TPMs. Blanket prohibition on circumvention.	Indefinite. Possible to use TPMs to control even public domain data.	National laws based on the WIPO Copyright Treaty
Sui Generis Database Rights	Prevents extraction and/or reuse of substantial parts of databases.	Registration of databases involving substantial investment in its contents.	15 years. Separate and cumulative protection for each new investment.	EU Member States' laws based on Database Directive. (+ Mexican law).
Patents and Plant Breeders' Rights	Does not protect data, but may restrict its use for inventions or breeding.	Application for inventions or varieties that meet certain conditions.	10-20 years from the date of application regarding the invention or plant variety.	National laws based on TRIPS Agreement and UPOV Convention.
Confidential Information	Prevents the disclosure, acquisition or use of data, if contra honest practices.	None. Owners of data need only keep info secret, e.g. via non-disclosure contracts.	Indefinite. Protected as long as info is secret, valuable, and safeguarded.	National (or subnational) laws based on TRIPS or other trade agreements.
Personal Privacy	Grants a person control over limited (personally identifiable) information.	None. Enforcement via court or administrative procedures may be costly.	Lasts for life. (Inheritable "personality" rights not relevant to ag & nutrition.)	National (or subnational) laws. General mention in international agreements.
Licensing Contracts	Does not create rights in data; merely transfers data access/use rights amongst parties.	Standard-form (e.g. Creative Commons) or custom-made contract. (Only binds parties, not others).	Specified by contract. Can be temporary or permanent, revocable or irrevocable, etc.	Varying national (or subnational) contract laws; nternational standard practices.
Traditional Knowledge	Prior informed consent and benefit sharing needed to access/use TK.	Must create norms and/or procedures at community or state level to set terms of access/use.	Potentially indefinite. Conditions of use/access set by local community norms.	National laws based on Nagoya Protocol or International Treaty (many countries not members).

Table 2: The Legal Rights and Instruments Affecting Ownership of Data

Summary of Data Ownership Mechanisms

Technical and social issues are absolutely essential to achieving data openness for agriculture and nutrition. When it comes to enforcing rights, however, ownership is ultimately a legal issue related to property. Technical, social and legal governance mechanisms are all dynamic, constantly shifting to respond to the contexts and priorities of diverse stakeholders. Table 2 summarizes the intellectual property rights that those interested in the ownership of data should be aware of and actively engaged with.

A key takeaway from this review of mechanisms that facilitate ownership of open data is that those open agriculture and nutrition data stakeholders who are most vulnerable—small-scale farmers in local communities in developing countries, have the least legal protection. This is not a coincidence. The lack of enforceable ownership rights over open data collected from and/or used by poor farmers contributes to their marginalization. The parties with the most enforceable ownership rights are data intermediaries. Intermediaries—including inter-governmental organizations, well supported NGOs, multinational corporations and other private-sector actors—are able to take advantage of the legal protections offered them in order to exert control over data.

Ownership is a significant factor shaping power dynamics among open data stakeholders.

For example, copyrights and database rights do not accrue to the person about whom data pertains, or to the person who provided the data; they are owned by the entity that made investments in the collection, selection, or arrangement of the data. Confidential information is legally controlled by the entity that has it, not the person it relates to (with the limited exception of personally identifiable information). Licensing contracts almost always favour the entity that chooses applicable terms and conditions, leaving others' ability to access or use "open" data subject to the whims of the data owner. Local community norms may matter a great deal to those within the community, but there are almost no enforceable international norms that bind outsiders to respect local community choices.

Yet, ownership alone is not enough to ensure the benefits of open data are shared inclusively by all stakeholders. Even with an ownership interest, certain open data stakeholders may lack the institutional and technical capacity to benefit from the data being provided. So, explains Ajit Maru, Senior Officer at the Global Forum on Agricultural Research Secretariat, farmers need to be involved in the basic decision-making process, providing input on which data information should be generated, shared, and exchanged[36]. The decision to make even individual farm related data available should not be automatic, but rather made in collaboration with local farmers sharing resources and market access, thereby recognizing that this data has community implications including of ownership and use[37]. This also ensures that data elements sensitive to specific groups are dealt with in a culturally relevant, useful and trustworthy manner.

36 Ajit Maru, "Rights of Farmers for Data, Information and Knowledge A CIARD E-Discussion" CIARD (blog), October 3, 2014, accessed July 14, 2016 http://www.ciard.info/news-and-events/blog/rights-farmers-data-information-and-knowledge-ciard-e-discussion.

