

Workforce Needs For a Systems Approach to Studying the Earth

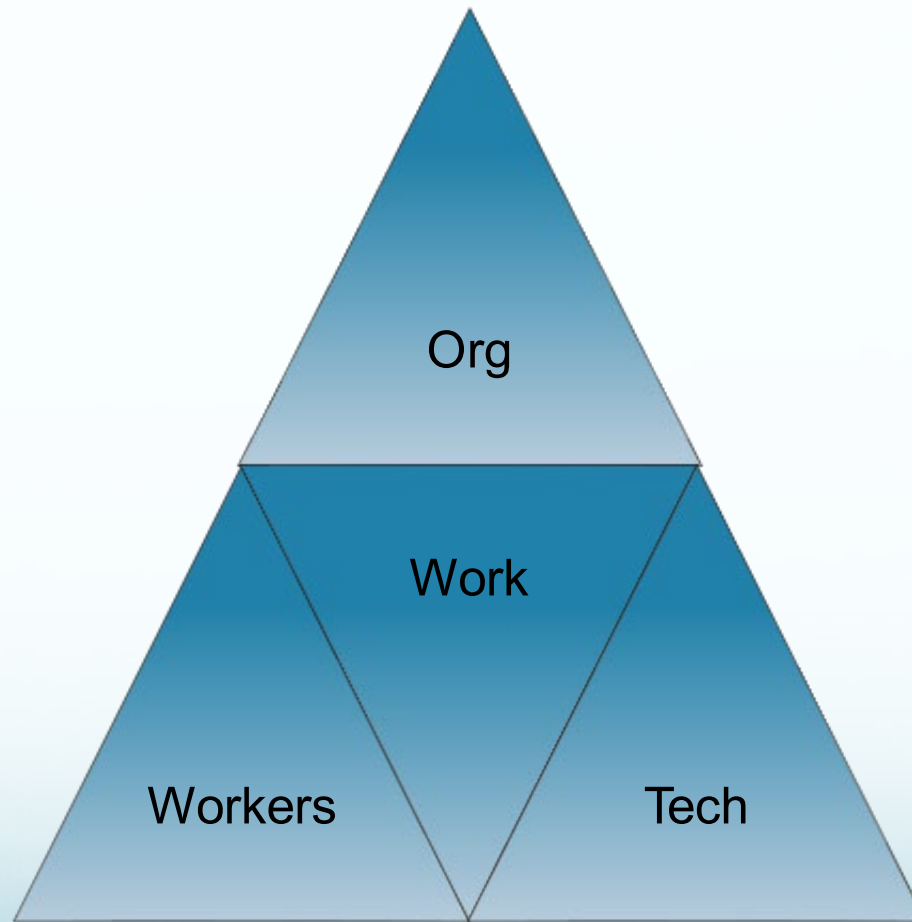
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Technology, Work, and Workers

