# Cooling a Warming Planet?
# Public Forums on Climate Intervention Research

## Results Report Launch

Consortium for Science, Policy & Outcomes

November 6, 2019

Arizona State University

Consortium for Science, Policy & Outcomes
at Arizona State University

# Agenda

| | |
|---|---|
| 11:30 am | Welcome, project introduction, and lunch |
| 11:45 pm | Participant data and forum results |
| 12:15 pm | Panel discussion and Q&A |
| 1:30 pm | Adjourn |

Uncertainty

Lock-in

Moral hazard

Governance

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# Project Team

Daniel Sarewitz (PI)
Mahmud Farooque (Co-PI)
Ariel Anbar (Co-PI)
Stephen Romaniello
John Nelson
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Ira Bennett

Jason Lloyd
Kimberly Quach
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Emily Hostetler
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**Project Funding from:**

Alfred P. Sloan FOUNDATION

ECAST
EXPERT AND CITIZEN ASSESSMENT OF SCIENCE AND TECHNOLOGY

CSPO
Consortium for Science, Policy & Outcomes
at Arizona State University

Museum of Science

ASU PlanetWorks
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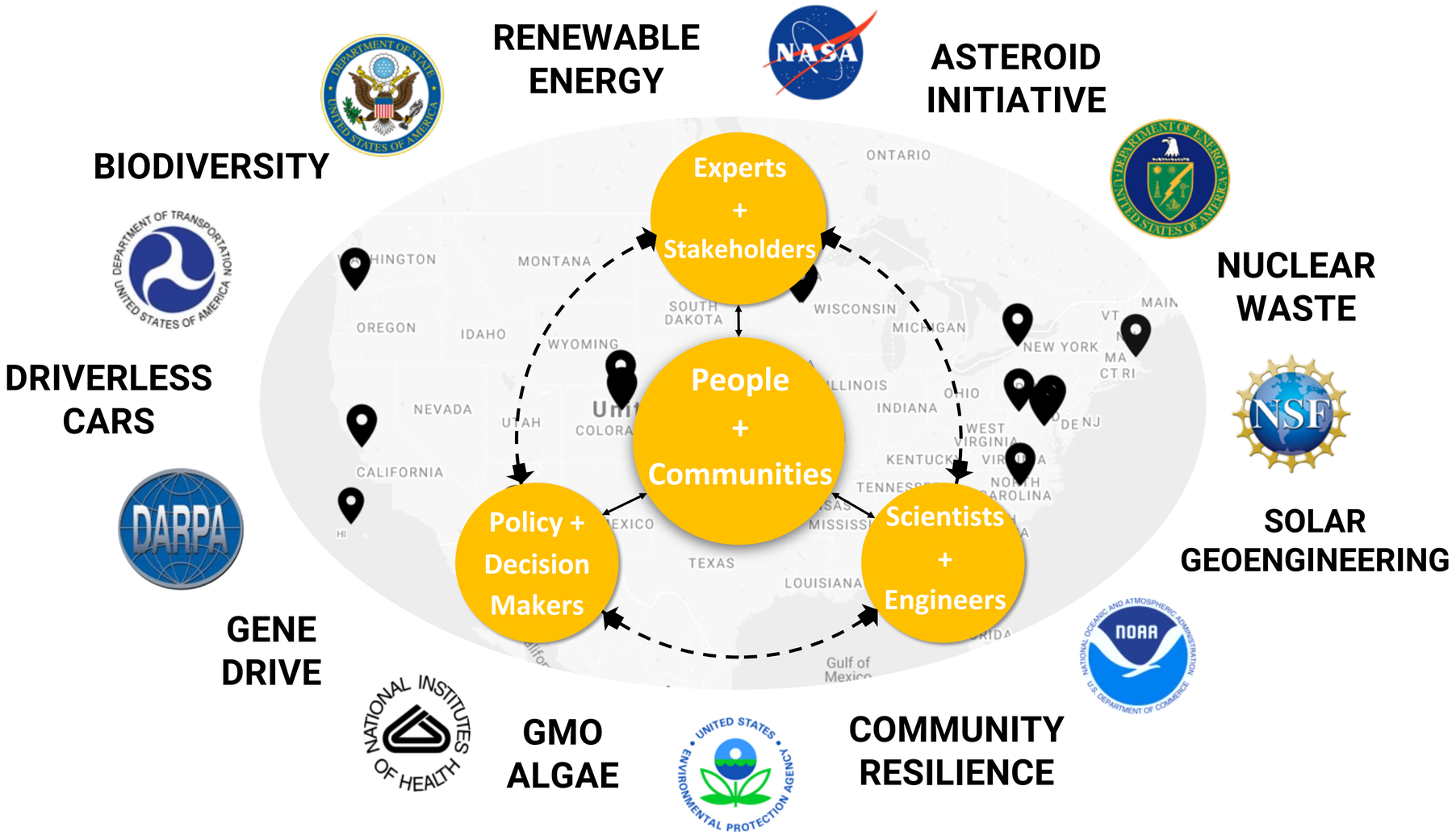
# ECAST Network

## Deliberative decision-making for more **informed**, **inclusive** and **desirable** outcomes




**60 deliberations across 16 cities**

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# What is Participatory Technology Assessment (pTA)?

- Diverse representation
- Deliberative multi-directional learning
- Informed lay public participants
- Clear, comparable, and usable outputs, formats, outcomes

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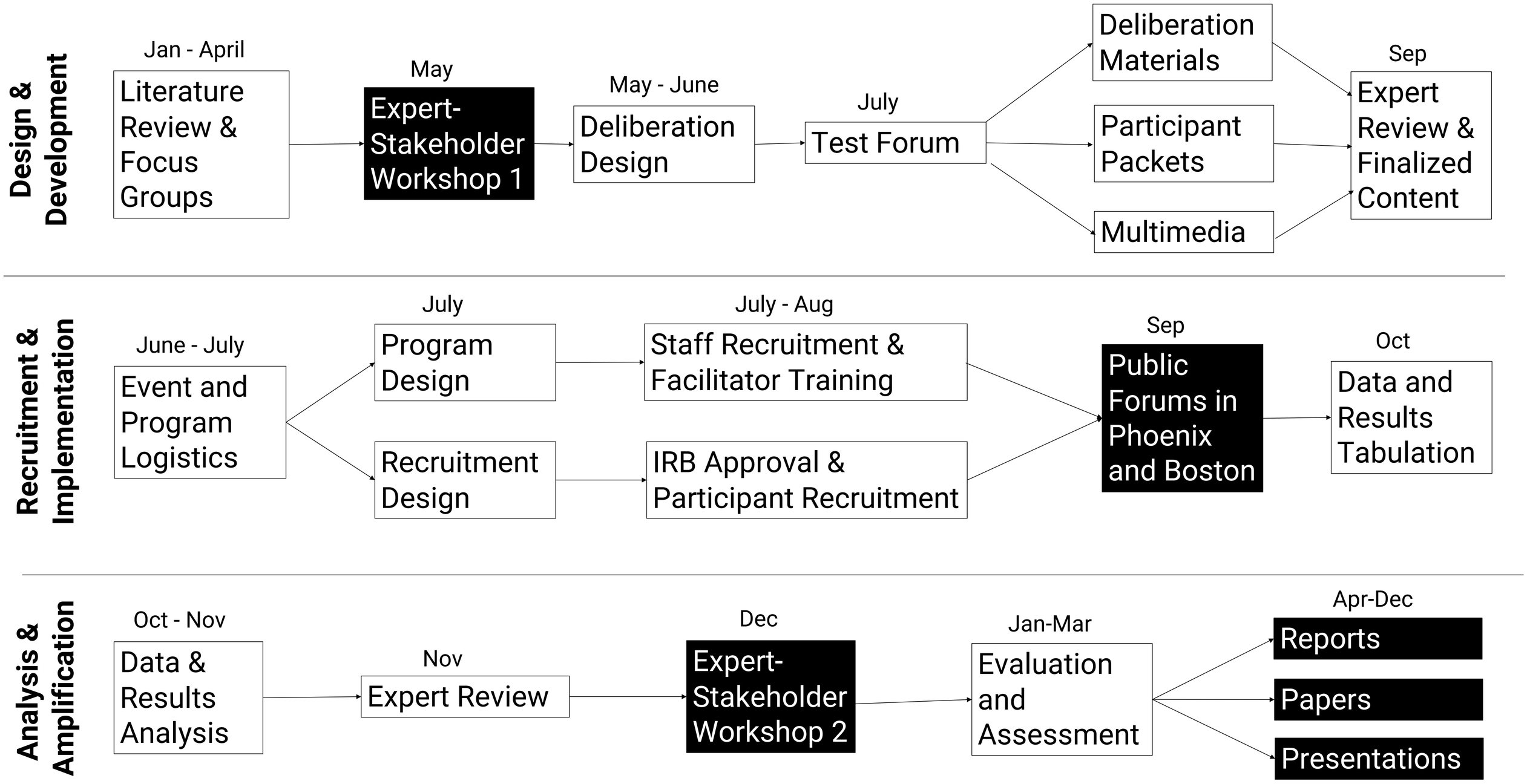
# Project Timeline



# Forum Sessions

## What research topics?

### Cirrus Cloud Thinning

### Stratospheric Aerosols

### Marine cloud brightening

### Ocean Surface Microbubbling

### Sea Ice Thickening

### Cool Infrastructure

Painting roads, roofs, and other infrastructure in reflective colors and increasing reflective plant cover could help reflect incoming sunlight and reduce local temperatures.