37 Andre Jellema, Wouter Meijninger, and Chris Addison, Open Data and Smallholder Food and Nutritional Security, CTA Working Paper 15/01 (Wageningen, NL: Technical Centre for Agricultural and Rural Cooperation (CTA), 2015) http://www.cta.int/images/Opendataforsmallholders-report_.pdf.

38 Ednah Akiiki Karamagi and Mary Nakirya, "Tools for Enhancing Knowledge Sharing in Agriculture: Improving Rural Livelihoods in Uganda," in PLA 59: Change at Hand: Web 2.0 for Development, ed. Holly Ashley, Jon Corbett, Ben Garside, and Giacomo Rambaldi (London, UK: IIED and the Technical Centre for Agricultural and Rural Cooperation, 2009) at 1, http://pubs.iied.org/14563IIED.html.

CASE STORIES: HOW STAKEHOLDERS SEE OPEN DATA OWNERSHIP AND GOVERNANCE

It is important to offer not merely an abstract account of ownership issues associated with open data. Drawing upon three selected case studies in agriculture and nutrition at the community, international, and commercial level, this section will illustrate how open data ownership may be differently conceived and applied. This section highlights some of the complexities and nuances knowledge intermediaries face in ownership and governance of open data.

Growing Open Data in a Grassroots Community

"Farmers hold the information necessary to improve their livelihoods. They simply require the platforms and resources to enable them to share that information"[38]. This is one of the core mandates behind the non-government organization, BROSDI, short for the Busoga Rural Open Source and Development Initiative. BROSDI is an established non-governmental organization that seeks to reduce food insecurity in rural communities in Uganda by helping facilitate the exchange of agricultural and nutritional information.

Working directly with local stakeholders and government officials at the district level, BROSDI mobilised farmers from different villages who collect indigenous knowledge on the nutritional, agricultural, and post-harvest practices of specific crops. The information collected is primarily qualitative, which sheds light on grassroots community conceptions of data. It is transmitted through knowledge sharing forums and meetings held in local communities, which reveals something about grassroots community notions of openness.

Village Knowledge Brokers (VKBs) became known to the district officials and the communities as information vanguards, and were trained in varying fields: bookkeeping, team working, content gathering and dissemination, negotiation, basic computer skills, and more. Following the local forums, the collected information was shared with BROSDI who did basic editing. BROSDI then worked with third-party government representatives, NARO, to validate the information collected by removing myths, and replacing them with scientific evidence. Once validated, BROSDI then repackaged it, including translating the information into local languages, and disseminated it to the farmers and communities through various on and offline platforms including, videos, audio, printed newsletters, websites and text blogs, and SMS text messaging[44]. There are no financial costs to the communities to access and use the information.

At the grassroots level, BROSDI has empowered the rural communities to utilize the open information provided to them through ICTs. Information has been both generated and shared at the local level, leading to a sense of community ownership. In turn, the communities have experienced few problems of exploitation or conservative hoarding of information[41].

While the information collected by BROSDI is conceived by the community as open data, it does not align well with the dominant model in developed countries or international discourse, which defines open data as machine-readable, accessible online and (at least implicitly) normally quantitative. Semantic differences have not, however, prevented BROSDI from achieving its objective of improving food security.

The organization operates as an important intermediary as the information it provides has helped communities share and promote improved farming practices. Such intermediaries play a useful role in the open data ecosystem, as they are trusted parties that not only generate and share data, but also help translate open data visions[42]. At its core, BROSDI embodies the fundamental notion of openness by allowing full and free access to its information that can be used, modified, or shared[43].

39 + 40 "BROSDI Encourages Farmers to Think Outside the Box in Uganda," GODAN (the Global Open Data for Agriculture and Nutrition Initiative) (blog), February 27, 2016, accessed July 14, 2016 http://www.godan.info/brosdi-encourages-farmers-to-think-outside-the-box-in-uganda.

41 Tim Davies, "Data, Openness, Community Ownership and the Commons," Tim's Blog (blog), September 2, 2015, accessed July 14, 2016 http://www.timdavies.org.uk/2015/09/02/openness-community-ownership-and-the-commons.

42 Ibid; See also François Van Schalkwyk, Michael Cañares, Sumandro Chattapadhyay, and Alexander Andrason, Open Data Intermediaries in Developing Countries, (Tagbilaran City, Philippines: Step Up Consulting Services, 2015) http://dx.doi.org/10.6084/m9.figshare.1449222.