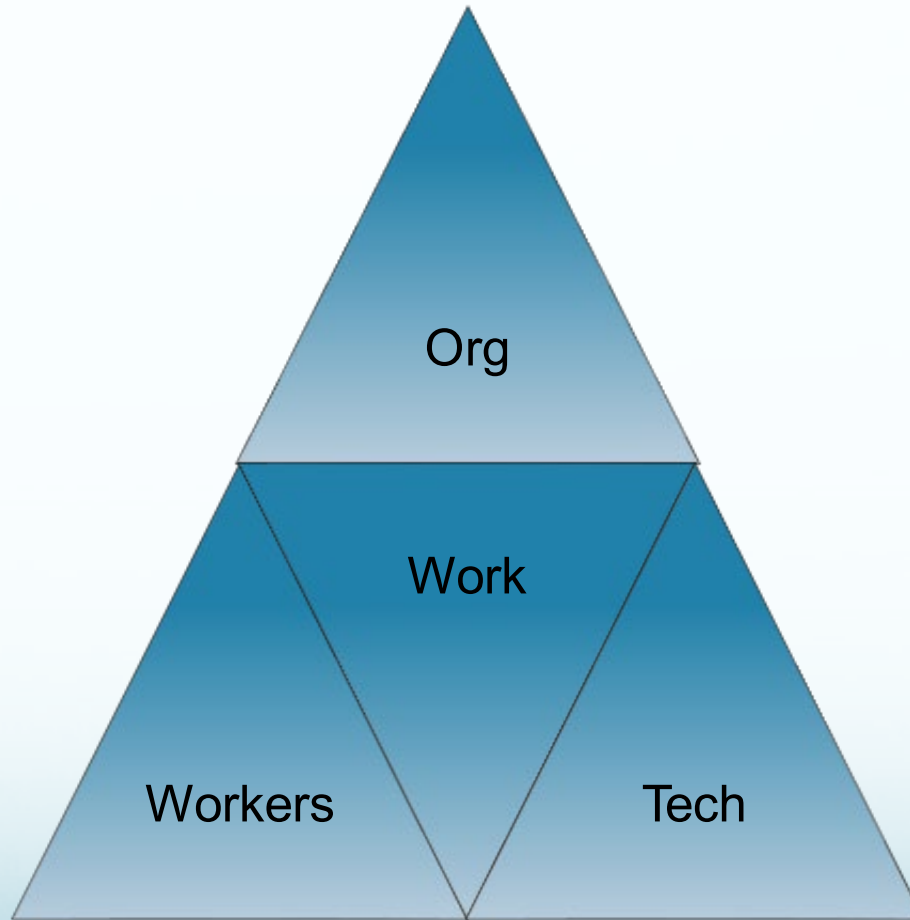
- Technology
 - Instruments, Tools, Methods
- Work Practices: What workers do
- Interconnectedness
 - Working Individually, Team, Crowd
- Organization: Size and Complexity
 - Single, Small Team, Large Group
 - Roles and Responsibilities
 - Ownership and Decision Making
 - Company, Partnership, Consortium, Center, Lab



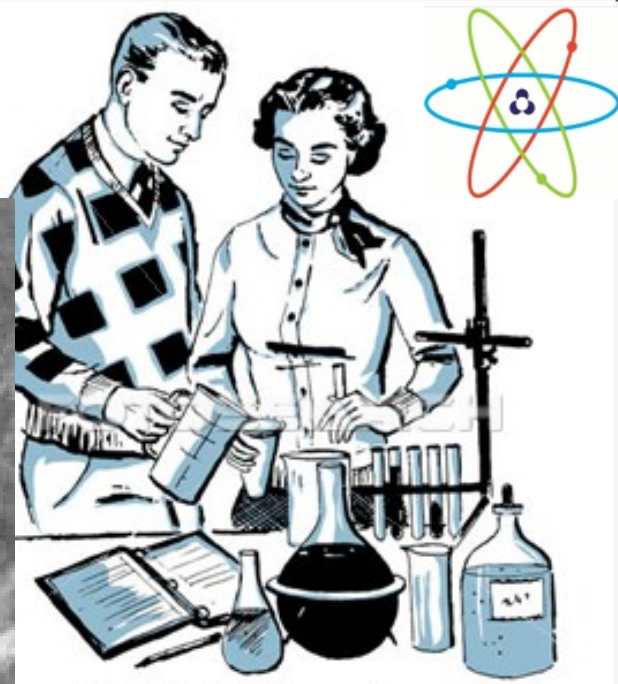
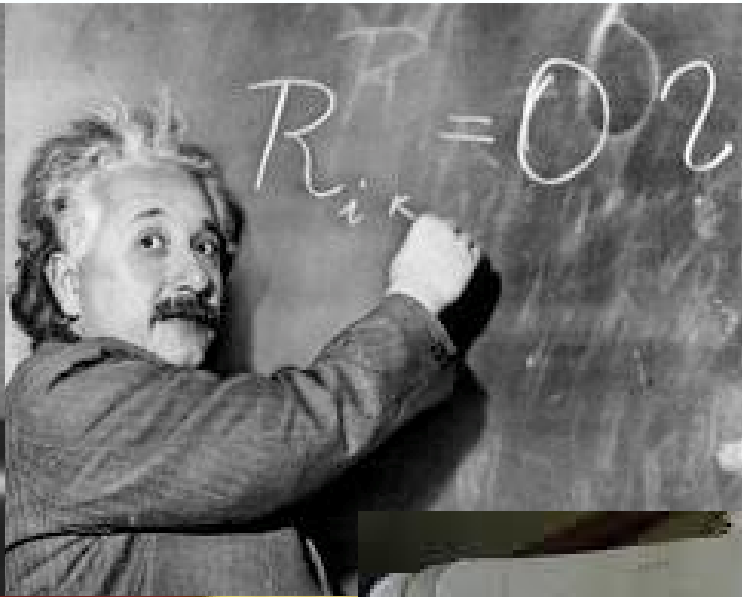
Research is Sociotechnical

