Guiding innovation sustainably:
Applying principles of sustainability and anticipatory governance

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Introduction & Problem Statement

* Nanotechnology promises to address grand challenges
* Uncertainty and complexity are associated with emerging technologies, such as nanotechnology
* Limited formal guidance and regulations are available
* Practitioners are uncertain about how to create nanotechnology sustainably

Research Goal & Question

Goal:

Align risk governance, sustainability principles and anticipatory governance to create a synthesized framework for a design and evaluative tool used

Focal questions:

(i) Which actors are currently occupied in the nano-technology innovation process?

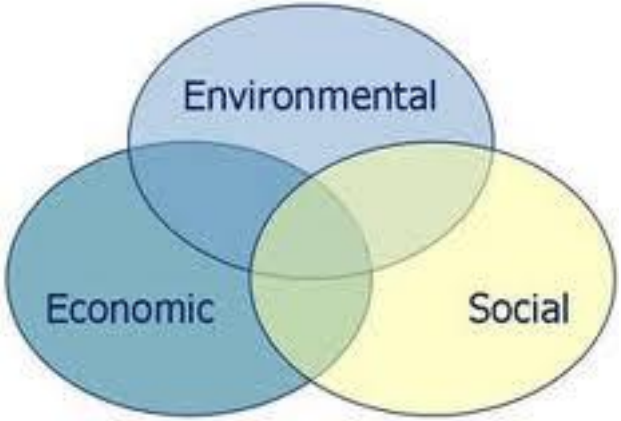
(ii) What responsibilities do they express as their and which do they assign to others? and

(iii) How do those responsibilities align (or contrast) with the sustainable anticipatory governance framework?

Selected Frameworks

Risk Governance

Sustainability Principles



Anticipatory Governance

* Engagement
* Integration
* Foresight
* Ensemblizeation

Value-based Responsibilities

* A = Socio-Ecological Integrity Maintained
* B = Publically / Culturally Engaged & Fostered
* C = Commercial Opportunities Reaped
* D = Risk Mitigated / Ameliorated Equitably
* E = Benefits Realized Equitably
* F = Future-oriented / Foresight
* K = Knowledge / Information Generating
* T = Transdisciplinary / Collaborative Practices

Synthesize Framework - Concept

INNOVATION PHASES	DISTINCT RESPONSIBLITIES FROM LITERATURE						
EARLY DISCOVERY & EXPERIMENTATION (A)	A.1.i A.1.ii	A2	A3	A4	A5	A6	A7
PROOF OF CONCEPT & MARKET (B)	P1	P2	P3	P4	P5		
SCALING PROTOTYPE TO MEET DEMAND (S)	S1	S2	S3.i S3.ii	S4	S5	S6	
COMMERCIALIZED (C)	C1	C2	C3	C4	C5	C6	
POST – COMMERCIAL (PC)	PC1	PC2	PC3				
HOLISTIC / SYSTEMIC (H)	H1	H2	H3	H4	H5	H6	H7

Research Design & Methods

Real-Time Technology Assessment

Socio-cultural Characteristics

Organizations: 400 Estimated

Expert Interviews (n=45)

Cluster statements on responsibility (like-like)

Assigned responsibility to selected frameworks

Who are the practitioners engaged?

* Academic researchers (scientists and engineers) (n=9);
* Academic leadership and support (n=5);
* Business consulting and legal services - supporting nanotechnology business (n=6).
* Government funding and support (n=6);
* Government regulators (n=2);
* Industrial companies directly working with nanotechnology (n=9);
* Insurers (n=1);
* Investors (n=3);
* Media (n=2) and;
* Non-government organizations (n=2)

Sample Data Table (of 900+)

Organization	C/S/SE	Values	Responsibility Code	n
University Researchers				
Understand application of knowledge to human challenges or market gap	S	A, E, K	A2, A.3.ii, P2, S1	17
Discovery (through basic research)	C	-		15
Federal Funding Agencies				
Funding Projects	C	-		22
Define research agenda	C	-		16
Evaluate potential solutions & create incentives to redefine markets	S	A, E	A.1.i, P2, S1, C1	6
Large Corporations				
Conduct research and development of products that have market value	C	-		12
Creating demand through value-added products, marketing and selling	C	-		9
Foresee unintended consequences of technology in localized contexts	SE	F, D	S2, S3, S4, S5	4
Entrepreneurs				
Create idea and take as far as possible towards commercialization	C	-		17
Application of discovery to translation to market	C	-		9
Venture Capitalist Funding				
Funding projects	C	-		21
Selecting investments	C	-		19

