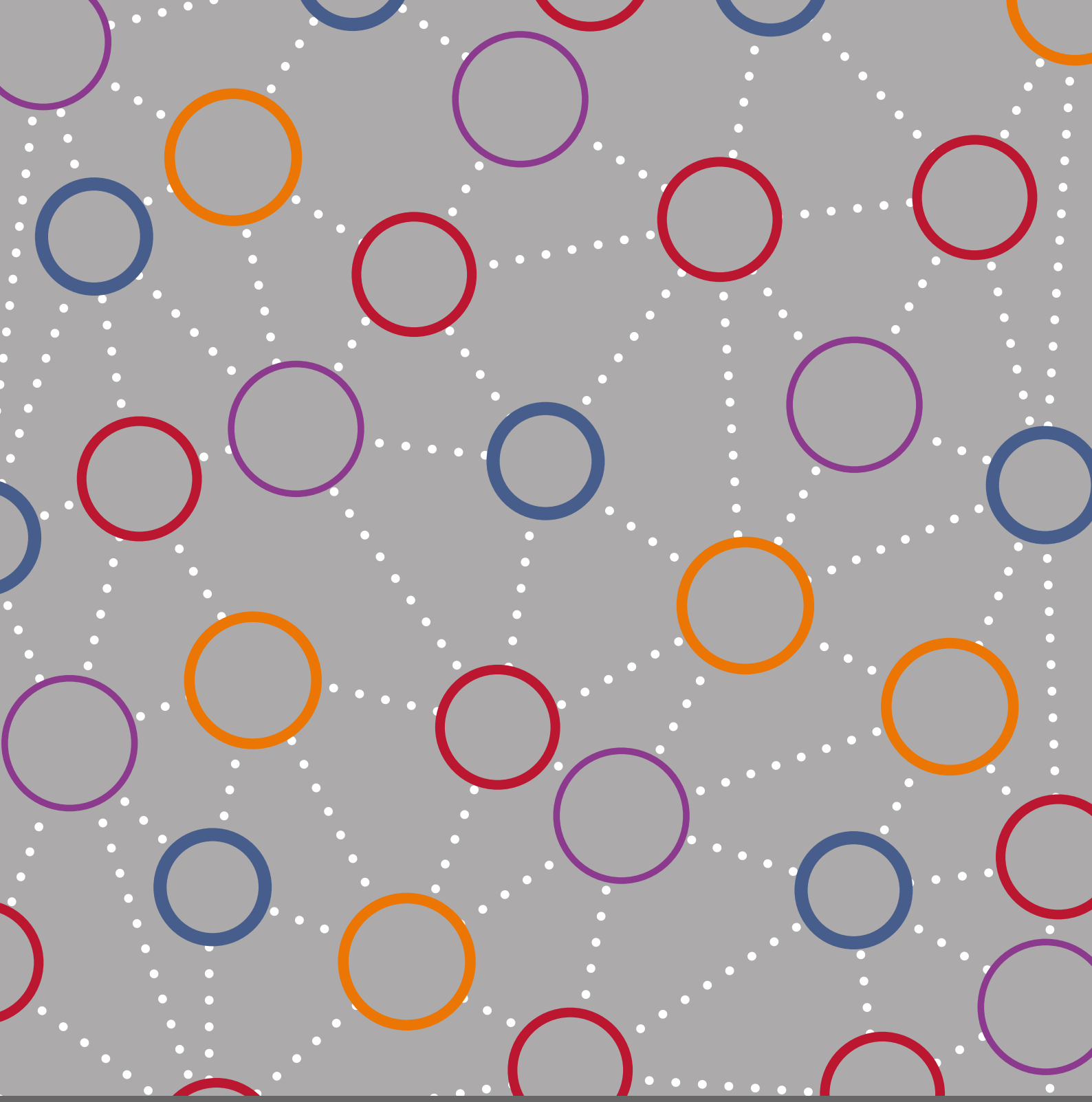

The frontiers of data interoperability for sustainable development

November 2017

development initiatives

Publish WhatYouFund
The Global Campaign for Aid Transparency

Contents

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Acronyms

API	Application Programme Interface
DAIP	Disaster Assistance Improvement Programme
EU	European Union
GPSDD	Global Partnership for Sustainable Development Data
HDC	Health Data Collaborative
IAEG-SDGs	Inter-Agency Expert Group on SDG Indicators
ISA2	Interoperability Solutions for public Administrations [programme]
JUDS	Joined-Up Data Standards [project]
MDG	Millennium Development Goal
NIEM	National Information Exchange Model
NSO	National Statistical Office
OPAL	Open Algorithms [project]
OpenHIE	Open Health Information Exchange
RHIE	Rwanda Health Information Exchange
SDGs	Sustainable Development Goals
SDMX	Statistical Data and Metadata eXchange
UNECA	United Nations Economic Commission for Africa
UNSC	United Nations Statistical Commission
UNSD	United Nations Statistics Division
UNWDF	United Nations World Data Forum

Executive summary

> There is an enormous gap in data use, integration [and] interoperability – the ability to make the most of all the data that are already available within national data ecosystems, regardless of their sources of production, and the ability to integrate and/or triangulate the various types and sources of data generated within countries.
>
> **2016 Africa Data Revolution Report**[1]

In simple terms, **interoperability is the ability to join up data from different sources in a standardised and contextualised way**. However, it is about more than just the form and structure of data, it is also about solving problems in a joined-up way. Interoperability can help reduce the time, effort and expense exerted on data collection; eliminate the frustration and risks associated with handling inconsistent and incomplete data; and meet the need for internationally comparable, sustainable, disaggregated data to ensure that no one is left behind.

Agendas including the Sustainable Development Goals, with its call to leave no one behind, the Data Revolution for Sustainable Development and the Open Data movement demand interoperability solutions at scale to help create a more holistic picture of development processes worldwide. Interoperability solutions rely on standards, which need to be set internationally to ensure consistency and comparability across the globe. However, standardisation needs to be driven by (sub)national needs and demands for better data. Changes to business-as-usual therefore need to happen from international to (sub)national levels and will take time.

Despite challenges, **progress in finding interoperability solutions is being made**. Based on our engagements over the course of the Joined-Up Data Standards project, in this paper we put forward five principles that we consider essential to implementing interoperability, including: **using and re-using existing standards, not overlooking metadata, using common classifications** wherever possible, **publishing data in machine-readable formats and ensuring that standards are user-driven**.

These guiding principles help to contextualise the frontiers of data interoperability for sustainable development that we have identified in this paper. Frontiers include: existing **principles being consolidated and universalised**, new **adaptable partnerships being formed** across data communities, stakeholders **moving away from exposing problems and towards solving them**, big **ideas starting to be turned into practical solutions**, and **global standards and regulations that work for all** starting to emerge.