- Easily targeted
- Few unpredictable impacts
- Effects are small on a global scale

## Who should fund research?

### Nongovernmental Organizations (NGOs)

### Federal Government

### Military

### Corporations

### Philanthropies

**Who are they?**
Philanthropic organizations typically fund a wide variety of projects that support research relevant to their foundation's mission. Sometimes philanthropies partner together to fund larger-scale programs.

**What types of projects do they fund?**
Philanthropies often award grants for research that is relevant to the foundation's mission through a proposal and review system. Philanthropies can directly solicit an organization or researcher to complete a project, which limits the diversity of proposals. Philanthropies can be narrow in focus. For example, they might exclude nuclear energy when funding research on sustainable energy sources.

**How much oversight do they provide?**
Each philanthropy has different processes for tracking project progress and providing oversight. Some organizations provide templates for tracking results, which include progress narratives, fiscal reports, and a final report. Others may only require a final report.

**How will they use the research?**
Philanthropies may discuss the research projects as evidence of their commitment to their stated mission, but are unlikely to further develop the research on their own. The outcome could encourage or discourage further research funding for the same method.

## Who should make decisions?

### Researcher Self-Governance

### Independent Advisory Committees

### Local & Regional Government

### Federal Government

### International Negotiation

International actors could create a high-level SRM policy through negotiation and treaties, allowing international stakeholders to have a say in how and whether SRM research is conducted. This could include establishing rules and principles for conducting SRM research, or limitations and regulations at smaller scales of oversight. For example, the United Nations Framework Convention on Climate Change organizes global efforts to address climate change.

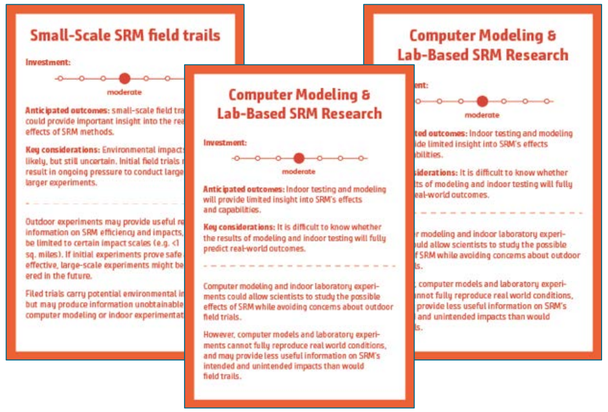
**Who makes decisions?**
Representatives of different governments' agendas and interests

**Whom do they represent?**
The global community

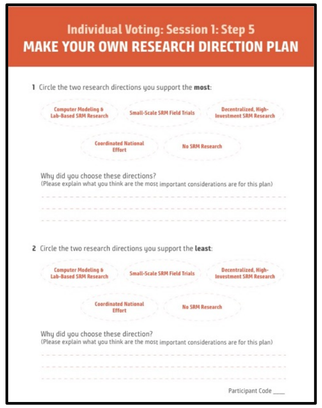
**How do they make decisions?**
Negotiations within constraints set by participating governments

# Session Structure

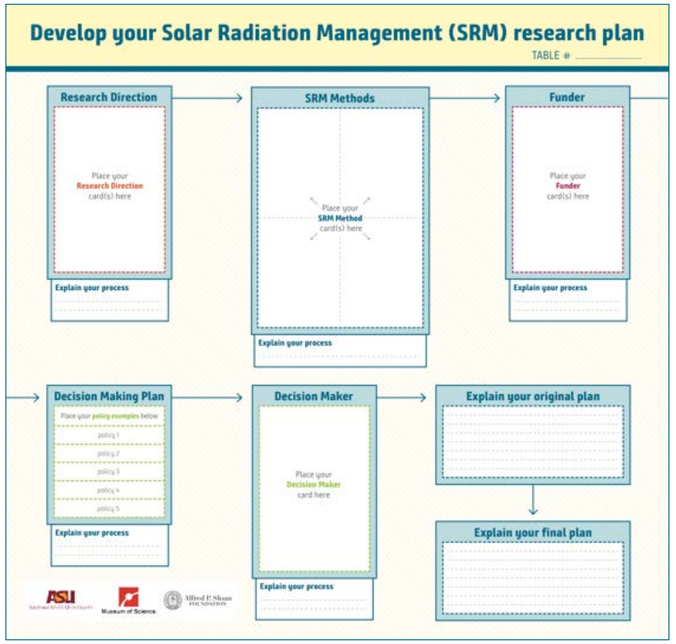

## Watch Video




## Table Discussion

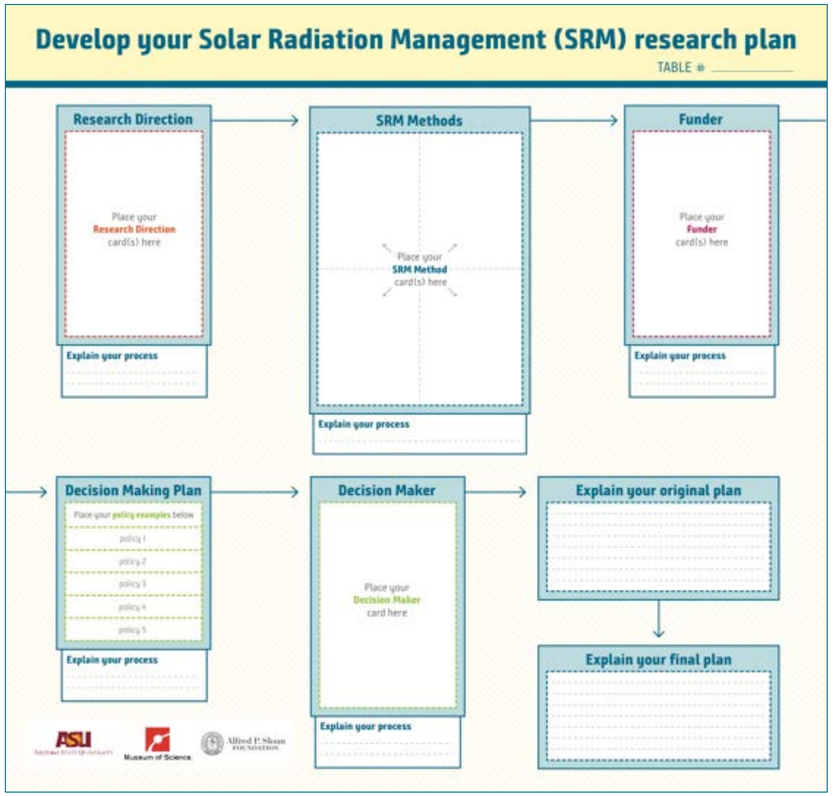



## Group Plans & Individual Response




## Share Results

# Data Collection Methods

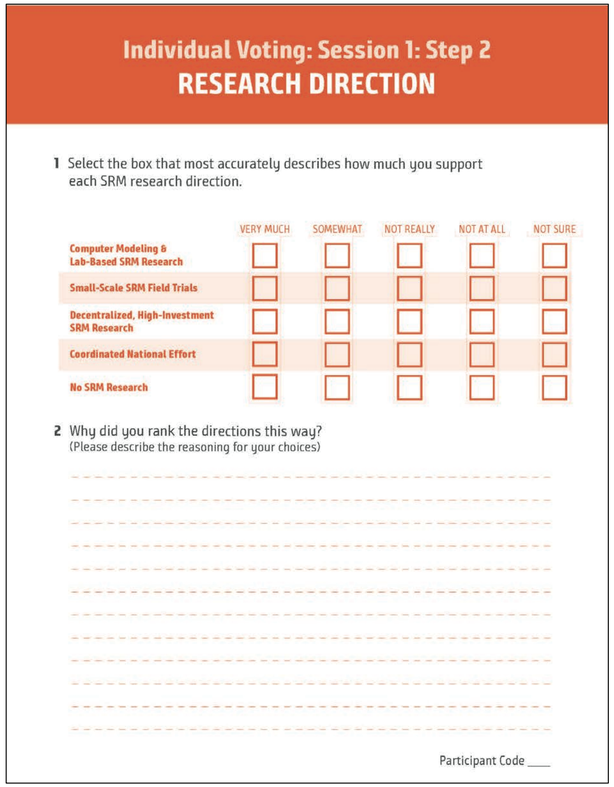



**Group Boards/Activities**

**Individual Response Sheets**

**Table Observer Notes**

**Table Recordings**



Individual Voting: Session 1: Step 2
RESEARCH DIRECTION

1 Select the box that most accurately describes how much you support each SRM research direction.

| | VERY MUCH | SOMEWHAT | NOT REALLY | NOT AT ALL | NOT SURE |
|---|---|---|---|---|---|
| Computer Modeling & Lab-Based SRM Research | ☐ | ☐ | ☐ | ☐ | ☐ |
| Small-Scale SRM Field Trials | ☐ | ☐ | ☐ | ☐ | ☐ |
| Decentralized, High-Investment SRM Research | ☐ | ☐ | ☐ | ☐ | ☐ |
| Coordinated National Effort | ☐ | ☐ | ☐ | ☐ | ☐ |
| No SRM Research | ☐ | ☐ | ☐ | ☐ | ☐ |

