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How Nanotech Risk Perception Informs EHS Decision Making

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Many reasons for studying nano risk (and benefit) perception

Perceptions drive behavior → best indicator of anticipated behavior

Not just ignorance or misunderstanding

Expert risk assessment (nanotox) won't necessarily change views

Experts' judgments affect their decisions and practices

Anticipate	workers' views
Anticipate	communities' views
Anticipate	points of convergence/divergence among different stakeholders
Vital knowledge	project of engagement and two-way/multi-way communication

Formal vs. lay understandings of 'risk'

Engineering 'Risk' = Probability x Consequence

Lay beliefs are based on more than just 'risk'

- *Qualitative risk* characteristics
- *Cultural* or political values
- *Social amplification* (and attenuation) effects, esp. process through which risk communication takes place
- *Trust* in risk managers / science
- *Experiences* of vulnerability and discrimination
- Properties of '*emergence*'
- Perceived *benefits* also matter!

What factors make novel technological risks seem less acceptable?

- Involuntariness
- Inequitable (distribution of risks and benefits)
- Inescapable / many exposed
- Unfamiliar / novel
- Man-made vs 'natural'
- Irreversible
- Invisible

- Danger to children
- Particular 'dreaded' outcomes (e.g. cancer)
- Victims identifiable
- Appears poorly understood by science
- Violates 'dose makes the poison'

Slovic, P. et al. In Slovic, P (2000) *The Perception of Risk*. London: Earthscan

Building knowledge about emerging public risk perceptions of nanotechnologies

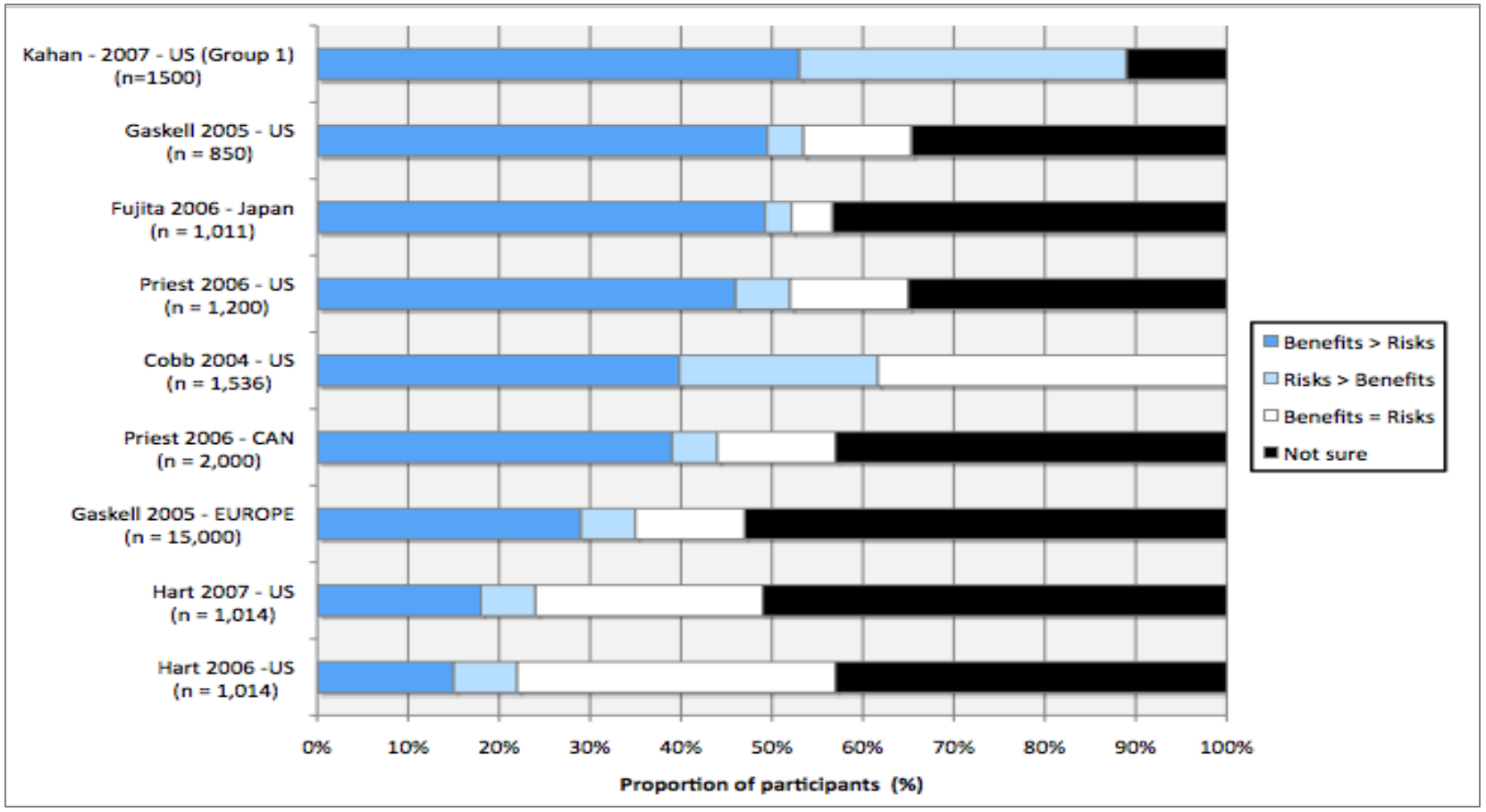
Upstream Challenges

- Lack of obvious history (hence this resides with other issues)
- 'Mental models' of risk processes are absent or ill-formed (analogies serve as proxy)
- Everyday experience also absent
- Inherent long-term uncertainties and potential regulatory gaps / lag
- 'Hype and hope' from technology promoters