Progress across these areas is being recognised and the **Cape Town Global Action Plan for Sustainable Development Data** launched at the first **UN World Data Forum** held in January 2017 calls for statistical methods to be modernised, including by leveraging the potential of interoperability. In response to this call, the UN Statistics Division and Global Partnership for Sustainable Development Data established a joint **Collaborative on SDG Data Interoperability**.

The Collaborative has the potential to play a crucial role in helping to coordinate progress across sectors and geographic regions and this paper suggests four recommendations for it to consider structuring its work around as it moves towards the second UN World Data Forum in 2018.

While the Collaborative will operate at an international level, to be meaningful interoperability solutions themselves have to have an impact at (sub)national levels. Our four recommendations (built on in Chapter 4) for the Collaborative are as follows:

- **Provide coordination around, and foster political support for, interoperability issues:** both across data communities and between data communities and the broader development community
- **Catalyse collaboration and knowledge sharing without duplicating existing work:** provide a forum for the sharing of national, regional and/or sectoral examples and lessons
- **Produce guidance and best practice recommendations for the consideration of global processes:** aimed at empowering governments to use data at (sub)national levels
- **Encourage new synergies across communities and between technical and policy stakeholders:** facilitate new case studies, approaches and partnerships across and within systems, both institutional and technical.

This report aims to provide an overview of the different definitions and components of interoperability and why it is important, and an outline of the current policy landscape (Chapters 1–2). It also explores the frontiers of interoperability policy and offers recommendations on what the role of the Collaborative could be in this fast-evolving landscape (Chapters 3–4).

The report is based on research and learning generated by the Joined-Up Data Standards project team at Development Initiatives and Publish What You Fund over the past two years, supplemented by desk research and inputs from key stakeholders from across constituencies who were interviewed as part of the drafting process. The report reflects the views of the Joined-Up Data Standards team at Development Initiatives and Publish What You Fund. While drawing on work and commitments made by the UN Statistical Division and Global Partnership for Sustainable Development Data, it is not a reflection of either organisation's views or positions.

Introduction

> Our main incentive is that we want to be able to deliver the data needed for meeting and monitoring the SDGs. Interoperability will enable us to deliver more and better data for different groups of users. This means faster, more relevant data, being able to provide a geospatial dimension and to be more open in the way we disseminate information. Ultimately it is about policy makers using data for better planning to address citizens' needs, but also citizens monitoring governments and holding them to account.
>
> **Dr Lisa Bersales, National Statistician, the Philippine Statistics Authority**

Recent years have seen significant progress in global discussions around the role of data to help meet and monitor the Sustainable Development Goals (SDGs)[2] and other aspects of the 2030 Agenda for Sustainable Development. Regarding interoperability in particular, the past two years have seen the principle being integrated into numerous international processes, from its articulation in the Addis Ababa Action Agenda,[3] to the Open Data Charter[4] and most recently its incorporation into the Cape Town Global Action Plan for Sustainable Development Data (Cape Town Plan).[5] Despite this progress, embedding the principle into day-to-day work remains a challenge, and this paper explores why that is. As decision-makers and advocates from local to global levels increasingly focus on the specifics of delivering and monitoring the SDGs, the urgency and opportunity for practical interoperability solutions is coming into ever-sharper focus.

Central to the 2030 Agenda is the appeal to 'leave no one behind' made by the UN Secretary-General at the opening of the Third International Conference on Financing for Development held in 2015. From a data perspective, the appeal has brought the need for far more disaggregated and granular data on left-behind, invisible and excluded groups to the forefront of global discussions. This is a welcome development that provides real opportunity for change in the way that data is collected, compiled, stored, aggregated and disseminated. To find and collect this data, stakeholders from across constituencies – at both national and international levels – will need to form new, adaptable partnerships and work together across previously segregated communities.

There is also a need to start considering **'data sustainability'** and to explore the role that interoperability solutions can play in helping to make sure that the right people consistently have access to the right data at the right time to help meet and measure progress towards achieving the SDGs. This need is made more urgent by the fact that a core tenet of the 2030 Agenda is country ownership and empowerment. Any new data streams, sets and interoperability models or tools need to be sustainable and integrated into existing working practices within national statistical offices (NSOs), line ministries and local government administrations.

At the first UN World Data Forum, held in South Africa in January 2017, governments, UN agencies, private sector companies, civil society organisations and global networks came together to explore innovative ways to apply data and statistics to measure global progress and inform evidence-based policy decisions on the 2030 Agenda. The Forum culminated in the launch of the Cape Town Plan,[6] which was adopted by member states at the 48th session of the UN Statistical Commission in March 2017. The Plan calls for a commitment by governments, policy leaders and the international community to undertake actions under a number of strategic areas and recognises the role of interoperability in modernising statistical standards and using new technologies and data sources to support mainstream statistical activities.

In response to this call to action, the United Nations Statistical Division[7] (UNSD) and the Global Partnership for Sustainable Development Data[8] (GPSDD/Global Partnership) established the **Collaborative on SDG Data Interoperability**[9] (the Collaborative). The Collaborative brings together a wide range of stakeholders to provide support, guidance and sharing of experience and best practice on how to join up data to meet and monitor the SDGs. The Collaborative has the potential to demonstrate how interoperability can be embedded into organisations' existing working practices and the value that it can impart.

Chapter 1: Interoperability: what it means and why it matters

Defining interoperability: different approaches to the same concept

A technical definition of interoperability

Interoperability is the ability to access and process machine-readable data from multiple sources, sometimes automatically, without that data losing meaning or integrity. Technology standards are key enablers of interoperability. Collectively, they allow different system components to be integrated and to work together seamlessly.

At the technical level, data interoperability requires **'syntactic interoperability'**, which is based on the widespread adoption of standard data formats, and the implementation of application programming interfaces (APIs) and connectors that allow data from multiple sources to be accessed and integrated.

Crucially, interoperability also requires data and information to be exchanged across systems without its context and meaning being lost; in other words, there is need for **'semantic interoperability'** across data systems. Semantic interoperability refers to how data items are described and mapped across different information systems in order to minimise ambiguity and ensure the adequate interpretation of individual data items. In this context, developing common vocabularies and classifications is crucial, for instance, to join up geospatial and statistical datasets.

For the lay user, perhaps the most important form of data interoperability is **'search interoperability'** which enables a user to conduct queries across two or more collections of data, most often through the World Wide Web.

Interoperability is a surprisingly tricky concept to define. In simple terms, it is ***the ability to join up data from different sources in a standardised and contextualised way***. This is a deceptively simple definition though. One of the greatest challenges when translating the concept into practice is ensuring that stakeholders share a common understanding of what it means. During the interviews for this paper, the first question[10] interviewees were asked was, "what does interoperability mean to you?" One interviewee poignantly responded by saying that, "the problem with interoperability is that it means different things to different people".