2 Why did you rank the directions this way?
(Please describe the reasoning for your choices)

Participant Code ____

# Who Were the Participants?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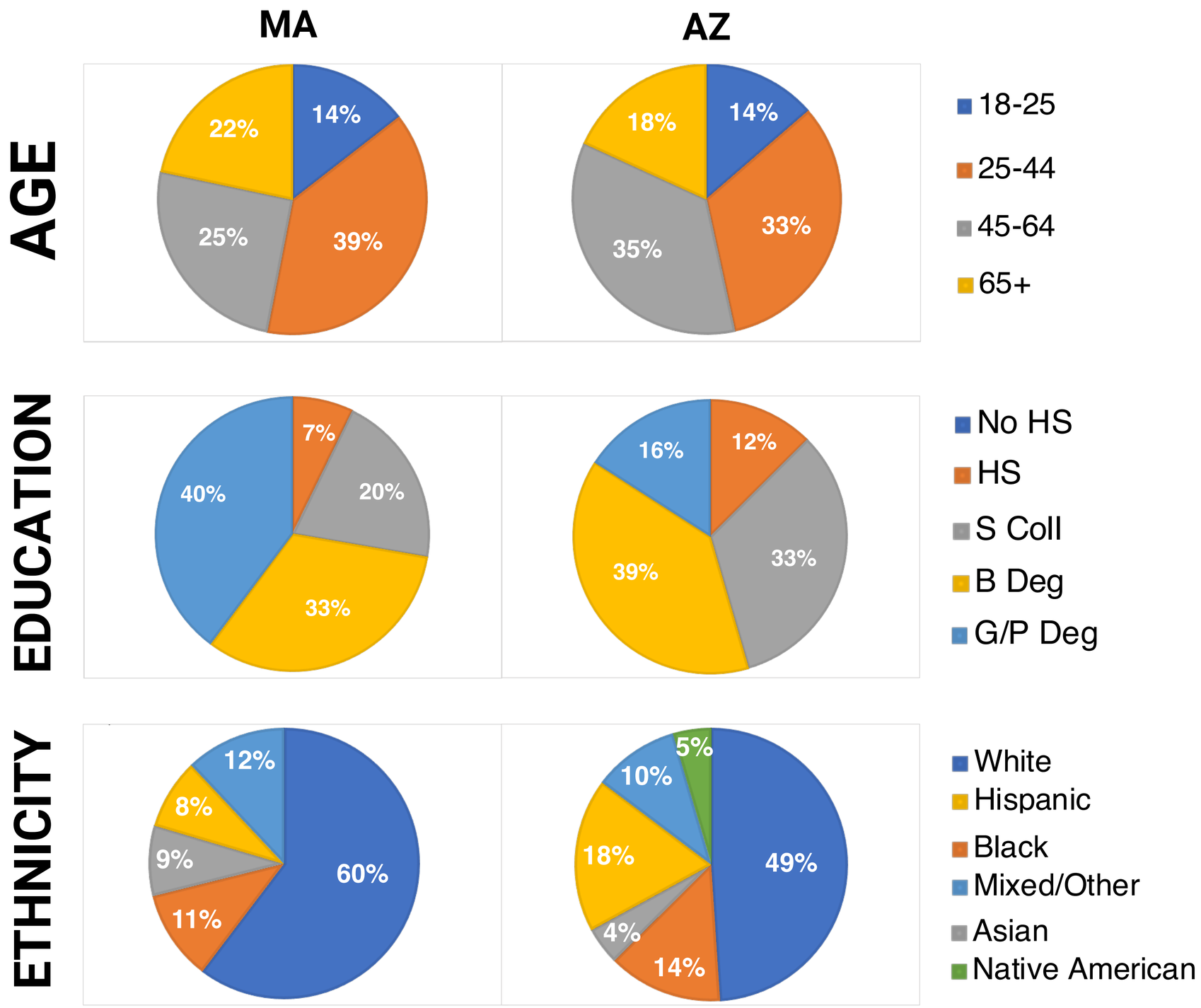
# Who Attended




**AZ: 88**

**MA: 83**

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# Influence of Participation

| | Combined Pre | Combined Post | Combined Pre vs. Post T-Test |
|---|---|---|---|
| *Pre/Post Survey Comparison Questions* | **Average** | **Average** | **p** |
| I am familiar with the topic of SRM research. | **4.4** | **2.0** | 8.5E-34 |
| I know the issues, arguments and perspectives related to climate change. | **3.2** | **2.3** | 1.2E-07 |
| Generally speaking, I think that climate change is happening. | **1.5** | **1.4** | 0.45 |
| I believe that climate change is mostly human-caused. | **2.1** | **1.9** | 0.18 |

5 participants rate disagreement (5, 6, 7)

7 participants rate disagreement (5, 6, 7)

**1** — Absolutely agree

**4** — Neither agree nor disagree

**7** — Absolutely disagree

# Climate Change Research Attitudes

| | Combined Pre | Combined Post | Combined Pre vs. Post T-Test |
|---|---|---|---|
| *Pre/Post Survey Comparison Questions* | Average | Average | p |
| SRM research is crucial to understanding how to battle the effects of climate change. | **2.7** | **2.4** | 0.027 |
| Experts and science in general will help solve most climate change problems. | **3.4** | **2.9** | 0.0074 |
| Technology generally causes more problems than it solves. | **4.7** | **4.9** | 0.37 |
| It is important to collect data on the public's ethical concerns about SRM research. | **2.3** | **1.8** | 0.0019 |
| It is important to collect public opinion data on decisions about SRM research directions. | **2.4** | **1.9** | 0.00068 |

| 1 | 4 | 7 |
|---|---|---|
| Absolutely agree | Neither agree nor disagree | Absolutely disagree |

# Influence of Participation – Regional Differences

| | AZ | MA | AZ vs. MA |
|---|---|---|---|
| *Participation in the forum…* | **Average** | **Average** | **p** |
| significantly increased my knowledge about climate change. | **1.65** | **2.55** | 1.3E-04 |
| significantly influenced my opinion about climate change. | **2.27** | **3.34** | 4.1E-04 |
| significantly influenced my knowledge about SRM research. | **1.55** | **1.74** | 0.27 |
| significantly influenced my opinion about SRM research. | **1.80** | **2.22** | 0.03 |
| enhanced my understanding of alternative perspectives to my personal opinion on climate change. | **2.01** | **2.41** | 0.07 |