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Understand application of S A,E,K A2, P2, S1 17
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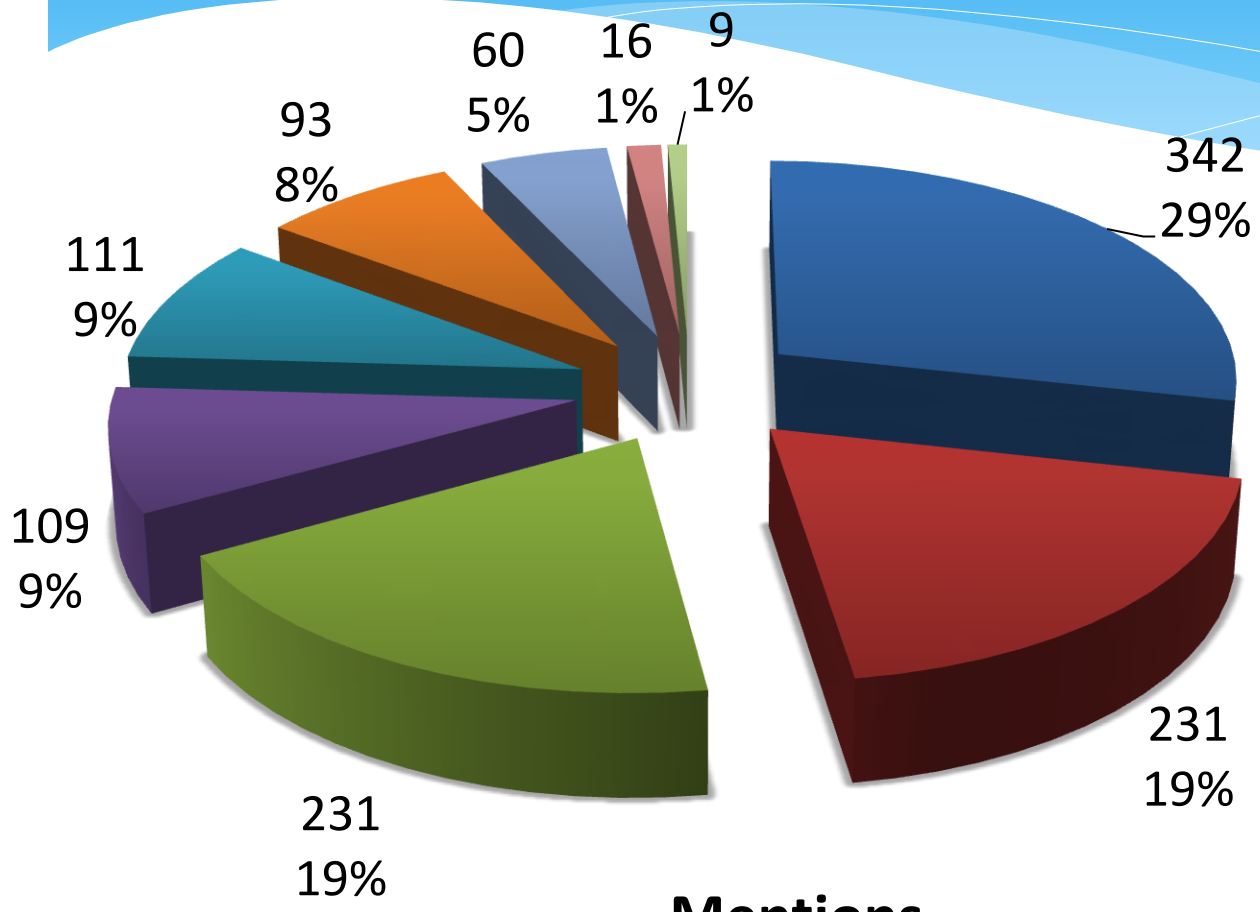
Evaluate potential solutions & create incentives to redefine markets S / A,E / P2,S1, C1 6

Who are the Actors?