43 "The Data Spectrum," Open Data Institute, (n. 5).

Open Data on the International Stage

Agricultural pests and diseases contribute to an estimated 30% to 40% of crop losses, undermining food availability and increasing food insecurity, and ICT-enabled data sharing can help solve these problems[44]. In order to address these challenges, Plantwise, a global programme established by CABI, has been working to strengthen plant health systems by providing advice to farmers in community-based plant clinics[45].

Working in collaboration with host countries, Plantwise assists in helping establish a network of plant clinics. The clinics follow an approach similar to clinics for human health, where a trained 'plant doctor' diagnoses a plant health issue and provides advice to farmers on methods to manage their crop problem. Clinics are supported by the Plantwise Knowledge Bank (PKB), an on and offline resource that assists plant doctors with diagnosis and treatment advice[46]. As a hybrid resource, the PKB combines content from a variety of sources including CABI's online data platform, governmental databases, and research publications[47]. Plant doctors also collect key crop information on standardized prescription forms, where the collected data is then digitalized and stored in the host countries' own Plantwise Online Management Systems[48].

While the information on the PKB is open to anyone, the data collected by plant clinics is both owned and access-controlled by agriculture or other government departments in host countries. Trade-related concerns underpin the decision for host countries to store their data in a closed part of the knowledge bank. Publication of data from the plant clinics is only made available through express permission of the host country, and even then may have restricted access, such as availability confined to specific regions.

Plantwise supports the transition to full access and use of all the data its plant clinics have collected. However, operating as an intermediary, the organization recognizes how the institutional context including local policy and culture, as well as privacy related constraints, can heavily influence a country's decision on the level of data openness it seeks to offer. Working with such highly sensitive agricultural information, Plantwise has been able to manage the significant processes and culture challenges of each host country in parallel to managing the delivery of the open data on the PKB[49].

Still, significant challenges exist. Farmers need incentives, not obligations, to share their knowledge about plant health. That, explains CABI's Head of Open Data, Martin Parr, requires "a better understanding of, and models for, data ownership and stewardship, to help us build a data rights charter for agriculture."[50]

Open for Businesses: Big Data in the Private Sector

In the context of the challenge to feed a growing population, Syngenta—a global agrochemical company—has committed to helping farmers enhance their crop productivity and use limited resources more efficiently[51]. As a way to address these challenges, Syngenta created and implemented the Good Growth Plan, an initiative that aims to deliver on six global sustainability targets intended to improve global food security.

To measure their progress, Syngenta carried out in-field data collection on more than 3,600 farms, covering 21 different crops in 42 countries. It is now publishing some of its datasets online[52]. Syngenta is working in collaboration with open data organizations such as the Open Development Institute as a way to improve the reporting process and quality of their datasets, as well as to ensure transparency. While some datasets can be accessed, used, and shared at no cost, they are owned by Syngenta. The company selectively releases certain (not all) data under permissive licenses (e.g. Creative Commons Non-commercial-NoDerivatives and Attribution-Share-Alike licence)[53]. With regard to benefit sharing, farmers are given access to the selected data, which Syngenta explains will provide them more crucial information and greater control over farming practices and decisions.

The interplay between Syngenta, farmers, and the public highlights a modified definition of open data. Although the datasets are made available through an online platform, Syngenta remains both the author and owner of the data it chooses to make open. As a "large-scale consumer of data and seller of database products"[54], the information collected by Syngenta can be understood as an asset that provides financial advantages for the company[55]. These considerations, combined with data privacy and commercial issues, as well as marketing incentives, play a role in the company's determination of the amount and type of data that is open[56].

Syngenta staff explain the factors contributing to its success with open data, and what others might do to emulate its open data experience: "We need a culture shift and a change in our mindset. We need to ask whether our assumptions about the benefits of closed data are still valid. We can learn about the benefits of making data open, how to mitigate risks and how to use and publish data better." [57]

Synthesis and Lessons from Open Data Stories

Taken together, these case stories suggest that the answer to the question, "how might ownership issues with open data be governed?", depends in large part on what kind of data is being discussed. The appropriate governance model for data covering the traditional knowledge of ILCs is likely to be different from the model for governing qualitative data held by a well supported NGO, and for governing big data collected by a multinational corporation. These stories also suggest that governance solutions must be found at both local and global levels. Table 3 compares and contrasts observations from each of these three distinct contexts.

