2013 NNI R3 Stakeholder Workshop

Nanotechnology Multi-Stakeholder Risk Perception: Implications for Risk Analysis, Management, and Communication

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Washington, DC

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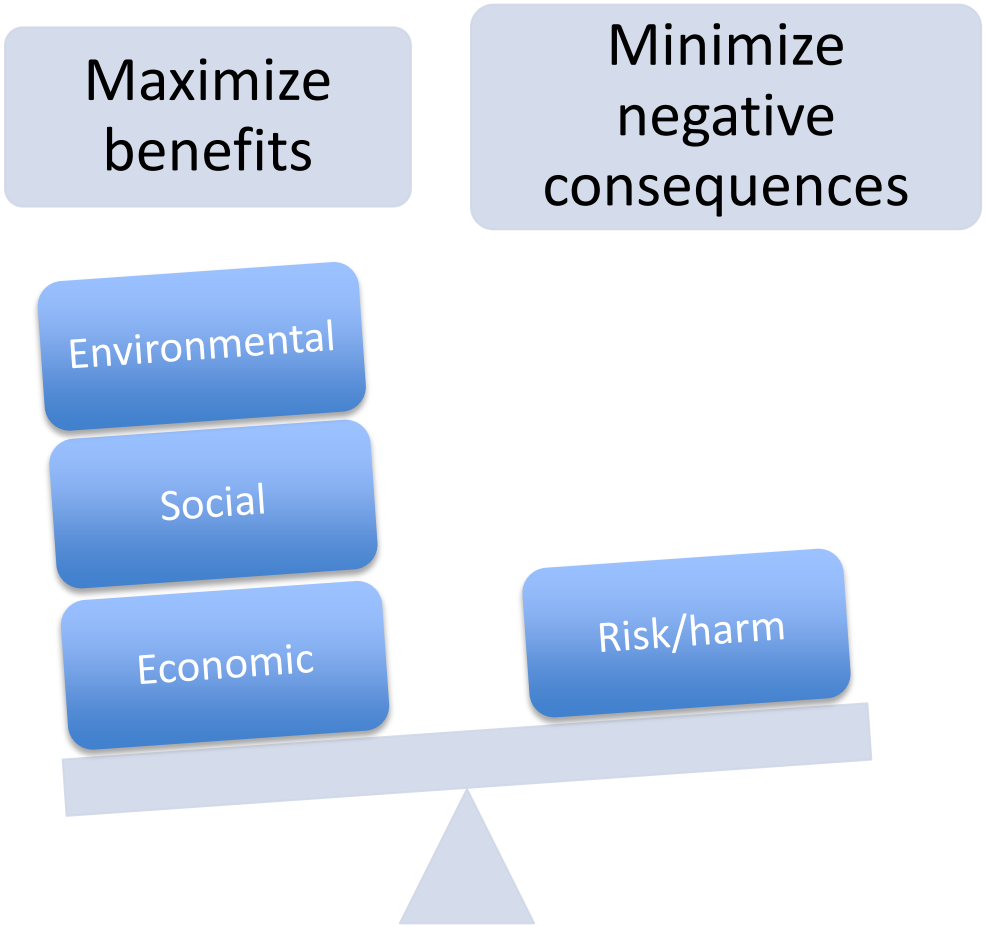
SES 0938099

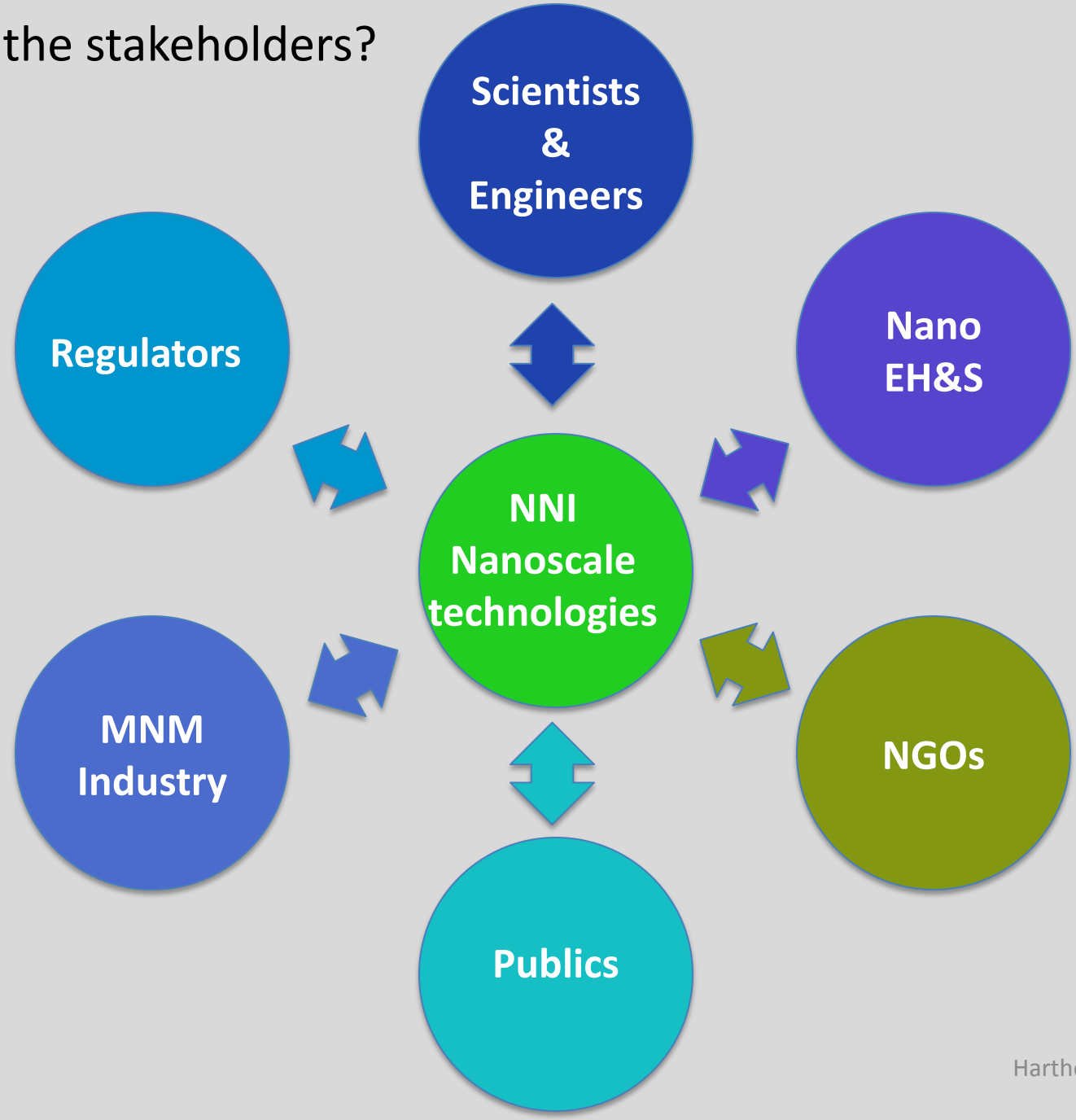
Main points of talk

- Responsible, ethical risk analysis, management and communication are key parts of responsible development
- Depend on good evidence about risks, *and about society*
- Emerging evidence from systematic research on key stakeholder groups
- Implications for multi-stakeholder dialogue

NAS 2006: "**responsible development** [of nanotechnologies] … **implies a commitment to develop and use technology to help meet the most pressing human and societal needs, while making every reasonable effort to anticipate and mitigate adverse implications or unintended consequences.**"



Who are the stakeholders?



