## **A Science Chapter**

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### 1. Point of Departure

Following the <u>political declaration adopted at the occasion of the United Nations'</u> <u>75th anniversary</u> in September 2020, the UN Secretary-General in September 2021 released the <u>Our Common Agenda</u> policy. The Common Agenda includes a proposal for a Global Digital Compact to be agreed upon at the UN Summit of the Future in September 2024. This will result from a stakeholder engagement process involving governments, the United Nations system, the private sector (including tech companies), civil society, grass-roots organisations, academia, and individuals, including women and youth.

The Global Digital Compact is expected to "outline shared principles for an open, free and secure digital future for all". The Common Agenda report suggests issues that it might cover the following:

- **1.** Digital connectivity;
- Excellence in digital data collection, aggregation, interoperability and management;
- **3.** Avoiding Internet fragmentation;
- **4.** Providing people with options as to how their data is used;
- **5.** Application of human rights online;
- **6.** Promoting a trustworthy Internet by introducing accountability criteria for discrimination and misleading content.

A background note on the Global Digital Compact is available <u>here</u>.

### 2. Introduction

United Nations Member States adopted a Declaration on the Commemoration of the Seventy-Fifth Anniversary of the United Nations (A/RES/75/1), which contains the following pledge:

"We will improve digital cooperation. Digital technologies have profoundly transformed society. They offer

unprecedented opportunities and new challenges. When improperly or maliciously used, they can fuel divisions within and between countries, increase insecurity, undermine human rights, and exacerbate inequality. Shaping a shared vision of digital cooperation and a digital future that shows the full potential for beneficial technology usage, and addressing digital trust and security, must continue to be a priority as our world is now more than ever relying on digital tools for connectivity and social-economic prosperity. Digital technologies have the potential to accelerate the realisation of the 2030 Agenda. We must ensure safe and affordable digital access for all. The United Nations can provide a platform for all stakeholders to participate in such deliberations.

Digital science is an interdisciplinary field that combines computer science, mathematics, and other related disciplines to develop innovative approaches for analysing and modelling complex data sets and data systems, including natural, social, and technical systems. Digital science is based on collecting, analysing, and interpreting large data sets generated by various sources, such as sensors, simulations, experiments, and surveys. Nevertheless, science interpretation entails an additional step requiring the construction of logical scientific arguments that explain the data, and validation mechanisms, including scientific knowledge and individual expertise. The emergence of synthetic data is another important innovative development to support research and development in healthcare and other sectors facilitating the privacy and security of individuals.

Digital science is essential for our future because it revolutionises many aspects of our lives. Here are a few ways digital science is important:

 Advancing scientific research: Digital science enables researchers to analyse vast amounts of data and discover patterns and correlations that were previously difficult or impossible to detect, especially in electronic health records (enhancing the use and utility of real-world evidence). This leads to breakthroughs in genetics, neuroscience, and climate science;

- Improving healthcare: Digital science facilitates healthcare transformation by enabling doctors and researchers to analyse patient data to enhance existing services, develop new services and products and develop personalised treatments. This can lead to better outcomes and lower costs.
- Enhancing education: Essential to sustainable healthcare systems are both digital and health literacy. This literacy is needed for everyone, including healthcare professionals (both for qualification and continuing education), patients, carers, policymakers and citizens. Digital science is making education more accessible and personalised. For example, it enables online learning platforms to offer customised lessons and assessments to individual students based on their learning styles and progress.
- Transforming business and industry: Digital science drives innovation in finance, transportation, and manufacturing by enabling companies and public sector governments and organisations to analyse data and optimise their operations.
- Enhancing population health data: Digital data can be collected, aggregated and combined (especially with non-clinical data such as social determinants of health) at a highly granular level to create new insights and fuel greater levels of precision or personalised medicine.
- Digital science improves our understanding of ecosystems, their functions, and the provision of the services enabling underpinning data and knowledge for decisions and actions urgently needed for conservation.

Digital technology has revolutionised how scientific research is conducted, disseminated, and shared. One of the key benefits is that it enables open science, a movement to open the processes of scientific knowledge creation, evaluation, and communication, as defined in the 'UNESCO Recommendation on Open Science'. This openness fosters seamless collaboration among researchers from different parts of the world, who can work together to solve complex problems that require diverse expertise. In addition, open science allows for the meaningful involvement of society in scientific research by providing opportunities for citizen science projects and other forms of public engagement. This contributes to a more equitable and inclusive scientific enterprise.

