

SciTec

OSLO METROPOLITAN UNIVERSITY AND OECD  
**DIGITAL TECHNOLOGY FOR  
SCIENCE AND INNOVATION**  
EMERGING TOPICS FOR POLICY AND ASSESSMENT



Pilestredet 46, Oslo, Norway  
NOVEMBER 5, 6, 2018

[www.oslomet.no/oecd](http://www.oslomet.no/oecd)



# INFORMATION

## BACKGROUND

Much is written today on digital technologies, their interactions with economies and societies, and the pace of digital innovation. The OECD is undertaking extensive analysis of the economic, social and policy implications of digital technology, examining themes ranging from productivity impacts in business, to e-health, e-government, digital commerce, and Industry 4.0. Major OECD publications will be launched in early 2019 as the culmination of a two-year organisation-wide programme of work titled Going Digital.

In early 2019 the OECD's Committee for Scientific and Technological Policy will produce a Synthesis of various streams of work, conducted under its responsibility, that examine how digital technology is affecting science and innovation. The Synthesis will focus on the ways in which developments in digital technology might require new or modified policies for science, technology and innovation (STI). This workshop will inform that publication, while suggesting new ideas for future OECD work.

## WORKSHOP AIMS

The workshop will examine emerging developments in digital technology and what they signify for policy on STI. To help guide OECD governments, the workshop will aim to identify untapped opportunities to use digital technology in science and innovation processes. It will also point policymakers to where changes in digital technology could require changes in the design of mainstream policy approaches. The workshop will likewise identify themes and questions likely to become important in the future, but which are currently understudied. The workshop will explore subjects ranging from the uses of AI and blockchain in science, to using digital technology to draw on the collective intelligence of science and innovation communities, how Virtual Reality and AI might facilitate STEM education, novel means of accelerating technology diffusion, and digital technology for open science. The workshop will also examine and compare the main features of public programmes in leading economies to support AI.

## PARTICIPANTS AND FORMAT

In addition to specialists in science, technology and innovation policy, participants will include experts in digital technology. This mix is intended such that technologists might offer out-of-the-box ideas on policy opportunities. Presentations will be short, with an emphasis on debate, exchange and exploration of frontier issues.

 OSLOMET

Oslo Metropolitan University (OsloMet) is active in basic and applied research in new technologies as well as their societal roles and consequences. It is co-initiator of the European-wide CLAIRE network and the Norwegian NORA coalition of AI laboratories.

Note: Because a main goal of the workshop is to identify and reflect on emerging practices and possibilities, the discussion could range beyond the identified topics.

# WORKSHOP AGENDA

## MONDAY NOVEMBER 5

9:00-9:15 AM

### **Welcome and Introduction**

[Paul Chaffey](#)

State Secretary to the Minister of Local Government and Modernisation, Norway

[Morten Irgens](#)

Vice Rector, Oslo Metropolitan University

[Dominique Guellec](#)

Head, Division for Science and Technology Policy, OECD.

9:15-9:45 AM

### **Initial reflections**

*Moderator:*

[Dominique Guellec](#),

Head, Division for Science and Technology Policy, OECD.

*Presentation:*

[Bruce Damer](#)

Founder, the Biota Institute, and research scientist, University of California at Santa Cruz  
The Origin of Computing

*Discussion*

All Workshop participants

# WORKSHOP AGENDA

## MONDAY NOVEMBER 5

9:45 – 11:00 AM

### **Blockchain – facilitating integrity, reproducibility and scope in science and innovation**

*The distributed ledger technology that underpins Bitcoin has many potential applications in science and innovation. Many blockchain applications are only as yet at a proof-of-concept stage, but novel uses are foreseeable, and practical developments are underway, in such areas as secure data exchange, time-stamping of novel ideas, safeguarding the integrity of research databases, and scientific publication. This session will explore, inter alia*

1. *What are the most significant current and potential uses of blockchain for STI?*
2. *Which ongoing initiatives are most worth following for policymakers?*
3. *What policy developments are needed to achieve the potential benefits of blockchain in STI?*

11:00-11:30 AM

Coffee break

*Moderator:*

[Catherine Mulligan](#),

Visiting Researcher at Imperial College London and CTO of GovTech Lab at University College London.