Publics'

Perceptions of Nanotechnologies

- Survey and Experimental Research
- Qualitative / Deliberative Fora

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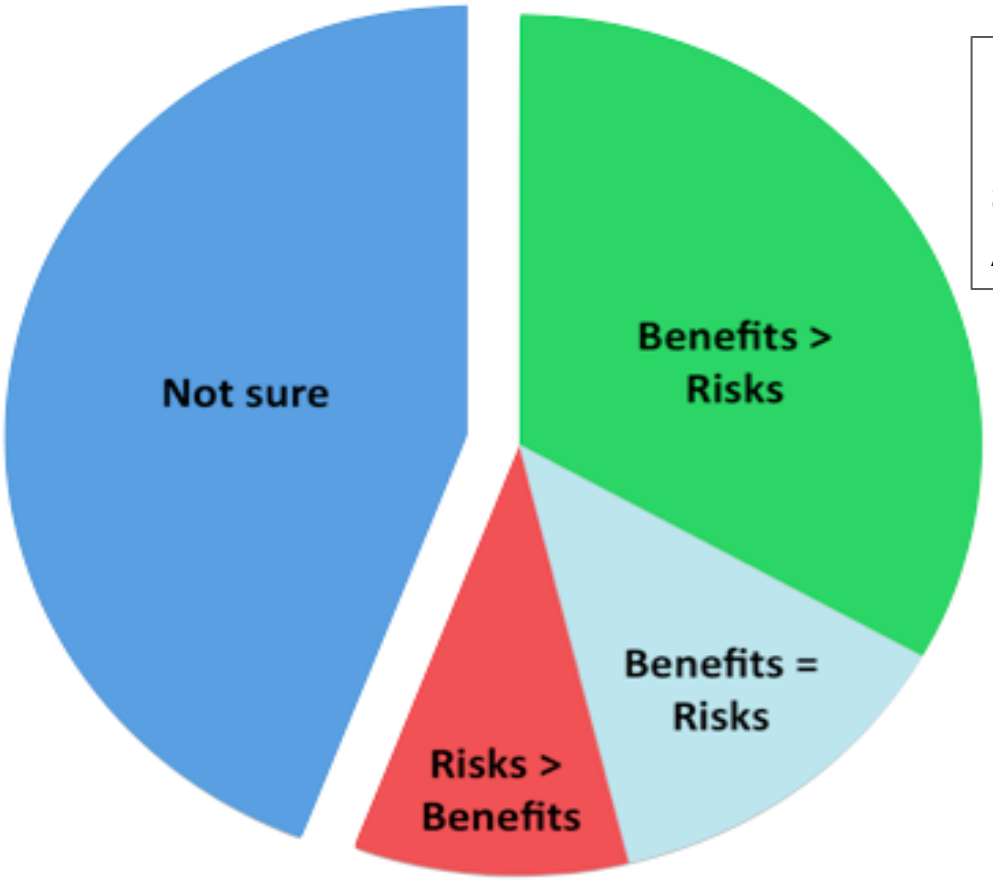
Who are the relevant public(s)?

- Democratic participation:
  - Self selected (e.g., GM Nation—worried; NISEnet—interested science museum)
  - "Invited public" (UCSB and ASU deliberative research—quasi-representative)
  - Representative research sample (UCSB/UBC/Cardiff, ASU/UW-Madison, others)
  - NGOs--activated for a reason (environmental, consumer safety, ***local*** issues)

Public perceptions of nanotechnology risks and benefits: Benefit centric, but high uncertainty and potential malleability



Based on quantitative metaanalysis of 22 studies 2002-2009 in N Am, Europe, and Japan

