# Pathways Towards Open Data Standards for Agricultural Sustainability in New Zealand

In the related Policy Brief *Improving Sustainability through Investment in Primary Sector ICT Capabilities and Open Data Standards* we presented the opportunity to begin solving the major challenges from increasing data volumes, increasing data complexity and low primary sector ICT capability by defining and adopting open data standards for agricultural sustainability assessment and reporting (SAR).

This policy brief explores the opportunity in more detail and identifies pathways to enable meaningful progress towards the goal of improving SAR in New Zealand.

Defining the challenge

Increasing consumer and regulatory requirements for food are leading to increases in the need for trusted, reliable food production data to be shared between participants in the supply chain.
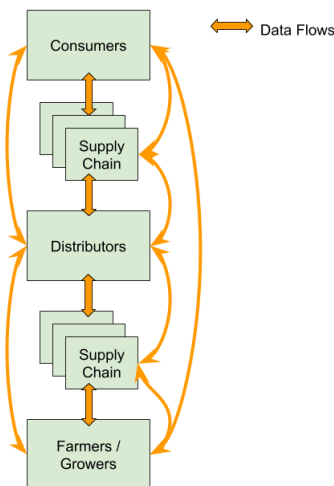
Agricultural supply chain data needs to flow in multiple directions between many supply

- The growing demand for sustainability assessment and reporting requires the establishment of secure and reliable protocols for data exchange.
- Currently, the lack of common 'data infrastructure' hinders opportunities for development and innovation. Most initiatives are not openly accessible.
- Progress has been made in the New Zealand agricultural sector in the last four years, but these initiatives are not directed towards sustainability data.
- A "Sustainability Data Standard" should be explored alongside the establishment of a broader code of conduct that includes regulators and potentially other stakeholder groups.
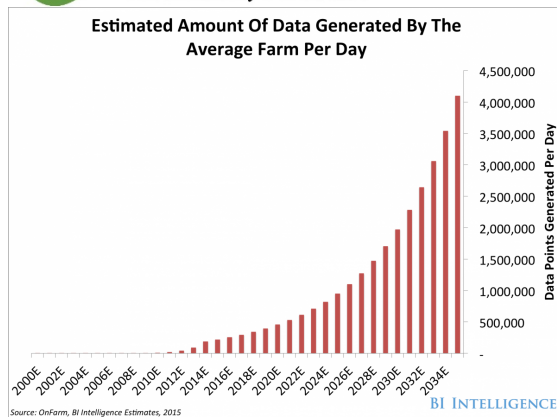
chain participants: farmers, distributors, consumers and everyone in between.

Agricultural supply chain data flows are being held back in New Zealand – and worldwide - by a lack of common "data infrastructure" to support easier data exchange and systems integration along the entire value chain. This is blocking opportunities for more rapid innovation and increased competition among agricultural information systems providers.

Current agricultural data management systems and frameworks are mostly closed, proprietary and non-scalable in the face of a forthcoming "cambrian explosion" of raw agricultural supply chain data. Market incentives to share sustainability data are also largely absent[1].

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[1] It should be noted that broader corporate sustainability reporting standards (internationally supported by organisations such as GRI - Global Reporting Institute and the Sustainability Consortium) also do not currently publish machine-readable data sharing standards.

Estimated Amount Of Data Generated By The Average Farm Per Day

Source: OnFarm, BI Intelligence Estimates, 2015

Identifying Solutions

Open data standards can inform decision making, enable innovation and promote transparency in agriculture. Examples such as the EU's Open Banking Directive are demonstrating how open data standards can accelerate development and innovation of market competitive services.

The comprehensive UK Open Banking Standards[2] are made up of four core components:

1. Technical Specifications
2. Security Profile
3. Customer Experience Guidelines
4. Conformance and Certification

Accelerated adoption of these Open Banking standards enables consumers to securely give financial services providers access to their financial information and opens the way to new products and services that help consumers and businesses get a better deal. It enables new applications to provide a more detailed understanding of finances.

In the same way as the Open Banking initiative has removed barriers to innovation, an Open Data Standards approach to agricultural data exchange – including SAR data - should be actively explored.