Approaches

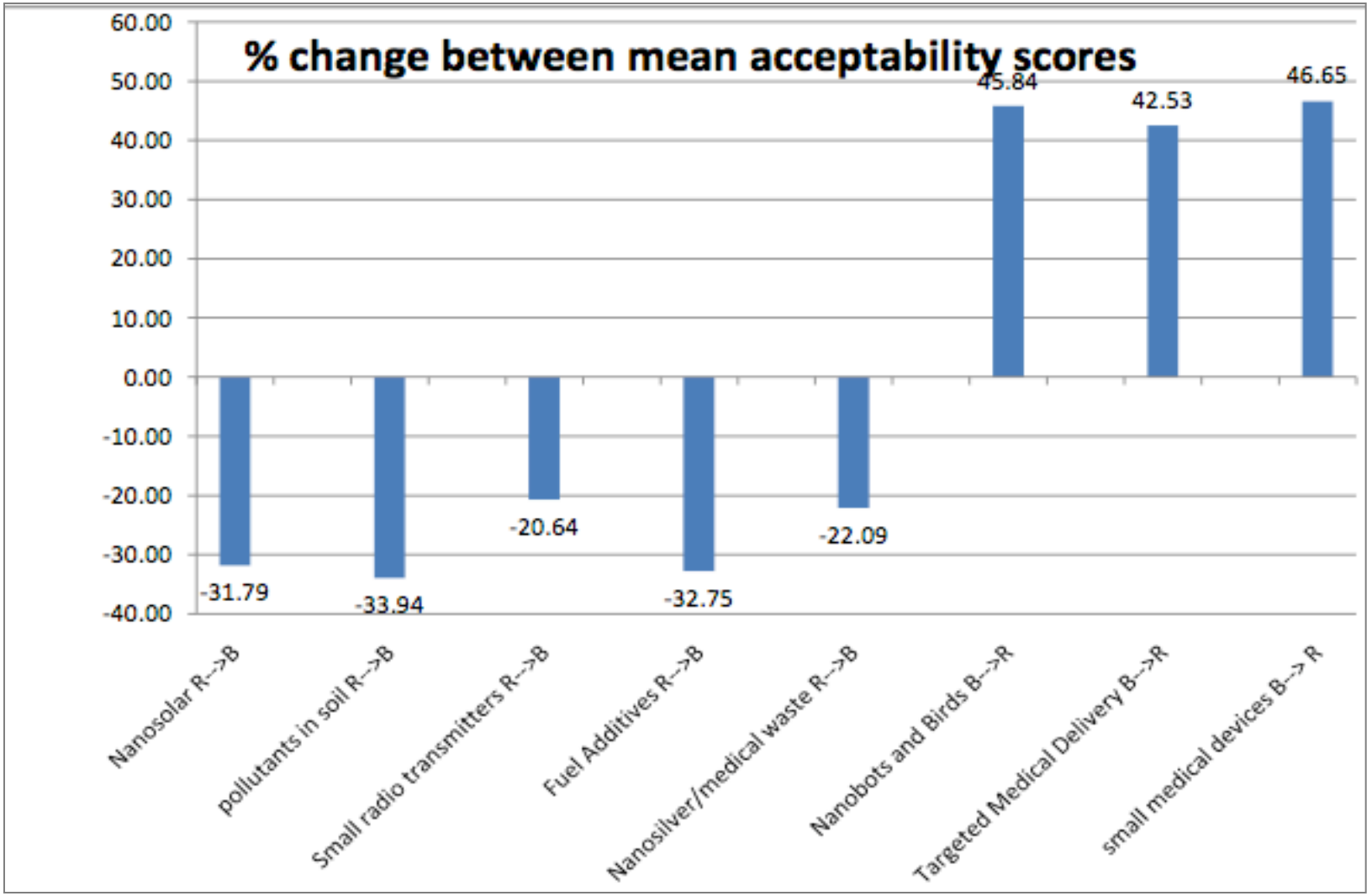
- Iterative Designs : mimic conversation/interview
- Anticipatory framing
- Creating experimental 'publics' with whom to engage
- Framing in the design stage becomes highly important
- Ethical concerns prominent

What do publics actually think?



Satterfield, Kandlikar, Beaudrie, Conti & Harthorn, 2009, "Anticipating Perceived Risk" *Nature Nanotechnology*

Unpacking Benefit - risk/benefit reversals



Satterfield, Conti, Harthorn et al. in preparation 2010

US-UK 2007 Comparative Deliberation: Application Matters!

Energy

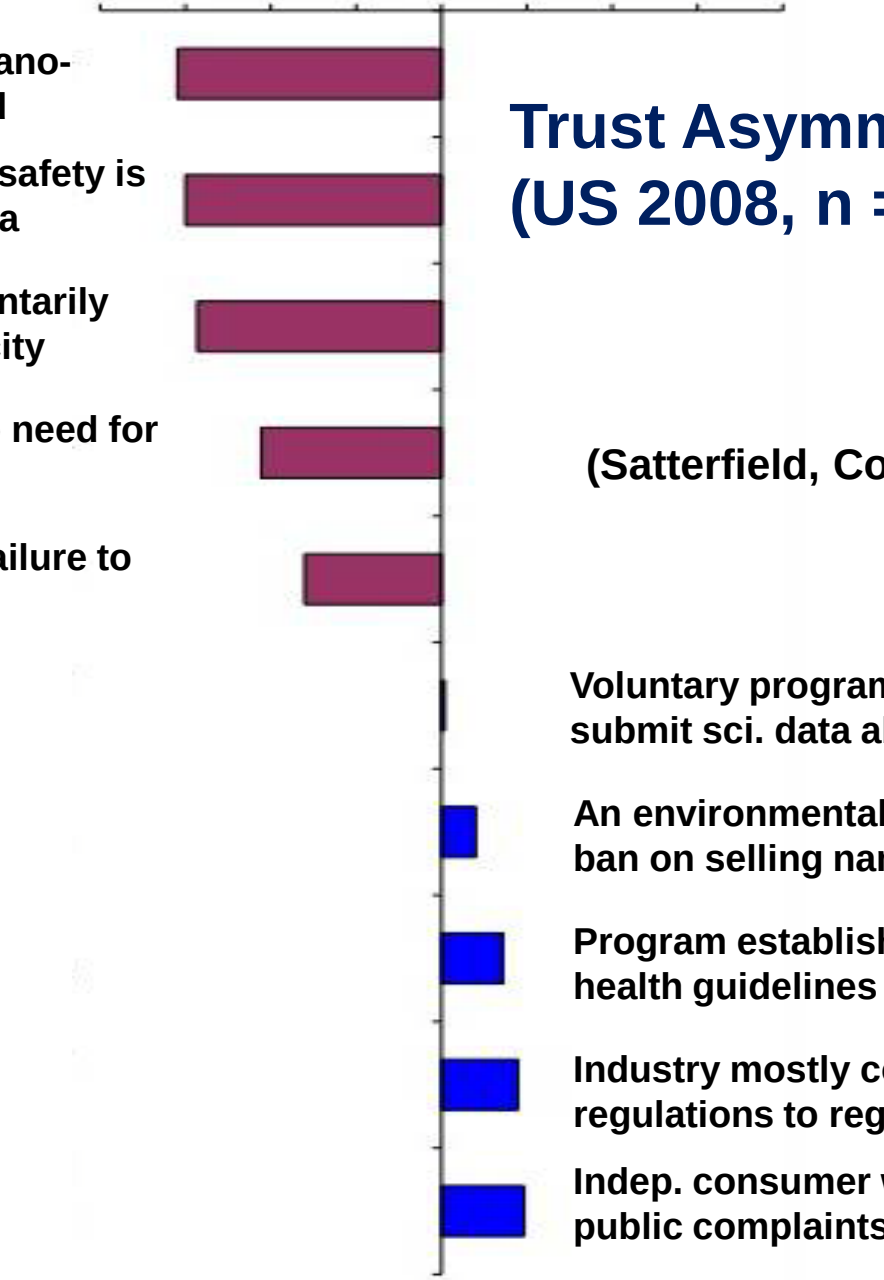
- Nano for resolving energy issues = *unchallenged good*
- Discussion consistent & urgent
- Responsibility: traditional combination of expert regulation, markets and consumer choice

Health and Enhancement

- Nuanced, more layered, and more multi-valent
- Particular 'moral' and ethical questions
- Responsibility (unprompted) multi-party body of citizens, government, business & scientists

Pidgeon, N.F., Harthorn, et al (2009) *Nature Nanotechnology*, Vol 4, Feb 2009, 95-98.