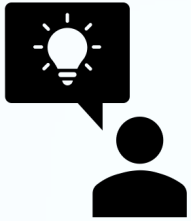


Move Fast and Break Things

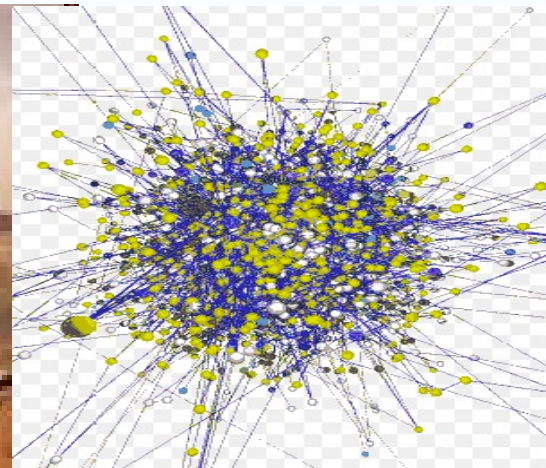


Traditional Research

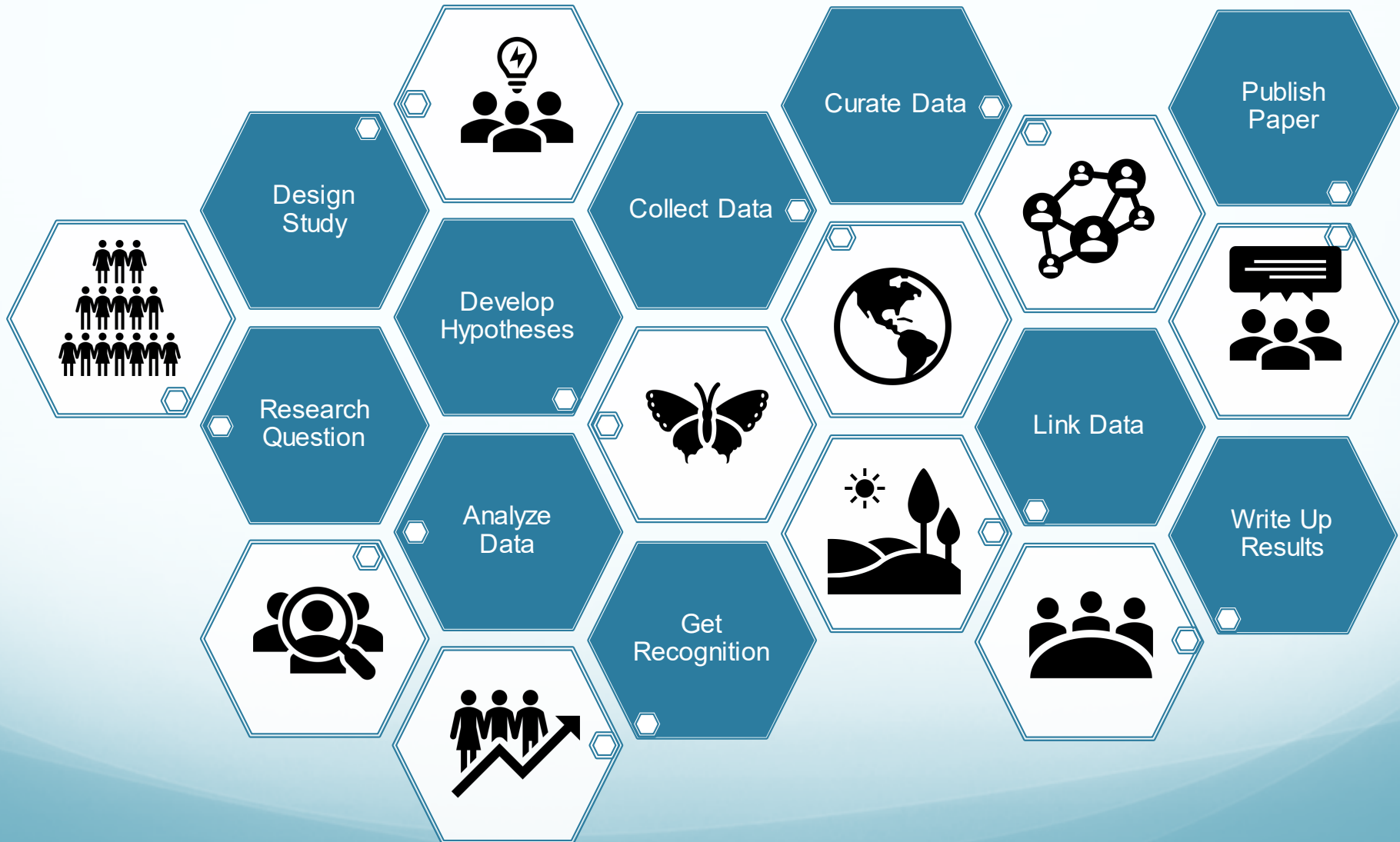




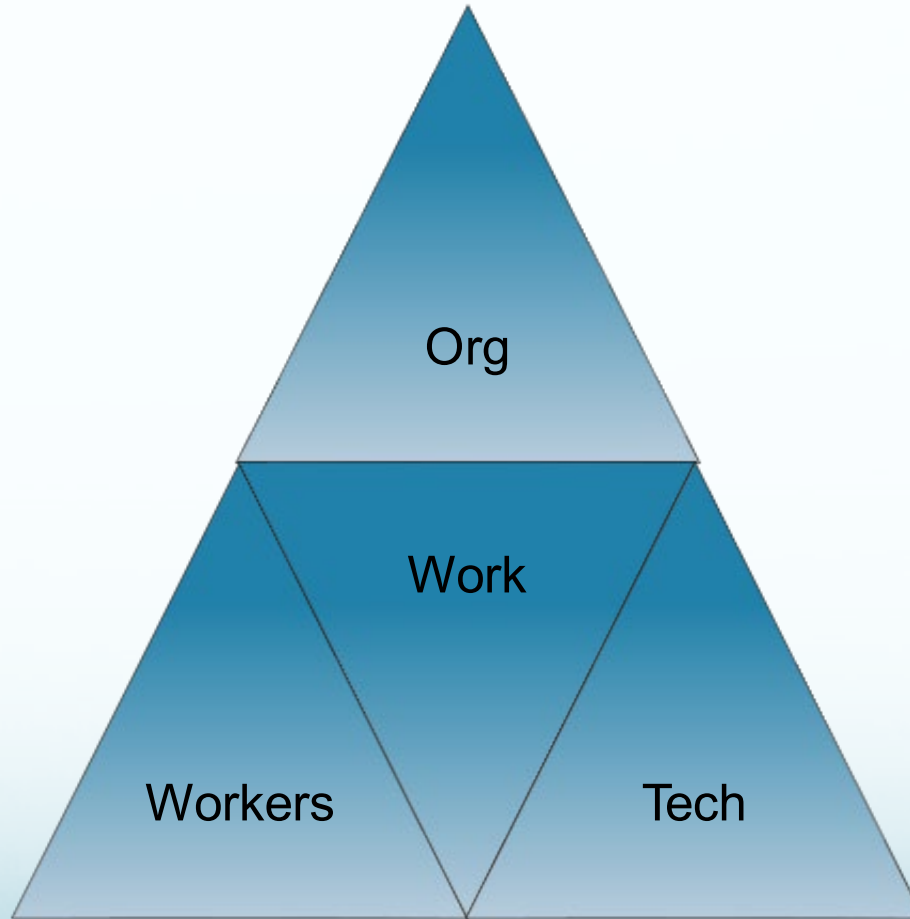
Modern Research



Disintermediation & Modularization



We've Moved Fast. What Have We Broken?



Known Workforce Issues

- High Turnover
 - Labor Mobility: To Industry; Students Graduate
 - Funding/Employment Insecurity
- Low Participation of Women and Minorities
 - Increasing Attention to Diversity, Inclusion, Equity
 - Pipeline vs. Alternative Pathways and Lower Barriers
- Reward Mismatch
 - Tenure vs. Lifestyle/Work Culture/Interesting Projects



Drivers: Broken Arrangements - Invisible Work Is Visible



- Commonly Invisible Work
 - Bricolage
 - Finding, Selecting, and Assembling Components
 - Articulation
 - Negotiating Agreements to Coordinate and Align Work
 - Organizing and Maintaining
 - Resources, Teams, and Communities
 - Emotional and Cultural Work to Stabilize Faultlines
