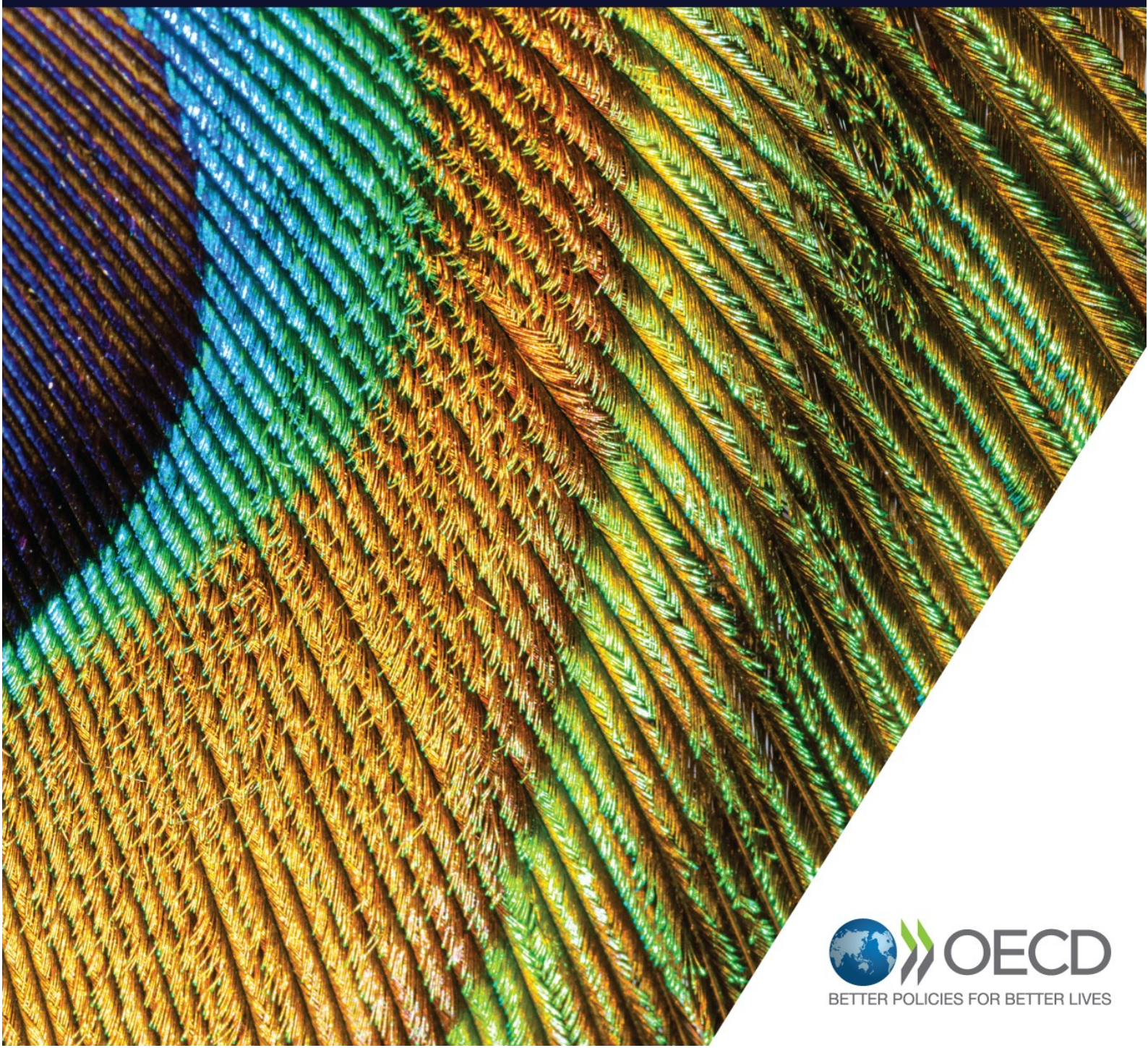
OECD
SCIENCE, TECHNOLOGY AND INDUSTRY POLICY PAPERS
APRIL 2024 No. 165