Trust Asymmetry in Nanotech (US 2008, n = 490)



(Satterfield, Conti et al. in prep 2010)

‘Acceptability’ Judgment Means for Nano- & Non-Nano Technologies by Race and Gender

Pollution sensors, toxic

Pesticides on food

Fuel-efficiency additives, nontoxic

Lead in dust or paint

Climate change

Coal and oil burning power plants

Anti-infection bandages, unsafe disposal

Energy efficient windows, health unsafe

Nuclear Power Plants

Data transmitters, privacy leaks

GMO

Surveillance Technologies

Cell Phone Radiation

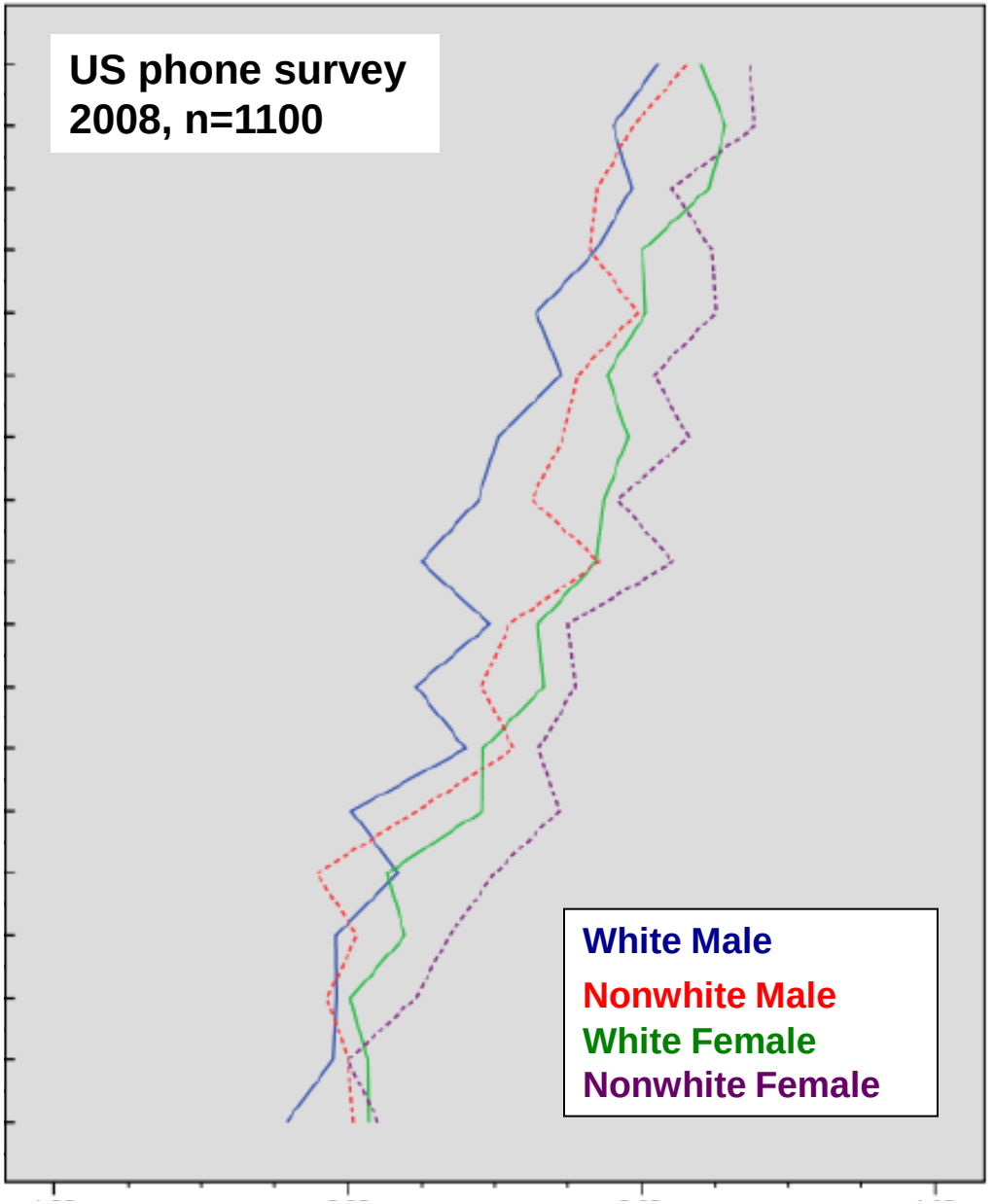
Medical diagnostics for the poor

Vaccines for Children

Oil spill remediation, effects on birds controlled

Targeted chemo delivery, avail. to poor

(generic) NANOTECHNOLOGIES



Satterfield, Conti, Harthorn et al. in prep, 2010

Current UCSB Industry Study:

- Data collection Fall 2009-Spring 2010 – *currently in progress*
- Objectives:
  - Update understanding of environmental health and safety practices since prior UCSB/ICON study, 2006
  - Expand knowledge of industry's views on risks posed by nanomaterials
- Endorsed by:
  - The working group on strategic area of nanotechnology, public research institute, AIST
  - Singapore's Institute of Materials Research and Engineering, A*STAR
  - American Industrial Hygiene Association (AIHA) Nanotechnology Working Group
  - International Council on Nanotechnology (ICON)

** Harthorn et al. 2010; UC CEIN IRG 7 data collection is currently in progress.*

SURVEY: Main Sections

Company Information

Nanoparticle-specific Information

Employee and Area Exposure Monitoring

Containment and Exposure Controls

Waste Management and Product Stewardship

Views on Risk Assessment and Risk Management

- Structured interviews
- Administered through a 45-minute phone interview
- Available online in English, Japanese and Chinese
- Confidential participation