- With Disaggregation
 - Invisible Work becomes More Important
 - Work Gets Redistributed, New Job Types Created

Workforce Needs

- Valuable Work Must Be
 - Made Visible
 - Accessible to All
 - Compensated Appropriately
- **Why is this hard?**



Driver: Competing Institutional Logics



- University Logics
 - Professional Partnership among (Tenure Track) Faculty
 - Duty of Care toward Students
 - Staff as Company Employees
- Categories Members Seen/Treated Differently
 - Differential Status (between and within)
 - Separate Decoupled Performance Review Systems
 - Different Forms of Compensation and Career Ladders
- Research = Tenure Track Faculty PI + Doctoral Student + Overhead for Staff and Facilities
- **THIS IS THE OLD MODEL!**

New Research Workforce



- Does Not Conform to Old Categories
 - Universities Struggle
 - Funders Struggle (NSF Budget Personnel Categories)
- New Roles Are More Fluid
- New Positions
 - Could Be Faculty, Staff, or Student
 - People Move between Categories
 - Require Culture of Mutual Respect and Inclusivity

Workforce Needs for a Systems Approach to Studying the Earth

Technology Moved Fast
Work has Changed
Organizational Arrangements are Breaking



Work Changes: Scale, Differentiation, Diversity, Disintermediation

Breakdown Signals

- High Turnover
- Low Diversity
- Reward Mismatch

Drivers

- Invisible Work More Visible and Important, not Compensated
- Work Redistributed in Large Modular Complex Mosaic of Research Resources & Teams
- Competing Institutional Logics for Research Workforce
 - PI = Faculty = Researcher
 - Mixed Distributed Teams, Consortia



Designing and Managing New Research Work

- Lots Known about Sociotechnical Work Systems, Knowledge Organizations, Teams
 - It's Transformation
 - Not Just Doing More of the Same Thing
 - Hard and Persistent Problems
 - Managing Tensions not Finding A Single Permanent Solution
- Organization of Research Work
 - is a Complementary Asset = Rate Limiter