As the box highlights, ***technical definitions tend to focus on the form and structure of data***, emphasising the role of data standards as enablers. As one interviewee put it, "without standards it is hard to use datasets that are published. Standards enable governments to understand which datasets are valuable and help guide them." Similarly, another emphasised the role of standards in ensuring consistency across datasets held by different entities.

Notwithstanding the crucial role that standards play as enablers of interoperability, another interviewee stated that, "yes, we need joined-up standards but that's not the heart of it. We need to solve problems in a joined-up way – whatever that means." ***Interoperability is therefore about more***

than just the form and structure of data, it is also about solving problems collectively. Interviewees emphasised numerous characteristics of the concept that help clarify what this means and what benefits it imparts.

Interoperability enables **improved data usability and use**: "it is all about what people want to do with the information; how to make best use of data." It is also about **bridging gaps and bringing data communities together**; "using data from different sources and helping to understand how to make best use of it collectively." Crucially, it is also about **improving relationships**: "there are [data] silos, projects managed in a vertical way that work in parallel ways and don't interact. Different entities control their data in different ways, so it is all about how entities interact with one another." **Interoperability can also be an incentive**, as one interviewee said, "lets make things better by putting data together!"

A point that interviewees all agreed on was that **interoperability is a priority that needs translating into practice**: "we see a lot of potential. This is a priority and we want to operationalise the concept." However, as with its definition, translating interoperability into practice can also take different forms. Forging common understanding and mutual appreciation between stakeholders for what interoperability in practice looks like is itself a challenge that needs solving in a joined-up way.

Why interoperability matters: making the case for added value

> On our first field trip to Katakwi and Kitgum [Ugandan rural districts] we set about randomly collecting data to get an idea of what was available. In every school, clinic and office, officials provided us with electronic and paper snippets of budgets, school results, clinic performance, and demographic data. We thought we had discovered hidden treasure, and back in Kampala we set about making sense of it all. This was hard work. We had data from schools, clinics, parishes, and sub-counties. Different aggregations didn't join up. Reporting periods didn't sync. It was as if we were peering into a room through a shattered piece of dirty glass and seeing a partial and distorted picture. It took us a while to realise that what lies inside this room is indeed an untapped goldmine: there is a lot of good quality development data in Uganda.
>
> The problem is that much of this data is not publicly available and none of it is available in an easy-to-use electronic format. The government is not deliberately 'untransparent'. It is keen that its data is properly used – perhaps, even, overly worried about its misuse – and shares it with anyone who can formally present a case for how they intend to use it. The challenge is to show these ministries the value of their data being used more widely.
>
> **Excerpt from *Adventures in the Data Revolution: Collecting Ugandan Data*, by Bill Anderson and Bernard Sabiti (2015)**

The experience[11] described in the excerpt illustrates the reasons why there is a need to translate the principle of interoperability into practice in the development sector. Drivers include: **reducing the time, effort and expense spent on data collection** that is routine in many countries; **eliminating the frustration and risks associated with finding inconsistent and incomplete data**; and, **making available sustainable, disaggregated data for effective decision-making at a (sub)national level** to ensure that no one is left behind.

As the excerpt indicates, one of the challenges preventing the adoption of solutions is persuading political stakeholders of the *value* that accessible, open and interoperable data can impart to them and other users. **Making the political case for why interoperability matters is always difficult because by its very nature, persuading people that it is beneficial requires persuading them of value that does not yet exist**. Creating the case for value means overcoming challenges including bridging gaps between data producers and users; ensuring that existing standards can, and are, being re-used; making data-producing entities more open and ensuring metadata is consistently provided; new standards are developed in key areas; and, existing inventories such as the UN's Global Inventory of Statistical Standards are modernised.[12,13]

Sectoral efforts that have successfully rolled out interoperable solutions provide useful insights into what value interoperability can add as well as cautioning against common pitfalls. The Open Health Information Exchange (OpenHIE)[13], for instance, evolved from the Rwanda Health Information Exchange (RHIE) developed in 2009 and is now an international endeavour that seeks to address a lack of interoperable data in the health sector. Its history highlights both value and challenges associated with interoperability:

> "Health information systems, like healthcare personnel, also typically operate independent from one another. The result is disaggregated information stored in different locations and formats, making it impossible for data to be harmonised, and for healthcare personnel to share knowledge, collaborate in care, and truly understand the full breadth of an individual's history… Rwanda believed a better information architecture could support their strategic plan to achieve the Millennium Development Goal of improving maternal health outcomes (MDG 5). The Ministry of Health sought to better coordinate care and reduce key indicators by bringing together information from multiple care stakeholder groups, including the community health workers, hospitalists, and health clinic clinicians who were all providing care to maternal health patients. They coordinated their work through information architecture, with the establishment of the RHIE.
>
> The work in Rwanda exemplified the possibilities of health information architecture. RHIE served as an important reference example, as it helped the larger global health community understand how to practically instantiate interoperability at scale, and helped highlight the many technical, socio-political and capacity development challenges that accompany this type of initiative."[14]

Within the JUDS project too we have attempted to address a number of common interoperability-related issues and have produced a series of discussion papers[15] highlighting our findings. Early research explored real-world challenges including: how MDG and SDG goals, targets and indicators could be semantically mapped across each other to aid in the transition to monitoring the SDGs; exploring discrepancies in how international organisations categorise small island developing states and the difficulties this presents; and the overlaps between major household surveys, the difficulties this presents for developing states, and how an interoperable, modular approach could help overcome the challenges. More recently, discussion papers have focused on technical issues including: how metadata standards can help enable interoperability across open data portals; why and how data cataloguing can help enable interoperability; and suggesting a standardised approach to identifying government entities.

While there are different views on what interoperability means, we propose that it is fundamentally about creating joined-up ways of producing, sharing and using data. To meet the data needs of the SDGs it is critical that interoperability solutions create value for front-line decision-makers and those engaged in government accountability. Solutions need to abide by the principle of country ownership. However, standards and guidance need to be formulated at the international level to ensure comparability across the globe. Notwithstanding this, global principles and guidance themselves need to be driven by local and national needs.