These three case stories do not, of course, encompass the entire range of actors involved in collecting, using, and sharing open data. Drawing upon Deloitte's five archetypal open data actors as a framework, one can identify and situate the case stories within one of five different categories, which include[58]:

- **Suppliers:** organisations that publish their data via an open interface to allow others to use and reuse it.
- **Aggregators:** organisations that collect aggregate open data and sometimes, other proprietary data, typically on a particular theme, to find correlations, identify efficiencies or visualise complex relationships.
- **Developers:** organisations and software entrepreneurs that design, build and sell web-based, tablet or smartphone applications for individual consumption.
- **Enrichers:** organisations (typically larger, established businesses) that use open data to enhance their existing products and services through better insights.
- **Enablers:** organisations that facilitate the supply or use of open data, such as the competition initiatives.

These particular archetypes are intended to illustrate the various intermediaries that influence and shape how open data is shared. Depending on the type of actor involved, the goals, responsibilities, and methods of sharing data will differ.

There is, however, a missing voice among these archetypes. How open data is shared is also influenced by the type of farmer involved and individuals' access to available information. Even when data is made open, for more vulnerable small-holder farmers or individuals that lack the financial, educational and institutional capacities, it is unlikely they will be able to make effective use of the data[59]. Moreover, there is a risk of exploitation. One (speculative) example of the potential for exploitation is the examination of open data on soil profiles by powerful intermediaries, who might use the information to drive up prices of agricultural inputs as a way to extract greater margins from farmers[60].

44 Wright et al., "Using ICT to Strengthen," (n. 2).

45 + 46 D. Romney, R. Day, M. Faheem, C. Finegold, J. LaMontagne-Godwin, E. Negussie, "Plantwise: Putting Innovation Systems Principles Into Practice," Agriculture for Development 18 (Spring 2013): 27 http://www.taa.org.uk/assets/pubs/Ag4Dev18_web_upload.pdf. See also Cambria Finegold, MaryLucy Oronje, Margo C. Leach, Teresia Karanja, Florence Chege, and Shaun L. A. Hobbs, "Plantwise Knowledge Bank: Building Sustainable Data and Information Processes to Support Plant Clinics in Kenya," Agriculture Information Worldwide 6, (2013 / 2014): 96–101 http://journals.sfu.ca/iaald/index.php/aginfo/article/view/658.

47 + 48 Carolan et al., How Can We Improve, (n. 1).

49 Margo C. Leach and Shaun L. A. Hobbs, "Plantwise Knowledge Bank: Delivering Plant Health Information to Developing Country Users" Learned Publishing 26 no. 3 (2013): 180, at 185 http://onlinelibrary.wiley.com/doi/10.1087/20130305/full.

50 Martin Parr, "Who Owns Open Agricultural Data?" CABI: The Plantwise Blog (blog), December 4, 2015, accessed July 14, 2016 https://blog.plantwise.org/2015/12/04/who-owns-open-agricultural-data/.

51 + 52 Syngenta, The Good Growth Plan Progress Data - Productivity 2015, Syngenta (Dataset), published April 23, 2015, accessed July 14, 2016 http://www4.syngenta.com/~/media/Files/S/Syngenta/odi-progess/2015/data%20progress/c1productivity-description.pdf

53 + 54 + 55 Open Data Institute, Open Enterprise: How Three Big Businesses Create Value with Open Innovation, Working Paper: ODI-WP-2016-005 (London, UK: Open Data Institute, 2016) http://theodi.org/open-enterprise-big-business.

56 For example, Syngenta has excluded data sets from the USA in the Good Growth Plan. See Syngenta, The Good Growth Plan, (n. 51).

57 Elizabeth Fischer and Graham Mullier, "ODI Futures: How Can Open Data Improve Farmers' Choices?" Open Data Institute (blog), November 27, 2015, accessed July 14, 2016 http://theodi.org/blog/odi-futures-how-can-open-data-improve-farmers-choices. See also Open Data Institute, Open Enterprise, at 16, (n. 53).

58 Jellema, Meijninger, and Addison, Open Data and Smallholder Food, (n. 37).

The technological, social and legal framework governing data ownership is a significant factor in the power dynamics around open data. The fact that most vulnerable farmers do not really "own" any legal rights in respect of the data they provide or use—intermediaries like multinational corporate copyright holders, database manufacturers, and proprietors of data protected as confidential information do—poses a challenge to make open data more inclusive.