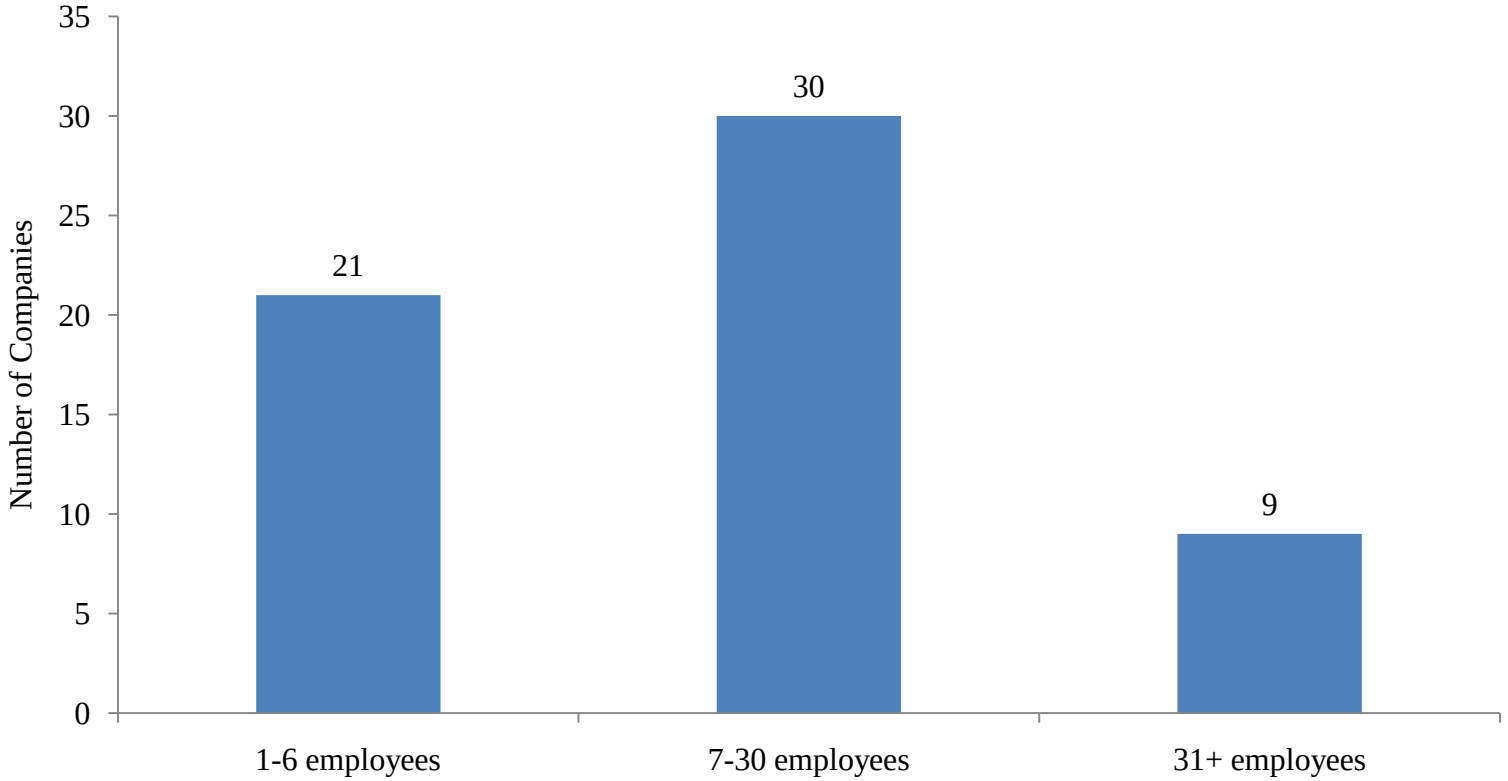
THE PARTICIPANTS

Table 1. Response rates by continent and country (n=60).

Continent (number contacted)	Response Rate	Country	Companies interviewed
North America (257)	*17%*	United States	43
		Canada	1
Europe (105)	*10.5%*	Germany	3
		Italy	2
		United Kingdom	2
		Finland	2
		Denmark	1
		Belgium	1
Asia (68)	*7.4%*	Japan	4
		China	1

** Harthorn et al. 2010; UC CEIN IRG 7 data collection is currently in progress.*

Number of employees that work directly with nanomaterials (n=59)



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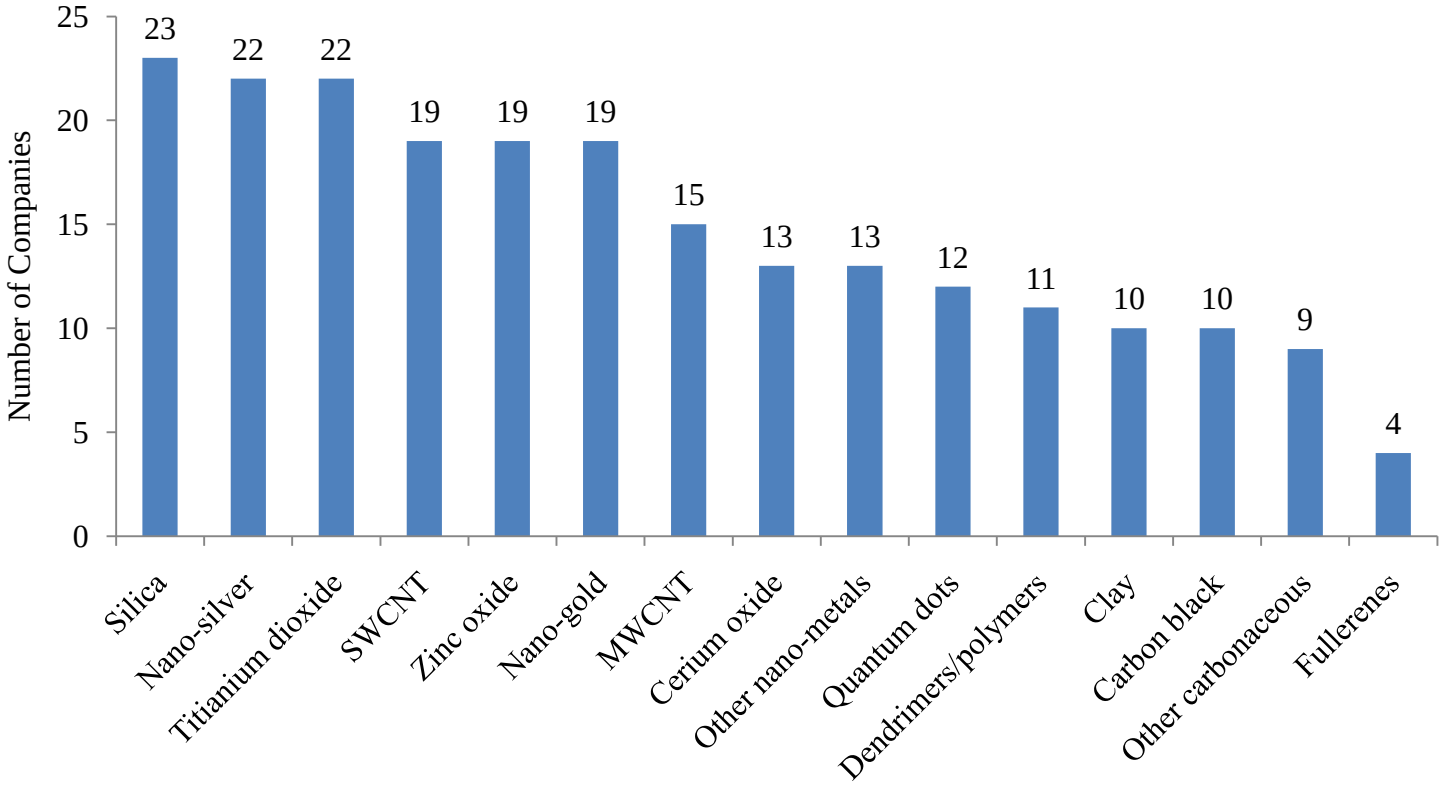
Types of nanomaterials handled



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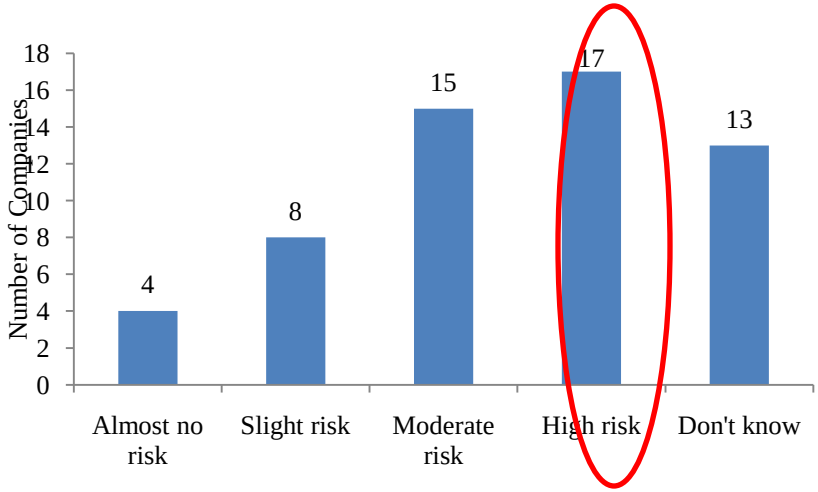
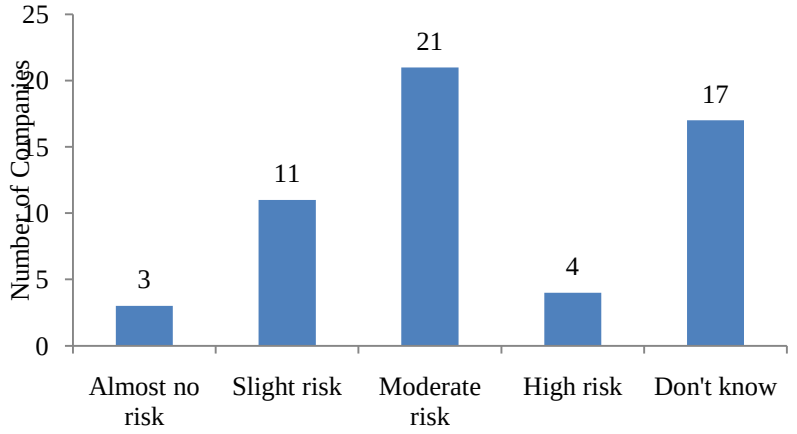
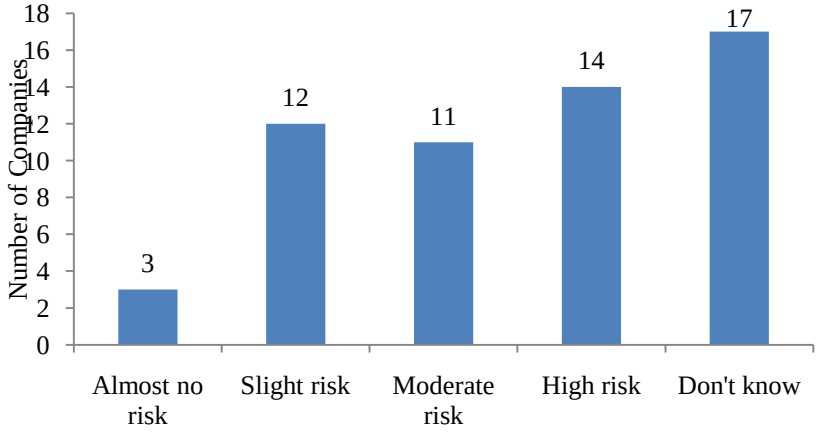
Level of perceived risk for CNTs (n=57)