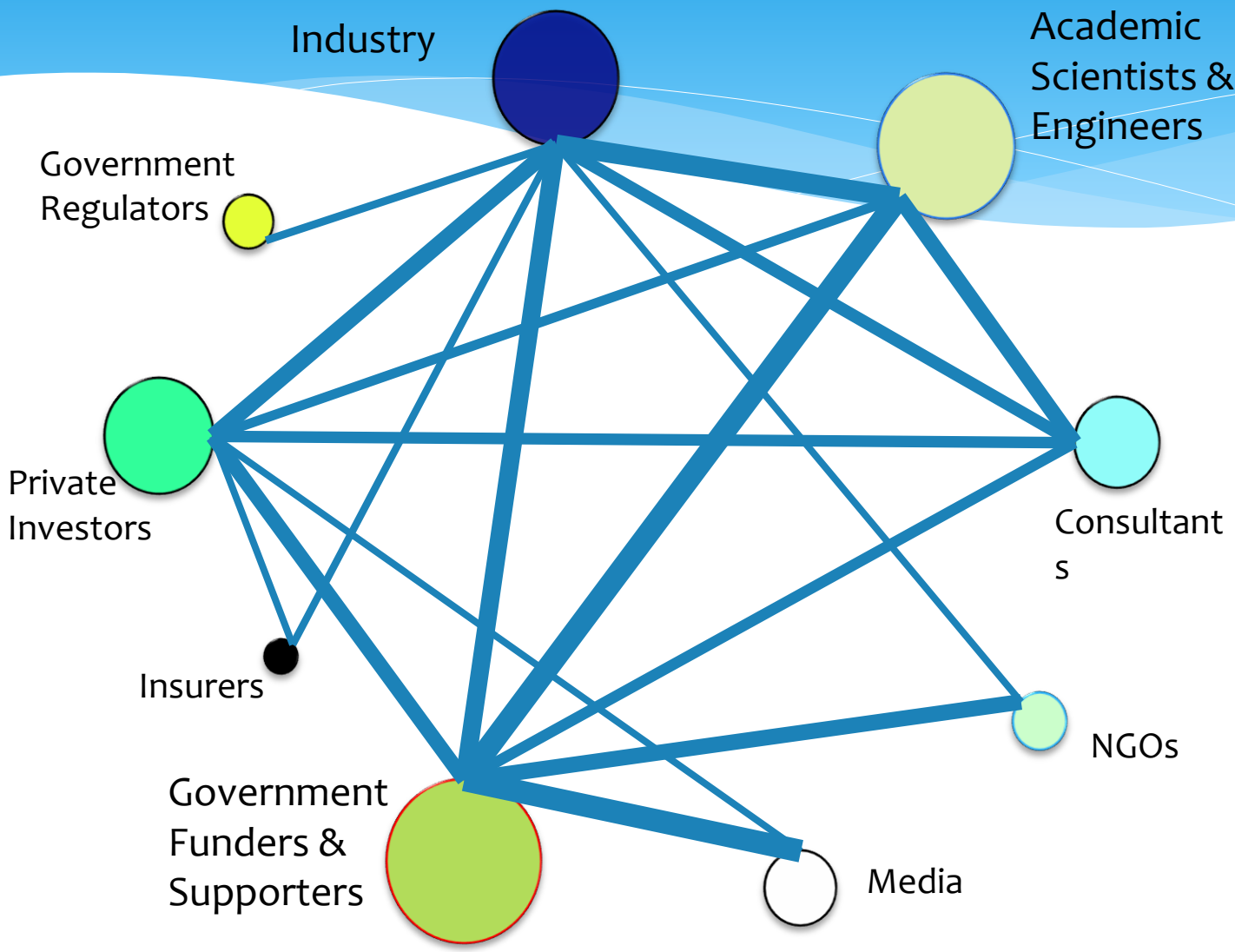


Mentions (n=1,202)