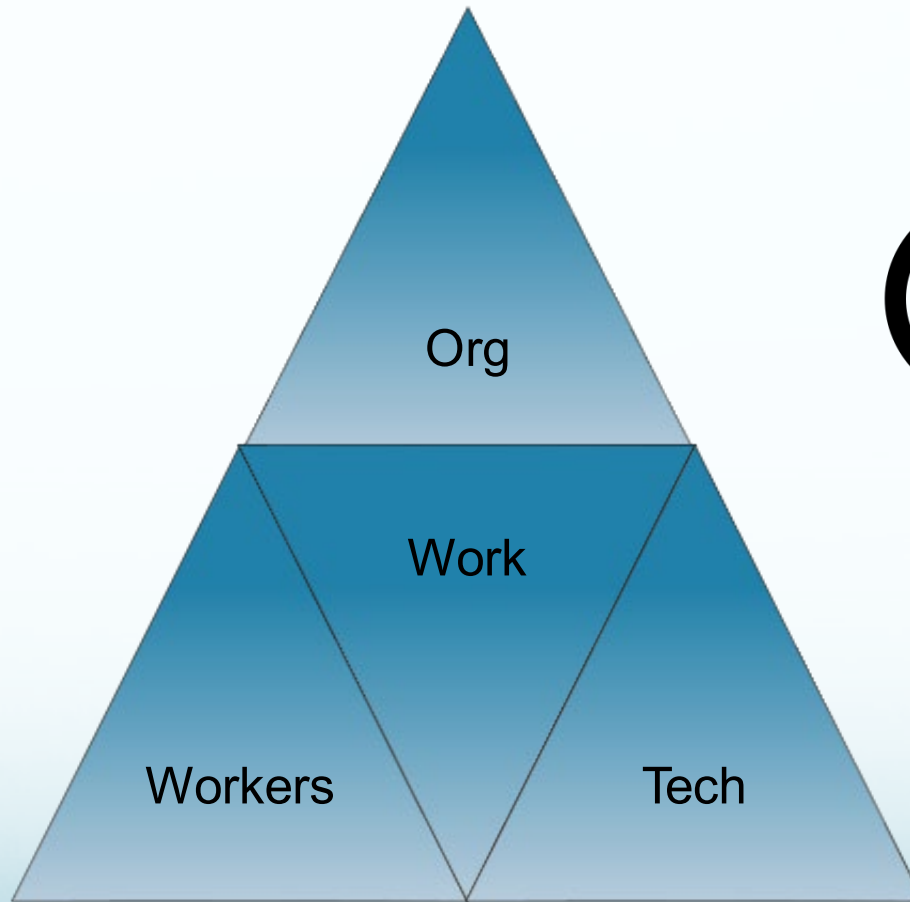
Is this Tractable? Yes!



❖ We Will Sort it Out

❖ We Need to Sort it Out Faster!

How to Accelerate Discovery?



Optimize the Research Work System

- Already Funding Technology
- Support Training in the New Research Model
 - Research Organization Management
 - Like NSF's I-Corps, Scholarship for Service or Graduate Research Fellowships
- Transform Organizations Doing Research
 - Identify and Lower Barriers to the New Research Model
 - Like NSF's Advance Program, Includes Program
- Align Funder Policies and Practices with the New Research Model



Research Evidence:
Creation/Synthesis

Understanding The New Research
Work Arrangements

Translational
Science

Realizing the
Potential

Re-Aligning Research
Organizations

New Research Work

- Practices, tools, processes...
- Leadership, Culture
- Workers

Consortia
Universities
Funders

Move Fast and Fix Things

- Align Technology, Work, and Organizations to Support the New Research Workforce
- Getting Research Work Systems Right
 - Address National Priorities
 - Solve Societal Grand Challenges
 - Accelerate Impact