Institution	Category	Goal	Nature of Data	Classification of Ownership	Method of dissemination
BROSDI	Local NGO/ CSO; philanthropic	Empower local communities to utilize ICT, share and promote better farming practices through local content to improve food security.	Local: Indigenous knowledge and information.	Community/ local, public.	Online and offline platforms: videos, audio, printed texts, SMS text messaging.
Plantwise	International NGO; inter-governmental involvement; philanthropic	Strengthening plant health systems, crop protection, and pest management to improve farmer livelihoods and food security.	Hybrid: aggregated statistical data, diagnostic reports, and factsheets.	Host country ownership of plant clinics data, open access to Plantwise Knowledge Bank.	Online and offline: factsheets, Google app, online portal - Plantwise Knowledge Bank.
Syngenta	Multinational corporate commercial	Maximize shareholder value. Ensure food security for a rapidly growing population	Big data: Aggregated statistical data.	Corporate, permissive licenses for use of data derivatives.	Online portal.

Table 3: Practical Experiences and Perspectives on Open Data

59 Gurstein, "Open Data: Empowering," (n. 12).

60 Davies, "Data, Openness, Community Ownership," (n. 41); Ajit Maru, "Responses to ODI/GODAN discussion paper May 2015," accessed July 14, 2016 http://www.godan.info/responses-to-odigodan-discussion-paper-may-2015.

POSSIBLE GOVERNANCE SOLUTIONS FOR OPEN AGRICULTURAL AND NUTRITIONAL DATA

The previous section highlighted just three examples from the limitless array of applications of open data principles worldwide. No single governance mechanism is capable of resolving ownership issues across all diverse contexts. This section, therefore, introduces several governance strategies that could work in sequence or combination to address various aspects of the ownership challenges related to open agricultural and nutritional data. It offers a practical path forward for stakeholders to advance their own individual and collaborative work in this field.

There are four possible governance strategies presented. The first is inter-institutional cooperation to build understanding and consensus about the terms and conditions of ownership of open data. The second is model frameworks adopted at the local, national or regional level that can offer a governance example other jurisdictions might emulate. The third is a social certification scheme that leverages the power of ethical consumerism and market pressures to promote best open data practices. The fourth and final strategy is to work toward an international agreement on ownership of open data. These are shown in Figure 1.