International Initiatives

There are several international initiatives to improve sharing of agricultural supply chain data. The appendix contains a high level analysis of key international initiatives identified, including:

- AgGateway
  - Including AgGateway Global Network
- EU INSPIRE
- OECD Data Portal
- UN FAO
  - SAFA
- Consumer Goods Forum
- Open Data Institute

A common feature across many of these initiatives is that they generally define proprietary data formats rather than openly accessible standards.

This leads to barriers to adoption and interoperability between players in the value chain, slowing down innovation and progress.

One notable exception to this is the European INSPIRE project. This directive aims to create a European Union spatial data infrastructure for the purposes of EU environmental policies which will enable the sharing of environmental spatial information among public sector organisations, facilitate public access to spatial information across Europe and assist in policy-making across boundaries.

Another standout is the work carried out by the Open Data Institute (ODI) to increase data sharing in agriculture:

"Agriculture is being transformed by data – especially open data – that is being used to help farmers, researchers and policymakers make more informed decisions.

Farmers use it to decide how and when to fertilise, plant or harvest; researchers use it to access crucial information; policymakers need it for evidence-based investments, and other

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[2] https://www.openbanking.org.uk/providers/standards/

groups can use it to make services more efficient across the agriculture value chain."

- Open Data Institute

The ODI's philosophy is that agricultural supply chain data should be "FAIR":

F indable A ccessible I nteroperable R eusable
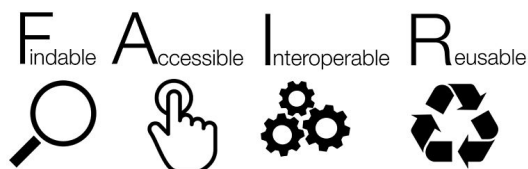
The ODI recently worked with the Bill & Melinda Gates Foundation to explore how to enhance data access and sharing within agriculture programmes in four regions: Andhra Pradesh and Odisha (in India), Ethiopia and Tanzania. They carried out a detailed "data ecosystem" mapping approach to understand the various participants in the agricultural value chain.

New Zealand Initiatives

In the last two years there have been significant advances in developing open data standards and other communities of data sharing for New Zealand agriculture.

In New Zealand there are now several consortia / groups working in agricultural technology and data sharing. The NZSD has identified the following initiatives (refer to high level analysis in the appendix):

- New Zealand Farm Data Standards
- New Zealand Precision Agriculture Foundation
- AgriTech New Zealand
- New Zealand Government
- New Zealand Sustainability Dashboard

The most advanced of these is the recently published *New Zealand Farm Data Standards* driven by the meat and dairy industries. This is made up of three recent initiatives funded by DairyNZ (through the Transforming the Dairy Value Chain programme), the Red Meat Profit Partnership and the Ministry of Primary

Industries through the Primary Growth Partnership. These initiatives are designed for organisations involved in collecting, storing, and sharing primary production data in New Zealand:

- Farm Data Code of Practice
- Farm Data Standards
- Data Linker

These are complementary tools aimed at getting data moving across the primary sector in New Zealand - securely, efficiently and within a transparent framework. The standards leverage the EU INSPIRE standards work. The Data Linker component currently defines simple open data schema for:

Animal Carcass, Animal Merits, Animals Traits, Animal Sessions, Pasture Covers

Location Pasture Growth Forecast, Regional Pasture Growth Forecast, Financial, Livestock transaction, Farm profile, Benchmark, Farm Assurance, Maps, Dairy.

Recently the following Farm Data common data standard specifications have been published:

- Animal Data Standard
- Land Application Data Standard
- Financial Data Standard
- Irrigation and Effluent Data Standard
- Stock Reconciliation Data Standard
- Farm Features and Attributes Data Standard
- Pasture, Grazing and Feed Data Standard
- Farm and Model Data Standard
- Health and Safety Data Standard

It is unclear how well adopted these standards are or under what licence, if any, these standards are published - and any restrictions on their adoption by 3rd parties.

It is particularly noted that none of these emergent standards include sustainability data as part of their vocabulary - restricting the ability to share sustainability information.

Potential Objections

Data Sovereignty, Ownership and Security

The New Zealand Farm Data Code of Practice website states that:

"The Farm Data Code of Practice requires organisations to outline the steps they take to safeguard farmer data…[so that]… they will implement practises that provide farmers with utmost confidence their data is safe and is managed appropriately."