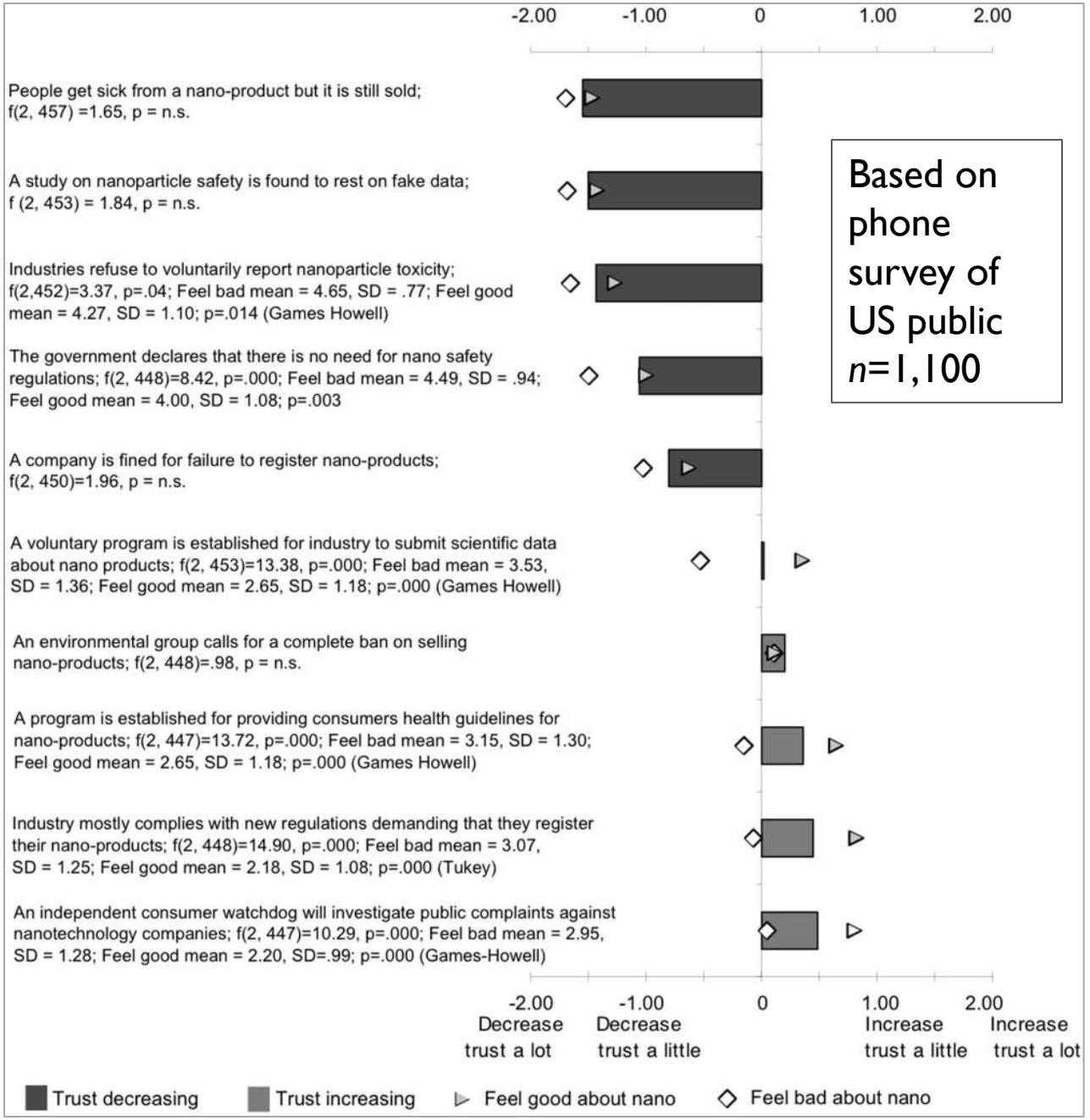
Slide courtesy of C. Beaudrie

Source: Satterfield, T. et al. 2009 Anticipating the perceived risk of nanotechnologies. Nature Nano 4: 752–758.

Trust and affect:

- Trust asymmetry prevails
- Mobility of views likely in the face of news
- But, benefit perception bigger driver than risk perception—positive regulatory actions move views
- →a particular opportunity for dialogue

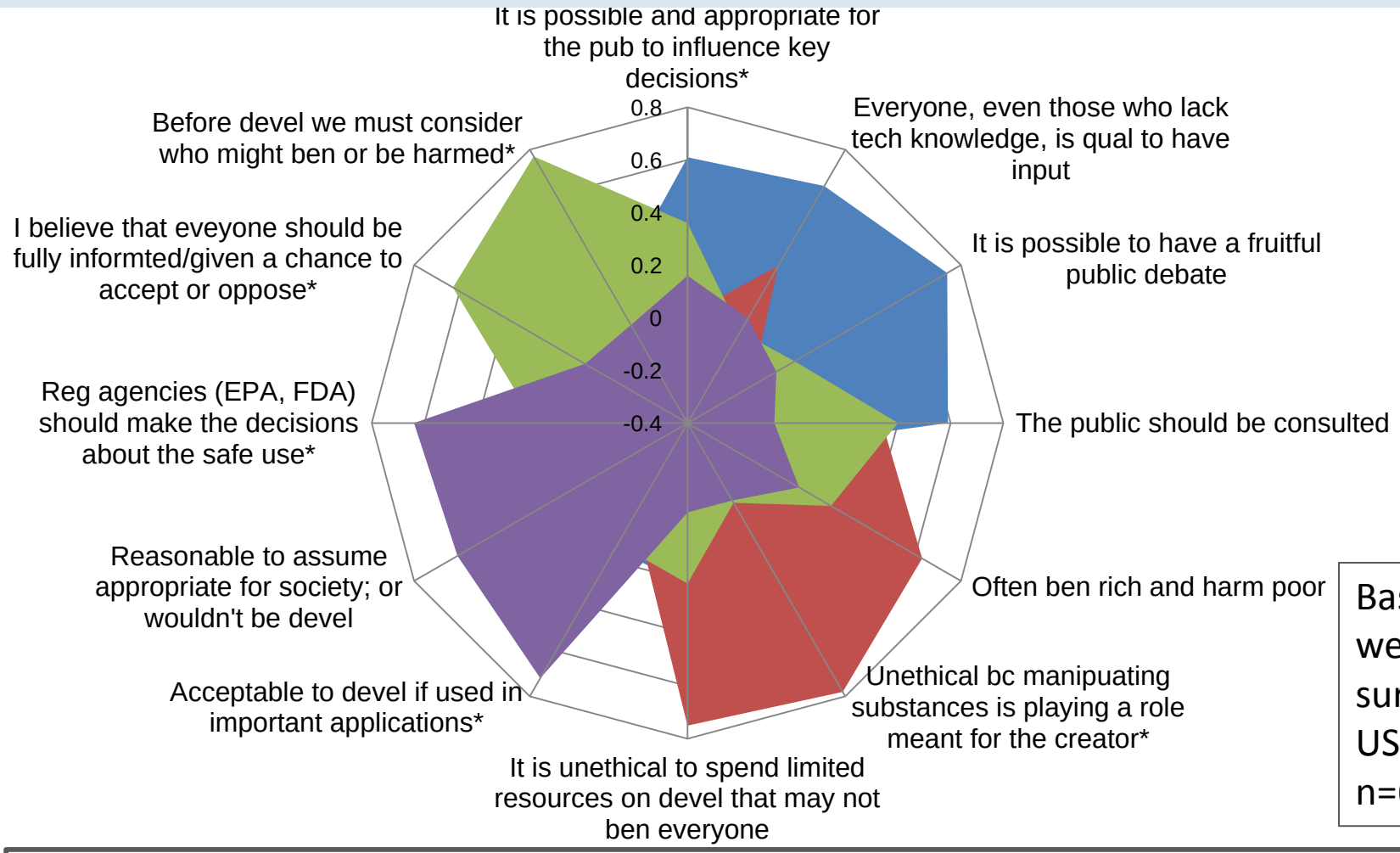
- Same study shows more mobility of views when bad news follows good—benefit only communication risky!



Based on phone survey of US public *n*=1,100

Source: Satterfield et al. 2012 Sci & Public Policy: 1-14

Public has distinct views on upstream ethics, linked to environmental acceptability of nanotechnologies



Based on web survey of US public n=697

Value a role for the public | **Equity and power**

Informed consent to develop | **Institutional trust**

Collins, Hanna, Satterfield & Harthorn, 2013 in progress

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Examples of Qualitative / Deliberative Approaches to Nanotechnology Assessment

UK

- Royal Society (2004
- Nanotechnology Risk and Sustainability (2004/5)
- NanoJury UK (2005
- Nanodialogues (2005/6)
- Smalltalk (2005/6)
- 'Which' Citizen NanoSummit (07)
- DEEPEN (2008-9)

Continental Europe

- Various (Netherlands, Switzerland, France, Germany, Portugal)

USA

- Macoubrie/Woodrow Wilson (2005)
- Madison Area Citizens' Consensus Conference (2005)
- CNS-ASU National Citizen Forum (2008)
- **CNS-UCSB Gender Deliberation** (2009)

USA/UK

- **CNS-UCSB Santa Barbara/Cardiff Workshops** (2007)

New Zealand

- McDarmaid Inst (2005)

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"Nanotechnologies and Upstream Public Engagement: Dilemmas, Debates and Prospects?"