FRAMEWORK FOR ANTICIPATORY GOVERNANCE OF EMERGING TECHNOLOGIES

Highlights



OECD
BETTER POLICIES FOR BETTER LIVES

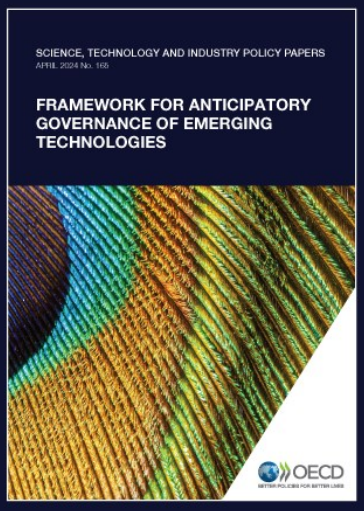
About the OECD

The OECD is a unique forum where governments work together to address the economic, social and environmental challenges of globalisation. The OECD is also at the forefront of efforts to understand and to help governments respond to new developments and concerns, such as corporate governance, the information economy and the challenges of an ageing population. The Organisation provides a setting where governments can compare policy experiences, seek answers to common problems, identify good practice and work to co-ordinate domestic and international policies.

About the OECD Committee for Scientific and Technological Policy (CSTP)

The CSTP fosters cooperation among OECD Member Countries and Partners in the field of science, technology, and innovation (STI) policy. Its goal is to contribute to economic, social, and scientific achievements, including growth, job creation, sustainable development, enhanced well-being, and advancing knowledge frontiers. It emphasises the integration of STI policy with other government policies.

The full report is accessible at
https://doi.org/10.1787/0248ead5-en



This document, as well as any statistical data and map included herein, are without prejudice to the status of or sovereignty over any territory, to the delimitation of international frontiers and boundaries and to the name of any territory, city or area.

Please cite this publication as:
OECD (2024), Framework for Anticipatory Governance of Emerging Technologies, OECD Science, Technology and Industry Policy Papers, OECD Publishing, Paris, https://doi.org/10.1787/0248ead5-en.

The use of this work, whether digital or print, is governed by the Terms and Conditions to be found at https://www.oecd.org/termsandconditions.
© OECD 2024

Policy highlights

Today's technological landscape presents not only unprecedented opportunities, but formidable challenges and deep uncertainties. Even as we invest heavily in emerging technologies to drive ecological, social, and economic transformations, we are confronted by governance challenges: threats to research integrity, intensifying competition over supply chains, autocratic misuse, and disruptions to our social systems. These developments underscore the urgent need for innovation not only in technology but also in our institutions.

To enable responsible innovation, the OECD has developed an important set of activities in technology governance. This new Framework for Anticipatory Governance of Emerging Technologies helps synthesise and advance this line of work. It complements the recently inaugurated Global Forum on Technology (GFTech), a venue for regular in-depth dialogue to foresee and get ahead of long-term opportunities and risks presented by particular technologies. The Framework provides a general set of considerations that are intended to be a useful guide in these and related discussions.

This new Framework for Anticipatory Governance of Emerging Technologies actively promotes responsible innovation across policy fields, emphasizing shared values, anticipation, societal engagement, agile governance, and international cooperation. Both the GFTech and the Framework are built on the premise that, even as technology seems more and more autonomous, value-driven policy choices can and should shape better outcomes.

In what is a central pillar of its argument, the new Framework for Anticipatory Governance of Emerging Technologies suggests that better technological outcomes can be achieved through forward-looking, “agile”, and participatory strategies. These include developing norms, standards, regulations and early-stage innovation processes like building technology roadmaps. This anticipatory approach encourages broader policymaking communities to collaborate closely to ensure the effectiveness of these governance processes and mechanisms.

Finally, the Framework emphasizes that international co-operation centred on shared values, a fundamental tenet of the OECD, has never been more important. Realizing the transformative potential of these technologies amidst shared global challenges calls for enhanced co-operation and a collective understanding of risks and opportunities. This points to an important role for the OECD on technology governance in the years ahead.