This Code starts from the position that the Farmer *owns* the data. This position is open to challenge, particularly when concerning farm-sourced data which is strongly tied to regulation and the public good: for example environmental, biosecurity, disease control and food safety. Regulators may consider contributing to help define more widely acceptable data ownership and stewardship rules.

Sensitivities surrounding sharing farm data with 3rd parties are deeply embedded within the farming industry. Data originators (eg farmers, industry bodies) constantly need reassurance that they retain control over their proprietary data and when data is shared it is with explicit permission for specific uses only.

As above, whereas there may be an argument for some farm data to become part of a "data commons" - for example environmental compliance information, emissions data, livestock movements to better control disease spread - and supply chains may operate with greater efficiency if data sharing does not encounter friction at every turn, in practice the rights of data owners will need to be clearly established and firmly respected.

The New Zealand Farm Data Code Of Conduct provides a positive starting foundation for establishment of rules and conventions - however it needs to be noted that this is an industry-led initiative and does not clearly take into account the information rights of regulators and sustainability stakeholders.

In practice, accelerated critical mass adoption of open data standards may drive "path of least resistance" momentum as it creates efficiencies and innovation throughout value chains.

Summary: Benefits from an Open Data Standards Approach

Projected benefits from an open data standards approach to agricultural sustainability data would be:

- Reduced systemic cost and complexity for sustainability assessment and reporting
- Clearer information for farmers, consumers, regulators - every value chain participant
- More transparent comparison of sustainability goals and outcomes
- Development and innovation of market competitive services

Summary: Risks from an Open Data Approach

- Inertia from value chain participants to invest leading to low adoption
- Lack of buy-in from farmers
- Inaccurate measurement data / assessment
- Misinterpretation of data
- Loss of data rights / confidentiality
- Slow regulatory uptake
- International competition given a "leg up" by leveraging standards work "for free"

Implications for Policy

- Agricultural sustainability data can be considered a subset of the broader agricultural value chain data, it does not stand separately.

- The opportunity exists to accelerate sustainability outcomes by developing an open New Zealand Sustainability Assessment and Reporting Data Standard.

- A sensible first step would be to investigate the feasibility of forging a "Sustainability Data Standard" which leverages the momentum of other agricultural data standards work being done – in particular aligning with the outputs from the New Zealand Sustainability Dashboard programme and the New Zealand Farm Data Standards initiative driven by the meat and dairy industries.

- In parallel work should be done to establish a broader code of conduct under which New Zealand agricultural value chains share sustainability data in a trusted and secure manner - including with regulators and potentially other stakeholder groups - for example supermarkets, consumers and even environmental monitoring groups

- Ongoing standards development work in New Zealand should participate in and contribute to international data standards work being carried out around the world – in particular with the international AgGateway consortium and EU INSPIRE initiatives which appear to be gaining critical mass on a global scale.

Contacts
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Further Information

New Zealand Sustainability Dashboard Website:
http://www.nzdashboard.org.nz/

Appendix: Agricultural Sustainability Data Standards Landscape Scan

The NZSD project has carried out a landscape scan of international and New Zealand initiatives to improve data sharing for agricultural sustainability assessment and reporting.

Our overall finding is that, on the face of it, few of these are particularly mature or well-supported by users or tools.

A common feature across many of the organisations and/or standards identified is that they are generally proprietary and not specifically published for open adoption to enable new innovation and market-competitive services to interoperate.

It should also be noted that broader corporate sustainability reporting standards (internationally supported by organisations such as GRI - Global Reporting Institute and the Sustainability Consortium) also do not currently publish machine-readable data or data sharing standards.

International Initiatives

AgGateway

AgGateway is a non-profit consortium of businesses serving the agriculture industry, mainly in North America. AgGateway states its aims are to promote and enable the industry's transition to digital agriculture, and expand the use of information to maximize efficiency and productivity.

AgGateway recently (June 2018) launched ADAPT - Agricultural Data Application Programming Toolkit, an open source software project supporting data interoperability between multiple Farm Management Information Systems (FMIS) and precision agriculture systems.