*Presentations:*

[Joris van Rossum](#)

Director of special projects, Digital Science, London.  
Using blockchain to improve scientific publishing.

[Mirjana Stankovic](#)

Tambourine Innovation Ventures, Washington DC.  
Using blockchain to facilitate innovation in the creative economy.

[Stefan Krauss](#)

Professor, Centre of Excellence, Hybrid Technology Hub, Norway  
Blockchain and science, what should governments do now?

[Chirdeep Chabra](#),

Founder, Ocean Protocol Foundation  
Combining blockchain and AI for novel and safe data sharing.

*Discussion*

All Workshop participants

# WORKSHOP AGENDA

## MONDAY NOVEMBER 5

11:30-12:45 AM

### **Artificial intelligence for science and innovation – current and emerging possibilities**

*The World faces many global challenges, from climate change to antibiotic bacterial resistance. Solutions to many, if not all, of these challenges require increases in scientific knowledge. AI has the potential to increase the productivity of science, at a time when some evidence suggests research productivity may be falling. The use of AI in science may also enable novel forms of discovery, enhance reproducibility, and could even have philosophical implications regarding the scientific process. AI's applications in science and industry have become numerous and increasingly significant. For instance, AI has predicted the behaviour of chaotic systems, tackled complex computational problems in genetics, improved the quality of astronomical imaging, and helped discover the rules of chemical synthesis.*

*The increasing use of AI systems in science could also affect sociological, institutional and other aspects of science, such as the transmission of knowledge, systems of credit for scientific discoveries, peer-review system, educational curricula, and systems of intellectual property rights. Accordingly, this session will examine, inter alia:*

1. *What are some of the most significant recent applications of AI in the scientific process?*
2. *What evidence exists regarding AI's possible effects on research productivity?*
3. *What policies and institutional norms are needed – or could be needed in future – to maximise the use and effectiveness of AI in science?*

12:45-14:00 PM

### **Lunch**

*Moderator:*

[Anna Felländer,](#)

Founder of AI Sustainability Center, Affiliated Faculty Royal Institute of Technology, Advisor to the Minister of Digitalisation

*Presentations:*

[Charles Fracchia,](#)

Founder and CEO, Biobright

An overview of recent and potential developments.

[Hugh Cartwright,](#)

Physical and Theoretical Chemistry Laboratory, Oxford University

AI in molecular and materials science.

[Holger Hoos,](#)

Professor of Machine Learning, Leiden University

Democratisation of AI by automating the creation of AI systems.

*Discussion*

All Workshop participants

# WORKSHOP AGENDA

## MONDAY NOVEMBER 5

14:00-15:00

### **Augmented Reality, Virtual Reality and AI in delivering skills for STEM and innovation**

*Digital technologies are beginning to facilitate skills development in novel ways. For example, in 2014 Professor Askok Joel, and graduate students, at Georgia Tech University, created an AI teaching assistant - Jill Watson - to respond to on-line student questions. For months students were unaware that the responses were non-human. iTalk2Learn, a European Union project, aims to develop an open-source intelligent mathematics tutoring platform for primary schools. Researchers at Stanford University are developing systems to train crowd-workers using machine curated material generated by other crowd-workers. Demonstrations of robot perception of affect have many implications for personalised learning. And, on an experimental basis, haptic technology has shortened the time required to train surgeons in France. This session will examine, inter alia:*

1. *What are the most promising current and emerging applications of digital technologies to improve the delivery of skills for STEM and innovation?*
2. *What is known about the costs and benefits associated with using digital media to impart STEM skills?*
3. *Do policies - or institutional norms - need to change to achieve the benefits of these teaching technologies?*