Comparative review of 18 nano deliberation projects in N. America and Europe

- Informed judgment, rather than intuitive, 'fast' thinking
- Benefit centricity quite widespread
- But also, latent ambivalence, unaffected by increased knowledge and awareness→
  - Skepticism toward government & industry
  - Concern about who represents the public's interests
  - Question the need for the product at all
- These latter are social, not technical, risk issues and predominate in US and UK deliberations (Pidgeon, Harthorn et al. 2009)

- Cautionary note: impact of public engagement often far harder to evaluate than processes themselves (Bickerstaff et al. 2010)

Source: Corner, A. & N. Pidgeon (2012). In *The Social Life of Nanotechnology*, Eds. B. Harthorn & J. Mohr, pp. 169-194. New York: Routledge.

Group vs. individual decision making: Gendered aspects of talk in US nano deliberation

- Men speak more than women and use more intrusive interruptions in deliberations on nano
- Whites use more intrusive interruptions than people of color
- Women speak more, use more backchannels/cooperative overlaps, and use more self-disclosure when discussing ***health and human enhancement applications vs. energy/environment applications***
- Men's patterns of talk do not vary across applications

Implications: subtle and overt group dynamics play a major role in deliberative settings, largely unexamined thus far

Source: Cranfill, Denes, Hanna, Shearer, Bryant and Harthorn, 2013. Under revision.

"Nanotechnology Risk Perceptions and Communication: Emerging Technology, Emerging Challenges"

Upstream research issues--Conceptual & Methodological

- Nanotechnologies v. diverse
- Applications v. diverse
- Unfamiliar & intangible concept
- Few analogies for mental models or RP
- Deeper ethics and values issues
- Unpacking benefit perception
- Role & impacts of dialogue processes

Risk communication

- Anticipatory dialogue (=upstream engagement)

Source: Pidgeon, Harthorn & Satterfield 2011 Risk Analysis: 1694-1700

Summary: Public perceptions of benefits & risks of nanotechnologies are contingent on:

- Toxicology—risk signal effects strong in experimental studies; but also:
- Publics' ongoing low familiarity/unformed views—benefit centricity anchored in positive views of 'new tech'
- High uncertainty linked w/ need for information
- Media coverage low & mixed message; changing media environment
- Inequality/social justice--gender, race, other social differences; vulnerability
- Trust in or betrayal by government and industry
- Application-specific views—e.g., nano food unacceptable even if all contextual features are positive (Conti et al. 2011)
- Environmental values--resilience, environmental justice
- New tech = job loss? (Scheufele et al. 2007)

NGOs'

Perceptions of Nanotechnologies

183 Organizations in database
88 "nano engaged" organizations

CRN
Center for Responsible Nanotechnology

GREENPEACE

ETC Group
ENERGY ENGINEERING FOR A SUSTAINABLE FUTURE

SOIL ASSOCIATION
ORGANIC STANDARD

CIEL

BIOLOGICAL FARMERS OF AUSTRALIA

NRDC

SVTC
SILICON VALLEY TOXICS COALITION

EDF
ENVIRONMENTAL DEFENSE FUND

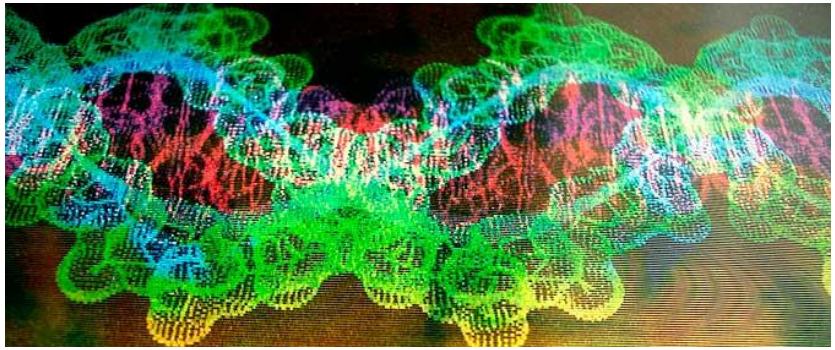
Nanotechnology issues?	• Consumer safety • Environmental protection • Other issues: development and human health
Specific nanomaterials?	• No, nanotechnology, generally • Nanosilver • Titanium dioxide
Goals?	• Increased EHS research • Product labeling • Government oversight • Public participation
Tactics?	• Issue reports, public statements, press releases • Lawsuits and legal petitions • Industry collaboration, forums

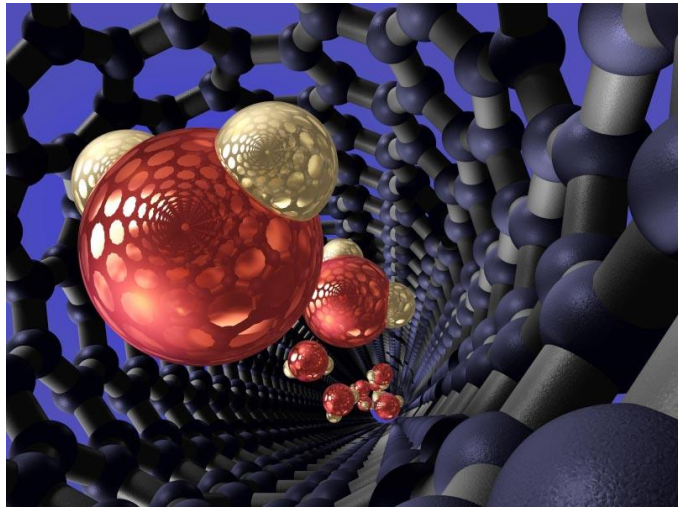
Engeman & Harthorn 2013 Research in Progress

