Sustaining a chemical knowledge commons

Akos Kokai, PhD

Clean Production Action Webinar | 2020.06.30

“Building a Chemical Commons” | 2012

Organized by
- Charlotte Brody (BlueGreen Alliance)
- Mark Rossi (Clean Production Action)
- Joel Tickner (UMass Lowell)

“Because our individual efforts will be strengthened by commonly created definitions and strategies that are designed to nurture, protect, and expand all alternatives assessment and chemical hazard work.”

THE COMMONS PRINCIPLES FOR ALTERNATIVES ASSESSMENT

Addressing Chemicals of Concern to Human Health or the Environment

In October 2012, a group of 26 environmental health scientists, advocates, funders and policy makers met in Boston, Massachusetts for two days of meetings entitled **Building a Chemical Commons: Data Sharing, Alternatives Assessment and Communities of Practice**. One of the key outcomes of this meeting was an agreement regarding the need for a common definition and set of principles for chemicals alternatives assessment. Following this meeting, a subcommittee met over four months in 2013 to refine a consensus set of principles. These principles were based on earlier foundational work by the Lowell Center for Sustainable Production, the Massachusetts Toxics Use Reduction Institute, the Environmental Defense Fund, and the BizNGO Working Group. These principles are now available to be shared and used in framing discussions about alternatives assessment and to guide decision making about safer chemical use.

Alternatives Assessment is a process for identifying, comparing and selecting safer alternatives* to chemicals of concern (including those in materials, processes or technologies) on the basis of their hazards, performance, and economic viability. A primary goal of Alternatives Assessment is to reduce risk to humans and the environment by identifying safer choices.

These Principles for Alternatives Assessment are designed to guide a process for well informed decision making that supports successful phase out of hazardous products, phase in of safer substitutes and elimination of hazardous chemicals where possible.

REDUCE HAZARD Reduce hazard by replacing a chemical of concern with a less hazardous alternative. This approach provides an effective means to reduce risk associated with a product or process if the potential for exposure remains the same or lower. Consider reformulation to avoid use of the chemical of concern altogether.

MINIMIZE EXPOSURE Assess use patterns and exposure pathways to limit exposure to alternatives that may also present risks.

USE BEST AVAILABLE INFORMATION Obtain access to and use information that assists in distinguishing between possible choices. Before selecting preferred options, characterize the product and process sufficiently to avoid choosing alternatives that may result in unintended adverse consequences.

REQUIRE DISCLOSURE AND TRANSPARENCY Require disclosure across the supply chain regarding key chemical and technical information. Engage stakeholders throughout the assessment process to promote transparency in regard to alternatives assessment methodologies employed, data used to characterize alternatives, assumptions made and decision making rules applied.

RESOLVE TRADE-OFFS Use information about the product's life cycle to better understand potential benefits, impacts, and mitigation options associated with different alternatives. When substitution options do not provide a clearly preferable solution, consider organizational goals and values to determine appropriate weighting of decision criteria and identify acceptable trade-offs.

TAKE ACTION Take action to eliminate or substitute potentially hazardous chemicals. Choose safer alternatives that are commercially available, technically and economically feasible, and satisfy the performance requirements of the process/product. Collaborate with supply chain partners to drive innovation in the development and adoption of safer substitutes. Review new information to ensure that the option selected remains a safer choice.

* "Safer Alternative: An option, including the option of not continuing an activity, that is healthier for humans and the environment than the existing means of meeting that need. For example, safer alternatives to a particular chemical may include a chemical substitute or a re-design that eliminates the need for any chemical addition." From Tickner, J. and Eliason, P. *Alternatives Assessment for Chemicals: From Problem-Evaluation to Solutions-Assessment and Implementation: A background paper created expressly for use in the March 31–April 1, 2011 Interagency Discussion on Alternatives Assessment, EPA Potomac Yards Conference Facility, Crystal City, VA*. March 24, 2011

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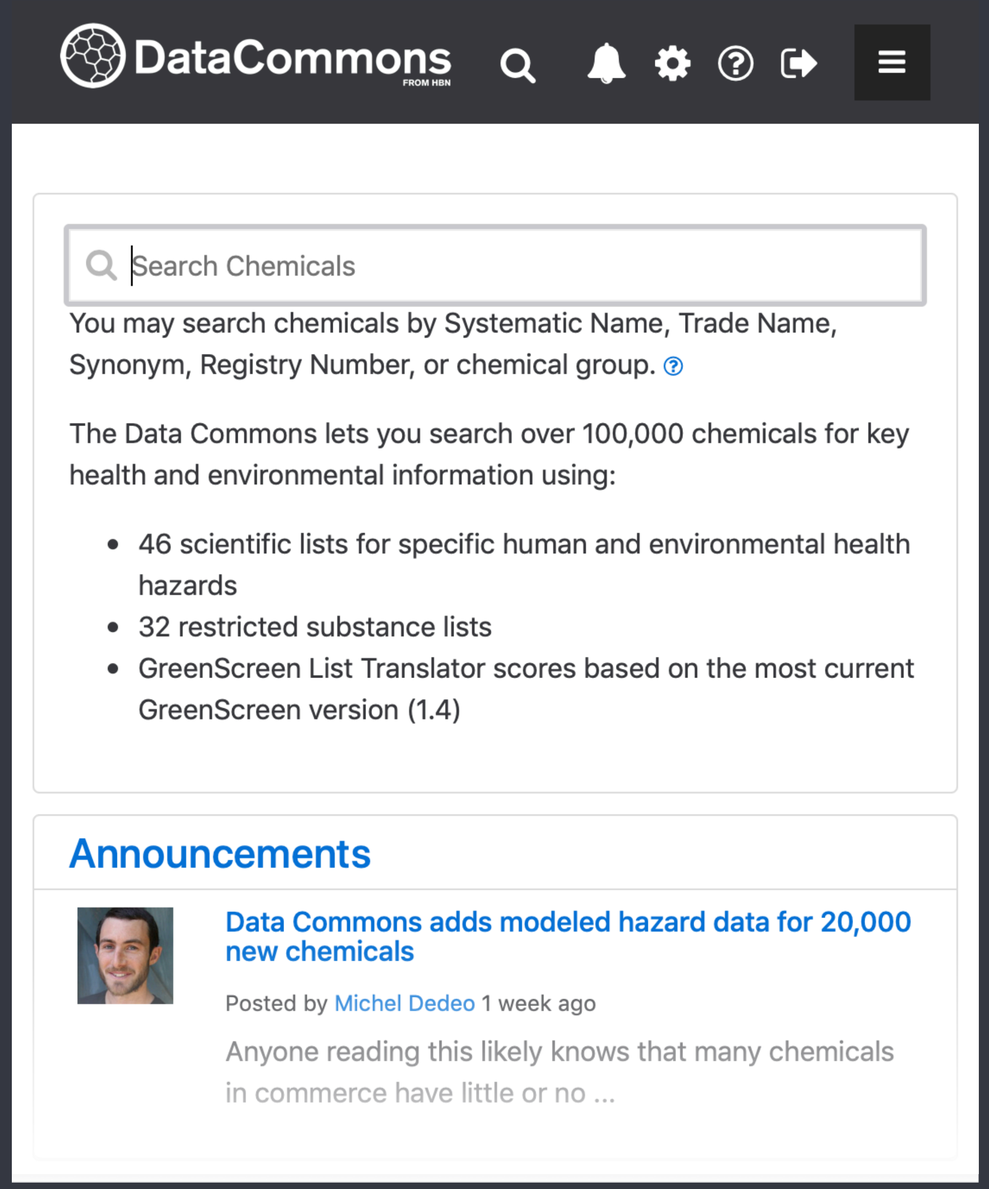