### 3. Unity of Science

If implemented correctly and systematically, digital science has the potential to help achieve unity of science by enabling interdisciplinary and transdisciplinary collaboration and providing tools for data sharing, analysis, and integration.

One of the challenges of achieving unity of science is that different disciplines often use other methods, theories, and languages, making it difficult to communicate and collaborate across disciplines. However, digital science tools such as data visualisation, artificial intelligence and machine learning, and network analysis can help to bridge these gaps by enabling researchers to work with large and complex datasets and identify patterns and relationships that might be difficult to detect using traditional methods. Nevertheless, social injustice is a major threat, if digital science is used adequately and would increase social gaps even further, especially in underdeveloped countries.

Digital science can also promote data sharing and collaboration across disciplines and national borders by providing open-access data repositories, such as the Global Biodiversity Information Facility and the Ocean Biogeographic Information System. These repositories enable researchers worldwide from different disciplines to access and analyse data from various sources, which can lead to new insights and discoveries. This is particularly useful in addressing the national and transboundary challenges associated with implementing the post-2020 global biodiversity framework and achieving a nature-positive world by 2030.

Data science can break down the traditional silos between academic disciplines and industry sectors to achieve "data in all policies" for evidence-based policies, innovations and solutions. This is illustrated in the "Health in All Policies " initiative (<u>https://healthyeurope.eu/</u>) and in the Health & Prosperity agenda developed in Northern Ireland.

Digital science can promote interdisciplinary and transdisciplinary collaboration by providing platforms for communication and cooperation, such as online forums, wikis, and social media. These platforms can engage researchers and non-academic practitioners from different disciplines and institutions in other countries to share ideas, best practices, collaborate on projects, and build new networks.

Overall, if applied properly across geographies, digital science has the potential to help achieve unity of science, increasing the capacities of less favoured/underdeveloped countries by providing new tools for equitable interdisciplinary and transdisciplinary collaboration, knowledge co-production, and data sharing. By partnering with decision-makers, civil society, and the private sector to co-produce tools and knowledge, novel digital science advances are more likely to have a beneficial impact on society. Interdisciplinary and transdisciplinary teams can make discoveries and gain a deeper understanding of the world around us by working together across disciplines and sectors, using digital science tools to integrate and analyse data and co-create decision support tools. This opens the door to discoveries and breakthroughs.

### 4. How digital science Supports the UN Global Digital Compact

Digital science can support the UN Global Digital Compact by providing tools and approaches to help achieve its goals. The UN Global Digital Compact is a call to action for companies to align their digital strategies with the UN Sustainable Development Goals (SDGs), which aim to eradicate poverty, protect the planet, and promote prosperity for all in all dimensions. Here are some ways in which digital science can support the UN Global Digital Compact:

- Big data analytics: Digital science can enable companies to analyse large datasets to identify patterns, trends, and insights that can inform their business strategies and help them achieve the SDGs while maintaining a positive balance.
- **2.** Artificial intelligence: Digital science can help companies to develop AI solutions that can automate tasks, reduce costs, and improve efficiency, while also promoting sustainable practices.
- **3.** Internet of Things: Digital science can enable companies to use IoT devices to collect data on their operations and environmental impacts, which can inform their sustainability strategies.
- 4. Blockchain: Digital science can support blockchain technology to track and verify sustainable practices in supply chains and promote transparency and accountability. Blockchain is also an energy-intensive technique with significant environmental impacts, which needs to be acknowledged.
- **5.** Digital education: Digital science can promote digital education and training, equipping workers with the necessary skills to contribute to sustainable development.
- 6. Overall, digital science can play a key role in supporting the UN Global Digital Compact by providing tools and approaches to help companies align their digital strategies with the SDGs and promote sustainable practices.

