WSIS+20 Review
Action Lines
Milestones, Challenges and Emerging Trends beyond 2025

C7 - E-Science

The Evolution of Context

WSIS Action Line C7. E-Science

Influence of New Technologies on Science and Information

- AI, mobile technologies, big data analytics, and cloud computing have transformed how scientific research and data are collected, analyzed, and interpreted. These tools have increased operational efficiency and expanded the scope of research projects by handling large datasets more effectively, which are essential for advancement of science.
- The rise of the internet and other digital platforms has drastically democratized access to scientific research, tools and processes. This has enabled a broader spectrum of scientific collaboration across continents. Scientists in the global south now have better access to global research initiatives, although disparities in digital infrastructure still pose as significant challenges.

Rights and Openness in Science

- There has been a significant push towards open solutions to scientific publications, software, and data, aimed at reducing barriers to research. This movement has been crucial for scientists in developing countries who often face limited access to scientific information, tools and processes. A global statutory mechanism (Recommendation of Open Science) and non-commercial approaches to scientific research have been important breakthrough in the recent times.
- As digital tools become essential for modern science, the right to access these tools equitably has become a critical issue. In the global south, there's a need for policies that ensure equitable access to these technologies to avoid a widening of the existing scientific knowledge gap.

The Evolution of Context

Policy Gaps and Capacity Limitations

- There's a notable lack of comprehensive policies that address the integration of digital technologies in scientific research, particularly in the global south. This includes policies, *inter alia*, on data governance, open access, ethical usage, which are crucial for maintaining the integrity of scientific research.
- There is a significant gap in the capacities to utilize advanced technologies effectively in less developed regions. Training and investment in local expertise are required to harness the full potential of these technologies.
- Scientific information are not culturally or linguistically accessible to all, particularly in diverse regions like the global south. This exacerbates the challenges in discerning verified information from noise.

Key Milestones: 20 years of Achievements

2003-2008

01

Enhanced Data and computing for science

Human Genome project completed its work two years prior to the experiment.

Emergence of Cloud Computing revolutionizing data storage and computational power accessibility. Science Experiments becomes more coordinated

Advancements in Big Data enables handling of massive datasets. Scientific Big data pushes the boundaries of large experimental research

2009-2014

02

Open Access, Public Engagement, and AI Advancements in Science

public participation in scientific research recognized (Zooniverse)
Governments and organizations begin launching open research data portals, promoting transparency and access to public data

MDG Evaluation establishes the linkage between sciences and development: processes

UNESCO Strategy on Open Access launched

Advancements in AI and machine learning start to significantly impact eScience

2015-2018

03

EScience integrated in development process

The UN adopts the SDGs, highlighting the role of eScience and data in achieving sustainable development
Enhanced scientific visualization techniques using virtual and augmented reality become more prevalent in research
UNESCO 2017 Recommendation in Science and Scientific Researchers

2019-2021

04

Openness and ethical contexts recognized as a condition for scientific research

COVID -19 Pandemic establishes the context for Open Data
High-performance computing capabilities continue to grow, supporting more complex and large-scale scientific computations.
UNESCO 2021 Recommendation on Open Science is adopted
UNESCO Recommendation on Ethics of AI is adopted

2022-2023

05

Automation in Scientific experiment advanced Policy and governance recognized as a missing element

ChatGPT becomes one of the key tools for scientific discovery and data analysis

Non commercial models of Scientific knowledge exchange mainstreamed

Development of policies and frameworks to ensure data privacy, security, and ethical considerations in eScience.

Challenges in implementing the Action Line

1. **Lack of policy framework that support escience agenda for government**
   - Development of policies and frameworks to ensure scientific research output, data and ethical considerations in eScience has failed to keep pace with the requirement.
2. **Technological Challenges**
   - Digital divide between developed and developing countries. Many countries in the global south lack the infrastructure, resources, and technical expertise to fully participate in and benefit from eScience initiatives.
3. **Increasing proprietary interests and business agendas in scientific research.**
   - Proprietary nature of business-linked research can restrict access to scientific data and findings, limiting the sharing of knowledge and collaboration that is essential for scientific progress.
4. **Operational and Infrastructural Challenges**
   - progression of eScience is constrained by the lack of universal access to high-performance computing resources, sustainable funding models for long-term projects, adequate infrastructure, and modern educational frameworks that equip researchers with necessary skills.
5. **Ethical and Cultural Challenges**:
   - Ethical considerations on data privacy and intellectual property, coupled with cultural and methodological barriers between disciplines, pose as challenges to effective collaboration and the ethical conduct of eScience.

Trends Beyond 2025

- Since its global adoption in 2021 as a statutory process, Openness of science is gaining traction as a movement aimed at enhancing the accessibility and reproducibility of scientific research, tools and processes. New scientific protocols, such as Diamond Open Access in 2023, have fostered accessibility and enhanced transparency in the research processes, leading to more reliable and verifiable scientific outcomes (http://goap.info). This will continue to remain as a key agenda
- The surge in data has necessitated the adoption of big data technologies and sophisticated analytics. Traditional tools are becoming useless because of the volume, veracity and complexity of data.
- AI and machine learning have become central to scientific processes, uncovering new insights and enabling researchers to tackle more complex scientific questions.
- Demand for robust and scalable data storage and processing capabilities has made cloud computing an essential resource in scientific research. Many platforms have emerged to provide flexible and scalable resources that can be adjusted as per any scientific project's demands.
- IoT devices and sensor networks are increasingly becoming more relevant in scientific research, this is enhancing the capabilities for real time data flow and predictive analysis
- Blockchain technology is emerging as tool to create “tamper-proof” records of research data, thereby enhyncing the reliability and accountability of scientific findings.

Opportunities Beyond 2025

- WISS process could:
  - Develop universal standards and regulations for all aspects of technology and scientific practices. Harmonizing these standards internationally can streamline the integration and safe use of technologies across borders, enhancing global collaboration and innovation.
  - Bridge the digital divide beyond improving infrastructure. It must ensure equitable access to science and ICT resources worldwide.
  - Promote sustainability in technological and scientific initiatives by adopting green technologies and practices in ICT operations - like energy-efficient data centers, and encourage sustainable scientific research methods.
  - Establish robust ethical guidelines to address the broader implications of emerging technologies. These frameworks could navigate issues related to ethics in scientific inquiries and the socio-economic effects of technological advancements.
  - Enhance collaboration across academia, industry, and government to strengthen research and development ecosystems is essential. Instill new south-south and north-south-south process to support non-commercial models such as Diamond Open Access and FOSS agenda and public research initiatives that focus on social good rather than profit.