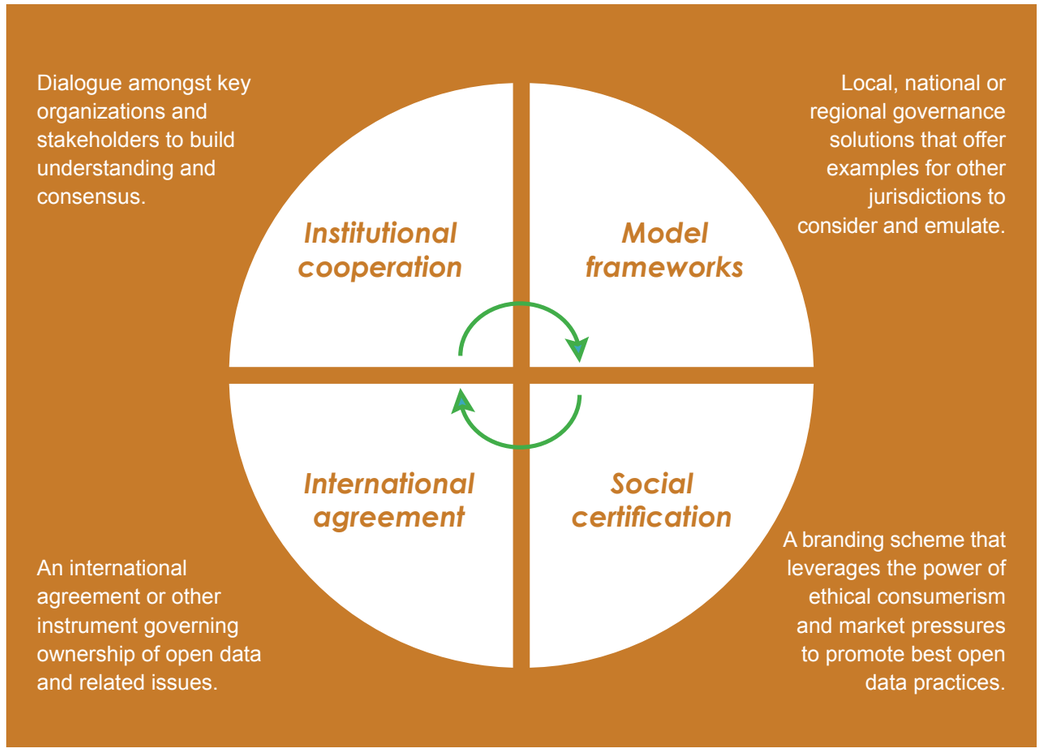


Figure 1: Strategy to Govern Open Data Ownership

61 "What is the Vital Data Infrastructure for Agriculture? Announcing a public consultation on an Agriculture Sector Package for the Open Data Charter," Open Data Charter, accessed on July 14, 2016

62 "Privacy and Security Principles for Farm Data," American Farm Bureau Federation, (37 signers as of March 3, 2016), accessed July 14, 2016 http://www.fb.org/issues/bigdata/privacysecurityprinciplesfarmdata.html; "Who We Are," Open Data Charter, accessed July 14, 2016 http://opendatacharter.net/who-we-are.

Inter-Institutional Dialogue and Cooperation

The first and most obvious strategy for working toward a governance solution to the challenges of ownership and open data is to continue inter-institutional cooperation. As a multi-stakeholder partnership, GODAN is already playing an invaluable role as the leading forum for thinking about open data in agriculture and nutrition.

In its role as a convenor, GODAN or a similarly situated organization may consider forming a working group to actively engage with ownership and governance issues. This might enhance the ability of a wide range of non-governmental, inter-governmental and private sector organizations to collaborate on solutions, such as drafting a consensus-based charter of open data rights and responsibilities.

The global community has established various forums and platforms by which key stakeholders can debate and study the future of open data. There are conferences such as the International Open Data Conference and the Global Conference on Agricultural Research and Development, as well as global multi-stakeholder action initiatives like an Agriculture Sector Package for the Open Data Charter[61], the Privacy and Security Principles for Farm Data[62], and others.

In continuing this work effectively, it would be crucial to have the support and engagement of:

- the open data community (represented by, for example, the Open Data Institute and/or Open Data for Development (OD4D) partnership);
- United Nations bodies responsible for both intellectual property and food and agriculture issues (including at least WIPO and the FAO);
- influential inter-governmental associations (such as the World Bank, WTO and OECD, for instance, as well as CFAR and similar bodies);
- major funding bodies who can help promote open data (for example, the European Union; national organisations such as the NSA, UK Department for International Development, Canada's International Development Research Centre; and philanthropic foundations like the Bill and Melinda Gates Foundation, the Ford Foundation, the Open Society Foundation, and others); and
- private sector, international NGO and grassroots community stakeholders (including the entities discussed in this paper, BROSDI, CABI and Syngenta, as well as grassroots farmers' groups).

Acting together, these groups have the power to establish a clearer and more inclusive understanding of what open data can be, promote dialogue about the best ways to deal with ownership challenges, and establish appropriate governance structures more generally.

This model has proven successful in open data generally, as illustrated by examples like the Open Data Charter[64]. A similar instrument could be contemplated for ownership and openness of agriculture and nutrition data specifically, if stakeholders had the right forum in which to discuss these issues.

Pioneering Model Laws/Policies at National Level

Even in the absence of international or inter-organizational cooperation, some countries have moved forward with an open data mandate. Countries like the United Kingdom and the United States arguably lead the pack, albeit in different ways.

The United Kingdom was recently ranked first in the world on the Open Data Barometer, scoring highly in all categories of analysis, from government policies to the availability of datasets to economic, social, and political impacts[65]. As such, it seems like a country that others would look to for example policies and practices they might borrow.

The United States, for example, pioneered a path toward open data through a series of official government policies established at the start of the Obama administration's time in office. Now, legislation has been proposed that would enshrine the principles of open data into law, and bind future administrations in the US[70]. The more countries that actively implement open data policies and practices, the more likely the effects will ripple around the world. In a way, this is what happened when the United States introduced legislation known as the Bayh-Dole Act in the 1980s. This legislation allowed recipients of public funding to privatize and commercialize research outputs through intellectual property rights. That law helped to usher in sweeping changes away from Open Science toward a much more closed model, and its effects have rippled throughout the world for over 30 years. There is the potential for new legislation promoting the opposite principles—openness—to help swing the pendulum the other way when it comes to ownership of data. Such opportunities should be further explored by the open data community.