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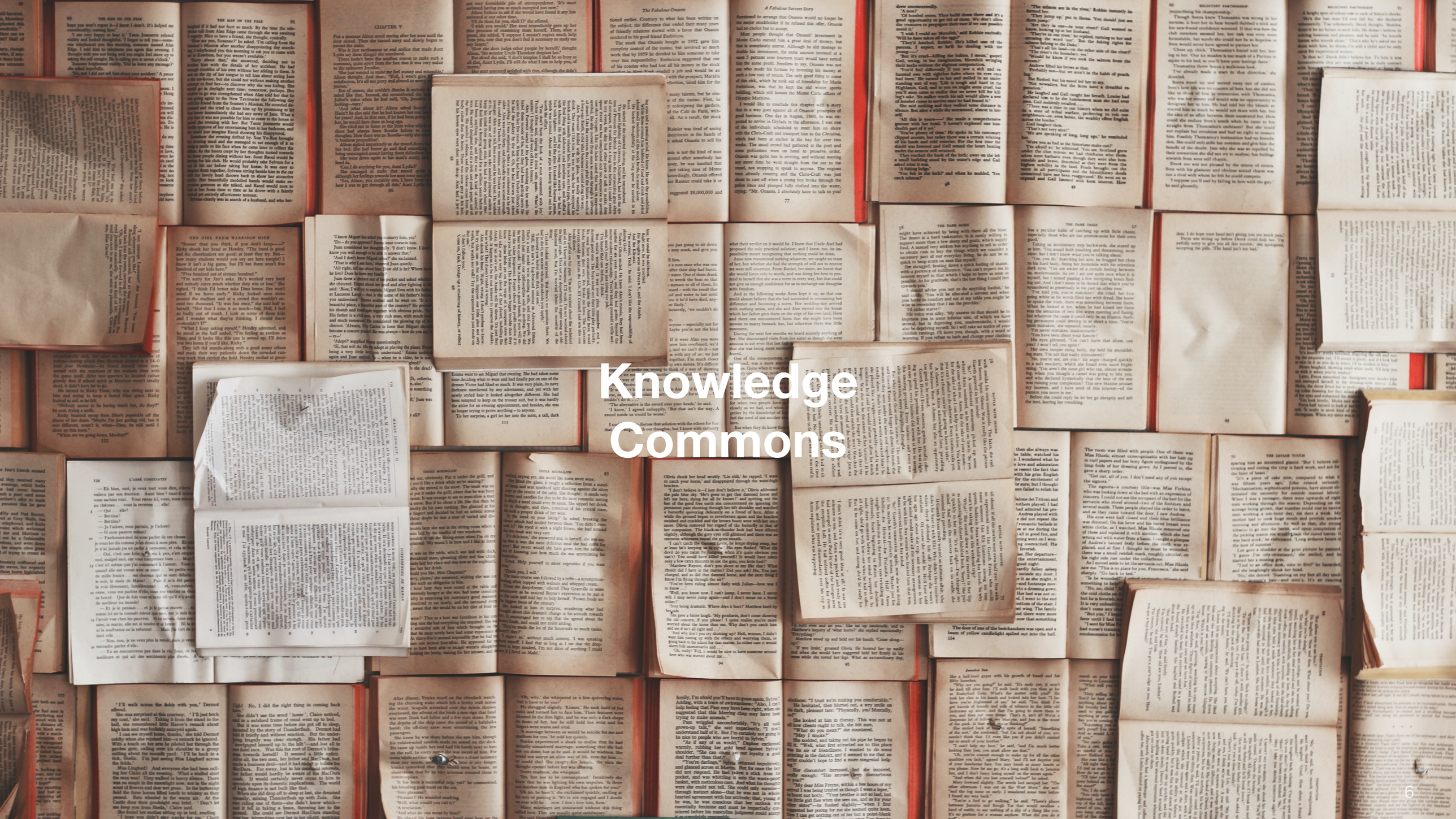
GOVERNING the COMMONS