Figure 1: Relationship between data standards, front-line data needs and sustainable data supply

Chapter 2: Harnessing the power of data for sustainable development: the role of interoperability

Interoperability and the data revolution for sustainable development

> The relationship between the Data Revolution and the post-2015 sustainable development goals has been the subject of much confusion. Data isn't just needed to monitor the goals but, more importantly, to meet the goals. Take maternal mortality. We do need to know how many women are dying, but, crucially, we need data that leads to an improvement in health services; data, for example, on the resources and performance of each clinic and hospital, on drug supplies and training pipelines.
>
> So what is so revolutionary about all this? It is the paradigm shift that is required for governments to recognise that national statistics on development must be based on disaggregated subnational data. Sustainable development requires sustainable data. This is a down-to-earth people-based revolution.
>
> **Excerpt from *Adventures in the Data Revolution: What Revolution?*, by Bill Anderson and Bernard Sabiti (2015)**

The data revolution for sustainable development[16] is about creating sustainable data infrastructures and ensuring that all people can be counted repeatedly and cost-effectively. It is not just about technology standards, but also knowledge sharing, the development of sustainable (sub)national capacity and systems, harnessing political support for data (from traditional and new sources), and increasing investments in information and official statistical production. Interoperability is a key tool that can drive and support this transformation.

The 2030 Agenda has reframed development as an integrated, indivisible and universal endeavour and squarely places the responsibility for meeting and monitoring the SDGs with national governments. In terms of meeting the goals, the SDG pledge to "*end all forms of poverty, fight inequalities and tackle climate change, while ensuring that no one is left behind*"[17] requires a level of data disaggregation that is not easily achieved.

To help monitor progress towards achieving the 2030 Agenda, the statistical community was tasked by the international community[18] to take action to transform how data and statistics are produced and disseminated to monitor the implementation of the 17 SDGs. The UN Statistical Commission (UNSC) was mandated to develop a global indicator framework supported by an Inter-agency and Expert Group on SDG indicators (IAEG-SDGs). A final global indicator framework was agreed at the 48th session of the UNSC in March 2017.[19] This places an increased demand on often under-resourced national statistical systems to produce the data required. Finding ways of making better use of existing datasets and standards, including by making them interoperable where possible, is imperative in helping to find ways to meet this increased demand.

In their role as central coordinating bodies within national systems, many NSOs have already begun carrying out gap analyses, mapping the data they have available at country level from existing and new sources to determine where

> National statistical offices have the fewest resources in government and struggle for visibility and recognition. Interoperability is about enabling them to take advantage of the opportunities of the data revolution and empowering them with the tools, skills and capacity to engage. Even when they do have the skills, a lack of governance, mechanisms and standards is a real barrier.
>
> **Francesca Perucci, Assistant Director, United Nations Statistics Division**

they have SDG data gaps. For example, Mexico's National Institute of Statistics and Geography estimates that it has data to cover approximately 40–50% of the SDG indicators. The Institute is in the process of designing its own national SDG indicators and looking to use non-traditional data sources such as Twitter, data from local research institutes and satellite imagery to fill them. This raises novel interoperability challenges, but also presents opportunities for best practices, recommendations and guidance to be shared with others.

The demands for data are growing as a result of the Sustainable Development agenda. **Few datasets tell a story in isolation and answers to real-world questions need data from different sources to be disaggregated and joined up** so that needs and impacts can be understood. Interoperability is a crucial component of the data revolution. While the revolution must be driven by country needs in accordance with the principle of national ownership, international partnerships and processes have a key role to play in setting standards, providing guidance and channelling resources.

Existing mechanisms: principles but not yet practice

> It is like a jigsaw: we have put together the pieces and found where we have gaps, now we need others to help us fill them. Guidelines and protocols on interoperability will be key to enabling us to use the data.
>
> **Enrique Ordaz-Lopez, Director General, National Institute of Statistics and Geography, Mexico**

Global and regional institutions are increasingly recognising the value of joined-up data (see Figure 2). Official statistics bodies are recognising the importance of embracing producers and users of new types of data as partners in their work. There has been considerable progress in bringing together stakeholders from across data communities, including national representatives, civil society, the private sector and academia. The GPSDD has been a key driver in supporting this process and advocating the benefits of the data revolution for sustainable development at a political level.

The UN World Data Forum (UNWDF)[20] represented a breakthrough for the international official statistics community, bringing together representatives from diverse data communities to discuss how to intensify collaboration efforts to harness the power of data for more sustainable development. It also signalled a shift in direction by the official statistics community towards a more inclusive process of partnership and consultation, which recognises the value of 'non-traditional data', for example citizen-generated data or data produced by NGOs or the private sector.[21]

The Forum adopted the Cape Town Plan,[22] developed by the High-level Group for Partnership, Coordination and Capacity-building for Statistics for the 2030 Agenda. This is based on consultation and input from members of the official statistical system and other data communities, including civil society, the private sector and academia. The Plan provides guidance for enabling national statistical systems to meet the data requirements of the 2030 Agenda, and identifies six strategic areas for action. Strategic area 2 of the Plan in particular sets out a roadmap for greater innovation and modernisation of national statistical systems[23] while recognising that this work will be country-led. It aims to:

- modernise governance and institutional frameworks to allow national statistical systems to meet the demands and opportunities of evolving data ecosystems
- modernise statistical standards, particularly those aimed to facilitate data integration and automation of data exchange across different states of the statistical production process
- facilitate the application of new technologies and data sources into mainstream statistical activities.

Importantly, the plan aims to develop a mechanism for the use of data from alternative and innovative sources within official statistics, to revise the Fundamental Principles of Official Statistics to include relevant aspects of open data initiatives and to:

> "define and implement standardised structures for the exchange and integration of data and metadata on the social, economic and environmental pillars of sustainable development and at all levels (global, regional, national and subnational), following the SDMX and related standards [and] promote interoperability of these systems to facilitate such integration".

Statistical Data and Metadata eXchange (SDMX)

SDMX is a global initiative to improve the exchange of statistical data and metadata. Initially developed for the exchange of fiscal data, it is increasingly being applied to data relating to socioeconomic indicators. SDMX standards are now the recommended conduit for state reporting on progress being made towards attaining SDG indicators. For more information see: https://sdmx.org.

Although the principle of interoperability is consolidated in the Cape Town Plan, significant questions remain on how data-sharing practices should be regulated and balanced with other concerns including confidentiality, anonymity, data integrity and security. The two NSO representatives interviewed for this report highlighted the need for international guidance on how to establish partnerships with new stakeholders such as the private sector, research institutes and NGOs and also on how to join up these new sources of data with official sources, while taking into account the Fundamental Principles of Official Statistics[24] and issues such as privacy and data integrity.