It is crucial, however, that open data governance not be steered by a statistical horserace measuring indicators that are inapplicable in, or worse, inappropriate for developing and least developed countries.

The entire continent of Africa fared poorly on the Open Data Barometer[66]. It is necessary to ask whether this is the fault of failed policies, or indicators that don't fairly capture the kinds of open practices that pervade Africa's enormous but informal economies. The shortcomings of statistical analyses and indexing in respect of Africa are very well documented[67], and partly explained by the reality that innovation in Africa is inherently collaborative[68]. Countries in other regions of the world are likewise comparing and considering foreign examples of open data policies[69].

While it may not be ideal to encourage every country to chase indicators catering to foreign rather than domestic circumstances, there are valuable policy lessons that might be learned from international experimentation and comparison.

Social Certification Scheme

One of the most significant concerns around ownership of data is not appropriation per se, but rather "misappropriation" of data, especially from poor or otherwise marginalized communities. This problem is not new, although it is perhaps becoming more serious and apparent in contexts it had not arisen before. Previously, this problem arose over benefit sharing from the exploitation of genetic resources and traditional knowledge, issues that are explored in the next subsection.

Lessons can be learned from other fields where social certification schemes have been used to encourage ethical consumerism through compliance with product standards. Two somewhat related examples from the realm of agriculture and nutrition are the fair trade and organic movements. These movements work because an independent body is in charge of developing standards, auditing behaviour and certifying compliance. Consumers can then trust the certification marks authorized to be used on standards-compliant products.

The same could be done for data. With appropriate consideration and coordination, an independent body could be established and empowered with the responsibility of certifying certain data-related practices as open or not.

Datasets and similar products could be branded with a recognizable mark, assuring providence and compliance with best practices throughout the value chain related to that data.

Numerous organizations are already involved in projects related to the certification of compliance with open standards. In a recent article titled, "50

63 Carolan et al., How Can We Improve, (n. 1).

64 "Open Data Charter," accessed July 14, 2016 http://opendatacharter.net.

65 Carlos Iglesias and Kristen Robinson, Open Data Barometer, Third Edition: Global Report (Washington, DC: World Wide Web Foundation, 2015) http://opendatabarometer.org/3rdedition/report/.

66 François van Schalkwyk, Open Data Barometer, Third Edition: Africa Regional Report (Washington, DC: World Wide Web Foundation, 2015) http://opendatabarometer.org/3rdedition/regional-report/africa/.

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70 Joshua New, "Congress is Stepping Up to Protect Open Data," Centre for Data Innovation (blog), April 19, 2016, accessed July 14, 2016 https://www.datainnovation.org/2016/04/congress-is-stepping-up-to-protect-open-data/; Jason Hare, "US Open Data Legislation: The Right Way to Open Data at the Federal Level." OpenDataSoft (blog), May 9, 2016, accessed July 14, 2016 https://www.opendatasoft.com/2016/05/09/us-open-data-legislation-right-way-open-data-federal-level/.

71 Jeffrey Pomerantz and Robin Peek, "Fifty Shades of Open," First Monday 21, no. 5, (2016) http://www.ojphi.org/ojs/index.php/fm/article/view/6360/5460.

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Shades of Open," openness scholars and advocates describe several initiatives that might serve as either hosts or examples for an open data certification system[71]. They mention the Open Source Initiative's "Open Standards Requirement for Software," the Public Library of Science "Open Access Spectrum", the Apereo Foundation's "Openness Index", the Open Knowledge Foundation's "Open Definition," as well as efforts by scholars to develop frameworks for assessing open access journals. Another interesting example that those authors do not discuss, but has significant potential to deal with ownership issues in open data, is Provenance, a hybrid open source and private sector initiative that uses Blockchain to solve transparency issues in supply chains[72].

A New Legal Regime – International Agreement

Some commentators have suggested the potential for even greater and more formalized commitments to improve and enable the effective use of open data, by developing an international agreement on open data. One model is to follow a similar structure to other international agreements that address concerns related to community ownership of valuable intangibles, such as the genetic resources governed by the Nagoya Protocol to the Convention on Biological Diversity or the International Treaty on Plant Genetic Resources for Food and Agriculture. Such an international agreement could conceivably be used as a regulatory mechanism to address some of the key obstacles facing open data, including for example issues of exploitation and benefit sharing[73].