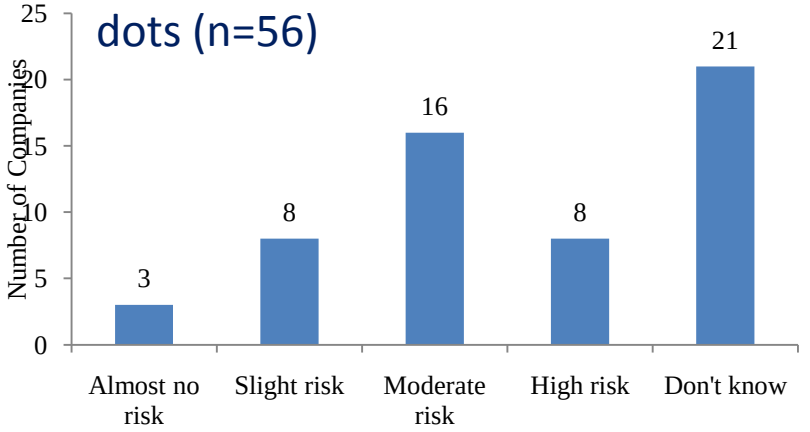
Level of perceived risk for non-CNT carbonaceous material (n=56)



Level of perceived risk for dry powders (n=57)



Level of perceived risk for quantum dots (n=56)



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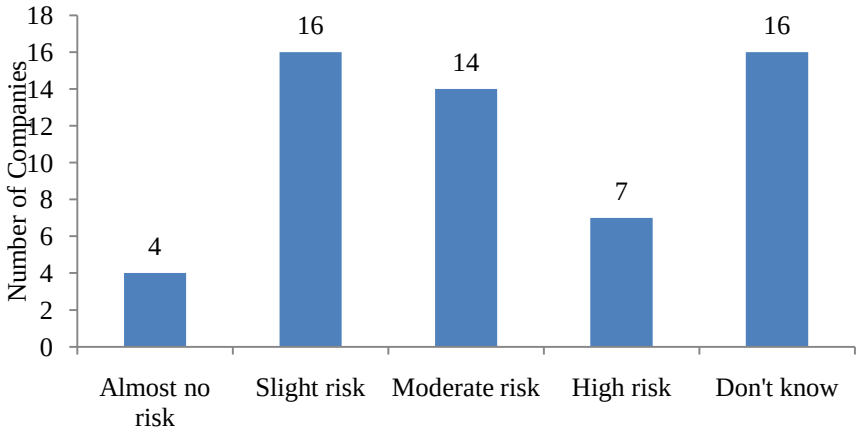
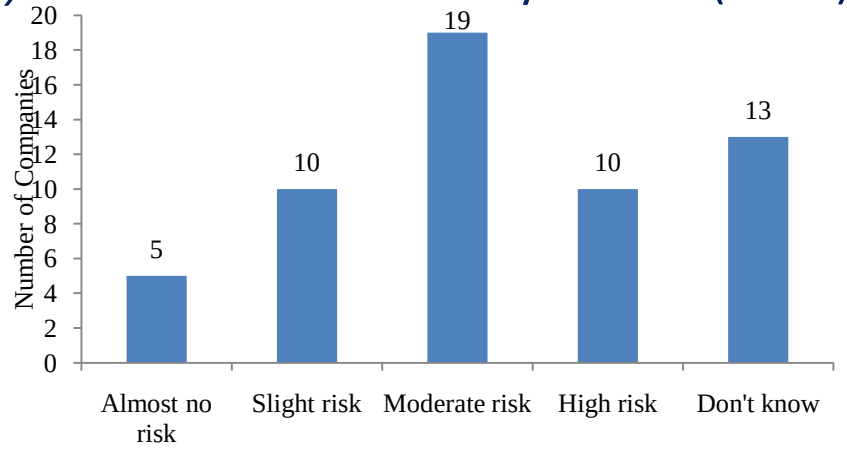
Level of perceived risk--metal oxides (n=57)