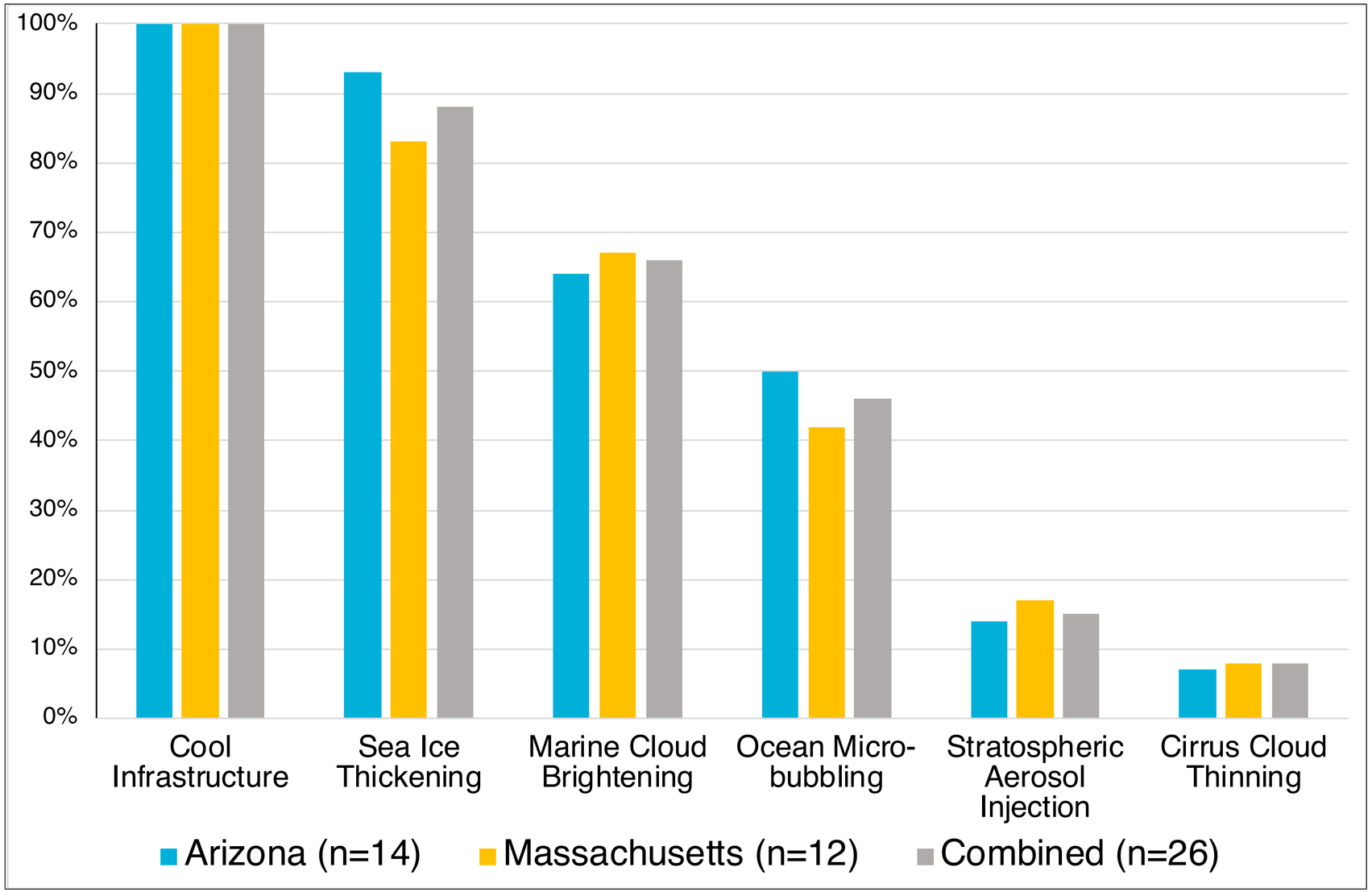
**1** — Absolutely agree

**4** — Neither agree nor disagree

**7** — Absolutely disagree

# Session 1 – Research Directions

# SRM Methods – Group Data




**Natural vs. Human-made:** "They can come up with a lot of experiments that doesn't need to use a lot of energy and bad chemicals;" "Methods that focus on reflection not on altering the atmosphere."

**Pragmatic:** "Practical, quick,…;" "Ideal for small-scale trials."

**Reversibility:** "All low risk, easily stopped."

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# "Natural" interventions preferred

Stratospheric Aerosol Injection favored by **less than 20%** of deliberative groups

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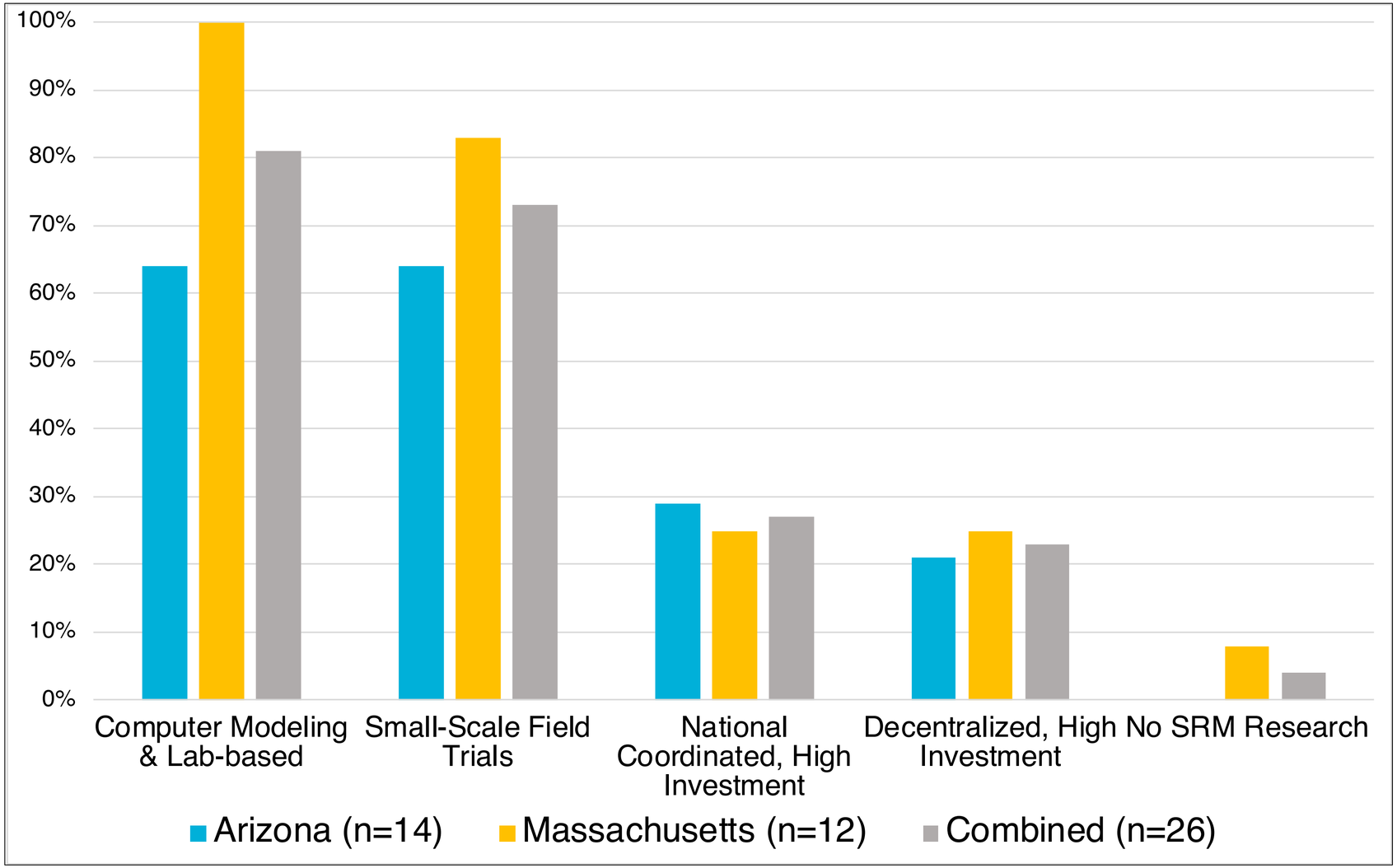
# Research Directions – Group Data




"Small scale research involves low risk and moderate funding. Less chance of negative ramifications."

"Modeling & field experiments would have highest payoff. These should be done before considering national or other expensive programs."

"'No Research' not acceptable (need to 'gain knowledge')"

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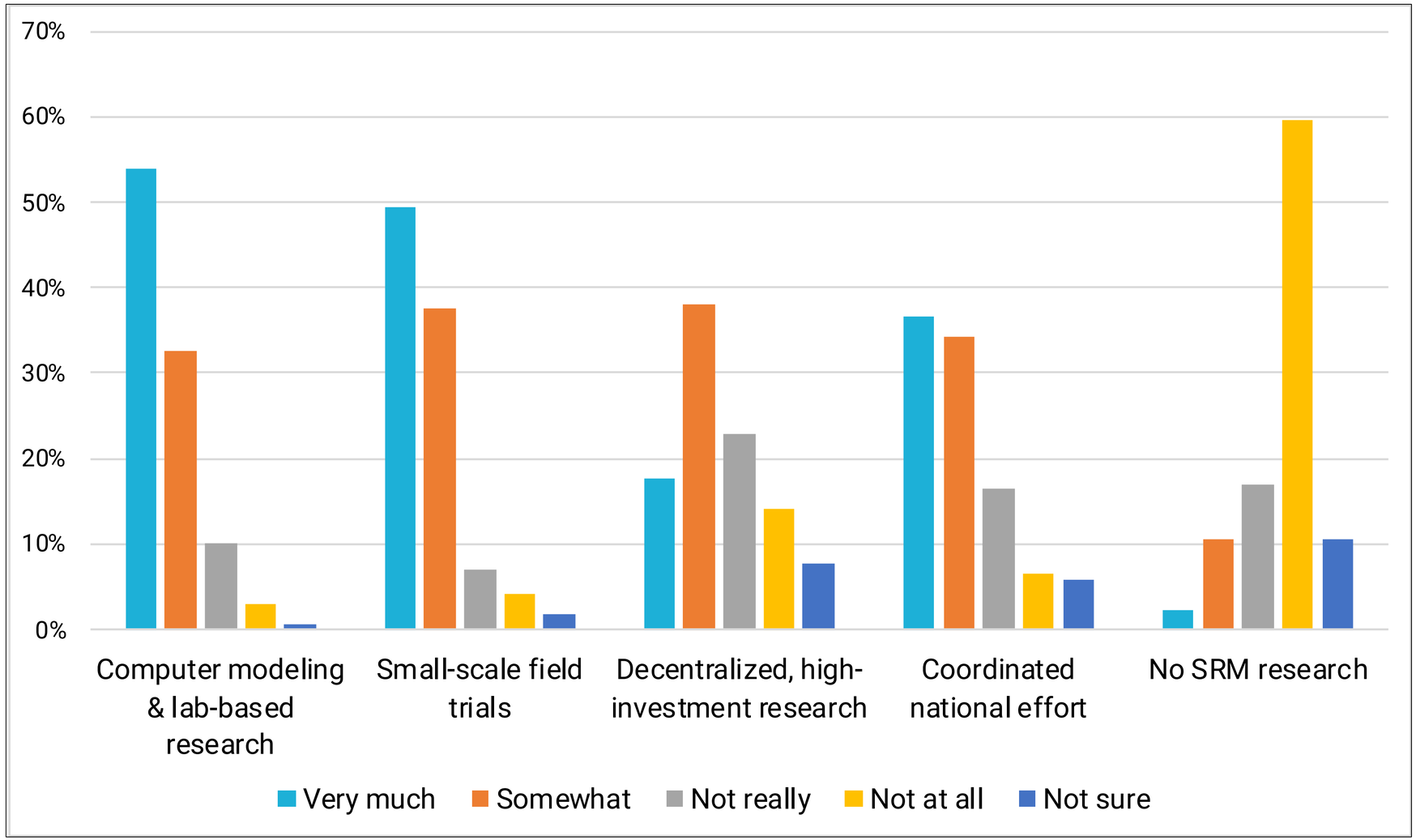
# Research Directions – Individual Data