ELINOR OSTROM

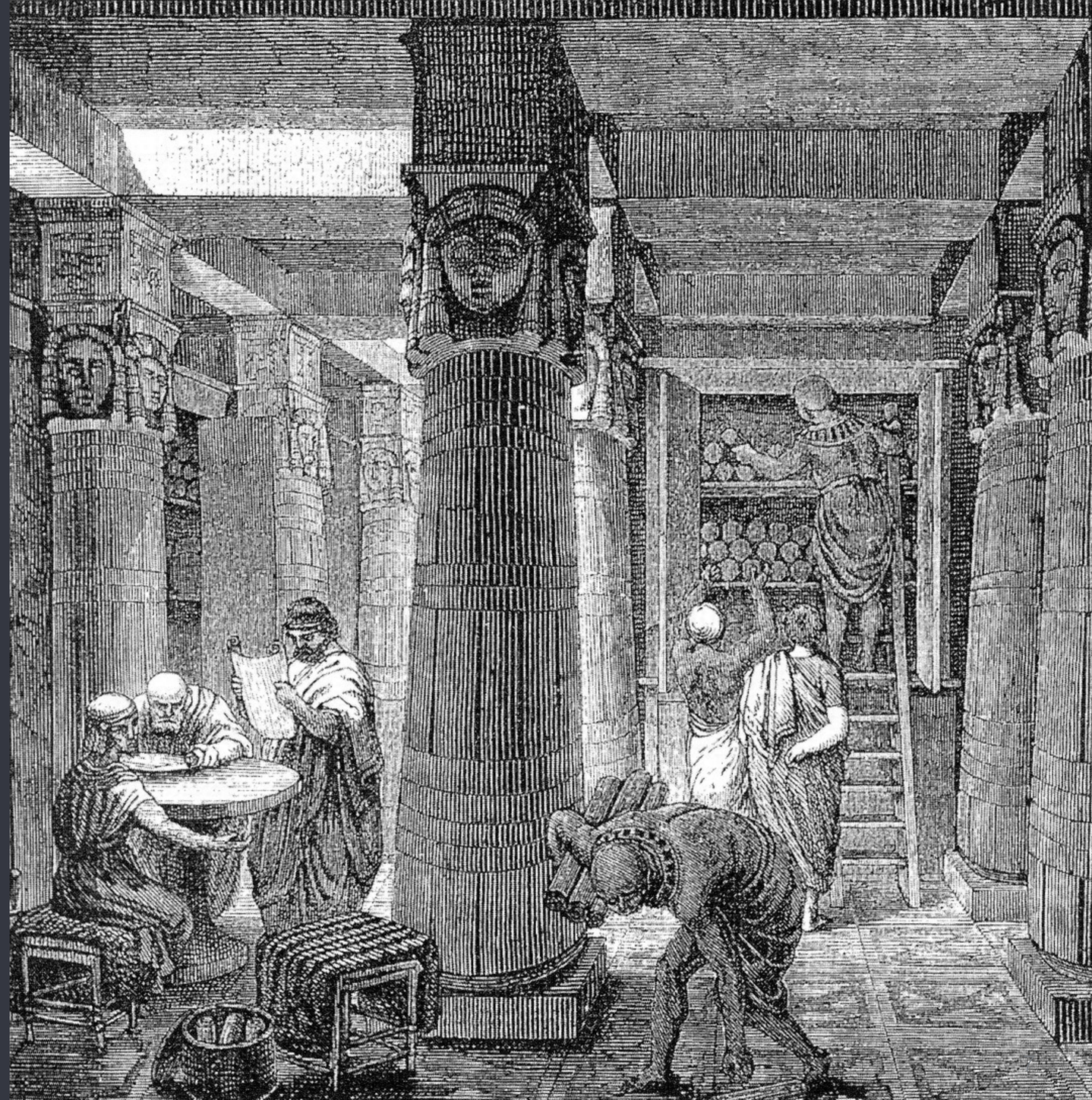
The Evolution of Institutions for Collective Action

2009 Nobel Prize Winner

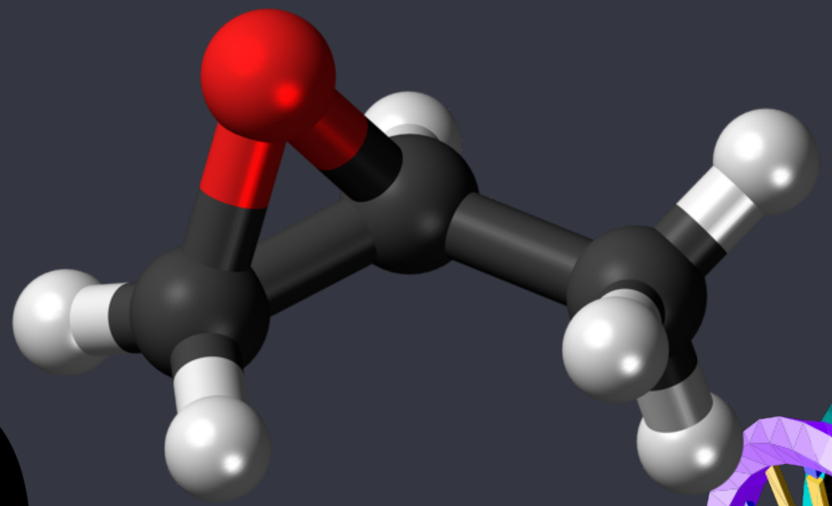
Political Economy of Institutions and Decisions