OECD Framework for Anticipatory Governance of Emerging Technologies

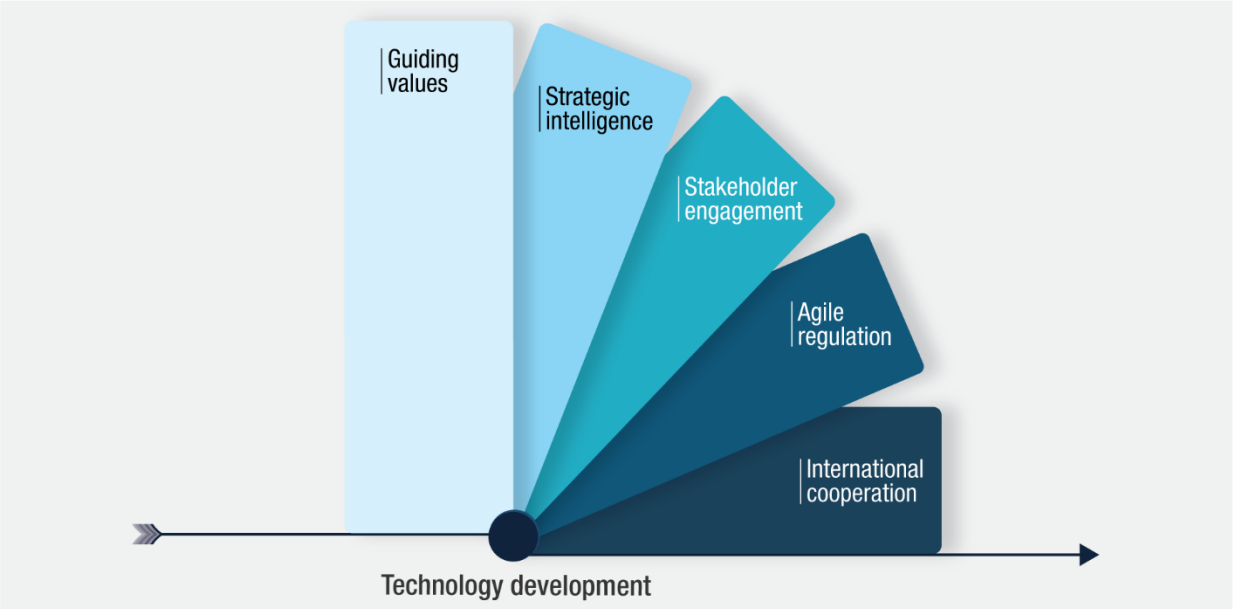
The political, economic and ecological stakes of realising good policies for emerging technologies have never been higher. Emerging technologies like synthetic biology, artificial intelligence (AI), advanced materials, neurotechnologies and quantum technologies can contribute to unprecedented gains in health, energy, climate, food systems and biodiversity. The promise of these technologies underscores the importance of the basic research that helps give rise to them. These technologies, as well as their convergence, will be key to future innovations in medicines, clean energy, and advanced manufacturing. A central challenge for innovation and regulatory policies will therefore be to support basic research and enable the development and diffusion of these technologies for economic prosperity, resilience, security and sustainable development.

Another goal for good emerging technology policy, however, will be to better anticipate disruptions, manage downside risks and bridge global technology divides. The release of generative AI and its sweeping functionality took many by surprise, underscoring the challenges of governing powerful new technology and highlighting the need for anticipation. The same emerging technologies that offer so much promise can also contribute to social disruption, loss of trust in governing institutions, inequality, and threats to security and human rights. For example, facial recognition and spyware are tools in mass surveillance, social media is a known vector for the active propagation of misinformation and reported mandatory involvement in genomics research violates human rights standards.

Five elements of emerging technology governance

This framework features five interconnected elements (Figure 1). These elements and their associated actions should be interdependent and interactional. Each of these framework elements apply to specific emerging technology contexts. The stage of technological development and the nature of the concerns raised in a technology case will determine how exactly the elements are applied.

Figure 1. Five elements of anticipatory governance apply to specific technology contexts



1. Guiding values

Technological development should be anchored in guiding values, both foundational (encompassing shared ethical, political, economic, and cultural ideals) and technology-specific (tailored to technology policy decisions). These values ensure that technology governance aligns with human rights, democratic principles, sustainability, equity, inclusion, safety, and the public good. Ethical, social, and political dialogue can nurture and develop this values-based innovation culture. Integrating these values throughout the entire process, from agenda-setting to deployment by innovators is vital to ensuring responsible and inclusive technological advancement.

Key actions

- **Place the consideration of values at the centre** of innovation policy to harness the positive potential of emerging technologies
- **Use foundational values shared by liberal democracies as a starting point** to anchor responsible innovation and identify values specific to technology contexts
- **Enable deliberative, accountable and trustworthy processes**, to prioritise and specify values in a given technology context. To do so, create fora within and across diverse communities, build capacity for meaningful engagement and ensure information integrity

  Embed values throughout the innovation cycle, including in agenda-setting, design of R&D, design of technology and regulation. This requires innovation actors to seek to align technological development with values in particular institutional contexts at particular loci in that process.