"Computer modeling is a safe way to test without messing things up and a good way to see potential pitfalls. Small scale trials are the next logical step so real world pitfalls can be observed that didn't happen in the lab."

[Decentralized/National]: I chose these two because I think they would generate the most diverse results & solutions as quickly as possible (time is no longer a luxury we have with climate change)

"NO research until we have equal world participation: This should be a world wide collective participation to avoid a disadvantage at the world level."

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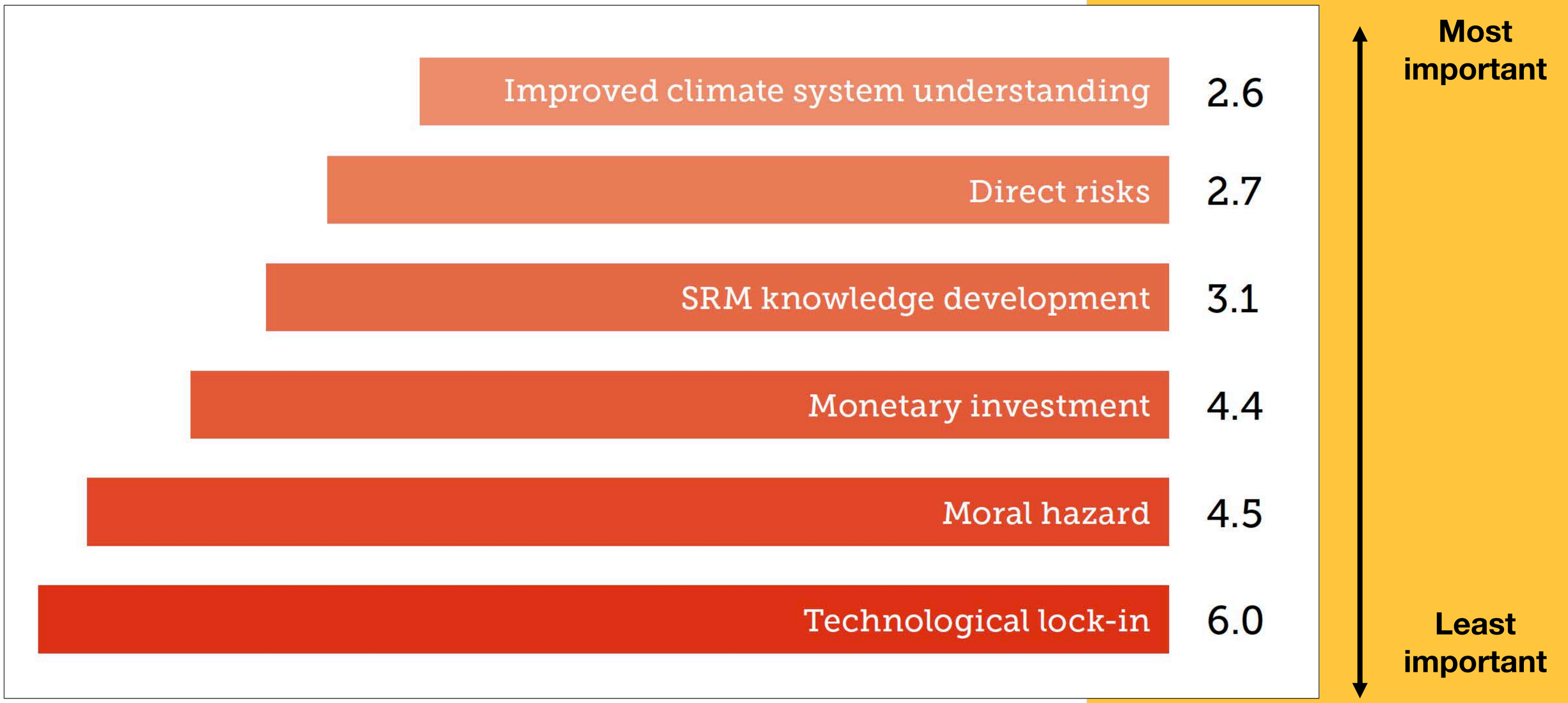
# Issues to Consider



# Conditional Acceptance

| PRIMARY/SECONDARY THEME | # of Statements |
|---|---|
| **Research Process** – *conditions related to research methods, data collection, outcomes, and approaches.* | |
| Data accuracy and reliability | 53 |
| Computer and lab research first | 33 |
| Small-scale research first | 17 |
| Context-specific research | 6 |
| Many approaches strategy | 6 |
| National-scale research first | 3 |
| **Economic Cost** – *concerns about the cost of SRM, including political implications.* | |
| Large-scale research expensive | 17 |
| Small-scale research cost effective | 17 |
| Funding is political | 6 |
| General statements about cost | 6 |
| Private funding preferred | 5 |
| Cost isn't a factor | 1 |
| **Cooperation** – *assertions that cooperation is necessary or difficult to achieve.* | |
| Leads to agreement | 12 |
| International cooperation necessary | 9 |
| Agreement is difficult | 8 |
| Leads to diverse ideas | 5 |

| PRIMARY/SECONDARY THEME | # of Statements |
|---|---|
| **Risk & Uncertainty** – *concerns about risk associated with the conductance and outcomes of research.* | |
| Unspecified risk | 35 |
| Environmental risk | 24 |
| Moral hazard | 14 |
| Reversibility of research | 8 |
| Social impact | 3 |
| Energy consumption of research | 2 |
| **Governance** – *conditions related to governing the research process.* | |
| Appropriate governance necessary | 35 |
| Public engagement necessary | 11 |
| Oversight and accountability | 8 |
| Researcher autonomy | 2 |
| Transparency | 1 |
| Property rights | 1 |

**Three-quarters** of participants set **some sort of condition** on SRM research

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Some sort of SRM research is a good idea