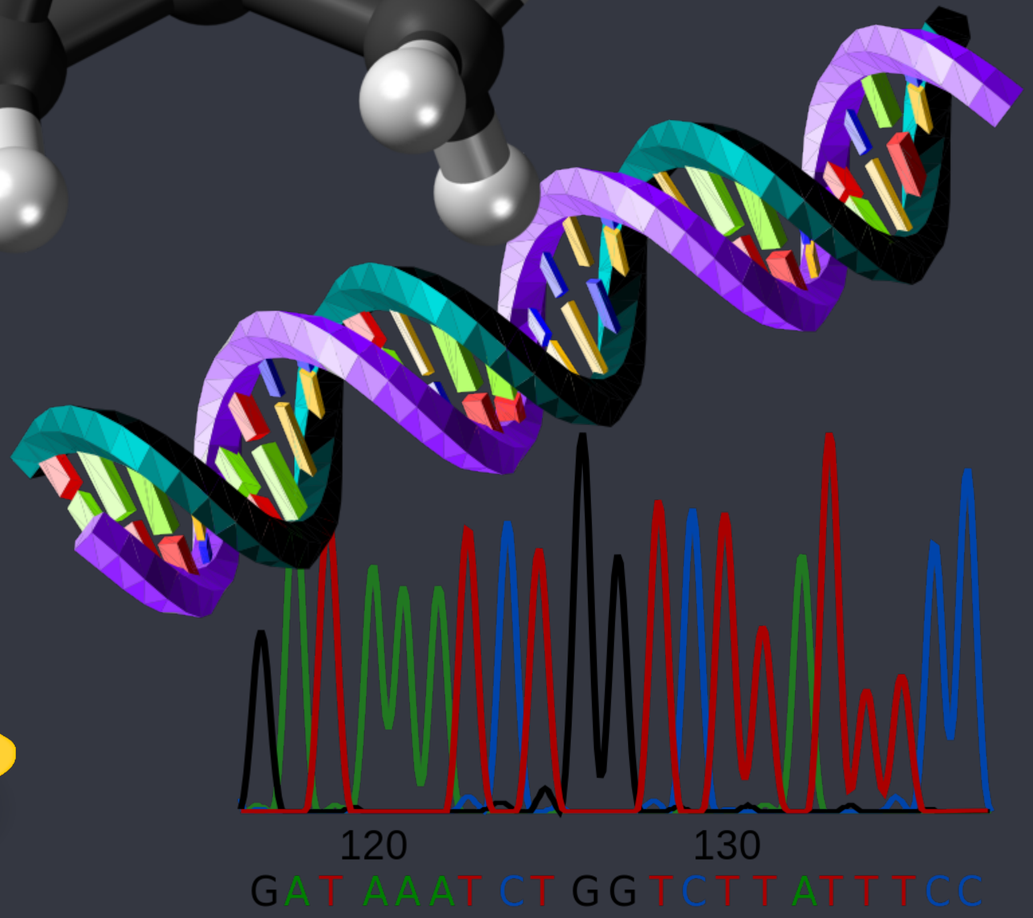

Knowledge
Commons

Knowledge commons



Knowledge commons





Hess, C., & Ostrom, E. (Eds.). (2007). *Understanding knowledge as a commons: From theory to practice.* MIT Press.
Schweik, C. M., & English, R. C. (2012). *Internet success: A study of open-source software commons.* MIT Press.
Frischmann, B. M., Madison, M. J., & Strandburg, K. J. (Eds.). (2014). *Governing knowledge commons.* Oxford University Press.

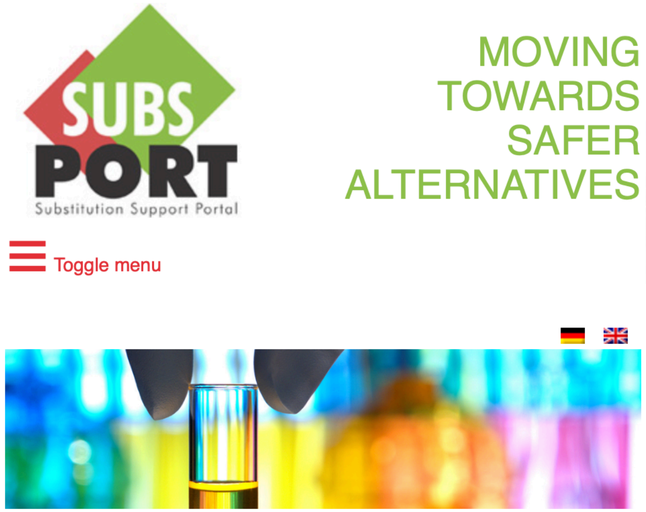
Knowledge commons

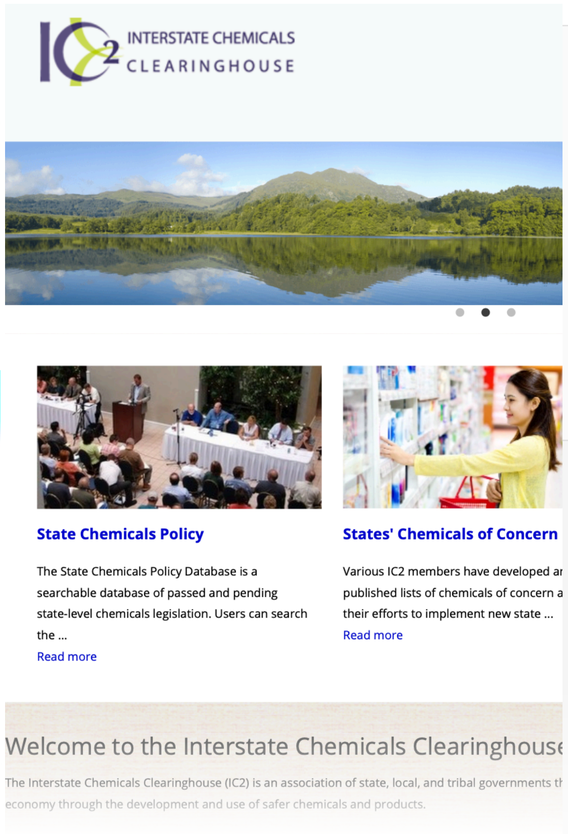
- Are governed by rules, protocols, and community practices
- Not the same as “open access”
- Face different challenges than natural resource commons