MNM* Industry's

Perceptions of Nanotechnologies

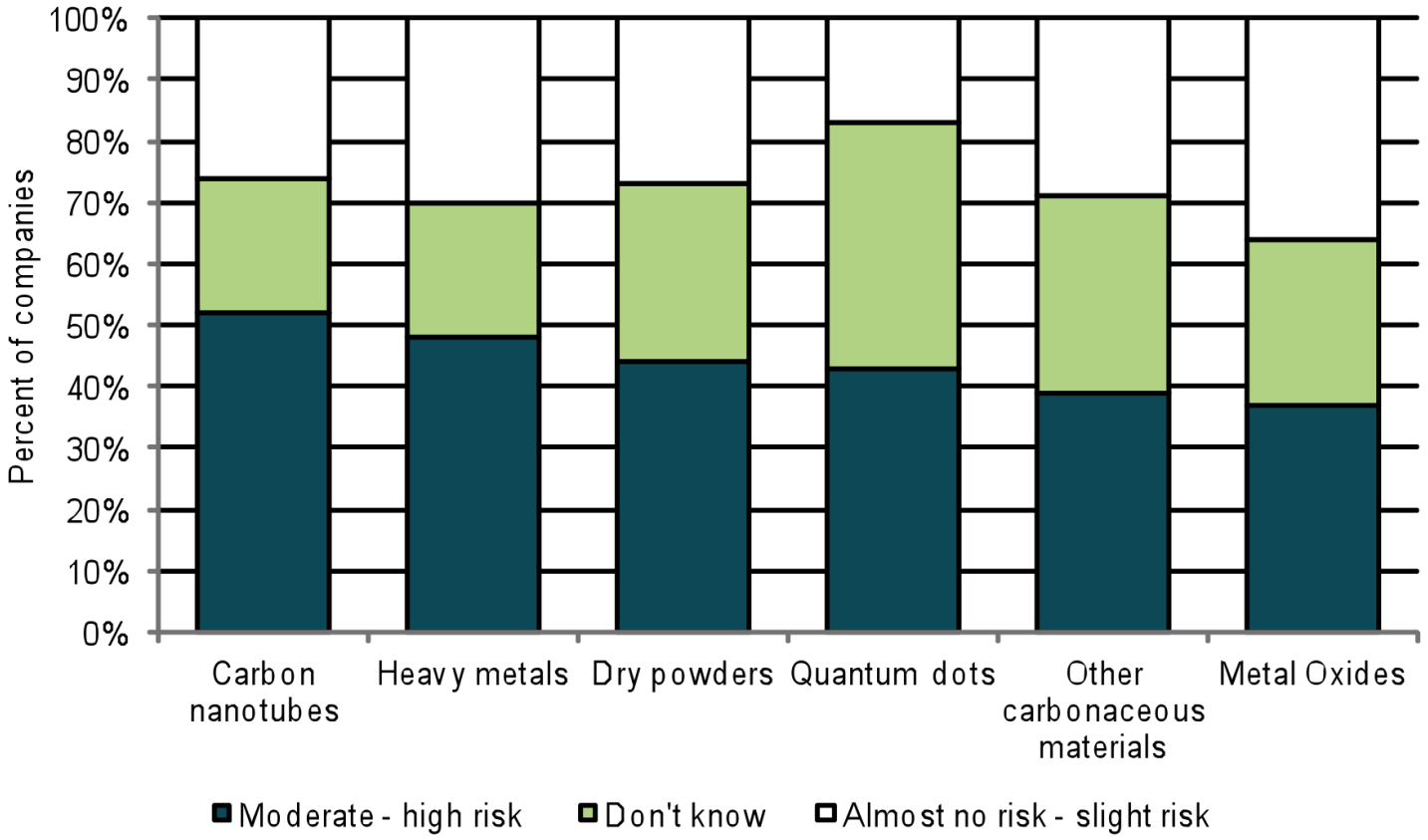
- Mixed interview/survey methods
- Qualitative/engagement dialogue





* MNM = manufactured nanomaterials

Nano Industry EHS and Risk Perception



2010 phone and web survey of 78 MNM companies in 14 countries

29% of respondents uncertain re: risks of 6 types of ENMs. Combined 'don't know' plus moderate-high risk per type = 64%(metal oxides) - 83% (quantum dots)

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Engeman et al. JNR (2012) 14:749-760

NSF: DBI 0830117
NSF: SES-0531184
NSF: SES-0938099

Nano Company Participants' Views on Risk & Regulation

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Engeman et al. JNR (2012) 14:749-760

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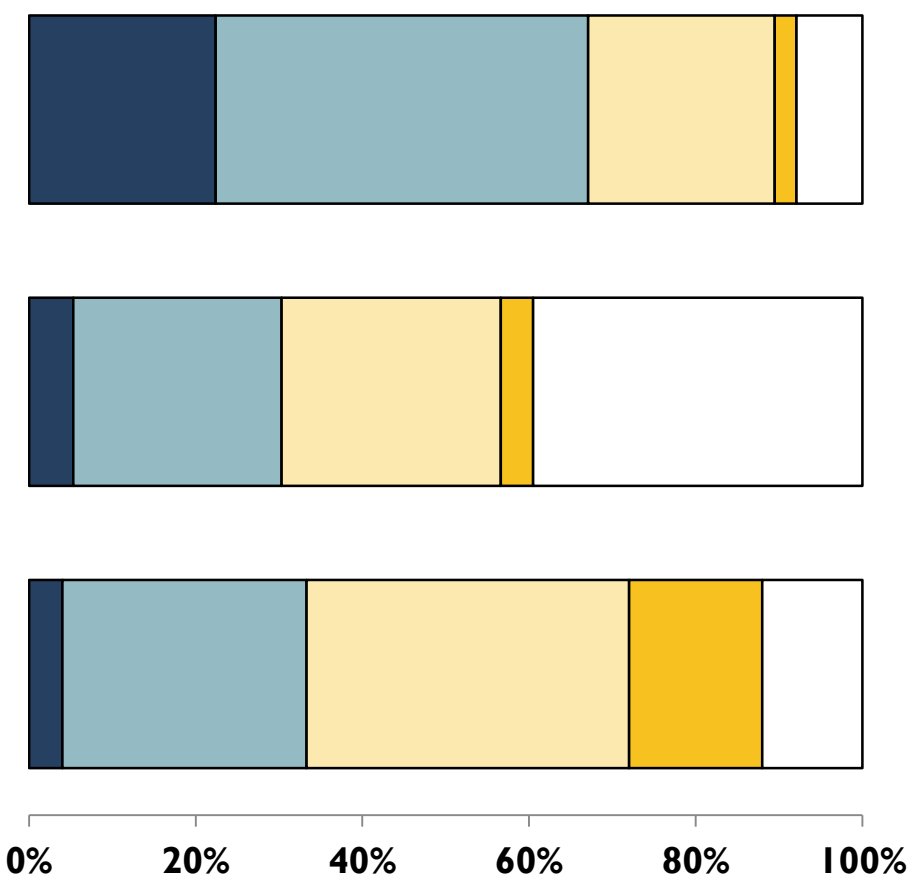
MNM Company Participants' Concern over Public Response

1. In my company, we worry that nanotechnologies may encounter **unwarranted public backlash** such as that which accompanied genetically modified foods in Europe (**59% agree**).

2. **Insurers** in my industry are increasingly **concerned** about nano-specific risks (34 % agree; **40% don't know**; 30% disagree).

3. **Direct involvement of citizens in policy decisions** about research and development of new technologies is **beneficial** (**55% disagree)**.



Source: Engeman et al. 2010 int'l survey results.