Approval is conditional

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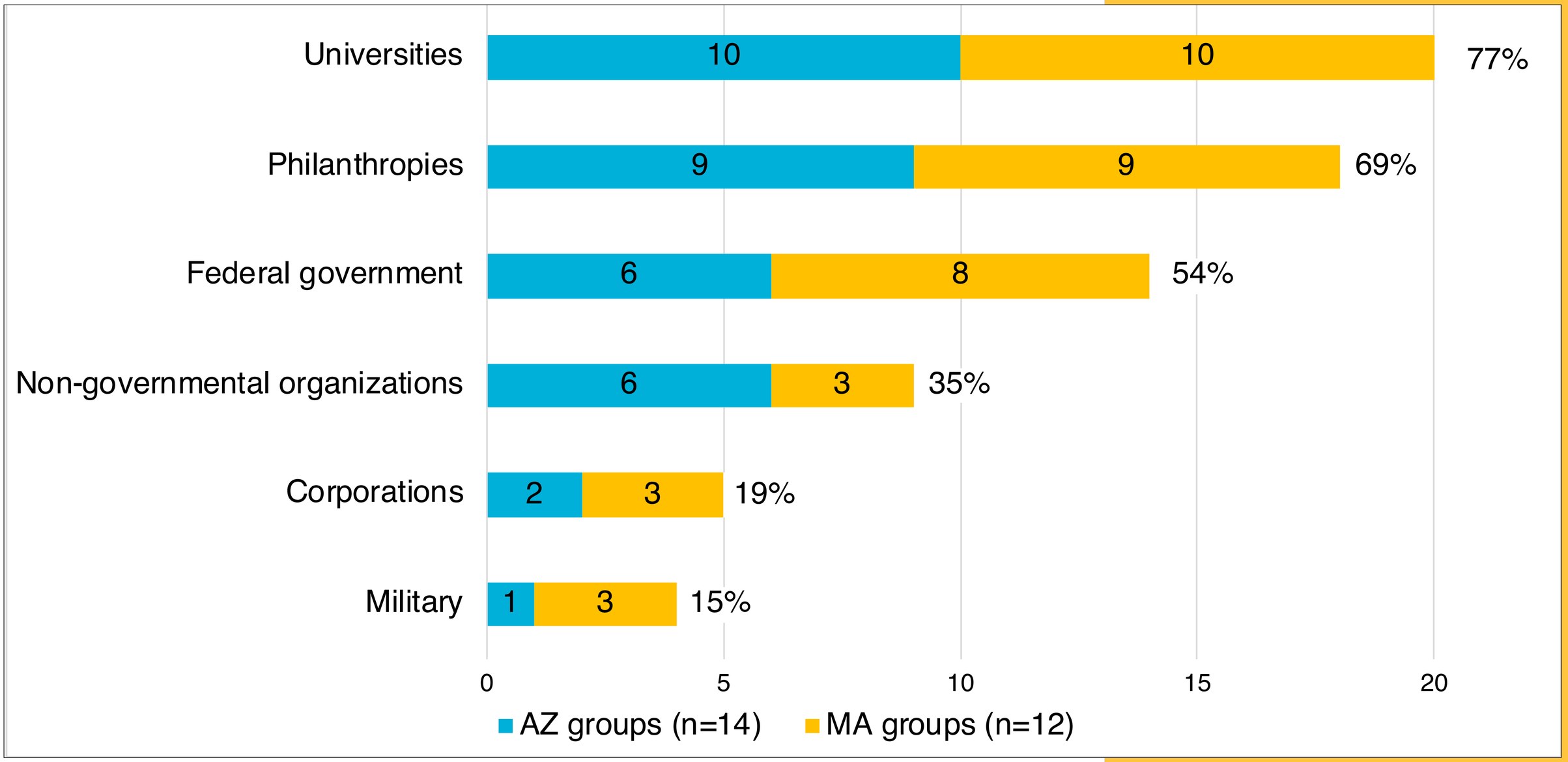
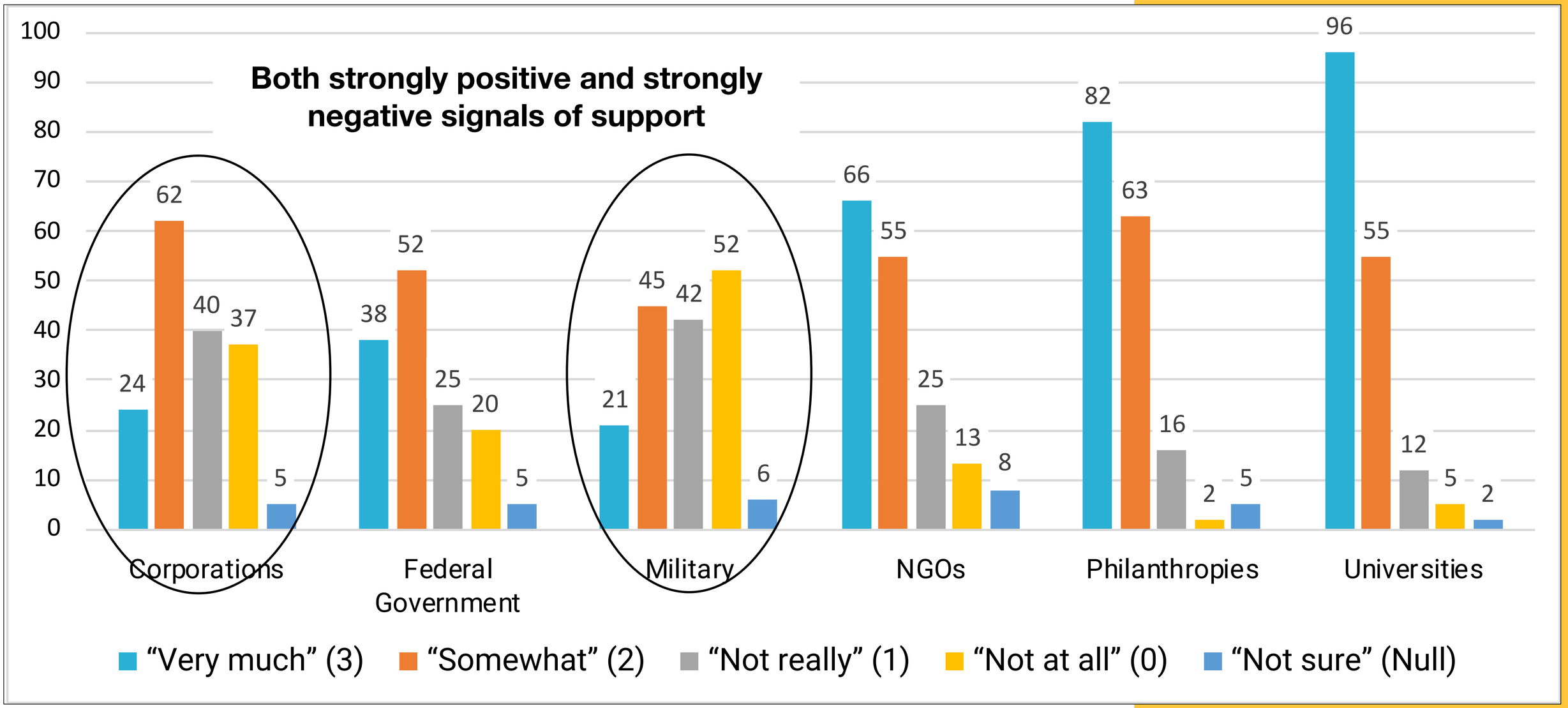
# Session 2 – Funding

# Funders – Group Data



# Individual Funder Support Ratings

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# Quotes on Funders

- “The most **objective & public good orientated research** comes from governmental or private philanthropy (who share the same overall public good mission) sources.”

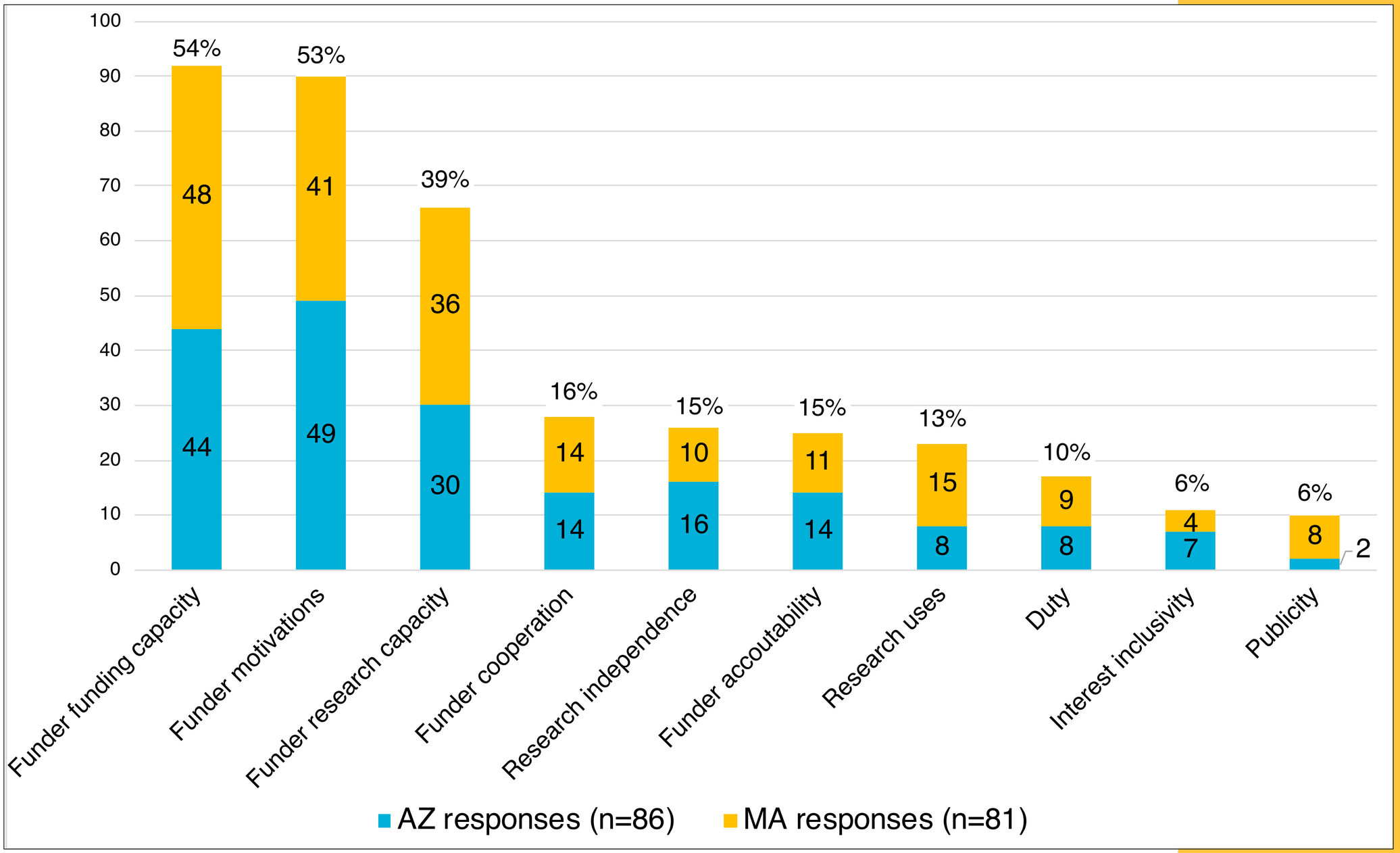
- “I don’t think the federal government is a good funder [because] it depends on who is in office . . . so the **amount of funding wouldn’t be consistent**.  Corporations are an okay choice, but there is a lot of risk because the company could go bankrupt.”