*Moderator:*

[Rebecca Gregory-Clarke](#),

Head of Technology – Immersive of Digital Catapult

*Presentations::*

[Emory Craig](#),

Director of eLearning, college of New Rochelle, New York  
An overview of recent experience and near-term possibilities delivering STEM education using AR and VR

[Julien Charoni](#),

Deputy Director in charge of Programs and Strategy,  
CEA TECH LIST, France

Development in haptic technologies: hands-on learning from a distance

[Marti Louw](#),

Professor and Director, Learning Media Design Center,  
Human-Computer Interaction Institute, Carnegie Mellon  
University

Cultivating human expertise and attention collectively

*Discussion*

All Workshop participants

# WORKSHOP AGENDA

## MONDAY NOVEMBER 5

15:00-16:15

Round table discussion

### **'Using digital technology to draw on collective intelligence for science and technology policy'**

*The combination of human and machine intelligence, or the combined intelligence of groups of humans, could provide a powerful resource in support of science and innovation. Ideas markets, for instance, which have been used in a variety of settings, might be enhanced using digital technology and deployed in creative ways to inform science and technology policy. To give another example, Polymath is an open forum in which professional and amateur mathematicians collaborate to solve long-standing problems in mathematics. ICT can allow the creation of larger and more diverse groups - organised in new ways, and in combination with machines - than has been possible previously. This session will explore, inter alia:*

1. *What actions would facilitate the development of ideas markets (that could eventually inform policy for science, technology and innovation)?*
2. *Might digital technology enable collective allocation of science funding, as a complement or alternative to peer review?*
3. *Could AI, or some combination of machine and human intelligence, provide an analytic backstop or expert second opinion in some policymaking processes?*
4. *What new ideas exist for employing collective intelligence in ways relevant to policy?*

16:15-16:45 PM

Coffee break

*Moderator:*

[Carina Antonia Hallin](#)

Head, Collective Intelligence Unit, Copenhagen Business School

*Discussants:*

[Robin Hanson](#)

Professor of Economics, George Mason University (via video)

Obstacles to expanding ideas markets. Where might we go from here?

[Johan Bollen](#)

Professor, School of Informatics, Computing and Engineering, Indiana University

Can the wisdom of crowds do a better job than conventional grant review in supporting research?

[Louis Rosenberg](#)

CEO and founder, Unanimous AI (via video)

Using AI and swarm intelligence to build super-intelligent 'Hive Minds'.

[Victoria Alsina](#)

Senior Fellow at the Governance Lab and Research Professor at the New York University Tandon School of Engineering. Democracy Fellow, Harvard Kennedy School  
Collective Intelligence and Lawmaking: The Birth of the CrowdLaw Movement

*Open discussion*

All Workshop participants

# WORKSHOP AGENDA

## MONDAY NOVEMBER 5

16:45-17:45

### Digital technology enabling open, citizen, collaborative and crowd-funded science

“Open science” refers to a practice of increasing access to peer reviewed scientific articles and scientific data among scientists, businesses, funding agencies, on-line journals and on-line platforms. The dissemination of government-funded research results has to date largely relied on scientific journals. However, this model is evolving. The Internet has pushed the marginal costs of online publishing near to zero. Data storage and archiving costs continue to fall. And advances in computer science are creating opportunities to organise, share and re-use vast amounts of data generated by public research.

Recent years have also seen the expansion of ‘citizen science’, whereby scientific research is conducted through ICT-enabled open collaborative projects. For example, ICT is helping science elicit input from the networked public to label, generate and classify raw data, and draw links between data sets. ICT is also allowing the networked public to take part in novel forms of discovery. For instance, in 2011, players of an online protein-folding game - Foldit - outperformed scientists by discovering the structure of a protein involved in the Mason-Pfizer monkey virus. This manner of developing scientific knowledge contrasts markedly with the practice of science over the past century. But citizen science is a recent, diverse and evolving organisational form, and many of its essential features are not well understood.