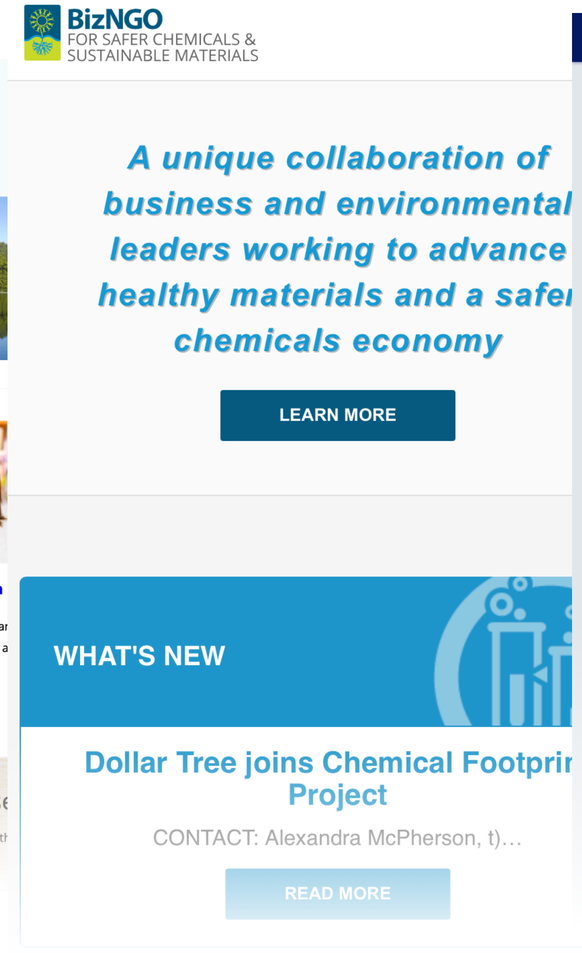
Hess, C., & Ostrom, E. (Eds.). (2007). *Understanding knowledge as a commons: From theory to practice.* MIT Press.
Frischmann, B. M., Madison, M. J., & Strandburg, K. J. (Eds.). (2014). *Governing knowledge commons.* Oxford University Press.

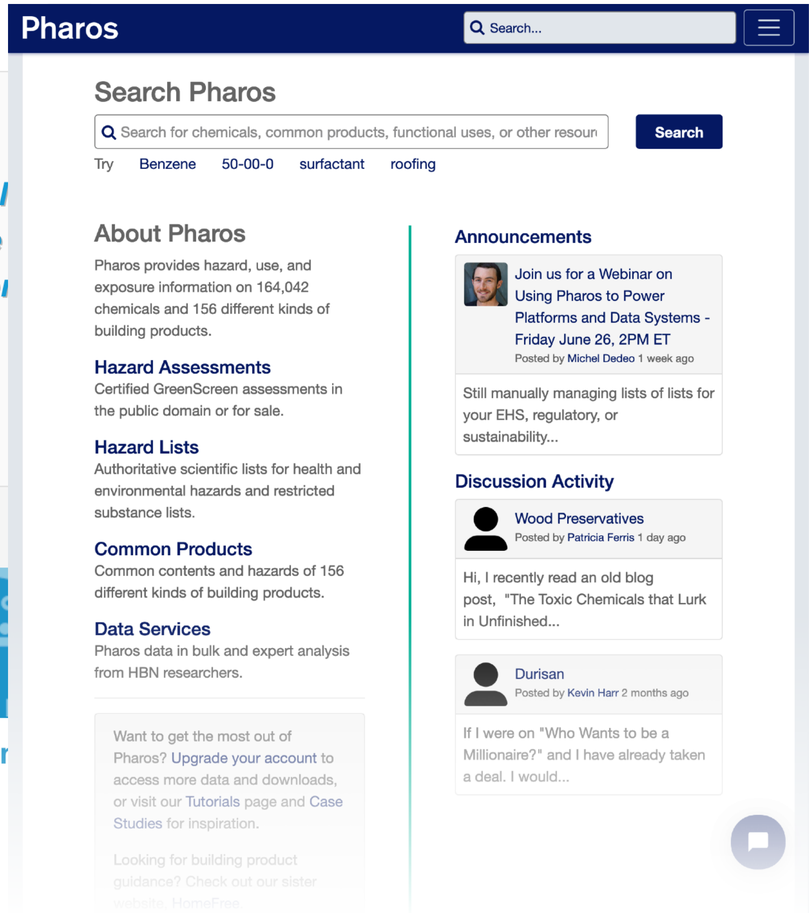
Why knowledge commons for safer chemicals?

Initiatives for knowledge sharing in CHA/CAA









Screenshots: https://www.subsportplus.eu | https://theic2.org | https://www.bizngo.org | https://pharosproject.net

Some knowledge resources for safer chemical substitution

Resource Type	Access	Who provides them	Examples
Assessment methodologies	Shared	NGOs and government agencies, sometimes with external input	EPA Safer Choice; GreenScreen; Cradle to Cradle Material Health
Certifications and standards	Shared	NGOs, firms, and governments	GHS; EPA Safer Choice Standard; Health Product Declaration
Data resources	Shared	NGOs, firms, and governments	Pharos; Toxnot; SIN List; PubChem
Chemical assessments	Mostly private; some shared	Chemical profilers & platforms	ToxFMD; Scivera; ChemForward; Pharos

Community goals motivate collective knowledge work

Community goals motivate collective knowledge work

Community goals	Underlying shared challenges
Create new shared resources	Lack of existing methods, tools, databases
Reduce duplicative work	Many disparate centers of activity Many disconnected data sources
Alignment on technical, methodological, and scientific issues	Scientific uncertainty & conflicting interpretations Hazard & exposure data gaps
Consistency & interoperability	Making the case for safer substitution in practice Having an aggregate effect on industry

The Chemical Hazard Data Commons

The Chemical Hazard Data Commons

- Provide publicly available data & tools for CHA/CAA
- Enable community participation in developing new knowledge resources
- Integrated into Pharos since 2019.09

ELEMENTA
Science of the Anthropocene

Kokai, A, et al. 2020. Building shared information infrastructure for chemical alternatives assessment. *Elem Sci Anth,* 8: 26. DOI: https://doi.org/10.1525/elementa.422