An international agreement may also help facilitate capacity building, technical enablement, and implementation of legislation required as a way to promote fair and equitable provision of open data[74]. On the other hand, an international treaty on open data benefit sharing may actually formalize the rights that in practice can be leveraged by powerful stakeholders, doing more damage than good. This is a complex issue warranting further study and debate.

Such an agreement would not be easy to reach. The process would take years, likely decades, to move past even preliminary negotiations. One significant challenge is the absence of a logical forum in which to hold such discussions. While the FAO would be one candidate organization for an agreement on ownership of data related to food and agriculture, it is questionable whether a data-related agreement limited to this domain is appropriate. It may be preferable to deal with open data as a topic that cuts across sectors and industries, making an organization like WIPO or the WTO a potentially more appropriate forum for discussions.

Even if a negotiating forum could be identified, there are fundamental preliminary issues that have yet to be resolved, including consensus-building on the meaning of "data" and "openness". Despite the definitions proffered by numerous organizations playing in this space, this brief paper and many other analyses have shown there remains considerable divergence of views and practices related to open data around the world.

For those reasons, a formal international treaty on open data should been as a long-term governance option, the pursuit of which ought not detract from more immediate and feasible possibilities.

73 Davies, Open Data, (n. 6).

74 + 75 Jellema, Meijninger, and Addison, Open Data and Smallholder Food, (n. 37).

76 "Agriculture and Nutrition session at Africa Open Data Conference," GODAN (the Global Open Data for Agriculture and Nutrition Initiative) (blog), September 15, 2015, accessed July 14, 2016 http://www.godan.info/challenges-for-global-open-data-in-agriculture-and-nutrition-the-godan-debate-at-aodc.

CONCLUSION

Open agricultural and nutritional data is becoming an increasingly vital resource in the advancement and innovation of farmer organizations, food production, value chain development, and provision of services[75]. Modern farmers use a considerable amount of data in making their day-to-day decisions, relying on key datasets such as weather data, market price data, and agricultural inputs data[76]. Often, the data that farmers in developing countries use is qualitative, derived from the traditional knowledge of ILCs, curated and transmitted with the help of NGOs like BROSDI. Initiatives operated by governmental or inter-governmental groups, such as Plantwise, use open data differently, and therefore face distinct issues of ownership and governance. Multinational businesses such as Syngenta are increasingly active in this area; they too have distinct interests and concerns around open data.

The predominant model of driving open data via voluntarily licence agreements, as opposed to more fundamental changes in the instruments governing data rights and responsibilities, presents substantial risks for all stakeholders. The most vulnerable actors lack the ownership rights to redress power imbalances in respect of open data. Intermediaries who have the most enforceable ownership rights have little guidance regarding the line between legal and ethical responsibilities to adopt fair data and benefit sharing practices. And the open data community as a whole faces uncertainty and instability in the governance of data ownership issues.

In the background of the open data movement, there remain overarching considerations that will influence how and if such data can be appropriated and utilized. In order for open data to be valuable, attention needs to also be paid to the capacity-related and institutional constraints of countries, particularly less developed and developing countries. For example, the report Delivering on the Data Revolution in Sub-Saharan Africa explained that basic components of national statistical systems in African countries, specifically Sub-Saharan African countries, remains weak[77]. There is limited access to technology, connectivity and the digital skills required to both use and publish datasets online. The costs and efforts associated with making such data available can also result in unequal distribution across a country, or even across different communities or groups within a country[78]. In other words, while everyone should have the potential to make use of open data, not everyone does. Many people lack the legal ownership rights—as well as digital infrastructure, financial resources, or skills and education—to share in the benefits of open data[79].

Numerous studies note the advantages open data can promote for governments and its citizens, including for example improving economic growth through innovation and enhancing social value[80]. However, without the basic building blocks such countries remain unable to capture the benefits open data can provide. Ultimately, this also speaks to the potential risks of greater exploitation by powerful actors, as those most vulnerable and without information may be willing to share more, while those least vulnerable may actually be the most cautious.

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78 Wright et al., "Using ICT to Strengthen," (n. 2).

79 Maru, "Rights of Farmers," (n. 36).

80 Hossain, Dwivedi, and Rana, "State-of-the-art in Open Data," at 29, (n. 7).

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DOI: 10.1079/CABICOMM-79-13