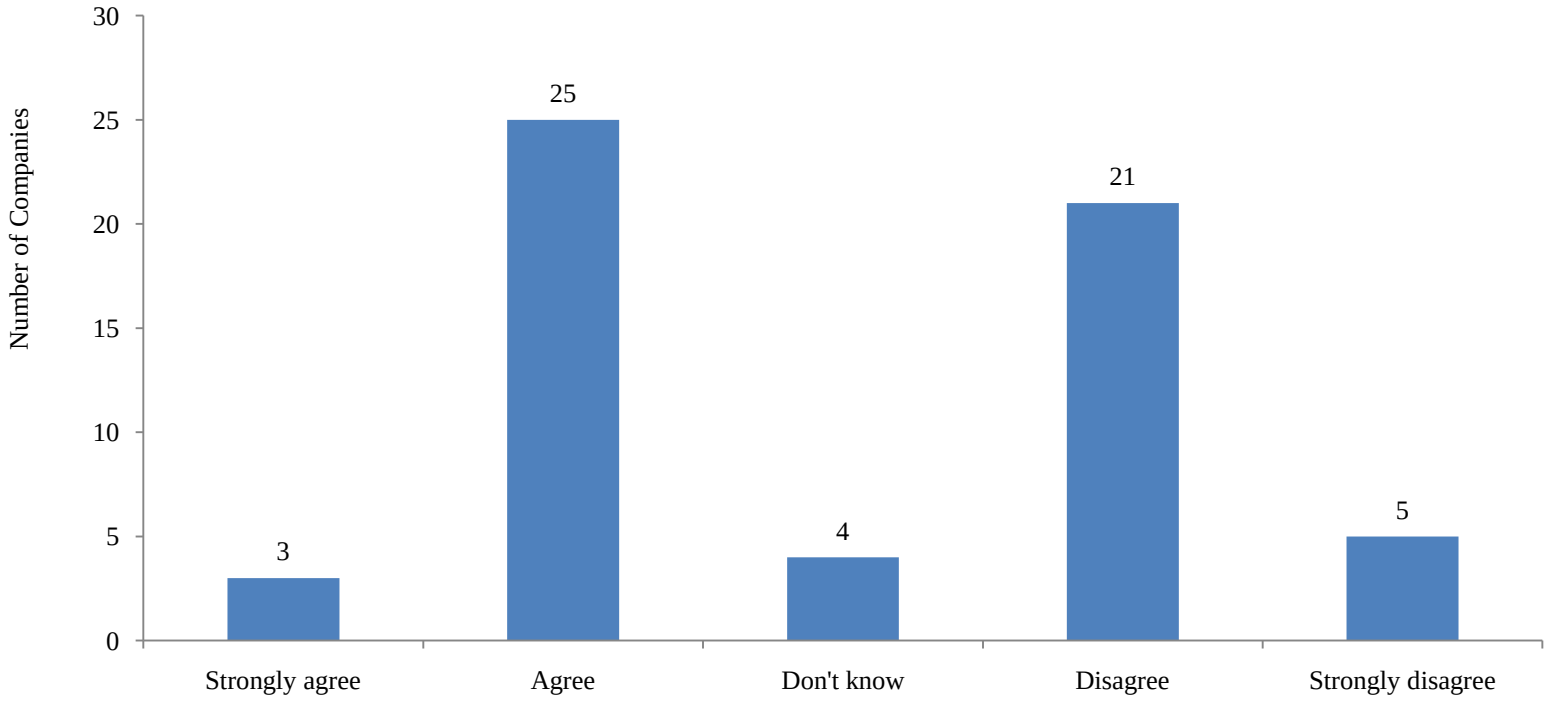


Level of risk for heavy metals (n=57)



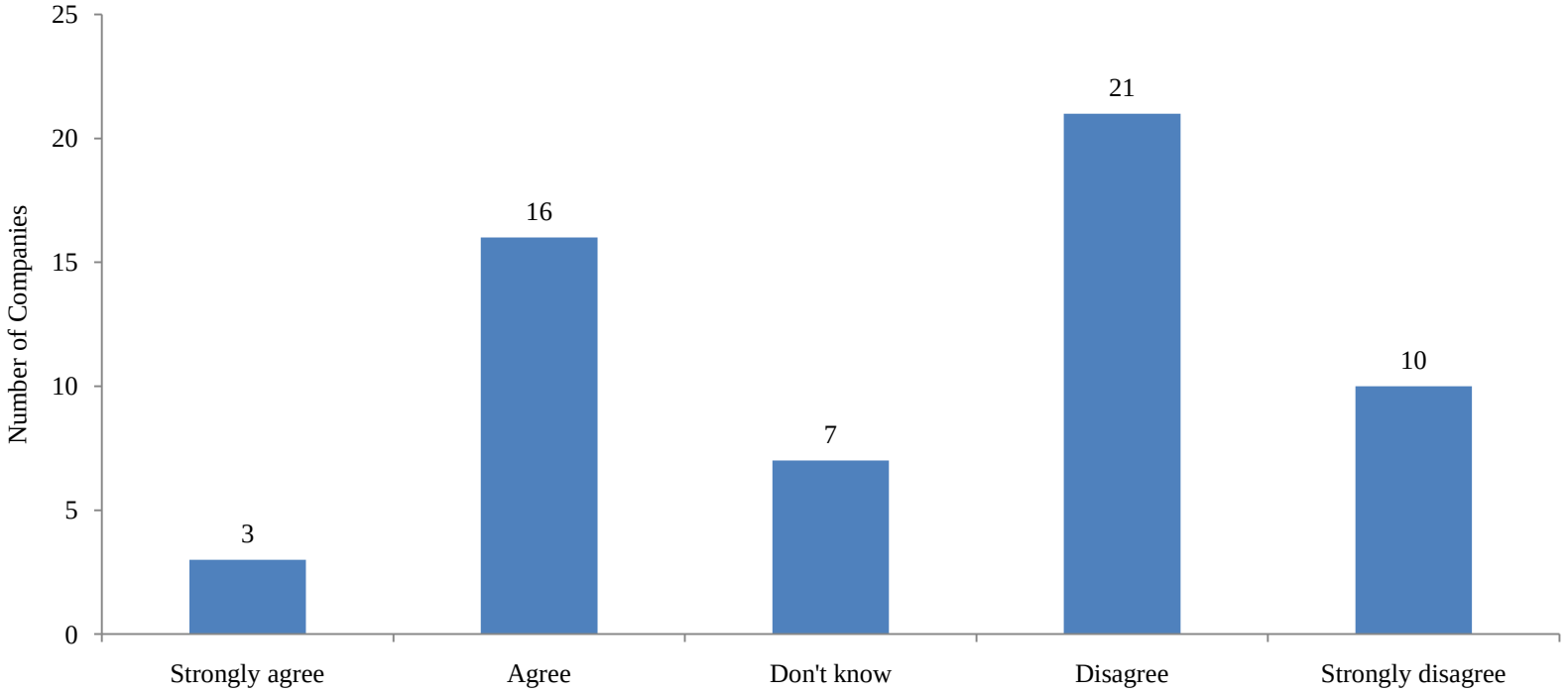
** Harthorn et al. 2010; UC CEIN IRG 7 data collection is currently in progress.*

Industry Views: “Voluntary reporting approaches for risk management are effective for protecting human health and the environment.”



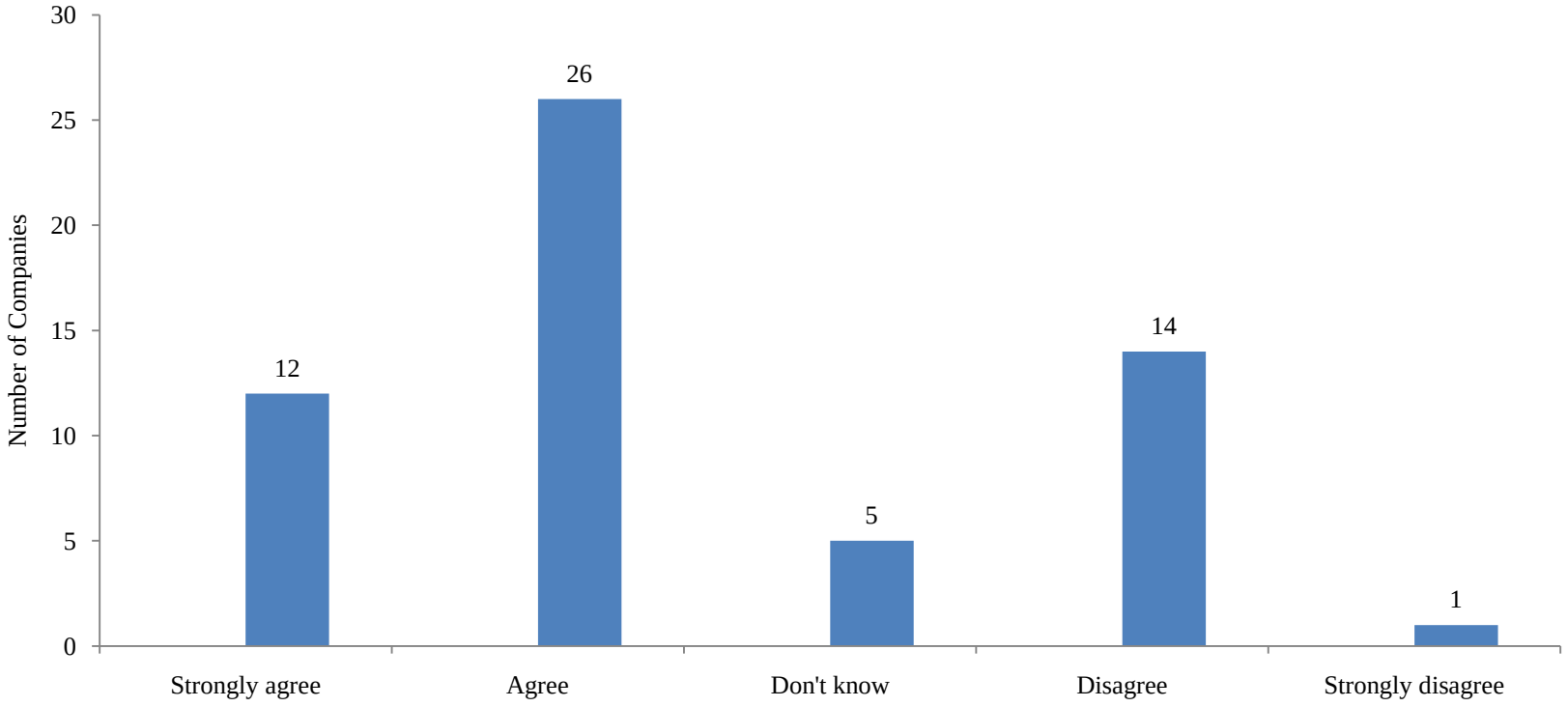
** Data collection is currently in progress.*