Figure 2: Interoperability in sustainable development processes

Chapter 3: The frontiers of interoperability policy: progress and developments

> We are realising that if we don't change, we won't be able to meet the needs of policy-makers by informing decision-making in real time. We need to develop guidance, protocols and best practices that help us to share data, especially from new sources. To achieve this we should be enabling different data communities to work together in order to build trust and understanding. It is a cultural shift that will take patience and time.
>
> **Oliver Chinganya, Director of the African Centre for Statistics at the UN Economic Commission for Africa (UNECA).**

Throughout our engagements over the course of the JUDS project, many stakeholders expressed interest in the principles that underpin interoperability. In response, we identified a set of guiding principles that we consider essential to implementing interoperability.[25] They are:

- **Use and re-use existing standards:** no new standards should be created in areas they already exist unless absolutely necessary. When new standards are created, they must be compatible with existing standards.
- **Do not overlook metadata:** metadata includes information on origin, authors/producers, date of production/version, etc. It is crucial for discoverability, accessibility and fostering trust and understanding of the context in which the data was produced.
- **Use common classifications wherever possible:** as more and more data is produced, we need to ensure that to the extent possible, the language used to define and classify that data is the same.
- **Publish data in machine-readable formats:** publishing data in machine-readable formats is crucial to interoperability. It enables a computer to access, identify and filter data in an automated way.
- **Ensure that standards are user driven:** for data to be usable, it has to be driven by the needs of users themselves. The process of ensuring that data is usable can be complex and require trial and error, but is crucial to long-term success and impact.

These guiding principles help to contextualise the five frontier areas set out below that we have identified where progress is being made in scaling-up interoperability solutions.

Consolidating existing principles

Principles that relate to interoperability are currently set out in documents covering a number of agendas – from the Open Data Charter, to Financing for Development outcome documents and most recently the Cape Town Plan, among others. Notwithstanding the different origins of these documents,

convergence across the agendas that underpin them is beginning to happen and the harmonisation of principles across communities is now less a question of *if* but *when*.

For example, it is a welcome development that open data has been included in the provisional agenda for UNSC's 49th Session in 2018. The Commission's encouragement for groups working on big data, geospatial and statistical integration, fundamental principles and quality frameworks to take relevant aspects of open data into account in their respective work programmes is also welcome.[26]

One of several next steps could include more detailed work on how Principle 4 of the Open Data Charter on interoperability could be incorporated into guidance for NSOs, such as the *Handbook of Statistical Organisation*.[27] Moreover, technical best practices, such as the World Wide Web Consortium's *Data on the Web Best Practices*[28] should not be excluded from efforts to consolidate and universalise existing principles and their use should be encouraged as standard practice.

As interoperability gains more traction it will be crucial to ensure that communication and advocacy efforts align across agendas and that knowledge and best practices are shared.

> At the core of official statistics and open data, is the idea that information is vital for institutions to deliver better results. The open data and statistics communities can benefit from working more closely together. For example, the open data community could learn from statistical practice on data quality by making sure structural metadata guides how data is generated and the statistics community could learn from open data's good practice on sharing timely and reusable information. Interoperability is a shared agenda for both communities that could greatly benefit an evidence-based delivery of SDGs.
>
> **Ania Calderon, Executive Director, Open Data Charter**

Moving beyond exposing problems and towards solving them

Much work has also been done by numerous organisations, partnerships and collaborations to start to move towards solving specific interoperability challenges. In the JUDS project, in addition to the series of technical discussion papers[29] that focus on challenges, a new suite of practical tools[30] is now focusing on solutions. Overall, an increasing number of data initiatives are creating more sector-specific practical guidance, tools and approaches including: the Open Data Charter's *Open Up Guides*,[31] the partnership-focused work being undertaken by the International Civil Society Centre,[32] Open Knowledge Foundation's 'Frictionless Data' packages,[33] the Health Data Collaborative,[34] and GODAN,[35] which aims to enable partners to share open data on agriculture and nutrition.

The Health Data Collaborative (HDC)

Launched in March 2016 within the context of the 2030 Agenda, the HDC is a multi-stakeholder initiative working to improve the availability, quality and use of data for local decision-making and to track progress toward the health-related SDGs. The HDC aims to support country-level statistical capacity and enable development partners to align their technical and financial commitments around nationally-owned health information systems and a common monitoring and evaluation plan. The HDC has established a Digital Health Systems and Interoperability Working Group which aims to: *"optimize the meaningful use and reuse of health information in low and middle income countries to support achievement of SDGs through the implementation of foundational digital health infrastructures"* and *"actively promote the development, use, and long-term support of digital health 'global public goods' "*.

Some interoperability solutions provide direct benefits to citizens. The US's National Information Exchange Model (NIEM)[36] provides a "common vocabulary that enables efficient information exchange across diverse public and private organisations." One of NIEM's success stories is the Disaster Assistance Improvement Programme (DAIP)[37] which provides,

> "a single access point for more than 40 federally funded forms of assistance. Using NIEM as the data layer foundation, DAIP connects partner agencies that provide disaster assistance to survivors… By consolidating benefit information, application intake, and status information into a unified system, survivors can apply for assistance from 17 US government agencies with a single, online application."

In addition to making life easier for vulnerable citizens, the DAIP system also ensures that the authorities receive near real-time and up-to-date information on how many citizens have been affected by a disaster, where they are, what support they are accessing and from which agency.

Open Data Charter's 'Open-Up' Guides

The Open Data Charter is working to support governments on how to integrate open data good practices – including interoperability – by developing and road-testing guides for sectors. For example, the ***Open Up Guide: Using Open Data to Combat Corruption*** developed by the Open Data Charter, Transparency International Mexico and the Open Contracting Partnership has mapped 30 priority datasets in the anti-corruption domain, identifying the key features the datasets need to have to be interoperable. The Guide is being road-tested with the Government of Mexico and further sector guides on climate action and agriculture are planned for the future.

Turning big ideas into practical solutions

A substantial share of current literature on the data revolution is still replete with generalisations about the benefits of technology, big data, open data and interoperable standards. But aspirational generalisations are no longer sufficient and increasingly these 'big ideas' need to be turned into practical solutions. This is starting to happen and efforts should be scaled-up moving forward.

On big data, the **Open Algorithms Project's (OPAL)**[38] initiative is exploring how statistical information can be produced from new data sources while "leveraging the power of platforms, big data and advanced analytics for the public good in a privacy-preserving, commercially sensitive, stable, scalable and sustainable manner." The way the OPAL project does this is to provide open access to statistical information extracted from privately owned, commercially sensitive data which remains protected and unexposed behind the data owner's firewall. The example of OPAL exemplifies how big ideas can be turned into practical and tangible solutions in the development sector.

OPAL also highlights the need for convergence between technical and policy professionals to ensure when applied as a solution, adequate governance and regulatory regimes are in place. User needs assessment workshops such as the one held in Senegal in April 2017[39] can play an important role in bringing stakeholders together. The EU's Interoperability Solutions for public Administration (ISA[2]) programme[40] is another example of how policy and technical experts can work together to foster interoperability solutions across countries.

