Working towards the SDGs through Research Infrastructure:
Projects, Program and a Perspective on the *Brno Declaration* from Australia

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Abstract

As implied by its title, the Brno Declaration on Fostering a Global Ecosystem of Research Infrastructures proposes an international network of research infrastructure (RI) to facilitate the coordination of work addressing "grand societal challenges" including the Sustainable Development Goals (SDGs). While this paper acknowledges the benefits RIs could provide for communities around the world, it also recommends that readers critically engage with the policy perspectives and call to action put forth in this Declaration. Though the term 'global' is in its title, the Brno Declaration makes no reference to non-Western knowledge. To illustrate the possibility of integrating Indigenous and Western knowledge, this paper discusses three RI initiatives from Australia relating to work on the SDGs - a language data commons, a drone cloud and a program supporting research in food security.

In October 2022, the *Brno Declaration on Fostering a Global Ecosystem of Research Infrastructures*[1] was presented at the International Conference on Research Infrastructures (ICRI). According to the European Strategy Forum on Research Infrastructures (ESFRI), this declaration is "an impactful policy document which highlights **the essential role of Research Infrastructures**" (RIs) (emphasis in the original).[2] The Declaration calls upon "policy-makers … to place RIs at the forefront of their policy-making."[3] It offers a description of RIs and their role in facilitating "problem-solving and solution-oriented approaches" to address "grand societal challenges, including the United Nations Sustainable Development Goals."[4]

However, unlike the *UNESCO Recommendation on Open Science*, the *Brno Declaration* offers no guidance on

> fostering open dialogue with indigenous peoples and local communities and respect for diverse knowledge holders for contemporary problem solving and emergent strategies towards transformative change.[5]

While it makes reference to the FAIR (Findable, Accessible, Interoperable and Reusable) Data Principles, it omits to discuss the CARE (Collective Benefit, Authority to Control, Responsibility and Ethics) Data Principles.[6] Both the FAIR and CARE Principles are a critical part of the work of the Australian Research Data Commons (ARDC), a national peak body for research data. The ARDC aims to accelerate research and innovation by driving excellence in the creation, analysis and retention of high-quality data assets. This brief discusses three ARDC co-investment initiatives contributing to

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[1] Hereafter '*Brno Declaration*.'

[2] European Strategy Forum on Research Infrastructures (ESFRI), *Brno Declaration on Fostering a Global Ecosystem of RIs* (14 December 2022).

[3] *Brno Declaration*, paragraph 1, page 4.

[4] *Brno Declaration*, paragraphs 1 & 2, page 2. The first two sentences of the Declaration reads, "Research Infrastructures (RIs) are top-class facilities which provide research and innovation (R&I) communities with unique knowledge and expertise, experimental devices and technical resources, extensive collections of data sets, and related ICT and computing services. These are essential to conduct breakthrough fundamental research and drive excellence, extending the frontiers of human knowledge beyond yet known horizons, to perform cutting-edge applied research, advancing the technology development and feeding into science-driven innovation, and to provide services in the support of tackling grand societal challenges, including the United Nations Sustainable Development Goals."

[5] In addition, we note the *UNESCO Recommendation on Open Science* also acknowledges that "open science should not only foster enhanced sharing of scientific knowledge solely among scientific communities but also promote inclusion and exchange of scholarly knowledge from traditionally underrepresented or excluded groups (such as women, minorities, indigenous scholars, scholars from less-advantaged countries and low-resource languages) and contribute to reducing inequalities in access to scientific development, infrastructures and capabilities among different countries and regions": UNESCO, *Recommendation on Open Science* (2021) 5.

[6] As above.

Australia's work on the SDGs: (i) the Language Data Commons of Australia (LDaCA), (ii) the Australian Scalable Drone Cloud (ASDC), and (iii) the Food Security Data Challenges Program. The paper concludes with a recommendation and brief comment on the *Brno Declaration*.