Industry Views: 54 % disagree or strongly disagree that "Direct involvement of citizens in policy decisions about research and development of new technologies is beneficial" (n=57)



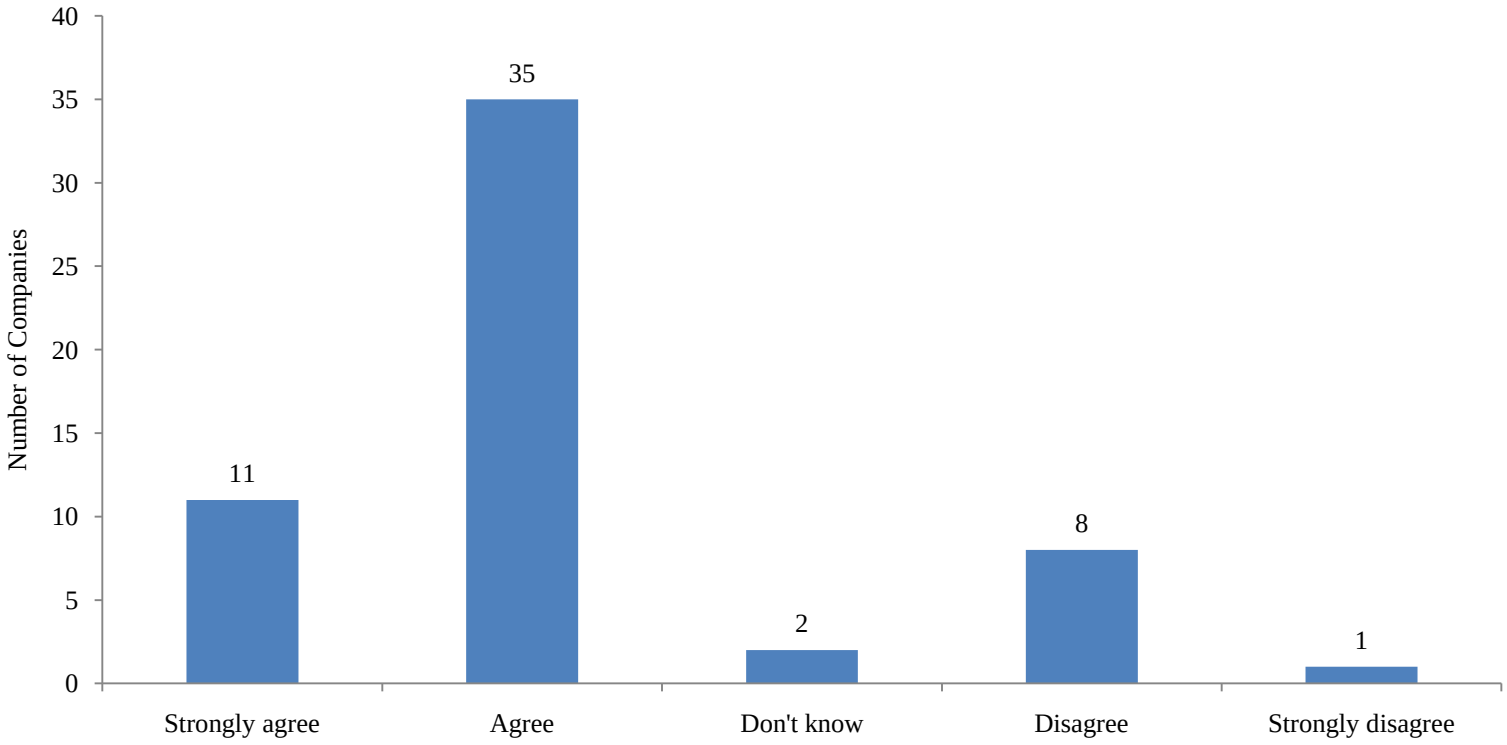
** Data collection is currently in progress.*

Industry Views: 66% agree or strongly agree that: “In my company, we worry that nanotechnologies may encounter unwarranted public backlash such as that which accompanied genetically modified foods in Europe” (n=58)