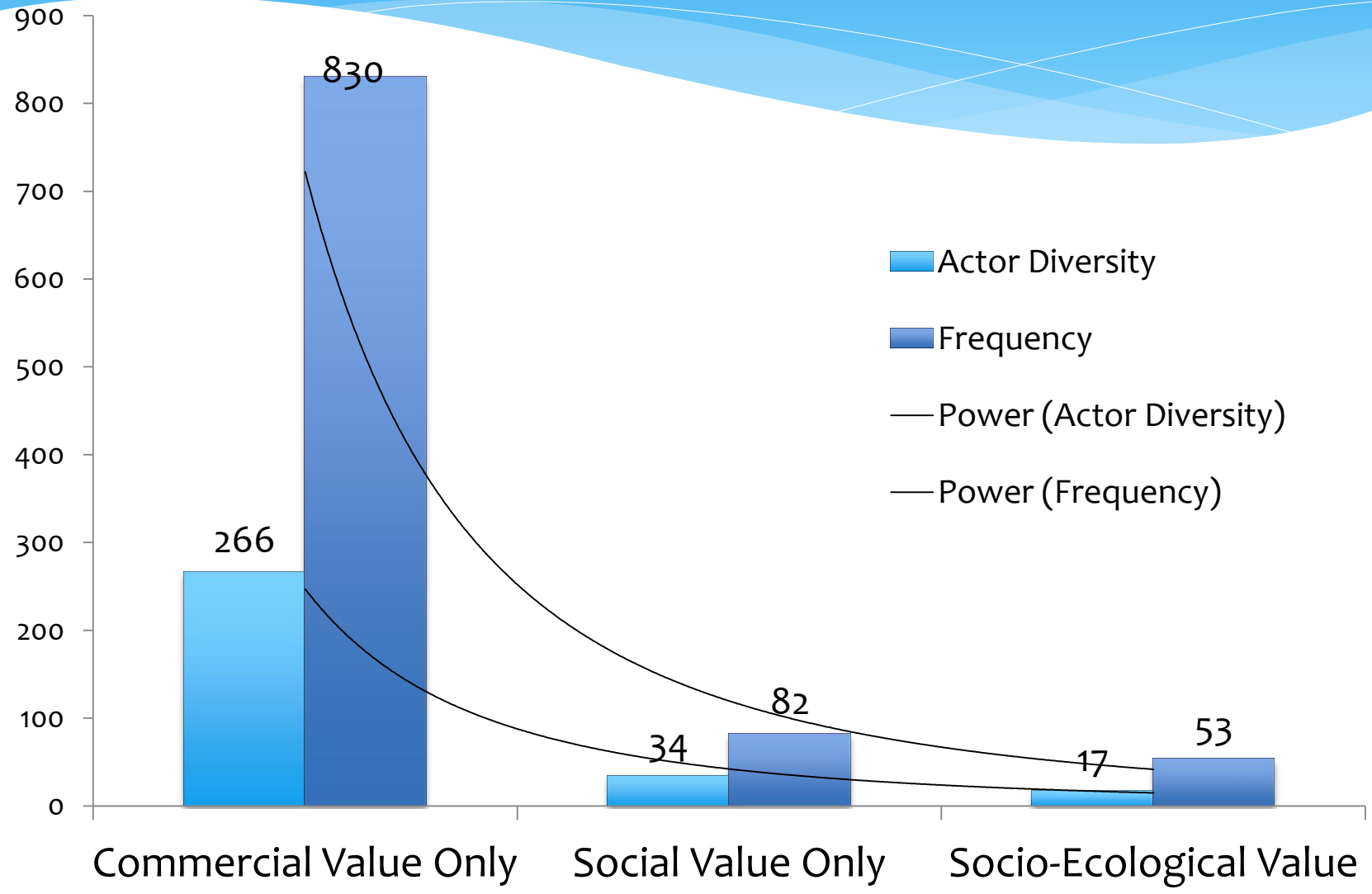
- Private Companies
- Federal Government
- Academics
- Business Services
- Private Investors
- Regional Government
- Public
- Media
- Advocacy (Non-business)

How are the actors aligned?