Scientists & Engineers

Nano EH&S

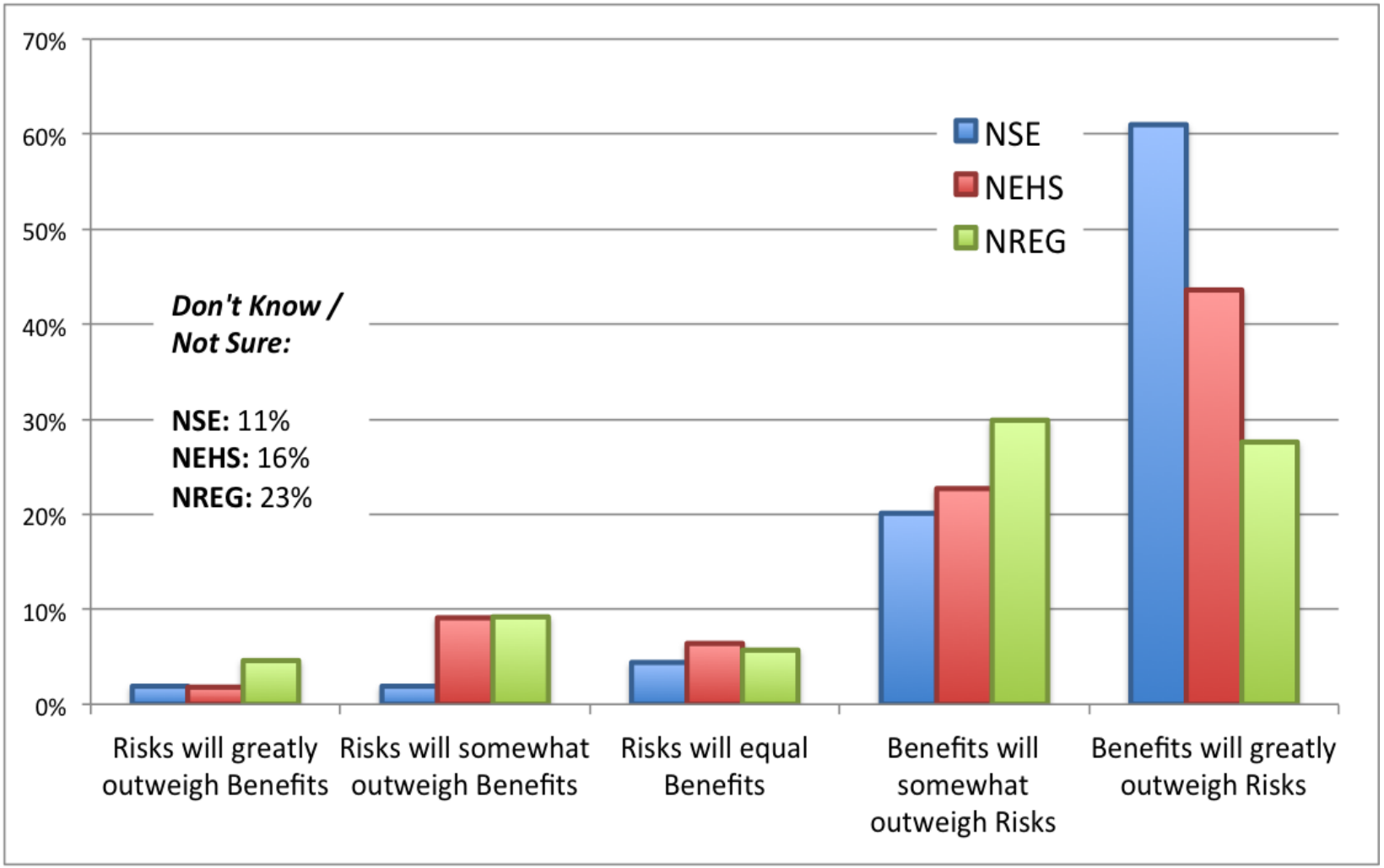
Regulators

Perceptions of Nanotechnologies

- Survey and Experimental Research
- Qualitative approaches

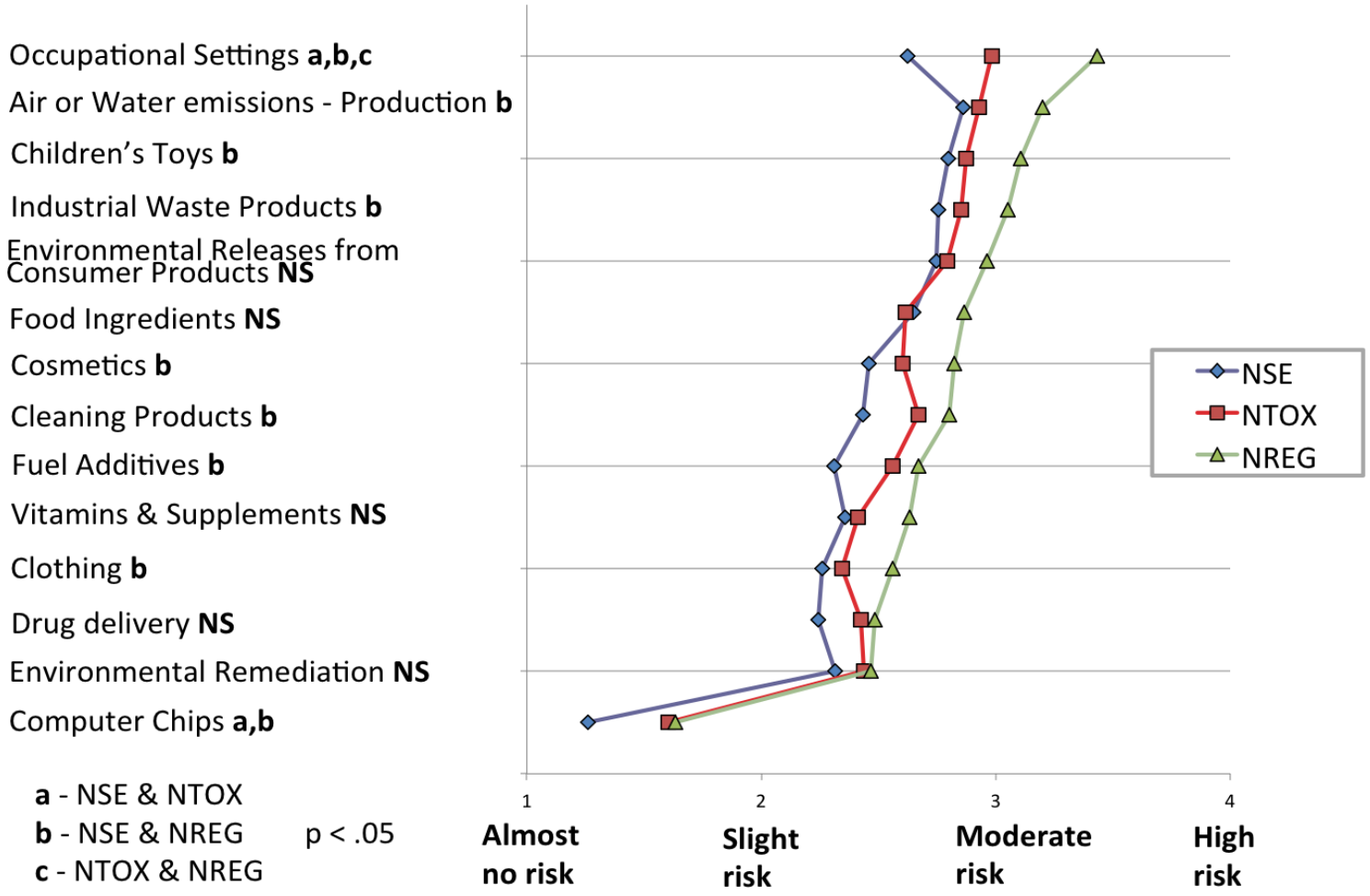
Photo credit UCSB CNSI

Scientists' and Regulators' ENM Risk vs. Benefit Perceptions—Benefits outweigh the risks, but notable group differences