Digital technology is also enabling collaboration among large and international teams of scientists. Recent research has highlighted both the enabling role of digital technologies in such teams, but also the role of information technology in exacerbating administrative burden in team science. And crowdfunding of science projects is an emerging phenomenon that appears to open possibilities for small-scale but meaningful funding for young scholars, in ways that are less averse than traditional funding to risky projects and to funding of female scientists.

This session will examine, inter alia:

1. What do we know about the effects of digital technology

as the medium in what large scientific teams co-operate, often internationally?

2. While debates on open science have generally focused on the publication process, what does this concept mean in terms of access to research tools?
3. If citizens contribute to science, how can their contributions be properly acknowledged? Likewise, in large scientific teams, how can all players be rewarded? Can blockchain technology play a role here?
4. Is citizen science a niche activity, or might it spread across the whole of science?
5. What potential exists for crowdfunding science projects?

*Moderator:*

[Carthage Smith](#)

Head, OECD Global Science Forum

*Presentations:*

[Linda Kahl](#)

Senior Counsel and Director of Ownership and Innovation, The Biobricks Foundation  
Legal and digital frameworks enabling open access to research tools

[Jan Youtie](#)

Professor, Georgia Institute of Technology  
Digital technology enabling team science: challenges and opportunities

[Lea Shanley](#)

Co-Executive Director, South Big Data Innovation Hub, Renaissance Computing Institute, University of North Carolina at Chapel Hill  
Accelerating scientific research and discovery through citizen science

[Chiara Franzoni](#)

Associate Professor, Milan Polytechnic (via video)  
Crowdfunding and scientific research

*Open discussion* All Workshop participants

# WORKSHOP AGENDA

## MONDAY NOVEMBER 5

17:45-18:15

**Taking stock day 1:**

**Reactions, new and outstanding questions**

*Moderator:*

[Alistair Nolan](#)

Senior Policy Analyst, OECD

*Commentators (8 minutes each):*

[Daniel Akenine](#)

CTO Microsoft Sweden, co-founder of addAI.org

[Lynda Hardman](#)

Manager Research & Strategy, CWI, and Professor, University of Utrecht

[Anna Felländer](#)

Senior Adviser, Founder of AI Sustainability Center, Affiliated Faculty Royal Institute of Technology, Advisor to the Minister of Digitalisation

*Open discussion*

All Workshop participants

19:00

**Dinner talk**

**followed by dinner**

[Bruce Damer](#)

The Origin of Life and The Future of Computing (and AI)

# WORKSHOP AGENDA

## TUESDAY NOVEMBER 6

9:30-11:00

### **National R&D and promotional strategies for AI: approaches and lessons to date?**

*The governments of a number of leading economies are now investing significant resources in strategies to accelerate the development of AI, its diffusion and AI skills. The rapid profusion of governmental strategies suggests concern about the possible effects of being left behind in what appears to be a race for the ultimate technological prize.*

*In April 2018 the European Commission outlined plans to boost investments in AI (and set related ethical guidelines). The Commission is increasing AI-related investment to €1.5 billion for the period 2018-2020, under the Horizon 2020 programme. It will support the development of AI in key sectors, from transport to health, connect and strengthen AI research centres across Europe, and encourage testing and experimentation. And following the Declaration of cooperation signed by 24 Member States and Norway on 10 April 2018, the Commission will start work with Member States to have a coordinated plan on AI by the end of 2018. Leading European researchers in AI have drafted plans for, and called on European governments to support, a European Lab for Learning and Intelligent Systems (ELLIS), built in the first instance around existing institutions in France and Germany.*