Other initiatives are exploring how big data correlations can be absorbed into the workflows of NSOs and line ministries. For example, the UN's Global Pulse Network, through its Pulse Lab in Kampala, Uganda, has conducted a number of pilots[41] using machine learning to analyse radio content in Uganda. The pilots "show how the exploration of unconstrained public radio discussion can inform programmes to achieve the SDGs." For example, public radio discussions on the influx of refugees from South Sudan into Uganda were analysed as part of one of the pilots. Insights gleaned from the conversations helped to reveal anecdotal evidence of the emerging food crisis and therefore helped in the completion of needs assessments.

> It has become vitally important to ensure free movement of data in Europe. Digital transformation of public services benefits EU citizens and businesses. EU local administrations improve thanks to digital services with direct benefit for citizens and businesses.
>
> **Mariya Gabriel, EU Commissioner for Digital Economy and Society, Digital Single Market Conference on the Free Movement of Data, 17 July 2017**

Big ideas are being turned into practical solutions at a regional level too. UNECA is championing the demand to make statistics open by default[42] and is targeting its campaign directly at its members' NSOs. Uganda's draft Open Data Policy[43] is an immediate outcome. Its vision is "to embed a culture of 'open data by default' within the Uganda public sector in order to drive public service efficiency, stimulate innovation and economic development".

Producing global standards and regulations that work for all

While progress is being made towards making existing standards more interoperable with each other, other than in limited instances, there is little sign that large standard-setting institutions are working together to develop new standards jointly. As all the examples given in this chapter, and many more, continue to evolve, there is a need for global standards that work for all to be developed. This will require new synergies and partnerships between institutions and organisations that have traditionally developed their own standards in isolation from one another.

One timely challenge relates to the need for more disaggregated data in order to meet the call to leave no one behind. Developing a global anonymisation standard to enable disaggregation is also arguably an essential component of developing scalable and replicable models for making statistical data open by default. This in turn is a precursor to opening up the opportunities linked to making the best use of existing data, including by making it interoperable with other data. In practice, the more that data is disaggregated, the greater the risk of privacy violations. While OPAL has found ways of overcoming this challenge in the way it harnesses the potential of big data, there is still an urgent need for a pragmatic and trusted global standard to govern the anonymisation of microdata. How for example can NSOs currently be expected to open up the wealth of information hidden in the microdata of national censuses?

More broadly, while technical solutions are being found, the scale of the policy, legal and institutional challenges decision-makers face when attempting to set up system-wide regulatory regimes to govern data sharing, interoperability and integration should not be underestimated. Officials in public administrations often have valid concerns about confidentiality, individual privacy and data protection, and open data licensing versus copyright law, all of which have a significant impact on their ability to use new sources of data. NSOs interviewed for this report emphasised the need for common principles and guidance on how to address the policy, legal and institutional challenges they are facing when using non-traditional sources of data, including big data or data generated by new actors such as the private sector, academia or NGOs. International organisations, as both producers and users of large development data sets also need to address many of these challenges.

Returning to the example of big data, a starting point in identifying an approach is set out in the UN Development Group Guidance Note, *Big Data for Achievement of the 2030 Agenda: Data Privacy, Ethics and Protection.*[44] This effectively summarises existing traditional and well-established legal and regulatory principles[45] to help guide the instances in which it would be legal, ethical and appropriate to integrate big data into development data systems.

> Interoperability is critical from an accountability perspective. Governments are doing business with private sector on service delivery to support development outcomes and this is the activity most vulnerable to waste and corruption. For example, procurement monitors want to be able to track project spending against departmental budgets. If available, the data will often be in different formats held by different government departments or even by international aid donors in their own systems.
>
> **Lindsey Marchessault, Director, Data and Engagement, Open Contracting Partnership**

Notwithstanding the existence of this guidance, traditional legal principles are insufficient in and of themselves to provide a holistic regulatory framework. For this to be achieved, safety measures need to be built into data systems from the outset; so-called 'privacy by design'.[46] This view is set out more clearly in a recent article, *Regulation of Big Data: Perspectives on Strategy, Policy, Law and Privacy*[47] in which the authors contend that,

> "appropriate regulation of Big Data in the private and public spheres lies beyond the capacity of such traditional legal instruments as constitutional principles, statutes, regulations, and case law. To be effective in the Web of Data there is an increasing need to complement them with other tools of semantic and algorithmic nature."

This is one of the key emerging areas where regulations and standards are still needed.

Creating new adaptable partnerships

The first UNWDF opened the door for new partnerships in the data revolution for sustainable development and created the opportunity for the Collaborative to emerge. Bridges between NSOs and other data communities are being built and the UNWDF process that started in Cape Town in January 2017 will continue to play a crucial role in consolidating mutual understanding and trust between them.

Significant progress is also taking place at national level with many countries creating links between their national development strategies and other frameworks including the SDGs and the African Union's Agenda 2063[48] – both in terms of strategic alignment and their data assets. A number of national-level actors are also leading the way in forming new and innovative partnerships through the data revolution roadmaps processes, some of which are supported by the GPSDD[49]. Moving forward, the GPSDD can play a crucial role in fostering new synergies and partnerships, as well as helping to raise the political profile of the data revolution for sustainable development data.

Although progress is being made, NSOs interviewed for this report also highlighted the tendency for government working groups to work in parallel silos. They lack opportunities to interact but also often want to control their own data, rather than collaborate and share it. Similar tendencies are also reflected at the international level as standard-setting work continues to take place in highly specialised technical, issue and organisation-specific forums. As a result data silos persist, limiting the possibilities of data integration. Despite increasing acknowledgement that data silos form as a result of institutional decisions, solutions are still primarily sought in technical circles with limited policy engagement and leadership across data communities. Partnerships are therefore needed not just across sectoral issues or data communities, but across professions too – between statisticians, data scientists, development experts, economists, lawyers and politicians, as in the earlier examples of OPAL and ISA[2].

Changes in the way that institutions and individuals work with data on a day-to-day basis will take time and patience. In the meantime, Development Initiatives' discussion paper *Common cause, common language: harmonising key concepts in the Data Revolution*[50] highlights that a number of countries have adopted a broad, inclusive definition of the 'national statistical system', expanding it to include non-traditional stakeholders and data communities. Were this approach adopted more widely, it could help foster even more new synergies and partnerships.

Chapter 4: The role of the Collaborative on SDG Data Interoperability: recommendations

> The clear benefit is that we do have the possibility to turn interoperability into a universal political framework. Working in partnership with UNSD will enable us to scale this up and deliver much bigger change. We need to hardwire this into the Collaborative from the beginning in terms of the work we are doing and the way we are working.
>
> **Dr Claire Melamed, Executive Director, Global Partnership for Sustainable Development Data**

The JUDS consultation paper *From Principles to Practice: a consultation on joined-up data standards*[51] published in July 2016 called for joined-up coordination and integrated structures and mechanisms to drive the data revolution for sustainable development forward, "at speeds commensurate with both the aspirations and urgency of current global ambitions." Despite progress in certain sectors, regions and countries, there is still an urgent need for multi-stakeholder coordination at the *global level* to help guide and inform discussions around interoperability and bridge the gap with (sub)national decision-makers' needs.