Source: Beaudrie, Satterfield, Kandlikar, & Harthorn 2013 under review

Scientists' and Regulators' MNM Risk and Benefit Perceptions— Application context effects & group differences



Web-survey of 424 nano experts on their views of MNM risk and regulation

NSE – Nanosci and engineers

NTOX – Nano EHS researchers

NREG – Nano regulators, risk assessors in govt

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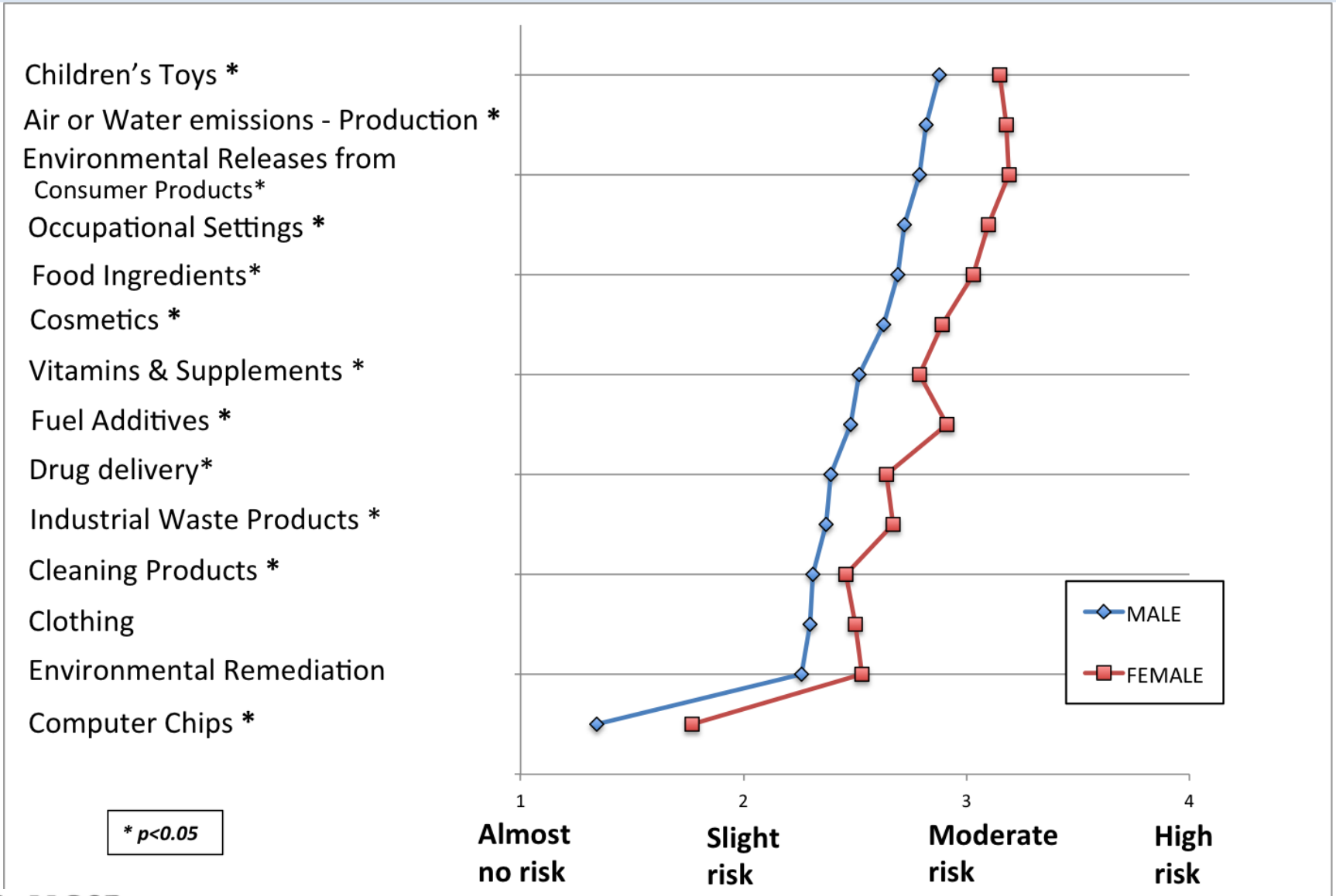
Beaudrie, Satterfield, Kandlikar, & Harthorn. 2013. Under review.

Experts' risk perceptions differ by gender



Beaudrie, Satterfield, Kandlikar, Harthorn. 2013. In prep.

Experts workshop: Nanotech Risk Screening Using a Structured Decision Making Approach

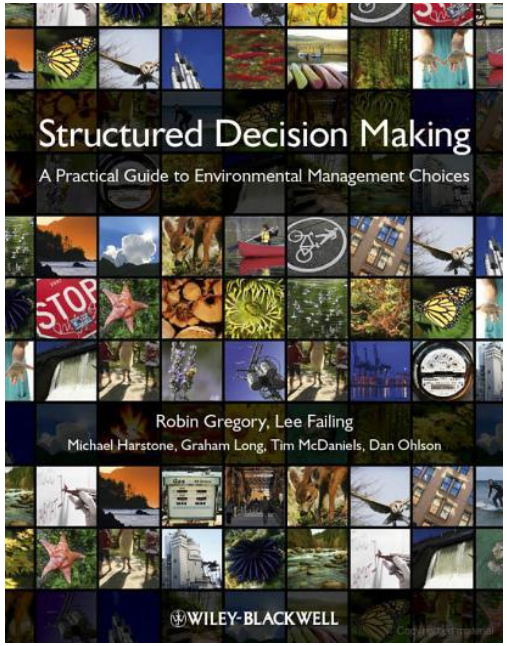
May 24-25 at UBC, Vancouver, Canada

- **Nanotoxicology**
  - *Human Toxicology*
  - *Eco-Toxicology*
- **Human Exposure**
- **Environmental Fate and Transport**

- NIOSH
- Lawrence Livermore National Lab
- UCLA
- Washington University
- University of Alberta
- University of Rochester
- University of South Carolina
- University of Minnesota

Structured Decision Making (SDM) approach

- Appropriate when decisions are characterized by:
  - *Complexity and uncertainty*
  - *Difficult judgments – weighing the science, consequences of alternatives, priorities, risk tolerances*
  - *High stakes, limited resources*
- Engages experts and decision makers in productive decision-oriented analysis and dialogue



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Institute for Resources, Environment & Sustainability
University of British Columbia