2. Strategic intelligence

Recognizing the unpredictable nature of emerging technologies, policies should foster shared forms of strategic intelligence, involving the comprehensive analysis of technology's potential directions, economic stakes, and societal implications. Robust tools like horizon scanning, foresight and technology assessment should be employed to anticipate future challenges and

inform governance strategies. This anticipatory approach aids in the informed development of strategic visions, plans, and roadmaps for emerging technologies.

Key actions

- **Gather strategic intelligence in situations of technological uncertainty**. Strategic Intelligence is useable knowledge that supports policy makers in understanding the relevant aspects and scope of the impacts of science, technology and innovation, and their potential future developments. It is particularly important for emerging and rapidly evolving technologies.
- **Identify, diagnose, assess**. (1) horizon scan to pick up weak signals for potential technologies of high interest; (2) diagnose the technology for levels of policy concern and ripeness for governance interventions using six dimensions; (3) appraise using broader array of tools and a wider involvement of experts and society -- assessing risks, uncertainties, and potential technology futures.
- **Build capacity through international co-operation and best practice exchange**. Advance the development of national and international foresight and technology assessment initiatives on emerging technologies by supporting national scientific agencies or institutes, offer targeted funding opportunities, and/or support collaborations between academia, government and industry.
- **Nurture ecosystems of intelligence**. Build an ecosystem of technology appraisal that is broadly inclusive of stakeholders and publics and coordinated across agencies.

3. Stakeholder engagement

Policies should prioritize the proactive engagement of stakeholders and the broader society in the policy-making cycle. Similarly, engaging diverse actors early in the technology development cycle enriches the understanding of issues, fosters trust, and aligns technological innovation with societal needs. Care is needed to balance the range of perspectives and ensure that vocal vested interests do not dominate the process. Tools for societal engagement, including capacity-building, communication, consultation and co-creation should be leveraged to ensure broad-based participation and alignment of science and co-design of technology strategies and governance.

Key actions

- **Determine an appropriate breadth and depth of engagement activities** by diagnosing the technology case in terms of the six assessment factors.
- **Invest in building a long-term foundation for societal engagement**. Select engagement tools and techniques based on their purposes: capacity building, communication and consultation, and/or co-creation.
- **Use deliberative processes to co-design technology strategies and agendas** with policy makers, science advisers, other experts and citizens to better align science funding and societal priorities.
- **Encourage interdisciplinary research and engineering** to infuse technological development with diverse perspectives and ethical, legal and social considerations
- **Develop "collaborative platforms"** with partners in industry, start-ups, and civil society, to nurture emerging technologies.

4. Agile regulation

Given the fast pace and evolving nature of emerging technologies, governance systems must strive for agility and anticipation through adapting regulatory tools, fostering inter-agency co-operation, developing forward-looking governance frameworks, and ensuring responsiveness

to stakeholder concerns. Experimentation and testing under regulatory supervision should be encouraged to foster innovation, reduce uncertainty, and ensure that governance systems remain relevant and effective. Policy makers should also explore the potential of non-binding governance approaches such as high-level principles, technical standards and codes of conduct.

Key actions

- **Implement adaptive and iterative regulatory assessment cycles**, respond to stakeholder and public concerns, and coordinate across regulatory silos.
- **Use experimentation tools** like testbeds and regulatory sandboxes for adaptive policy learning.
- **Use outcome-based approaches** that can prove more effective in new policy areas where limited evidence is available, such as emerging technologies.
- **Consider non-binding governance approaches** (high-level norms, principles and guidelines, technical and normative standards, codes of conduct and by-design approaches) as complementary approaches to public governance.
- **Engage and incentivise the private sector** for responsible innovation early on. This requires a new set of policy perspectives and tools, like the "ethics-by-design" paradigm and the Responsible Business Conduct approaches.

5. International cooperation

Acknowledging the transboundary nature of technology, policies should promote international co-operation in the face of a shifting geopolitical landscape. Forward-looking dialogue in inclusive fora should be facilitated to coordinate approaches to emerging technology governance, share experiences, deepen understandings, and lay the groundwork for collective standard-setting. Promoting a multi-stakeholder, consensus-driven development of technical standards and principles ensures the interoperability of emerging technologies and the creation of markets for responsible technology products and services.

Key actions

- **Engage in forward-looking dialogue** within inclusive and multilateral fora
- **Help develop common analysis and agreed forms of evidence** and evidence-making to inform emerging technology governance approaches at the international level
- **Reinforce international co-operation in science and technology** development to bolster shared approaches to the ethics of science and technology
- **Develop international norms** – e.g. principles, guidelines and technical standards - based on shared values.