PRACTICE BRIDGE

Building shared information infrastructure for chemical alternatives assessment

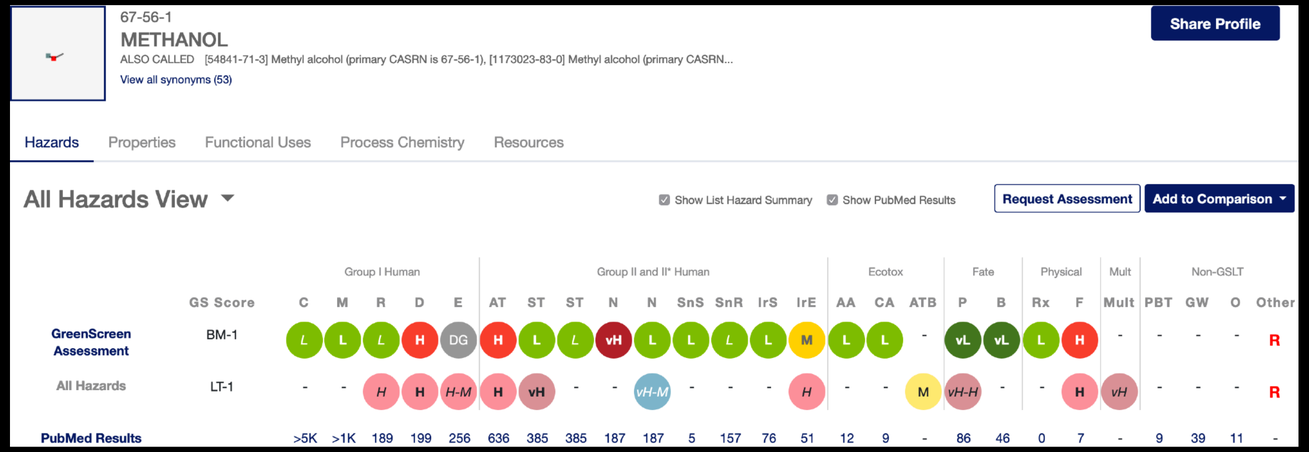
Akos Kokai*, Ann Blake†, Michel Dedeo‡ and Tom Lent‡

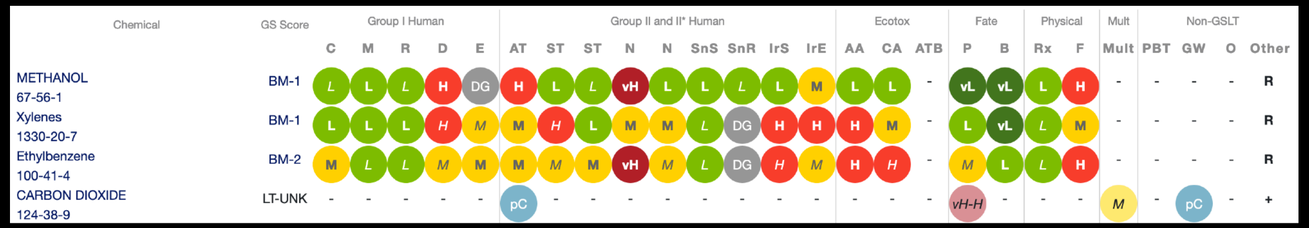
The substitution of hazardous substances with safer alternatives is being driven by policy pressures and business demands. As a result, scientific techniques for chemical alternatives assessment (CAA) have been established and communities of practice are emerging. Interest in safer chemical substitution is widely shared throughout a range of stakeholder groups across science, industry, public policy, and advocacy. Yet there is an unmet need for intentionally designed public information infrastructure to support the highly knowledge-intensive nature of CAA. We report here on the process of developing the Chemical Hazard Data Commons, an experimental project intended to support a diverse community of practitioners by providing publicly accessible chemical hazard data and tools for understanding it. In an arena where market forces and regulatory regimes have largely failed to generate the necessary knowledge, this project represents a novel application of a commons-based approach emphasizing building shared intellectual and technical capacity for CAA. The Data Commons—now a part of the related Pharos Project—includes an online portal providing simultaneous access to many different sources of information and enabling effective interactions with it. Foremost among these interactions are search and retrieval of hazard information about chemical substances, uniform display of the most relevant information, and the ability to automatically screen substances against consistent and transparent hazard-based criteria. We describe the motivation for the project and report on the principles and key considerations that guided its design as a participatory information infrastructure. We present our approach to organizing chemical information; the process of community engagement and planning; and how we constructed the system to provide functional tools. We discuss the outcomes of the project and highlight important challenges—such as fostering active participation and planning for long-term governance. With this article, we hope to inform future efforts for the collaborative development of knowledge resources for chemical alternatives assessment.

Participatory information infrastructure

Information infrastructure

- Organizing data meaningfully
- Practical tools based on accepted frameworks (e.g., GreenScreen LT)





Participatory information infrastructure

Participatory

- Community engagement in development
- Interactive system (forums, projects)
- Aggregating community expertise

Collaborative knowledge production: How?

- Harness people's interest & available expertise
- A variety of motivations; no universal incentive structure
- Channel attention to problems that need solving
- Make it easy to contribute
  - Modular projects
  - "Microcontributions"

Benkler, Y. (2006). *The wealth of networks.* Yale University Press.
Schweik, C. M., & English, R. C. (2012). *Internet success: A study of open-source software commons.* MIT Press.
Nielsen, M. A. (2012). *Reinventing discovery: The new era of networked science.* Princeton University Press.