The ADAPT solution is open source software implementation (built in C# upon the .NET Framework), not open data standards. Hence it is not implementation-agnostic and not directly supportive of an open competitive ecosystem for innovation.

However, the AgGateway consortium appears to have critical mass internationally on FMIS interoperability - it would definitely be worth examining how sustainability data use cases could be included in the ADAPT project.

The related AgGateway Global Network which aims to promote and establish global collaboration and coordinated use of global agricultural eBusiness standards, guidelines and implementation processes. This organisation is founded by large corporates and not-for-profit organisations in North America, Europe and with a focus on establishing a presence in Latin America. Currently there is no presence in Asia or Australasia.

EU INSPIRE

The European INSPIRE Directive aims to create a European Union spatial data infrastructure for the purposes of EU environmental policies and policies or activities which may have an impact on the environment. This European Spatial Data Infrastructure will enable the sharing of environmental spatial information

among public sector organisations, facilitate public access to spatial information across Europe and assist in policy-making across boundaries.

The Directive came into force in May 2007 and will be implemented in various stages, with full implementation required by 2021.

The European INSPIRE Geoportal is the central European access point to the data provided by EU Member States and several EFTA countries under the INSPIRE Directive. The Geoportal allows:

- monitoring the availability of INSPIRE data sets;
- discovering suitable data sets based on their descriptions (metadata);
- accessing the selected data sets through their view or download services.

The INSPIRE data standards cover many themes related to agricultural sustainability - for example the Data Specification for Soil provides a comprehensive set of guidelines for describing the properties of soil based upon internationally accepted scientific literature.

OECD

The Organisation for Economic Cooperation and Development (OECD) provides a downloadable database of statistics around a wide number of economic and environmental subject areas.

The OECD data portal currently provides statistics on two indicators related to Sustainable Agriculture - *Nutrient Balance* and *Agricultural Land*, based upon its 2013

publication *OECD Compendium of Agri-environmental Indicators*.

UN FAO

The Food and Agriculture Organization of the United Nations FAOSTAT website provides free access to food and agriculture data for over 245 countries and territories and covers all FAO regional groupings from 1961 to the most recent year available.

FAOSTAT provides basic descriptions of the datasets as well as providing these in machine readable format (XML and JSON). These metadata descriptions do not conform to any stated open standard.

UN FAO SAFA

Sustainability Assessment of Food and Agriculture systems (SAFA) is an initiative of the Food and Agriculture Organisation of the United Nations.

FAO built on existing efforts and developed a universal framework for Sustainability Assessment of Food and Agriculture systems

(SAFA). After 5 years of participatory development, SAFA was presented to FAO member countries on 18 October 2013. The SAFA Guidelines, Indicators and Tool and App are freely downloadable from the FAO website.

Uptake of the SAFA tool appears to have been very limited and further development of the SAFA tool appears to be discontinued and no data standards were developed. The "Agenda to 2030" talks about "improving national data systems" and an "online platform" for sustainability assessment management - however there is only mention of sharing "experiences" and "best practices" and no mention of sharing data.

Consumer Goods Forum

The Consumer Goods Forum (CGF) is a global industry network whose members have combined sales of €3.5 trillion, and are connected to around 90 million jobs through their supply chains. The CGF is driving the Digital Consumer Transparency Solution project - dedicated to helping improve data accuracy, focusing on providing consumers with easy access to trustworthy information on the products they buy and use.

This transparency initiative aims to provide consumers with detailed information about the food, beverage, personal care, household and pet care products they use and consume. A Digital Consumer Transparency Solution leverages digital technology and smart devices to bring consumers information about hundreds of product attributes that go well beyond the label. Consumers will have easy

and instantaneous access to detailed information about thousands of products.

Both the TSC and CGF are undertaking initiatives to standardise sustainability assessment practices and facilitate alignment to multiple sustainability standards with a single platform.

Open Data Institute

The Open Data Institute works with companies and governments to build an open, trustworthy data ecosystem, where people can make better decisions using data and manage any harmful effects.

The approach pioneered by the Open Data Institute is well proven now: the key being to make the data easily portable and implementation-agnostic and support a diverse ecosystem of providers.