This need was recognised by both the UNSD and GPSDD at the UNWDF, where a pledge was made to establish a joint **Collaborative on SDG Data Interoperability**[52] to be convened by both organisations with a view to creating a space in which coordination across different initiatives can take place, knowledge can be shared, guidance derived and experimentation with solutions encouraged.

Collaborative on SDG Data Interoperability

The Collaborative is an outcome of the first UNWDF and is jointly convened by UNSD and the GPSDD.

It aims to contribute towards the development of a data ecosystem in which data from multiple sources relating to sustainable development can be easily accessed by anyone and integrated seamlessly with other information.

The Collaborative is multi-stakeholder by nature and is underpinned by principles of openness and inclusion, participation, non-duplication of existing work and encouraging replicability. It is open to all organisations, states, partnerships, institutions and businesses that have an interest in data interoperability for the SDGs.

It is a need that is recognised more broadly given that over-arching global guidance and principles to support the implementation of sector approaches at (sub)national level are still lacking. Neil Jackson, Chief Statistician in the UK's Department for International Development warned of the risks of duplicating the work done by existing initiatives and emphasised the importance of, "leveraging the results of experience for greater learning and impact – **in particular on joining up data across different sectors** – and feeding into global SDG processes. By helping to address some very specific interoperability challenges, the new Collaborative on SDG Data Interoperability could provide real added value and demonstrate impact [emphasis added]."

Although the need for the Collaborative is broadly recognised, a number of risks were also identified by interviewees. In particular, risks around whether or not the Collaborative has enough momentum behind it and is sustainable were identified. Ensuring that the Collaborative focuses on practical, achievable objectives will be crucial to mitigating against these challenges. More broadly, the Collaborative will need to contend with the challenge that different stakeholders define interoperability in different ways, highlighted in Chapter 1. This challenge is also an opportunity however; building a shared appreciation of challenges and solutions across different data and professional communities, and across policy and technical stakeholders, is itself a central rationale for establishing the group. Overall, stakeholders agreed on the need for the Collaborative to identify 'quick wins' to demonstrate proof of concept by the time of the next UNWDF in 2018.[53]

The Collaborative has the potential to play a crucial role in helping move discussions forward across all five areas identified in the previous chapter. Based on the experiences of the JUDS project and interviews conducted for this report which reveal where the Collaborative is able to add the most value, this chapter sets out four recommendations for the Collaborative to consider structuring its work around as it moves towards the second UNWDF in 2018.

Provide coordination around, and foster political support for, interoperability issues

> There are many international initiatives driving the open data and sustainable development agendas, but it is clear that successful implementation requires local ownership and the political will in order to change long-held work practices, and to engage meaningfully with users.
>
> **Shaida Badiee, Managing Director and Co-founder, Open Data Watch**

A key function of the Collaborative should be to facilitate coordination across data communities and also between data communities and the broader development community.

While stakeholders who were interviewed as part of the process of drafting this report support this agenda, some respondents questioned the extent to which there is buy-in from the broader community working on sustainable development or those working in specific sectors. There was strong consensus that the Collaborative should play a key role in continuing to build political support for this agenda, given that it is well placed to feed into broader political discussions at a global level on the importance of interoperability and the need for investment in this area.

Catalyse collaboration and knowledge sharing, without duplicating existing work

The Collaborative should provide a forum in which knowledge and examples pertaining to interoperability solutions can be shared.

Many stakeholders interviewed saw the role of the Collaborative as a 'catalyst for change' or an enabler/helpful knowledgeable advisor providing guidance to the wider community on data governance, standards and guidelines that promote and support interoperability. However, there was also strong consensus that the Collaborative's ultimate aim should be supporting and empowering national actors in meeting and monitoring implementation of the SDGs, in accordance with the principle of country ownership. In order to achieve this, mutual learning will have to be at the front and centre of the Collaborative's work to ensure that mutual understanding and appreciation for what interoperability means to different stakeholders is developed.

Produce guidance and best practice recommendations for the consideration of global processes

The Collaborative should aim to provide recommendations, guidance and new opportunities for synergy to empower governments to use data for decision-making and monitoring at the national level. Respondents suggested identifying and exploring activities at (sub)national level to provide evidence-based examples of how interoperability can be achieved in a particular country, potentially in relation to a specific SDG or indicator. Guidance and best practice recommendations should be based on what is already going on in-country and should be clearly driven in a bottom-up way by country needs.

The Collaborative should initially focus on identifying existing examples of good practice that have 'strategic resonance' and from which useful lessons and guidance relevant to others could be derived. Case studies should also be sequenced logically so that solutions can help foster new innovation over time. The opportunity of exploring work already being undertaken by NSOs on tier 2 or tier 3 SDG indicators in a particular national context where there is a lack of official data was also suggested. This could be done by mapping the standards and datasets that apply, identifying the gaps and potential new sources of data to fill them, hence building on the gap analyses work already conducted by the NSOs interviewed for this report. Making SDMX user-friendly by creating adaptors as a tool to simplify its use by NSOs was also suggested but it is important to note that more system-wide case studies also need to be identified.

The Collaborative should then bring together examples, discuss and derive recommendations, and feed them into global standard and guidance-producing processes.

Encourage new synergies across communities and between technical and policy stakeholders

The Collaborative should catalyse the formation of new synergies between stakeholders to develop new case studies, approaches and partnerships across and within whole systems, both institutional and technical.

Stakeholders interviewed as part of the drafting process highlighted the importance of reaching out to innovative and influential NSO champions and regional actors (such as the UN's Regional Economic Commissions) to involve them in the initiative. In terms of capacity building it was suggested that the Collaborative could benefit from Paris21's[54] expertise in this area.

One of the Collaborative's core objectives should therefore be to make the case for interoperability by demonstrating its benefits, in particular for governments and NSOs with limited resources while respecting the principles of country ownership and non-duplication. Developing practical examples or case studies on how interoperability has been achieved in a specific sector or country could support this process. The second UNWDF in 2018 would be a key opportunity to showcase these.