# 5. Data protection regulations and their impact on digital science

Data protection regulations can significantly impact and facilitate digital science because they govern the collection, use, and sharing of personal data, which is often used in scientific research. Here are some ways in which data protection regulations can impact digital science:

- Trust: Data Protection regulations have a fundamental role in striking a balance between protecting essential human rights and facilitating the development of science and healthcare innovation for the common good of mankind, also a human right. This balance explains the benefits to citizens of data sharing, especially health data while preventing inappropriate and unacceptable uses. Data Regulation is as much about ensuring the development and facilitation of trust by all in data sharing as it is about outlawing certain data uses.
- 2. Consent: Data protection regulations typically require that individuals give informed consent for their personal data to be collected and used in research. It also provides for the right to have your data deleted. This means that researchers must obtain explicit consent from study participants, which may be not only time-consuming for all parties concerned but also often inappropriate and intrusive and ultimately may limit the scope of the research required to achieve the SDGs.
- **3.** Anonymisation: Data protection regulations often require that personal data be anonymised before it is used in research. This can help to protect individuals' privacy and prevent the misuse of their data, but it can also make it more difficult for researchers to analyse the data and draw meaningful conclusions, especially for rare diseases. It also excludes any possibility of providing shared benefits such as the return of results. Anonymisation is potentially counterproductive to the integration of data for analysis and advances in areas such as precision medicine which requires analysis of different data types to identify potential treatments precisely. Technical advances and individuals publishing more data about themselves also makes anonymisation increasingly difficult in practice.

- 4. Data sharing: Data protection regulations can impact research data sharing between researchers and institutions. Researchers must ensure that any personal data they share is done so in compliance with their specific data protection regulations, which can make it more difficult to collaborate across institutions and countries as regulations differ, not only in the mechanisms and obligations required for sharing but even in the interpretation of terminologies. Data ownership also has impacts that need to be considered.
- **5.** Data security: Data protection regulations require that personal data and especially sensitive data, be kept secure and protected from unauthorised access. Researchers must ensure that their data handling procedures are robust and have adequate measures to prevent data breaches and cyberattacks.
- **6.** Overall, data protection regulations can impact digital science by limiting personal data collection, use, and sharing. While these regulations are essential for protecting individuals' privacy and preventing data misuse, they can also create challenges for researchers who need to access and analyse data to advance scientific research. As a result, it is essential for researchers to work within the framework of data protection regulations and to ensure that they comply with all relevant laws and regulations.
- 7. Data regulation is the competency of Member States, but it is in the best interests of all citizens and society to avoid unnecessarily complicated and diverse forms of regulation and governance which preclude scientific advances that would help fulfil the objectives of the SDGs. Data and healthcare know no borders, and the UN Global Digital Compact has the opportunity to foster a set of common principles for Global Data regulation and governance based on real consultation and trust at its heart.
- 8. Strong and fair governance systems for all data use or sharing can massively increase overall levels of trust and confidence that privacy is protected wherever necessary.

### 6. How will the data bias impact women and indigenous people impact digital science, and what can be done to overcome this?

Data bias against women can significantly impact digital science by perpetuating and amplifying gender inequalities in research and society. Here are some ways in which data bias against women can impact digital science:

Research design: Data bias can lead to research questions and methodologies that are biased against women, leading to a need for more representation and data in key research areas.

- Data collection: Data bias can lead to incomplete and inaccurate data about women, impacting scientific conclusions and developing policies and interventions.
- Data analysis: Data bias can lead to incorrect or incomplete scientific conclusions, further perpetuating gender stereotypes and inequalities.

Taking proactive steps to overcome data bias against women in digital science is important. Here are some potential approaches:

- Address unconscious biases: Researchers should be aware of their own unconscious biases and strive to address them in their research design, data collection, and data analysis.
- 2. Increase representation: Researchers should seek to increase the representation of women in research studies and data sets and ensure that they are accurately represented and included in research across fields.
- **3.** Encourage women's leadership in research: Women's issues are generally better addressed with women in the leadership of research projects, including random clinical trials (of both animals and humans) and activities. A concerted effort must encourage women's leadership in research activities.
- **4.** Promote interdisciplinary collaboration: Researchers from diverse fields and backgrounds should collaborate on research projects to help identify potential sources of bias and develop more accurate and comprehensive data sets.

- **5.** Increase awareness and education: Educational programs and awareness campaigns can help to raise awareness of data bias against women and promote strategies to overcome it.
- **6.** The development of synthetic women's data sets offers another opportunity to reduce gender data bias.