The ODI supports the publishing of free tools and guides to help organisations to manage, publish and use data. The ODI contributes to the creation of technology, tools, standards, and techniques - for example the creation of "data ecosystem maps" to identify the key stewards of data within . The ODI's work focuses on five themes:

1. Publishing – making publishing data in the open simpler than keeping it closed.
2. Collaboration – enable open data publishers and users to work together to create and maintain high-quality datasets.
3. Discovery – help people find the data they are looking for, and discover

relevant data they didn't even know existed.

4. Integration – automatically combine diverse datasets to create new insights and support decision making.

5. Infrastructure – create a resilient global data infrastructure so that open data is universally accessible and reliable.

The ODI has worked in diverse sectors including financial services (being a key contributor to the aforementioned Open Banking initiative in Europe), grocery, government, personal data management and accommodation. They are also involved in a number of projects in agriculture and nutrition.

Recently the ODI published an article: Creating FAIR and Open Agricultural Data Systems which contains the following quote:

"Agriculture is being transformed by data – especially open data – that is being used to help farmers, researchers and policymakers make more informed decisions...Farmers use it to decide how and when to fertilise, plant or harvest; researchers use it to access crucial information; policymakers need it for evidence-based investments, and other groups can use it to make services more efficient across the agriculture value chain."

New Zealand Initiatives

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New Zealand Precision Agriculture Foundation

This association of organisations connects participants in the Precision Agriculture (PA) value chain to one common organisation – land users, researchers, commercial companies, Regional Councils, primary industry organisations, rural professionals and students. Its focus is on increasing the uptake of PA technologies in land-based primary production systems, accessing funding for research and the development of PA technologies, building capability within the sector and promoting adoption of PA through industry events, symposiums and field days.

The PAA does not appear to be actively investing in the development of data standards.

AgriTech New Zealand

Agritech New Zealand is a new association, launched in mid 2018, which is part of the wider New Zealand Tech Alliance and is engaged with integrating agriculture and technology to strengthen New Zealand's primary sector.

A recent article Can we please build some New Zealand agritech platforms? by Agritech's founding Executive Director, Peter Wren-Hilton, identifies the current fragmentation which exists in New Zealand agritech.

Agritech New Zealand could become the nexus for the development of open data sharing standards covering the wider agricultural economy (eg including horticulture etc), not just meat and dairy industries.

NZSD

The NZSD project has developed a framework for sustainability assessment to make explicit the sustainability outcomes being targeted, using aligned indicators for assessing performance. This can be used by primary producers and organisations as a basis for developing their own framework.

Within each pillar a hierarchy of five levels (Figure) has been created. The first describes the goal for the pillar, which is broken into the outcomes if that goal is achieved. Each outcome is further divided into objectives, or the intent of these outcomes. The achievement or movement towards the objectives will be shown by indicators for which measurements can be developed by each end-user of the framework.
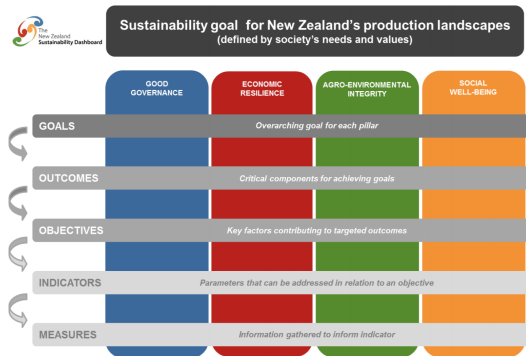
Figure : Outline of NZSD framework structure

There are no data-sharing or API data standards defined for the NZSD project. The various software implementations of this framework across various agricultural supply chains rely on proprietary data models and do not support sharing of data with 3rd parties.

Developing basic data sharing standards for NZSD would be a useful first "proof of concept" exercise to establish feasibility and demand.

New Zealand Government

The New Zealand Government is active in publishing open data and developing open data standards.

Key initiatives include:

- The https://data.govt.nz portal enables public to discover and use public data. At the time of writing there were 35 resources returned by the search term "sustainability".
- Similarly https://data.linz.govt.nz portal provides access to New Zealand public geospatial data held by LINZ.
- http://geodata.govt.nz provides a catalogue of New Zealand's publicly funded geospatial data.