Forms of collaboration

- Adding NGO research to the Data Commons
  - Unpublished US EPA regulatory documents (with NRDC)
  - Plastic packaging chemicals (with Food Packaging Forum)
- Shared scientific literature library
- Community discussion and support (forums)
- Collaborative development of chemical groups methodology
- Collaborative review of studies & datasets
- Collaborative work on hazard assessment science

Challenges to collaboration

- A poor fit between problem-solving needs, community availability, and online tools
  - Limited available ways of participating
  - High technical demands for participants
  - Long-term projects without compelling immediate benefits

- Majority of development effort went into tools
  - Lack of sustained community engagement efforts

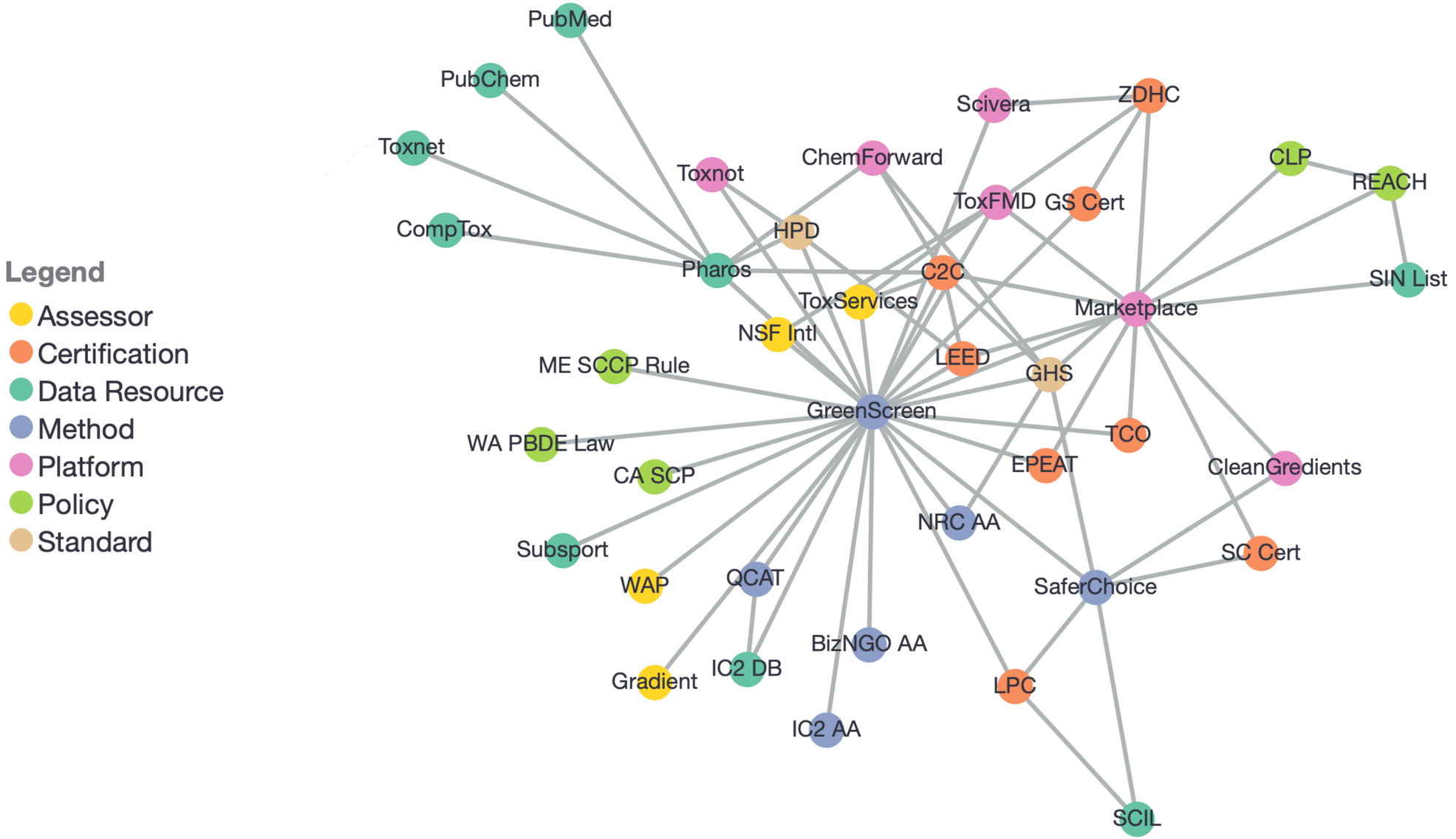
Lessons learned

- Shared information infrastructure and tools have benefited educational, NGO, and business projects

- “Scaling” chemical hazard assessment won’t work without addressing the institutional and economic background conditions

The GreenScreen Ecosystem

A knowledge network for safer chemical substitution



The GreenScreen “ecosystem” is a knowledge commons

Resource	Access	Provision
GreenScreen method	Shared	Clean Production Action with community input
Derivative methodologies	Shared	NGOs & governments
Associated tools, databases	Shared	NGOs & firms
GreenScreen assessments	Private; some shared	Profilers

How are knowledge resources are produced, verified, and shared?

Challenges for policy-relevant science

- Data gaps
- Scientific uncertainty
- Conflicting interpretations
- Political contestation

Judson, R., et al. (2009). The toxicity data landscape for environmental chemicals. *EHP.* 10.1289/ehp.0800168
Wilson, M. P., & Schwarzman, M. R. (2009). Toward a new U.S. Chemicals policy. *EHP*. 10.1289/ehp.0800404
Scruggs, C. E., & Ortolano, L. (2011). Creating safer consumer products: The information challenges companies face. *Env Sci & Pol.* 10.1016/j.envsci.2011.05.010

Challenges for policy-relevant science

- Contested definitions of safety
- What counts as acceptable evidence
- History of adversarial deconstruction & delegitimization of science (U.S.)

Jasanoff, S. (1987). Contested boundaries in policy-relevant science. *Social Studies of Science,* 17(2). 10.1177/030631287017002001
Markowitz, G. E., & Rosner, D. (2003). *Deceit and denial: The deadly politics of industrial pollution.* University of California Press.
Vogel, S. A. (2013). *Is it safe? BPA and the struggle to define the safety of chemicals.* University of California Press.
Boudia, S., & Jas, N. (Eds.). (2014). *Powerless science? Science and politics in a toxic world.* Berghahn.

Socially robust knowledge

Helga Nowotny

- Tested in the real world, not just scientific labs
- By an extended community of experts
- Through an iterative, participatory process of testing & modification

Nowotny, H., Scott, P., & Gibbons, M. (2001). *Re-thinking science: Knowledge and the public in an age of uncertainty.* Polity.
Nowotny, H. (2003). Democratising expertise and socially robust knowledge. *Science and Public Policy,* 30(3). 10.3152/147154303781780461
Iles, A. (2013). Greening chemistry: Emerging epistemic political tensions in California and the United States. *Public Understanding of Science,* 22(4). 10.1177/0963662511404306

Can the GreenScreen commons produce socially robust knowledge?