- “**Corporate greed** got us here (dangerous climate change being accepted in order to profit elsewhere in the economy) so I do not believe corporations’ **motives would be altruistic** enough for positive funding of any climate research.

- “Philanthropies -people's **commitment to a cause**, which they do benefit future generations.”

- [Military]: “The tech developed **could be used/seen as a "weapon"** by other countries & discourage international cooperation on the topic.” [Perhaps suggests guidance on which funding entities would make this distinction more difficult]

# Funder Themes from Individual Rationales

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# Motivations are critical


**Public good** focus

Funding **consistency**

Potential for **collaboration**

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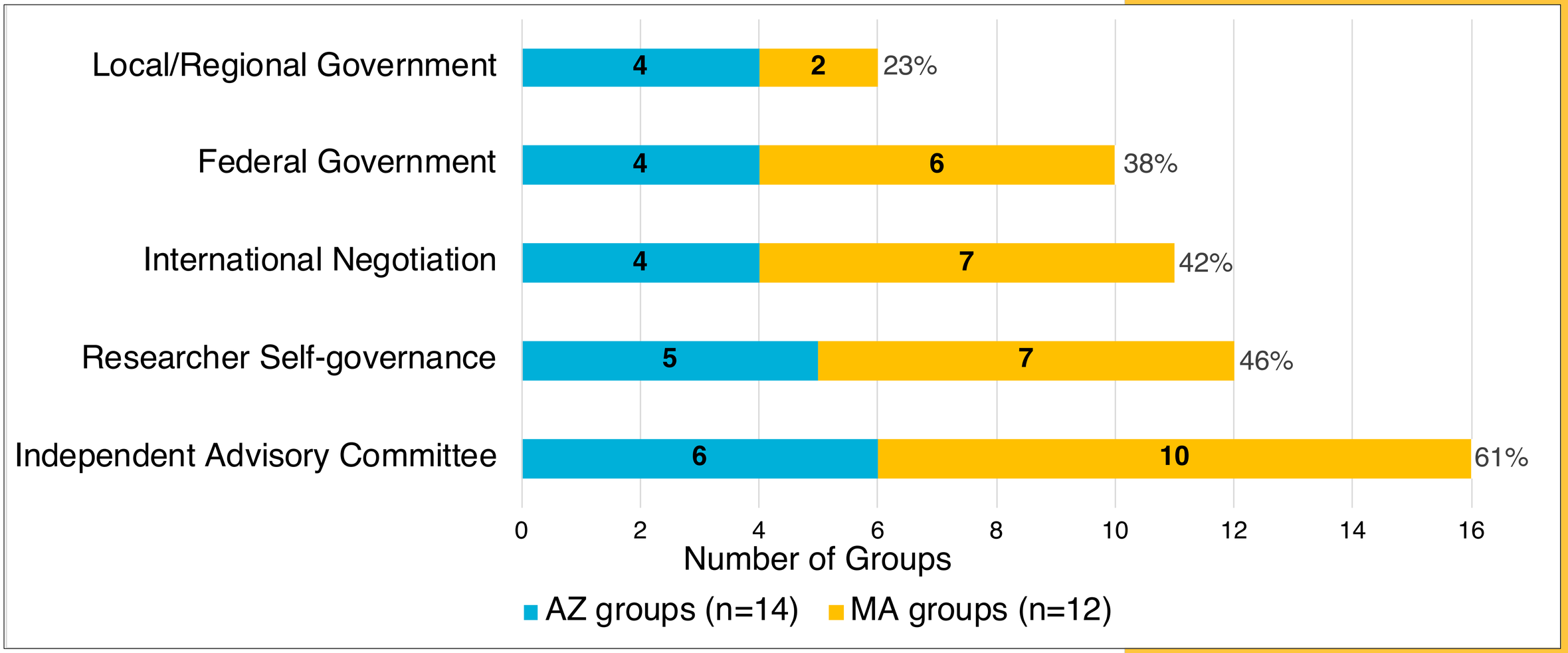
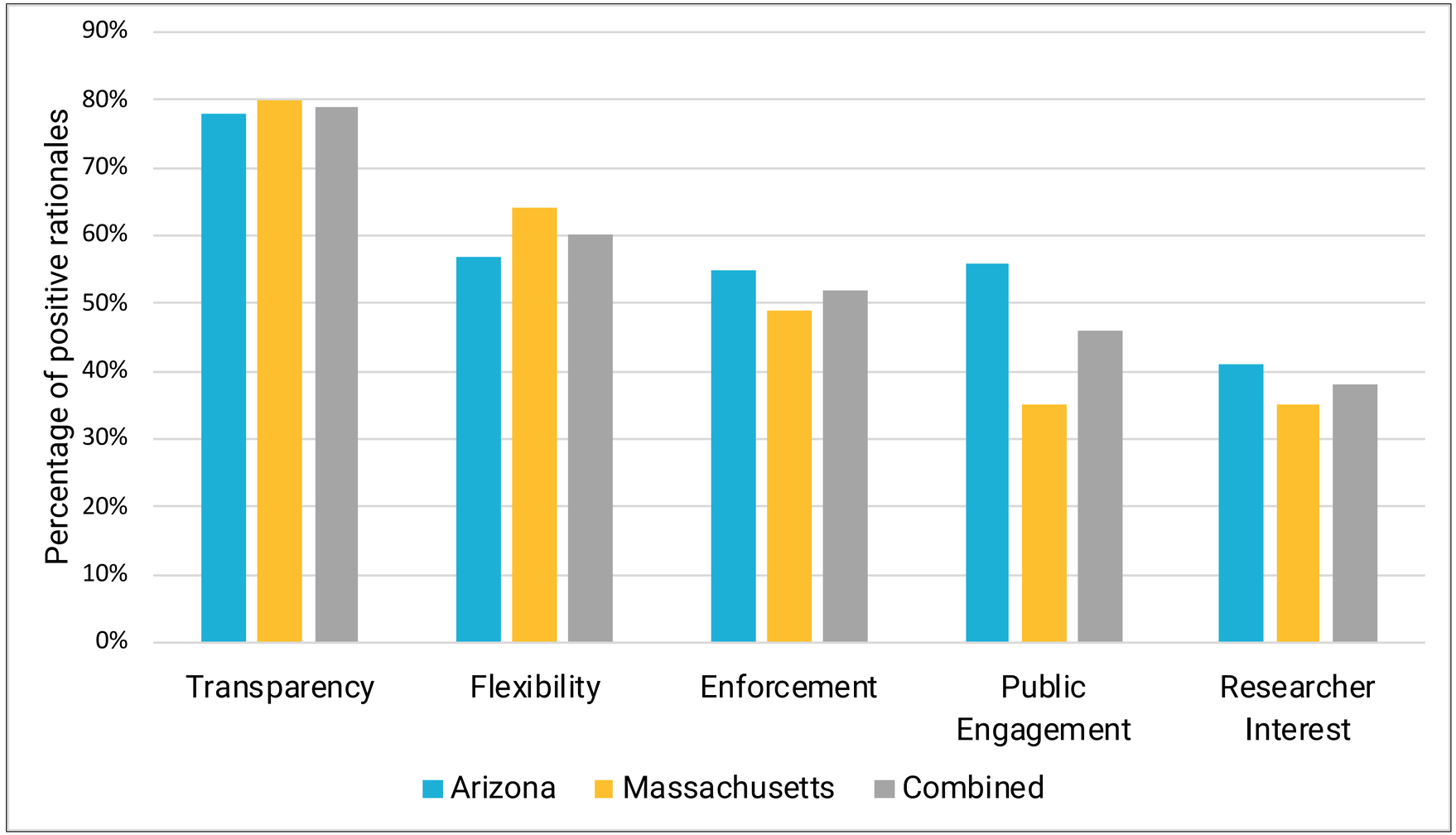
# Session 3 – Decision Making

# Decision-Makers – Group Data



# Decision-Making Priorities




"Public is widely affected and should be heard; public should be able to know what is going on in their own backyards."