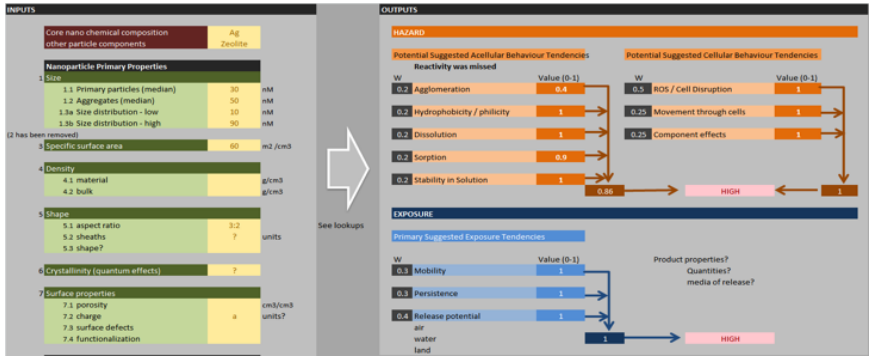
Source: Beaudrie, Kandlikar, Long, Gregory, Wilson & Satterfield 2013

Experts workshop: Nanotech Risk Screening Using a Structured Decision Making Approach

Project

- **Phase I - Ideation (UBC Expert Workshop)**
  - Framework Confirmation & Testing Initial Concept
- **Phase II - Proof of Concept**
  - Structural and Logical Framework
  - Prototype NRST web tool
  - Peer Verification
- **Phase III - Deployment and Integration**
  - Web + database implementation
  - Integration and Deployment

Web-based NRST mockup*




DRAFT

Nanotechnology Risk Screening using a Structured Decision Making (SDM) Approach: A summary of results from a nanotechnology experts workshop

Summary Report – *DRAFT*
May 1, 2013

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Institute for Resources, Environment & Sustainability
Liu Institute for Global Issues

Report available at: www.cns.ucsb.edu

- NRST = Nanomaterial Risk Screening Tool; mockup at nanoscreen.org

Source: Beaudrie, Kandlikar, Long, Gregory, Wilson & Satterfield 2013

Example: multi-stakeholder collaboration

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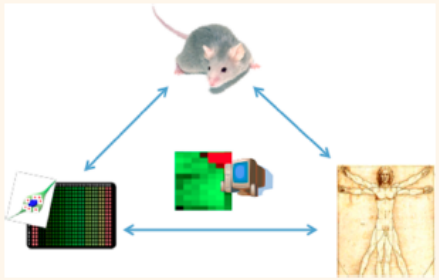
PERSPECTIVE

A Multi-Stakeholder Perspective on the Use of Alternative Test Strategies for Nanomaterial Safety Assessment

Andre E. Nel,[†,‡,⊥,∥,*] Elina Nasser,[‡,⊥] Hilary Godwin,[‡,⊥,∥] David Avery,[‡,⊥] Tina Bahadori,[¶] Lynn Bergeson,[#] Elizabeth Beryt,[‡,⊥,○] James C. Bonner,[□] Darrell Boverhof,[■] Janet Carter,[△] Vince Castranova,[▲] J. R. DeShazo,[‡,○] Saber M. Hussain,[●] Agnes B. Kane,[▽] Frederick Klaessig,[‡,▼] Eileen Kuempel,[▲] Mark Lafranconi,[○] Robert Landsiedel,[●] Timothy Malloy,[‡,††] Mary Beth Miller,[‡‡] Jeffery Morris,[¶] Kenneth Moss,[¶] Gunter Oberdorster,[§§] Kent Pinkerton,[⊥⊥] Richard C. Pleus,[∥∥] Jo Anne Shatkin,[‡,¶¶] Russell Thomas,[##] Thabet Tolaymat,[△△] Amy Wang,[▲▲] and Jeffrey Wong[▽▽]

ABSTRACT There has been a conceptual shift in toxicological studies from describing *what* happens to explaining *how* the adverse outcome occurs, thereby enabling a deeper and improved understanding of how biomolecular and mechanistic profiling can inform hazard identification and improve risk assessment. Compared to traditional toxicology methods, which have a heavy reliance on animals, new approaches to generate toxicological data are becoming available for the safety assessment of chemicals, including high-throughput and high-content screening (HTS, HCS). With the emergence of nanotechnology, the exponential increase in the total number of engineered nanomaterials (ENMs) in research, development, and commercialization requires a robust scientific approach to screen ENM safety in humans and the environment rapidly and efficiently. Spurred by the developments in chemical testing, a promising new toxicological paradigm for ENMs is to use alternative test strategies (ATS), which reduce reliance on animal testing through the use of *in vitro* and *in silico* methods such as HTS, HCS, and computational modeling. Furthermore, this allows for the comparative analysis of large numbers of ENMs simultaneously and for hazard assessment at various stages of the product development process and overall life cycle. Using carbon nanotubes as a case study, a workshop bringing together national and international leaders from government, industry, and academia was convened at the University of California, Los Angeles, to discuss the utility of ATS for decision-making analyses of ENMs. After lively discussions, a short list of generally shared viewpoints on this topic was generated, including a general view that ATS approaches for ENMs can significantly benefit chemical safety analysis.



Main points/issues/questions

1) *All* stakeholders have perceptions of benefit and risk that affect their views of problems, processes, and solutions. Systematic mixed methods research comparing these complex, contingent & dynamic views is important for risk analysis & communication and responsible development.

2) Technical risk data alone won't effect decisions—judgments will be involved, by different stakeholders, with varying biases, values, and stances, and differing levels of power and interest; better outcomes if address.

3) (Some) scientists and industry are ambivalent about public; (some) publics are ambivalent about technology, industry & government—upstream/midstream dialogue and incorporation of *social risk issues* likely important.

4) Novel multi-stakeholder collaborations using cutting edge methods merit full attention.

5) Where is there *meaningful* change from engagement and participation? (e.g., UK Royal Society 2004, Responsible Nano Forum 2009).

6) Do nanotechnologies pose novel challenges for risk assessment, management & communication?

Thank you!

- Research participants in all these different communities
- Lead collaborators: Terre Satterfield at University of British Columbia and Nick Pidgeon at Cardiff Univ, UK
- Colleagues, collaborators, students, and postdocs in the CNS-UCSB and UC CEIN, in particular: Milind Kandlikar & Christian Beaudrie (UBC), Paul Slovic & Robin Gregory (Decision Research), Shannon Hanna (NIST), Mary Collins (UMD), Patricia Holden & Cassandra Engeman (UCSB), and Hilary Godwin & Andre Nel (UCLA).
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Democratizing Technologies: Assessing the roles of NGOs in shaping technological futures

Conference: Nov 13-15, 2014, UC Santa Barbara

- To what extent, and in what areas, are NGOs attempting to fill the governance roles traditionally provided by nation states – and with what results?
- When are the agendas and policies advocated by NGOs adopted by states or in international agreements? When do industries or companies respond to NGO-advocated standards?
- How are new media changing the landscape for NGO engagement, participation, recruitment and dissemination?