*The US federal government spent an estimated US \$1.2 billion on unclassified AI research in 2016, according to In-Q-Tel. Much larger sums are being deployed in China. In July 2017 China's State Council issued the document A Next Generation Artificial Intelligence Development Plan. This document sets out an ambitious blueprint for China's development and use of AI to 2030, by which time the country aims to possess a globally leading AI industry. Many local governments in China have also created plans and built research centers focused on AI. For example, in June 2017 the government of Tianjin, a city*

*near Beijing, announced plans for a US\$5 billion fund to support the AI industry.*

*This session will address, inter alia:*

1. *What are the main features of national strategies to support the development and diffusion of AI?*
2. *What are the principal modes of support used, and what pitfalls and strengths do they entail?*
3. *Across the various initiatives, how is work with industry organised?*
4. *What is known thus far about the efficacy of the support measures being used?*

*Moderator:*

**Dominique Guellec**

Head, Division for Science and Technology Policy, OECD.

*Presentations:*

Canada: **Elissa Strome**, Executive Director, Pan-Canadian AI Strategy at CIFAR

China: **Xue Lan**, Tsinghua University

Europe: **Morten Irgens**, Vice Rector, Oslo Metropolitan University

Singapore: **Tze Yun Leong**, Director, AI Technology, AI Singapore

United Kingdom: **Philip Young**, Head of Strategic Policy Delivery, Digital Catapult

*Discussion*

All Workshop participants

11:00-11:30 PM

### **Coffee Break**

# WORKSHOP AGENDA

## TUESDAY NOVEMBER 6

11:30-12:30

### **Group discussion**

#### **Leaders of National Innovation Agencies**

*Senior executives of national innovation agencies will be invited to comment on the implications of the preceding workshop discussions, raise questions (for any participants), set out relevant plans or ongoing projects in their own agencies, consider opportunities for cross-agency collaboration, and reflect on the types of additional evidence and policy-relevant research they require.*

*Moderator:*

[Alistair Nolan](#)

Senior Policy Analyst, OECD

*Speakers:*

[Eva Camerer](#) (Norway)

Manager of Innovation policies and Analysis,  
Innovation Norway

[Robert Rudnitsky](#) (USA)

Associate Director for Policy, Office of Advanced  
Manufacturing, National Institute of Standards and  
Technology (NIST)

[Ana Correia](#) (Europe)

Directorate-General for Research, European Commission

[Steffen Wischmann](#) (Germany)

Department for Innovation and Society, VDI/VDE Innovation  
+ Technik GmbH, Germany

*Open discussion*

All Workshop participants

13:00-14:30 PM

### **Lunch**

# WORKSHOP AGENDA

## TUESDAY NOVEMBER 6

14:30-15:30

### Remaining questions and further thoughts

*This session will begin by seeking participants' views on a number of questions key for the OECD:*

- *In the context of the technologies discussed at this Workshop, what needs to be better understood in order to enhance public policy for science, technology and innovation?*
- *What types of evidence gathering and research would it be most useful for an international public organisation, such as the OECD, to focus on?*

*In addition, questions that participants wish to raise but which have not been addressed will be collected on a whiteboard through Day 1 and the morning of Day 2. These questions will also be raised in this session. Hypothetical questions might here include, for example: What significant issues or opportunities has this workshop not addressed? Are there novel or underappreciated ways of combining technologies (such as AI + blockchain) which might bring unexpected consequences for policy?*

15:30-15:45

Closing remarks

*Moderator:*

[Ken Guy](#)

Director, Wise Guys Ltd. United Kingdom

*Discussion initiators*

[Svein Olav Nås](#)

Special adviser, Research Council of Norway

[Maarten van Steen](#)

Scientific Director, the Digital Society Institute (DSI),  
University of Twente

[Caroline Paunov](#)

Senior Policy Analyst, Division for Science and Technology  
Policy, OECD

[Alexander Nouak](#)

Managing Director, Fraunhofer ICT Group

*Open discussion*

All Workshop participants

Morten Irgens – Vice Rector, Oslo Met University