I. The Language Data Commons of Australia

In the context of the 2030 Agenda for Sustainable Development, Indigenous language vitality, retention and the condition of which they are today are pertinent to all 17 SDGs. Language retention and vitality predicates the socio-economic, determination and health and well-being outcomes of language custodians. Languages in vulnerable conditions indicate vulnerable communities. Through empirical research, Indigenous scholars have established the direct correlation between Indigenous language vitality and the demise in health equity, quality of life and ultimate death of Indigenous language custodians.[7] Such findings underscore the significance of the roles and duties of governments, as articulated in international human rights instruments. The *UN Declaration of the Rights of Indigenous Peoples* (2007) stipulates that States have obligations to "take effective measures" to support the use of Indigenous languages in education[8] and media,[9] and ensure that

> Indigenous people have the right to revitalise, use, develop and transmit to future generations their histories, languages, oral traditions, philosophies, writing systems and literatures, and to designate and retain their own names for communities, places and persons.[10]

In addition, States are also required "to ensure that Indigenous peoples can understand and be understood in political, legal and administrative proceedings, where necessary through the provision of interpretation or by other appropriate means."[11]

The LDaCA national infrastructure project focuses specifically on the management of language data including access to knowledge and access controls, processes for secure data storage and the training of data stewards. To facilitate access to collections with appropriate controls, LDaCA is developing a suite of standards, technologies, tools and systems to catalogue, index and publish data. LDaCA aims to construct a portal for the discovery and access of nationally significant language data and, thereby, enhance the conservation of the linguistic and Indigenous knowledges pertaining to cultural applications of science and the preservation of cultural heritage by the most effective integration of the FAIR principles through a CARE principles-oriented governance framework.[12]

II. The Australian Scalable Drone Cloud

Uncrewed Aerial Vehicles (drones), have the potential to democratise access to much needed capabilities supporting a wide array of SDG-related activities from ecosystem monitoring to sustainable farming, to Indigenous mapping. However, technical complexities and the lack of common best practices make almost every aspect of drone use challenging, particularly for users with limited resources or technical capacity.

Drone and 3D geospatial time-series datasets are large and hard to manage and visualise; processing requires high-end hardware, and workflow development requires expert knowledge. Consequently, solutions are commonly developed by well-resourced groups who build custom pipelines requiring domain expertise to implement. Such bespoke solutions are effective, but expensive and not easily "reusable" because of the hardware and expertise required to implement them. Consequently, published drone workflows are infrequently fully "FAIR."[13] Drone-derived datasets are similarly hard to publish FAIRly due to their large size and complexity (3D, time-series, etc). When commercial solutions exist, they generally do not support custom pipeline development or allow bulk data export, leading to lost data and vendor lock-in.

[7] Hallett, D., Chandler, M.J. and Lalonde, C.E., 2007. Aboriginal language knowledge and youth suicide. *Cognitive Development*, 392; Carpenter, K. and Tsykarev, A., 2020. (Indigenous) Language as a Human Right. *UCLA Journal of International Law and Foreign Affairs,* 49.

[8] *UN Declaration of the Rights of Indigenous Peoples* (2007), Art 14.

[9] *UN Declaration of the Rights of Indigenous Peoples* (2007), Art 16.

[10] *UN Declaration of the Rights of Indigenous Peoples* (2007), Art 13(1).

[11] *UN Declaration of the Rights of Indigenous People* (2007), Art 13(2).

[12] Russo Carroll, S. et al, Global Indigenous Data Alliance, 2018, *CARE Principles for Indigenous Data Governance*; GO FAIR, 2016, *FAIR Principles.*

[13] Wilkinson, M. D., et al., 2016, The FAIR Guiding Principles for scientific data management and stewardship, *Scientific Data,* 1; ARDC, *FAIR Data*, (12 May 2022).

This lack of FAIR frameworks supported by open, "cloud-native" platforms leads to duplications of effort, where multiple groups re-solve the same problem while less resourced users are unable to access these solutions. This is inefficient, expensive and prevents wider uptake of solutions. By recognising that most domains using drones share many of the same challenges, we as a community can identify common blockers and then create open solutions for them. This "solve once for everyone" approach requires shared data standards (enabling rapid reuse of code and data sharing) supported by open source software, backed by cloud-native online platforms which democratise access to high-end computational environments at low cost. This strategy enables "fair-from-capture" workflows for drone data and is particularly effective when implemented in a modular, domain-agnostic way. For the above reasons, the ASDC project is establishing a national, cloud-native platform for working with drone data.