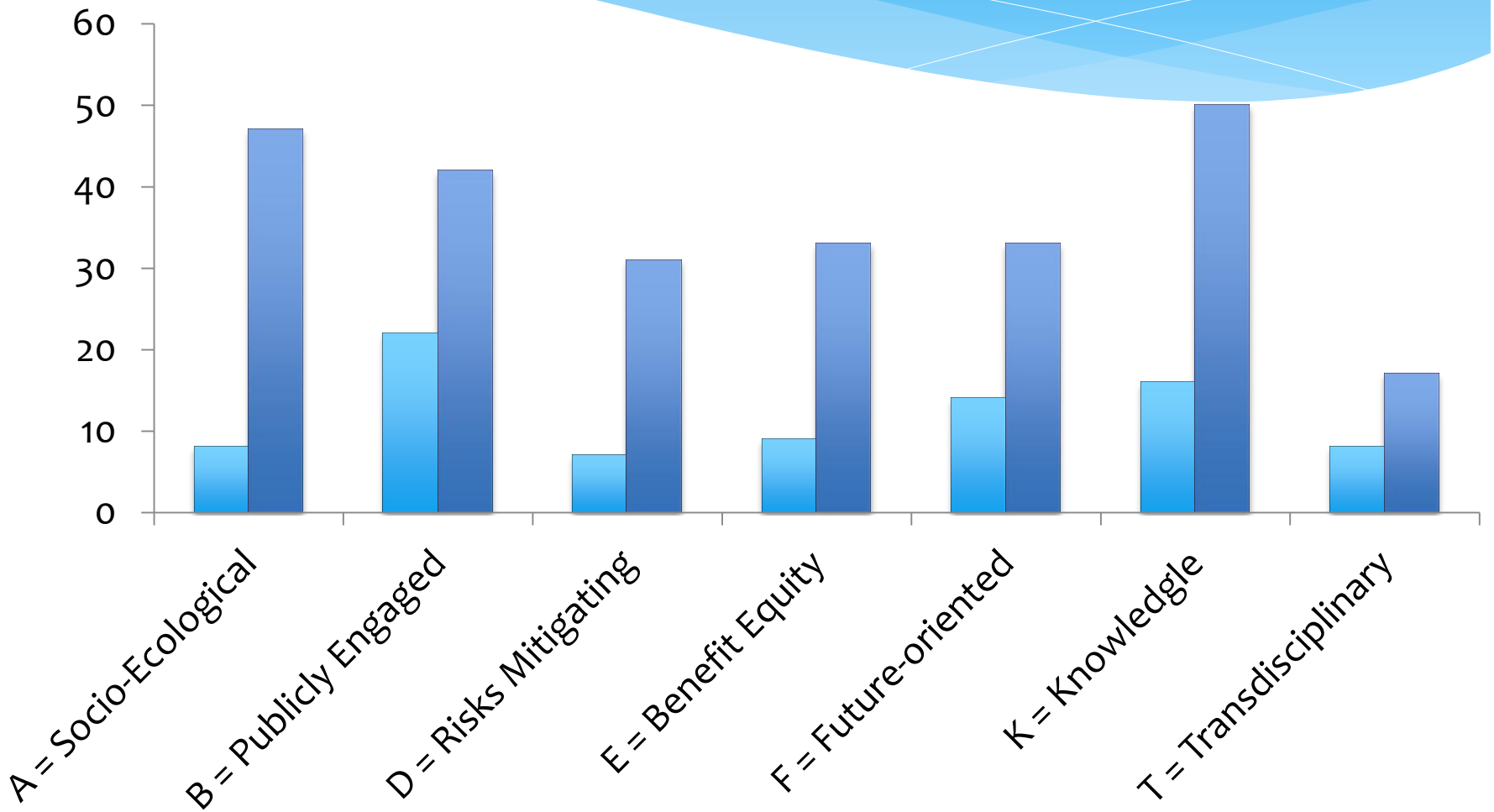
Agent Network Analysis of the Nanotechnology Innovation Ecosystem