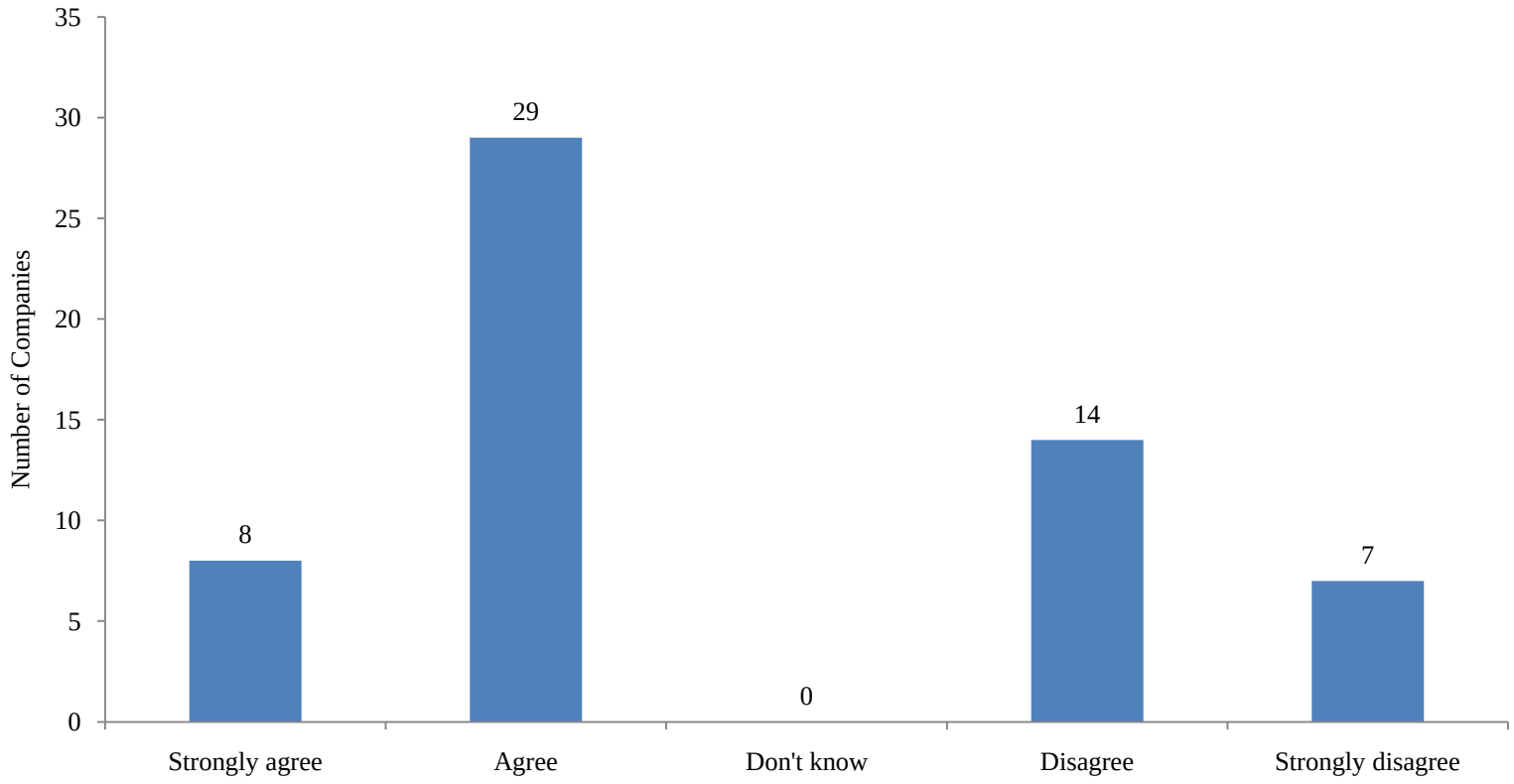
** Data collection is currently in progress.*

Industry Views: 81% agree or strongly agree that: “Businesses are better informed about their own workplace safety needs than are government agencies” (n=57)



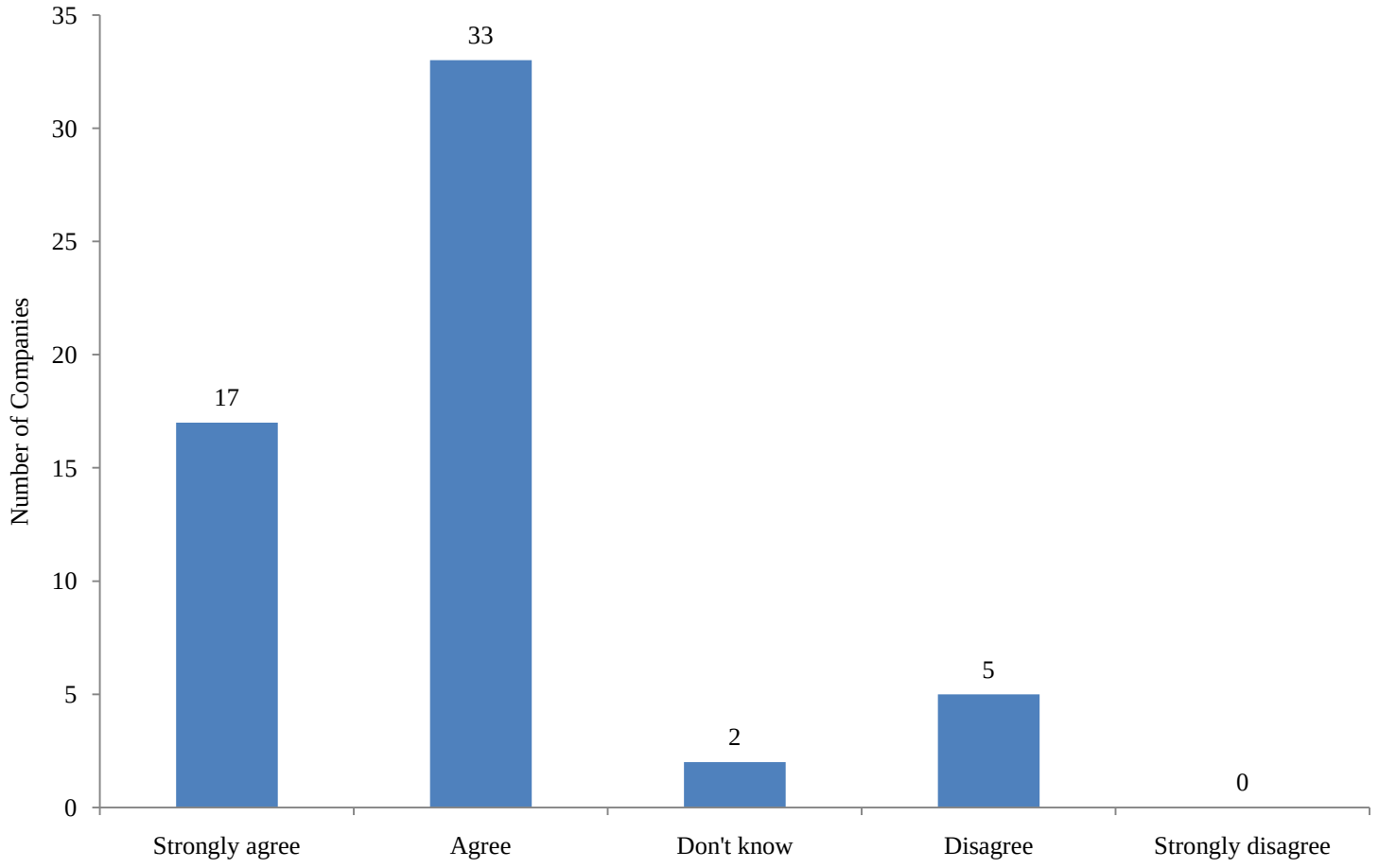
** Data collection is currently in progress.*

Industry Views: ~2/3 agree that: “Employees are ultimately responsible for their own safety at work” (n=57)



** Data collection is currently in progress.*

Industry Views: 88% agree or strongly agree that: “Workplace safety should take priority over scientific and technological advancements” (n=57)



** Data collection is currently in progress.*

Conclusions: Value in nano risk perception research

Toxicology important but NOT ENOUGH

- Demonstrate current levels of awareness and familiarity
- Show complexity of judgments—multifactorial and dynamic
- Benefit perception important & needs further study
- Applications likely strong factor (same NM in different applications likely to generate different response)
- Trust a major issue; vulnerability and discrimination lead to lack of trust (this is not ignorance!)
- Regulatory actions likely to produce amplification **&** generate trust
- Industry experts show sensitivity to different NMs in their judgments

But:

- Upstream nano research is easier said than done—many novel aspects, strong framing effects, and dependence on proxy events

NEW CNS-UCSB Study: Nano Regulator Views on Risk and Regulation

- Multi-level and cross-national study of regulator views related to risks and regulation of nanotechnologies in health, environmental, and workplace safety
- All interested participants invited; qualitative interviews
- Prof. Joe Conti, Sociology & Law, Univ. of Wisconsin, Madison
- jconti@cns.ucsb.edu or 608-262-4688

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