Aims and audience

- **leverage emerging technologies** for societal benefit
- **anticipate, prepare for and act** on governance challenges in future emerging technology contexts
- **build longer-term governance capacities** to deal with emerging cases more effectively and efficiently

The framework might also inform national emerging technology strategies in addition to shaping emerging technology governance activities on the national and international level. The framework might also be a source of guidance for technology governance discussions within the OECD Global Forum on Technology, as well as future OECD work, including on future OECD legal instruments.

As the implementation of anticipatory governance requires a whole-of-government approach and collaboration across agencies, the framework has been designed with and for actors from

a variety of sectors and agencies, e.g. governmental science and technology policy communities, regulatory communities, foresight and strategic units, and sector specific agencies in health, environment and economy.

Rationale for a general framework: common governance questions

Specific emerging technologies and applications have unique governance needs that will differ across sectors and stages of innovation. Still, emerging technologies pose many of the same policy questions and challenges, for example:

- How to **balance risks and benefits** of emerging technologies under conditions of political, technological and economic uncertainty?
- How to **adapt governance to converging technologies** that cut across multiple regulatory categories?
- How to **rally multilateral actors** to engage in cooperative governance approaches given accelerating global competition?
- How to **address the mismatch between the transboundary nature of technology and the jurisdictional boundaries of governance** and regulation?
- How to **engage a broader range of actors** in the design of technology and governance to make emerging technology more inclusive, democratic and effective?

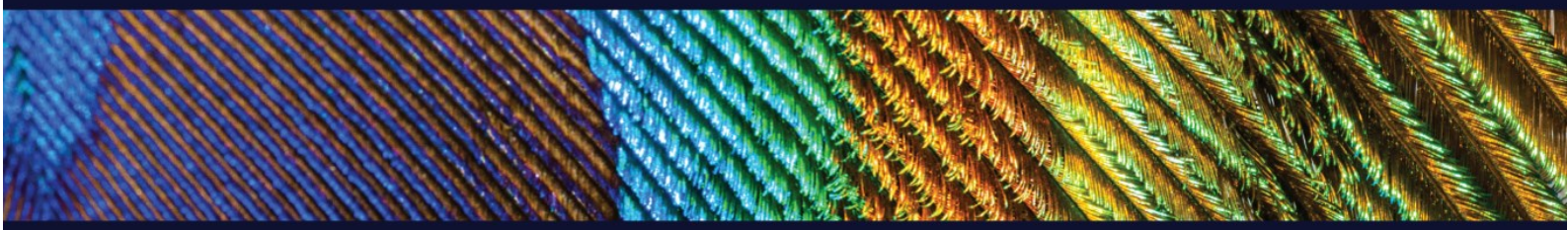
This framework brings together existing OECD standards, policy tools, and good practices to propose a general approach to the governance of emerging technologies. Working with and building upon governance work on specific technological areas, the framework aims to address recurrent issues and policy questions.

Importance of anticipation

To help address these challenges and answer these questions, this framework places anticipation at the centre of emerging technology governance. The common drivers noted above -- and experiences with, for example, AI, neurotechnology and biotechnology – point to the need to take on new kinds of forward-looking approaches to emerging technology governance. What might be called, “Anticipatory technology governance” encourages a shift in how we imagine the challenge of governance from the management of technological risks to “getting ahead” of technology developments.

This approach seeks address technology as it emerges and evolves to increase the power of governance both to stimulate innovation and manage risks. The framework aims to guide the development of national and international norms and standards, but also elements at earlier stages in the innovation process such as setting technology strategies, agendas and roadmaps, codes of scientific and engineering practice, and the organisation of research and development.

The notion of anticipation here promotes consideration of potential concerns through open and inclusive processes in order to better align innovation and regulation trajectories with societal goals. Different policymaking communities will need to work hand in hand to achieve this vision. Recent OECD recommendations such as the OECD Recommendation on Responsible Innovation in Neurotechnology, have stressed the potential utility of upstream engagement, technical standards, and codes of practice within the communities of science and technology policy. In a complementary fashion, the OECD Recommendation for Agile Regulatory Governance to Harness Innovation stresses the need for a more forward-looking and agile approach within regulatory communities.



OECD
BETTER POLICIES FOR BETTER LIVES

For more information:

www.oecd.org/sti

sti.bnct@oecd.org