Empirical investigation

- Formal rules and protocols
- Informal community norms
- Processes of GreenScreen method development
- Quality-control processes for GreenScreen assessments
- Scientific controversies

Method development processes

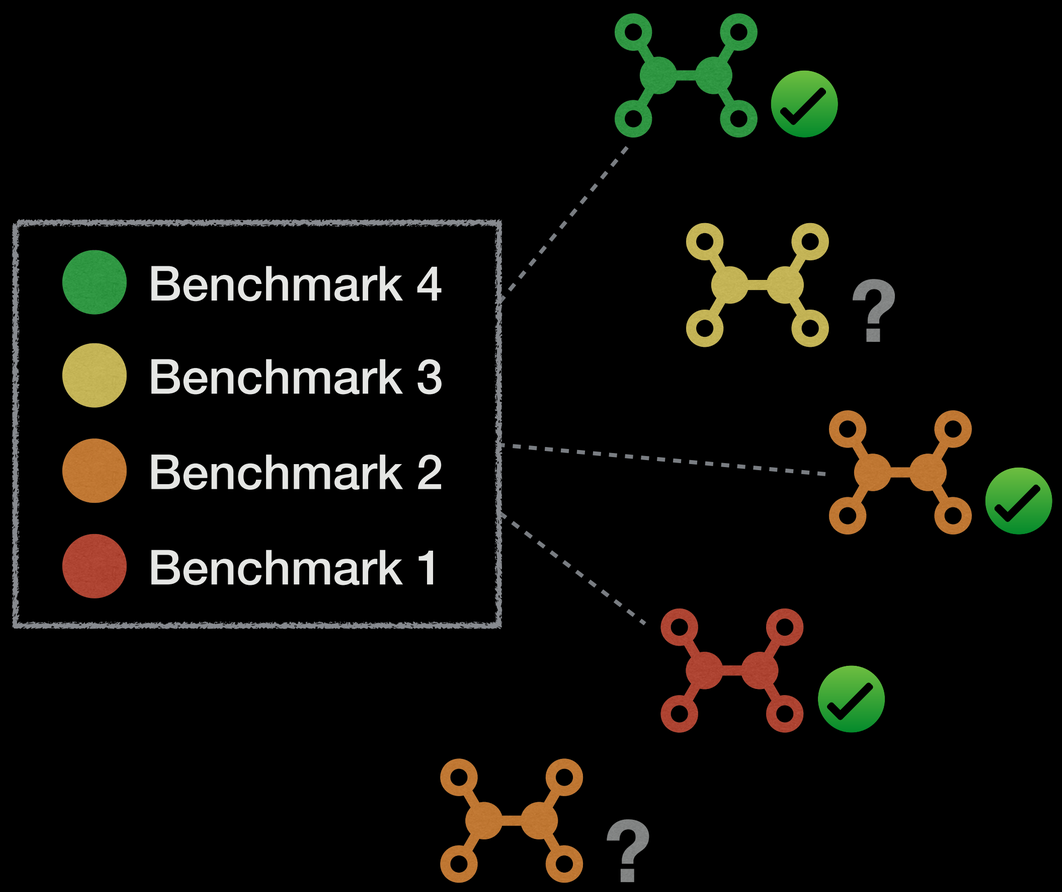
Socially robust knowledge	GreenScreen method
Tested in the real world	Yes
Extended expert community	Yes
Iterative, participatory testing & modification	Yes

- Formal mechanisms for community input
- Open and iterative processes
- Practical testing

Chemical assessments

Quality control processes

- Profiler accreditation
- Limited transparency rules
- Conflict resolution protocols
- Intellectual property rights



Chemical assessments

Socially robust knowledge	GreenScreen assessments
Tested in the real world	Yes
Extended expert community	Sometimes, depending on access
Iterative, participatory testing & modification	No

- Verification processes don’t include community review or stakeholder participation
- Community is excluded from knowledge unless granted access

Commons dilemmas

Underproduction

- How to produce a breadth of chemical hazard & alternatives knowledge to meet community demands?
- How to produce GSAs for many, many more substances?

Privatization

- How can the commons provide actionable chemical knowledge for everyone who needs it—not just private sector clients?

Quality control

- How to produce chemical-specific knowledge that is robustly verified?
- How will knowledge from the commons stand up to outside tests of validity?

Influential background conditions

- The proprietary market for chemical knowledge
- Legal regimes and industry practices that structure the market
  - IP rights
  - Chemical CBI protection
- Regulatory systems that have co-evolved with these conditions
- Scientific approaches co-evolving with regulatory systems…

Business model innovation?

- Pooled chemical assessment resources
- Lowering costs for access
- Offering some assessments free of charge (e.g. ToxFMD, ChemForward)
- Still shaped by background conditions

Economic & policy solutions?

- Government funding of CAA R&D
- Collaborative funding of full chemical assessments
  - Industry consortia
  - Civil society crowdfunding
- Regulatory or certification requirements to publish full CHA information

Should there be greater transparency and public access to chemical knowledge?

What is the purpose of transparency?

- Transparency as a form of public oversight in governing chemicals & materials
- Transparency as a tool for industry innovation & self-transformation

Thank you

Inspiration & action

Green chemistry & safer alternatives community

Research Advisors

Prof. Alastair Iles | ESPM

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Dr. Megan Schwarzman | School of Public Health

Funding

US National Science Foundation

Berkeley Center for Green Chemistry

Key concepts & findings

- Commons dilemmas
  - Underproduction
  - Privatization
  - Quality control
- Socially robust knowledge
  - Real-world testing
  - Iterative development
  - Extended peer community
- Tensions
  - What is the purpose of transparency?

Questions

- How might the CAA community approach “extended peer review” of chemical-specific assessments?
- What lessons would you take away from the Data Commons or GreenScreen case studies?

Thank you