Conclusion

> We are all pursuing a common objective: ensuring that the right data can be accessed and used by the right people at the right time so that they can make better-informed decisions. The commitments on interoperability exist, the technology exists too; all that is now required is the political will. For that to be fostered, joined-up leadership will be critical.
>
> **Except from *Joining-up data standards requires joined-up leadership*, a blog by Tom Orrell, published by GPSDD in August 2016**

Despite global recognition of the need for joined-up coordination and integrated structures and mechanisms to drive the data revolution for sustainable development forward, interoperability has remained a surprisingly tricky concept to define. In this paper we put forward a simple definition, describing interoperability as the ability to join up data from different sources in a standardised and contextualised way. It is fundamentally about creating joined-up ways of producing, sharing and using data.

Moving from principle to practice by embedding interoperability into day-to-day work continues to present challenges. The demand for solutions that scale is only going to grow in response to the need for a more holistic picture of development processes across the world, and data which is internationally comparable, sustainable and disaggregated. To meet the data needs of the SDGs in particular, it is crucial that interoperability solutions create value for front-line decision-makers.

Based on our engagements over the course of the Joined-Up Data Standards project, in this paper we put forward five guiding principles that we consider essential to implementing interoperability: using and re-using existing standards; not overlooking metadata; using common classifications wherever possible; publishing data in machine-readable formats; and, ensuring that standards are user-driven.

These guiding principles help to contextualise the frontiers of data interoperability for sustainable development that we have identified as areas where progress is starting to be made. These include: consolidating and universalising existing principles; forming new adaptable partnerships across data communities; stakeholders moving away from exposing problems and towards solving them; starting to turn big ideas into practical solutions; and, global standards and regulations that work for all starting to emerge.

The Collaborative on SDG Data Interoperability, formed following the first UN World Data Forum in January 2017, has the potential to play a crucial role in helping to coordinate progress across sectors and geographic regions abiding by the principles of openness, country-ownership and non-duplication at all times. This paper suggests recommendations for it to consider structuring its work around as it moves towards the second UNWDF in 2018, specifically around its role as a catalyst and facilitator. As it consolidates itself, the Collaborative will need to contend with the challenge of different stakeholders defining interoperability in different ways. However, this challenge is also an opportunity to build a shared appreciation of challenges and solutions that exist across different data and professional communities and is itself a central rationale for establishing the group.

Annex A: Interview questions

1. When we talk about interoperability what does this mean for you? Why is this issue important for this sector?

2. What do you think needs to happen to turn interoperability principles into practice (in the development sector) a) in the short term (next 2–5 years) b) in the longer term?

3. What are the incentives and benefits of interoperability for your organisation? What are the challenges you are facing in this area? How does this affect different stakeholders (e.g. standard setters, national statistics offices, the open data community)?

4. What are your expectations of the Collaborative on SDG Data Interoperability, which is being convened by the UNSD and GPSDD? What role should it play? What would success look like?

5. What do you think are some of the risks and challenges the Collaborative might face going forward?

6. What are the opportunities? What's the low-hanging fruit to focus on in the short term and deliver this change?

7. What do you think institutions/standard setters should do to better support interoperability?

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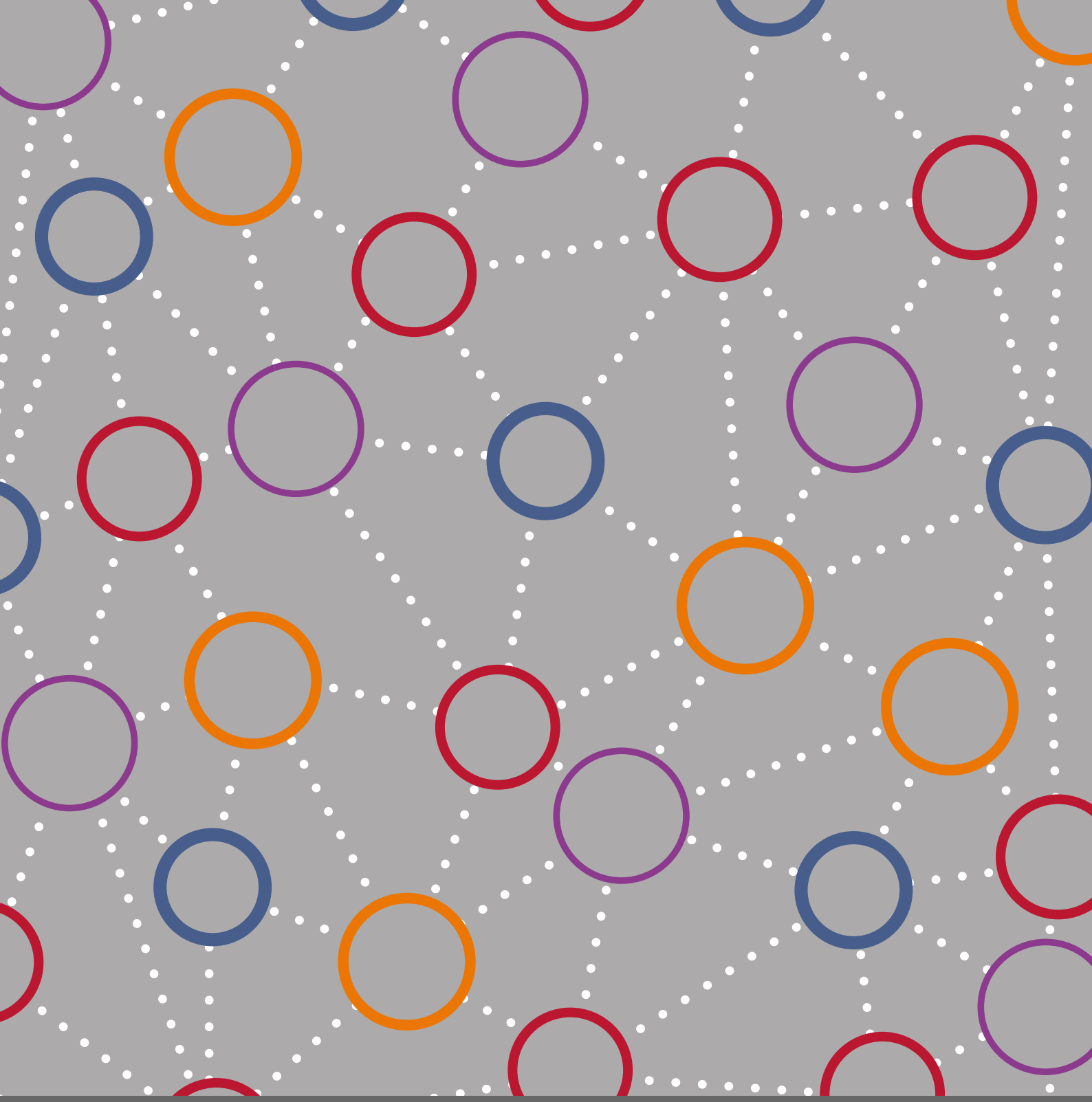

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