ASDC extends existing open-source software[14] into an integrated, cloud-native platform to enable standardisation of processing, analysis and pipeline development, visualisation and FAIR publishing, discovery and reuse of processing pipelines and drone data (via Research Data Australia). While ASDC is initially scoped as an Australian-based infrastructure capability, ASDC uses open source software that is in wide use internationally (eg ODM), so all improvements become available to users globally, and the intent is to make the ASDC platform available internationally in the longer term.

III. The Food Security Data Challenges Program

In partnership with key stakeholders in the food sector, the ARDC is investing in developing innovative digital infrastructure solutions aiming to improve research into Australia's production, distribution and consumption of safe and high-quality food through its Food Security Data Challenges (FSDC) program.[15] The program is situated at the intersection of research, industry and broader society, and intends to provide tangible and enduring economic, environmental and social benefits. The design of the program was strongly

driven by the SDGs, in particular Zero Hunger (SDG 2), Good Health and Wellbeing (SDG 3), Reduced Inequalities (SDG 10), Responsible Consumption and Production (SDG 12), and Life on Land (SDG 15). In addition, a comprehensive consultation process which investigated the societal problem of food security through the lens of national research priority areas, identified relevant data challenges and a portfolio of projects tackling these challenges was subsequently developed, addressing the following themes:

- food provenance and traceability - to trace and track food products through their life cycle with information such as where the product was grown or what resources were used in its production. These projects are particularly relevant to SDGs 2, 3 and 12;

- antimicrobial resistance (AMR) in food - to understand agribusinesses' antimicrobial use (AMU) to ensure safe food production and improve preparedness for AMR events (SDGs 3, 12 and 15);

- food equity and food relief - to identify areas with gaps in the supply of healthy and nutritious food and understand how these could be filled (SDGs 2, 3, 10 and 12); and

- food production including Agriculture (SDGs 2, 3, 12, 15) - to improve the efficiency and quality of food production.

The FAIR Principles are becoming increasingly well known within the food security sector. To extend its current work on data standards and data stewardship, the ARDC will attempt to raise awareness and understanding of the CARE Principles through the FSDC projects.

Conclusion

While the *Brno Declaration* underscores the importance of RIs and calls for its recognition around the world, a campaign is currently underway in Australia to support a positive outcome in the forthcoming national referendum on Indigenous Constitutional Recognition and an Aboriginal and Torres Strait Islander Voice. The above three case studies form part of the ARDC's on-going work to integrate the FAIR and CARE Data Principles to support efforts by governments and the wider community in Australia to work towards reconciliation with First Nations people. LDaCA is an innovative national initiative designed to support researchers and

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[14] The ASDC platform runs on Kubernetes for cloud-native infrastructure, Open Drone Map [ODM] for photogrammetry, Cesium, Potree and VR for data visualisation and Jupyter for processing and pipeline development.

[15] For the webpage of the Food Security Data Challenges program, see <https://ardc.edu.au/program/food-security-data-challenges/>.

communities including Aboriginal and Torres Strait Islander people to preserve, revitalise and promote languages for their communities and for future generations. Through the adoption of open source practices, the ASDC project aims to build nationally accessible infrastructure for drone-related research and innovation across a range of disciplines. Underpinned by a selected set of SDGs, the Food Security Data Challenges program is currently supporting a number of projects to develop innovative digital infrastructure solutions to improve Australia's production, distribution and consumption of safe and high-quality food. Given the potential benefits that could be derived from the above RI initiatives for Indigenous and non-Indigenous communities, this brief recommends that policy-makers, funders and other actors working in the STI ecosystem critically engage with the policy perspectives presented in the *Brno Declaration.* If the STI community were to adopt the *Brno Declaration*'s call to foreground RI and foster a global RI ecosystem to address the SDGs - then as the LDaCA case study shows - it is advisable such initiatives not overlook Indigenous and other marginalised communities and the knowledge, insights and lived experiences[16] they could bring to the task of building RIs.

Acknowledgments

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[16] This category of knowledge includes "situated knowledges," a concept from science and technologies studies. The concept of situated knowledge problematizes the position of both the subject (knower) and object (known), neither can be regarded as "innocent and waiting outside the violations of language and culture" (Haraway 1991, 109). For a theoretical perspective on situated knowledges, see Haraway 1988.