By promoting inclusion and diversity in research, researchers can develop more accurate and comprehensive data sets that can help to promote gender equality and address issues of inequality and bias in research and society.

# 7. Digital technologies are essential for healthcare delivery.

Digital technologies are increasingly important for healthcare delivery because they have the potential to improve patient outcomes, increase access to care, and lower costs. Here are some specific reasons why digital technologies are important for healthcare delivery:

- Telemedicine: Digital technologies such as videoconferencing and remote monitoring can enable patients to receive medical care from their homes, which can be particularly beneficial for patients in rural or remote areas. Telemedicine can also reduce the need for in-person visits, reducing carbon emissions and pollution, lowering costs and increasing care access and improving patient convenience and experience.
- 2. Electronic health records (EHRs): Digital technologies can support the creation and management of electronic health records, improving patient safety and enabling healthcare providers to access patient information quickly and easily.
- **3.** Data analytics: Digital technologies can enable healthcare providers to analyse large datasets in their EHRs to identify patterns and trends in patient health, which can inform treatment decisions and improve outcomes as well as lead to new products and services.

- **4.** Digital technologies can support the increase of health literacy across society, empowering citizens to greater independence, quality of life, well-being and fewer years of ill health.
- **5.** Mobile health (mHealth): Digital technologies can support the development of mobile health apps and devices, enabling patients to monitor their health and communicate with healthcare providers more easily.
- 6. Precision medicine: Digital technologies can support the development of precision medicine, which involves tailoring medical treatment to individual patients based on their genetics, lifestyle, and medical history.
- 7. Overall, digital technologies are important for healthcare delivery because they can improve patient outcomes, increase access to care, and lower costs. By embracing digital technologies, healthcare providers can enhance the quality and efficiency of healthcare delivery and improve the overall health of populations. Other sectors do not describe their services as digital, for example, financial services do not refer to mobile or digital banking, just banking. The challenge for healthcare is to become truly and universally digitally enabled when it delivers health services, not digital health, mhealth, ehealth or connected health services.

### 8. Biodiversity

Digital science has the potential to support biodiversity conservation by providing new tools for data collection, analysis, and management. By combining digital science, and local communities empowerment, with existing conservation methods, particularly those of Indigenous peoples, we can develop more effective strategies to protect and conserve the Earth's biodiversity:

1. Data collection: Digital science tools such as remote sensing, drones, and camera traps can collect data on biodiversity. This data can be used to monitor changes in biodiversity over time and track the success of conservation efforts.

With data science, data collection may not be supported by national geographical borders.

- 2. Data analysis: Digital science enables the analysis of large datasets to identify patterns, such as spatial and temporal distribution. This information can be used to inform conservation planning and management.
- **3.** Modelling: Digital science tools can be used to create models of ecosystems and simulate the effects of different management scenarios. This can help decision-makers assess the potential impacts of proposed actions before implementation.
- 4. Citizen science: Digital science can support citizen science initiatives, which involve members of the public in collecting and analysing data on biodiversity. This can engage communities in conservation efforts and raise awareness of biodiversity issues.
- **5.** Mapping: Digital science tools can create detailed maps of ecosystems and identify areas of high biodiversity, which guide conservation efforts and protect important habitats.
- 6. Living things data pattern determination: Digital science affords the opportunity to see the genetic/epigenetic/genomic similarities and differences in all living things on the planet to appreciate better how to thrive together in the future.

## **Contributing Organizations**

African Astronomical Society (AfAS) Africa Aga Khan University, Kenya ARC-Net research centre, University of Verona, Italy Biobanking and Biomolecular Resources Research Infrastructure, BBMRI, COST Research Programme, Belgium Council for Scientific and Industrial Research, Ghana Council for Scientific and Industrial Research, India ECHAlliance, Belgium ImiBio, Argentina Inter-American Institute for Global Change Research (IAI) LifeWarch ERIC Biodiversity Research Infrastructure, Spain Makerere University, Uganda Medical Research Council, South Africa National Research Foundation, South Africa The Digital Health Society, Ireland The European Topic Centre on Spatial Analysis and Synthesis (ETC-UMA), Spain University College, Dublin, Ireland Zhejiang University International Business School (ZIBS), China