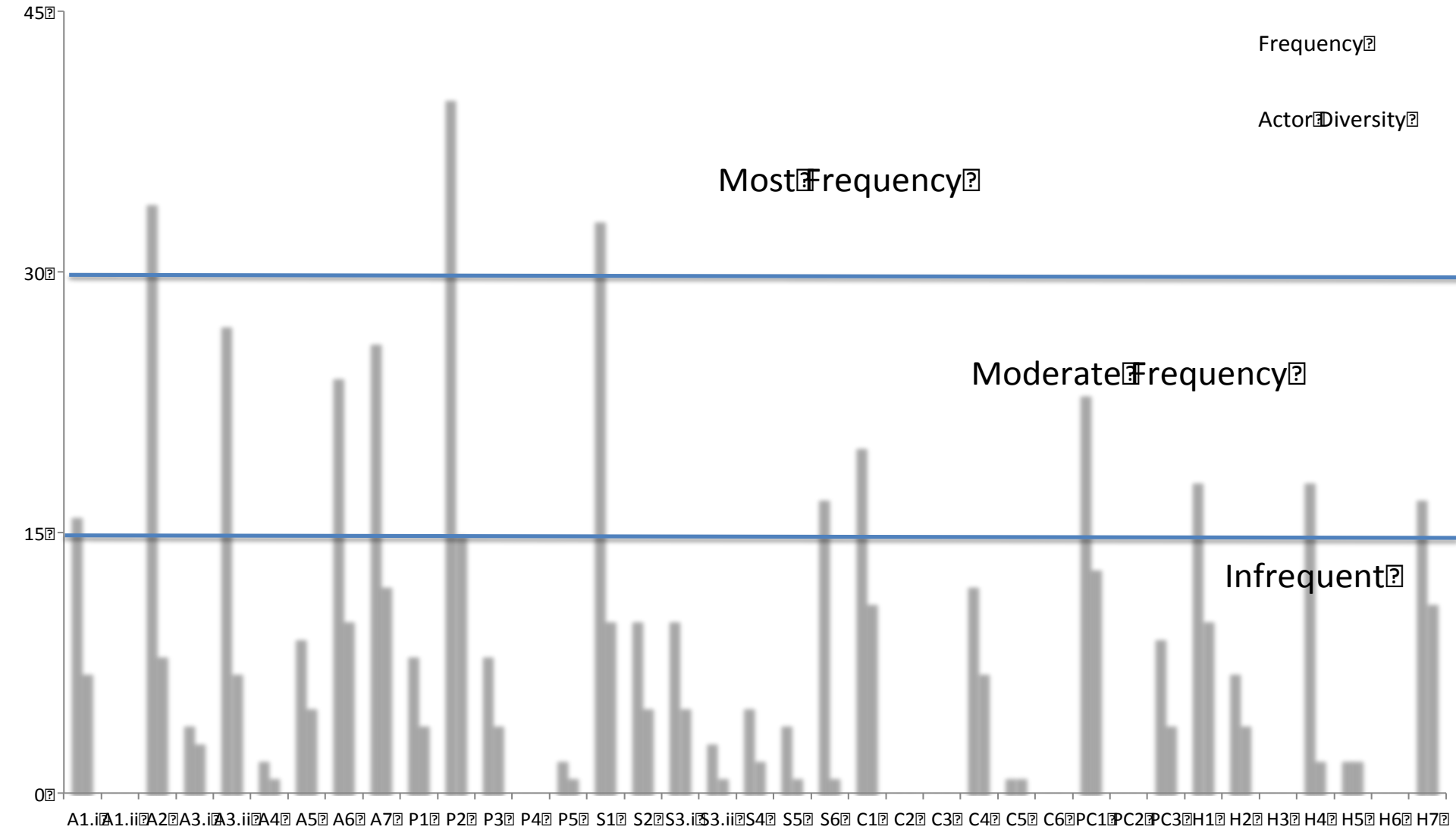
Commercial v. Non-Commercial Values



Broader Value Sets



Comparison to Synthesis Framework



Discussion Points

* Citizens and Users are not mentioned frequently.
* Triple Helix is dominate alignment of actors.
* Minimal connection to 'Risk Managing' actors.
* Commercial Values are dominant responsibility
* Lack of balance between three pillars of sustainability
* Evidence of broader values sets (seeds to nurture?)
* Primary Responsibility is Risk Managing (P2/S1) & Fund Disruptive Technologies (A1)

Discussion of Methods

* Building trusted relationships opened doors.
* Open-ended question: What are the responsibilities of that person/organization? captured requisite data.
* Diverse sampling and quantity of interviews offers a robust data set for analysis.

Concluding Thoughts

* Evidence of broader value sets.
* Lack of connection between diverse actors.
* User's Matter principle is not strongly recognized.
* Focus is on commercializing products to create value through the open market – we know the market inequitable.
* The three pillars of sustainability are in evidence, but with unequal distribution.
* Stronger responsibility toward Risk & Market Disruption

Thank You

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