"Researchers have control over science. Trust but verify. Non-compromising open access to public."

"Keeping researchers free to perform their work, while keeping the public abreast of their findings."

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# Decision-Making Priorities

| GOVERNANCE PRIORITY MAIN CATEGORY/SUB-CATEGORY | # of Statements | PRIMARY/SECONDARY THEME | # of Statements |
|---|---|---|---|
| ENFORCEMENT | | FLEXIBILITY | |
| For public accountability | 72 | Governance process | 51 |
| Through good rules of science | 14 | Vetting new and untested | 32 |
| As transparency | 7 | Researcher decision-making | 23 |
| On a global scale | 2 | Generates diverse ideas | 8 |
| Through the free market | 1 | Undefined | 8 |
| *Hinders progress* | 4 | *Creates bias* | 2 |
| TRANSPARENCY | | PUBLIC ENGAGEMENT | |
| Openness to the public | 62 | People should have a say | 51 |
| Promotes enforcement | 30 | Create awareness/education | 31 |
| Fundamental to governance | 27 | Encourages enforcement of rules | 8 |
| Good science | 17 | To save the environment | 6 |
| Creates public support | 13 | *Public shouldn't interfere* | 13 |
| Next research steps are flexible | 11 | *Hinders progress* | 17 |
| Undefined | 9 | RESEARCHER INTEREST | |
| Trust | 8 | Scientists know best/bring legitimacy | 36 |
| Aids cooperation | 6 | Helps motivate scientists | 23 |
| Generates clear facts | 4 | Promotes value free autonomy | 11 |
| *Hinders progress* | 1 | Inclusive/serves others | 3 |
| | | *Detrimental to the public* | 9 |
| | | *Not a priority* | 7 |

# Transparency is required


**Ambivalence** –
Public oversight vs.
Expert self-governance
**International** cooperation

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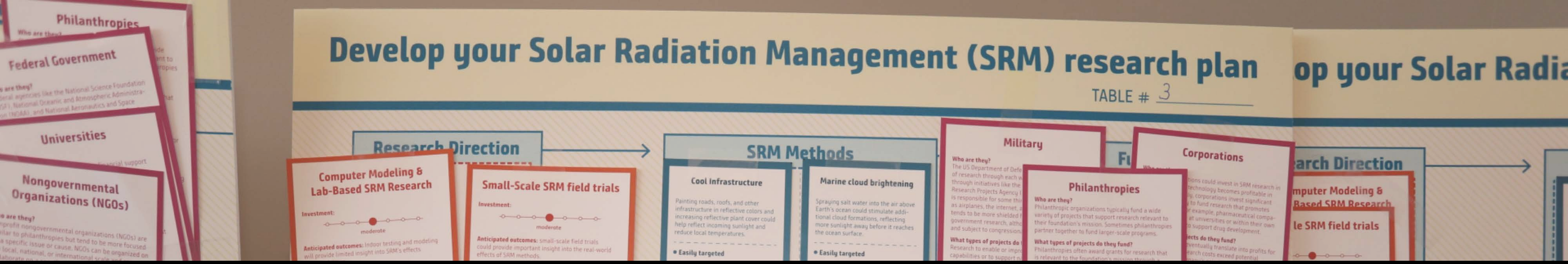
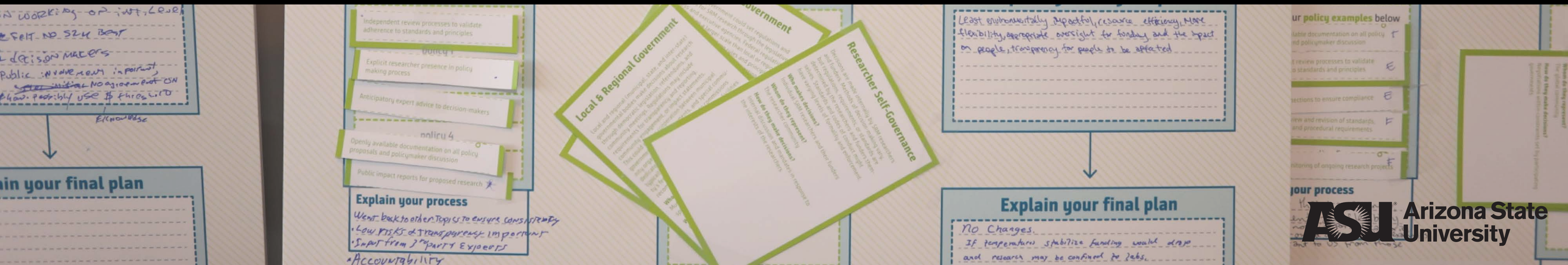



“Keep things small; govern transparently, flexibly, and inclusively; learn from past mistakes and be prepared to reverse course.
**Proceed—but with caution.**”

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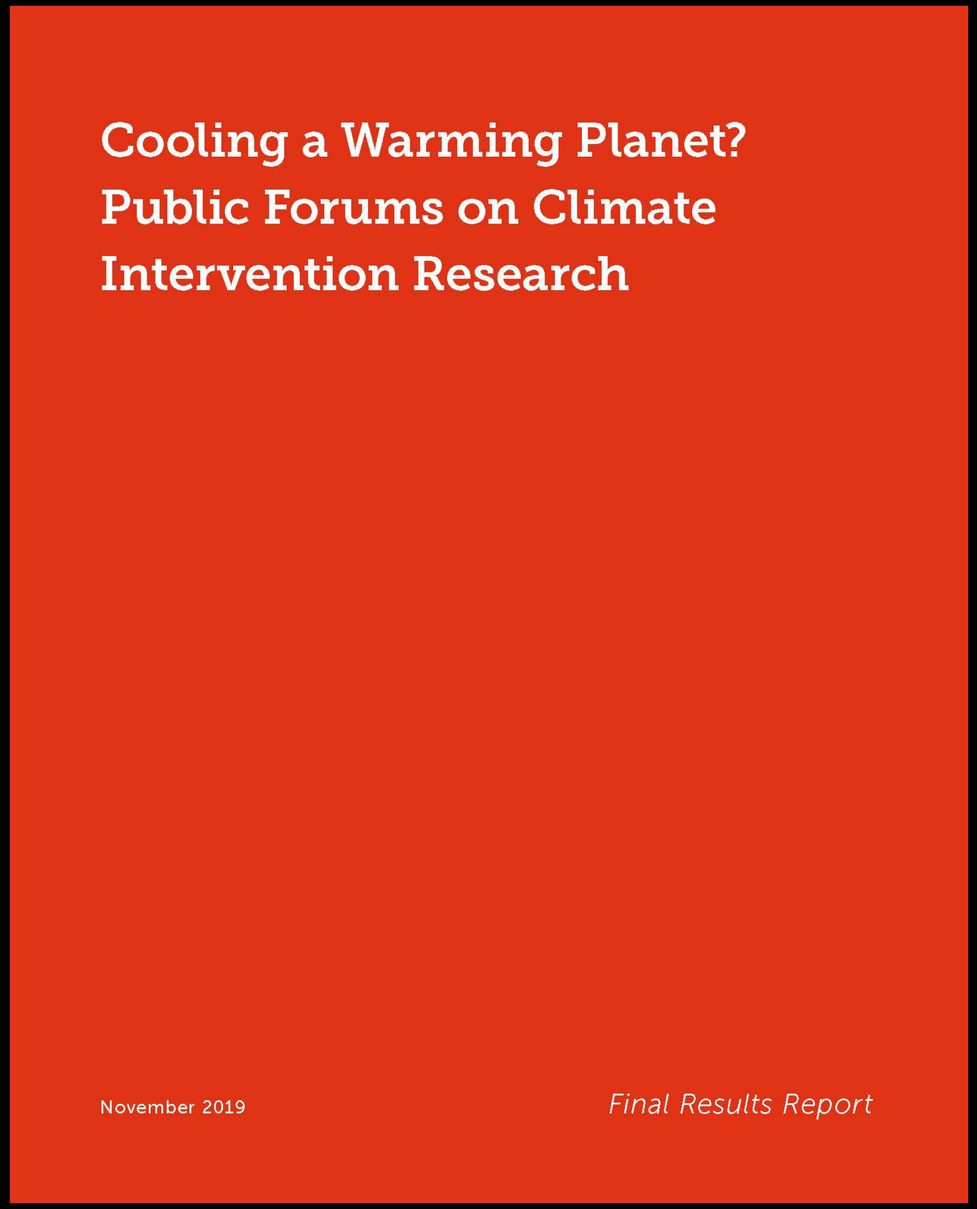
NOTTIN
LONDON
Cooling a Warming Planet?
A Public Forum on Climate Intervention Research
QUESTION FOR CONTENT EXPERTS

# Questions?




# Panel Discussion

**Frank Keutsch (Harvard)**

**Jane Flegal (Spitzer – remotely)**

**Shuchi Talati (UCS)**

**Virginia Chanley (GAO)**

**Moderator: Ivan Amato (AAAS)**

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