

Research Centers as Agents of Change in Different Institutional Contexts: HBCU, EPSCoR and RERC

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Presentation Outline

- Work in Progress!!
- The Scientific and Technical Human Capital model
- Human Capital and Social Capital in Research
- Center Patterns of STHC in Three Contexts
 - HBCU
 - EPSCoR states
 - Carnegie Extensive in Non-EPSCoR states
- Conclusions

The STHC Model

- Individual level:
 - Human capital: individual abilities for performing research
 - Social capital: socially embedded resources available to a researcher
- Group level: Aggregation of individual STHC for group goals
- Research Questions:
 - What effects do Centers have?
 - How do Centers Impact the Patterns of STHC?

Antecedents of SC & HC Theories

- Human Capital Theories:
 - Costs and rewards of training
 - Metaphorical uses in human resources discourse
- Social Capital Theories:
 - Facilitation of collective action
 - Friends, contacts
 - Embedded resources

Varieties of Human Capital in Research

- We need more than credential numbers
 - Tacit knowledge/skills
 - Cognitive abilities in context
 - Learning after terminal degree
- Especially relevant in context of R&D teams and organizations

Social Capital in Research

- Embedded Resources Mobilized for Purposive Action
 - Instrumental action (maximize gain)
 - Mostly access to information or expertise
 - Expressive action (minimize loss)
 - E.g. Professional service activities
- Quality of Social Capital
 - Social strata in the R&D system
 - Reach and range of social capital
 - Relationships across R&D social strata

[Role of SC and HC in STHC]

- Base resource is the number of qualified researchers
- SC and HC enhance the equivalent FTRs in the team
 - Skills brought to bear on projects (e.g. experiment set up and management)
 - Mobilizing embedded resources (e.g. # of successful contacts in last year)
 - Opportunities for developing and maintaining contacts (e.g. memberships, committees yielding useful contacts)
- Possible to think of an STHC “enhancement factor”
- A center could be a strategy to facilitate the conversion of SC of several researchers into HC of a single research unit (center)

[STHC Analysis: Data Gathering]

- Case studies:
 - Teams centered on PIs
 - Life course plus recent time period
 - Curriculum Vitae
 - Semi-structured interviews
 - Network questionnaires
- Survey of US Researchers
 - N=2086; Rrate: 36%

Center Cases in Three Contexts

- HBCU:
 - Physics/Materials Science Center at Alabama A&M
 - Keck Nanotechnology Center at Howard U.
- EPSCoR:
 - Engineering Center at Idaho State U.
 - CAPS at U. of Oklahoma
 - CEMR at New Mexico State U.
- Research Extensive:
 - RERC at Georgia Tech
 - BASC at U. Cal, Berkeley
- Planned: 2 HBCU and RE; 1 EPSCoR

Role of the Centers

- Agents of Change for different reasons
 - RE: Epistemic frontier
 - EPSCoR: varies by field
 - Regional strength: similar to RE on frontier
 - Other: Internal politics of the university
 - HBCU:
 - Institutional development: infrastructure
 - Change culture of university: more research
 - Positioning w/r to minority oriented policies

Types of Centers by Role

- Interdisciplinary RC (Intellectual focus)
- User Facility RC (Instrument focus)
- Administrative Umbrella RC
- Constituency RC (Customer Id focus)
- Activist RC (Visibility focus)
- Multi-institutional RC (Div. labor focus)

Leadership

- Embodiment of single individual
 - Scientific interests
 - Academic entrepreneur
 - Responsible for multiple connections
 - Significant ties to outside resources
 - Large mentoring role
 - Mostly men (women in RE)
 - Senior-junior pattern appears often
 - Future successor

Scientific Work

- Agenda setting varies by degrees
 - Very focused, integrated, adapting to changing goals
 - Collection of projects under center label
- Coherent agenda corresponds with epistemic comparative advantage
- Field effects also present (e.g. rehab)

Scientific Work

- Grad students carry tacit knowledge
 - Dependence on funding continuity
- Variation of degree of interdisciplinarity
- No significant increase in productivity
- No significant increase in traditional measures of impact
 - Citations
 - Journal impact index

Collaboration

- Nominated collaboration does not coincide with co-author network
- Variation in non-intellectual collaboration
 - Stability of support related to ties in DC
- Quality of SC ties is higher in RE and regional advantage EPSCoR centers

Organizational Dimensions

- Relationship with other academic units
 - Under VP of research
 - Under college dean
 - Inside department structure
- Some are tools of department strategy
 - Bridge departmental boundaries
 - Vehicle for inter-institutional collaborations
- Hybrids
 - Result of negotiation dept.-administration
 - Negotiated formulae for faculty reward

Organizational Dimensions

- Resource base effects
 - Relative access to lab equipment
 - Variation in teaching loads
 - Effect of administrative infrastructure
- RE generally higher on all counts
- Common problem for HBCU-EPSCoR
- Generates different center strategies

Organizational Dimensions

- Academic role
 - General source of support for graduate student projects
- Student support difference :
 - Undergrad : No significant difference
 - MS : 1.05 to .73 ($p < .000$)
 - PhD : 2.51 to 1.27 ($p < .000$)
 - Pdoc : .77 to .33 ($p < .000$)

Institutional Dimensions

- Labor patterns:
 - Much larger time support on soft money in research centers
- Grant support difference:
 - Center Aff: 25.69 hrs (N: 753)
 - Non_Center Aff: 16.74 hrs (N: 1274 p <.000)
- Work with industry :
 - Center Aff : 56% do
 - Non-CenterAff: 40% do
- Tool of inter-institutional relations
 - True RE, EPSCoR, HBCU

Concluding Remarks

- Centers are agents of change or “tools of flexibility”
- Centers are temporary arrangements
- Centers are “buffer” arrangements
- Center policies select leaders
 - Don’t produce “deep” org. change
- Centers have effect on STHC paths
 - Greater role of soft money
 - Important role for grad student research

[The End]

Concluding Remarks on Centers

- Patterns of SC show interesting dynamics:
 - Collaboration and Co-authorship are not the same
 - Contacts with funding agency PMs are important SC component
- Patterns of Human Capital:
 - Important role of one or two individuals who embody most of the diversity of the center
- Is this of consequence for policy?
 - Critical role of graduate students as carriers of tacit knowledge
- No clear evidence of conversion of SC into HC
- Difference between centers
 - Created in response to policy initiatives
 - Created as local initiatives
- Much of what we said would apply to teams generally

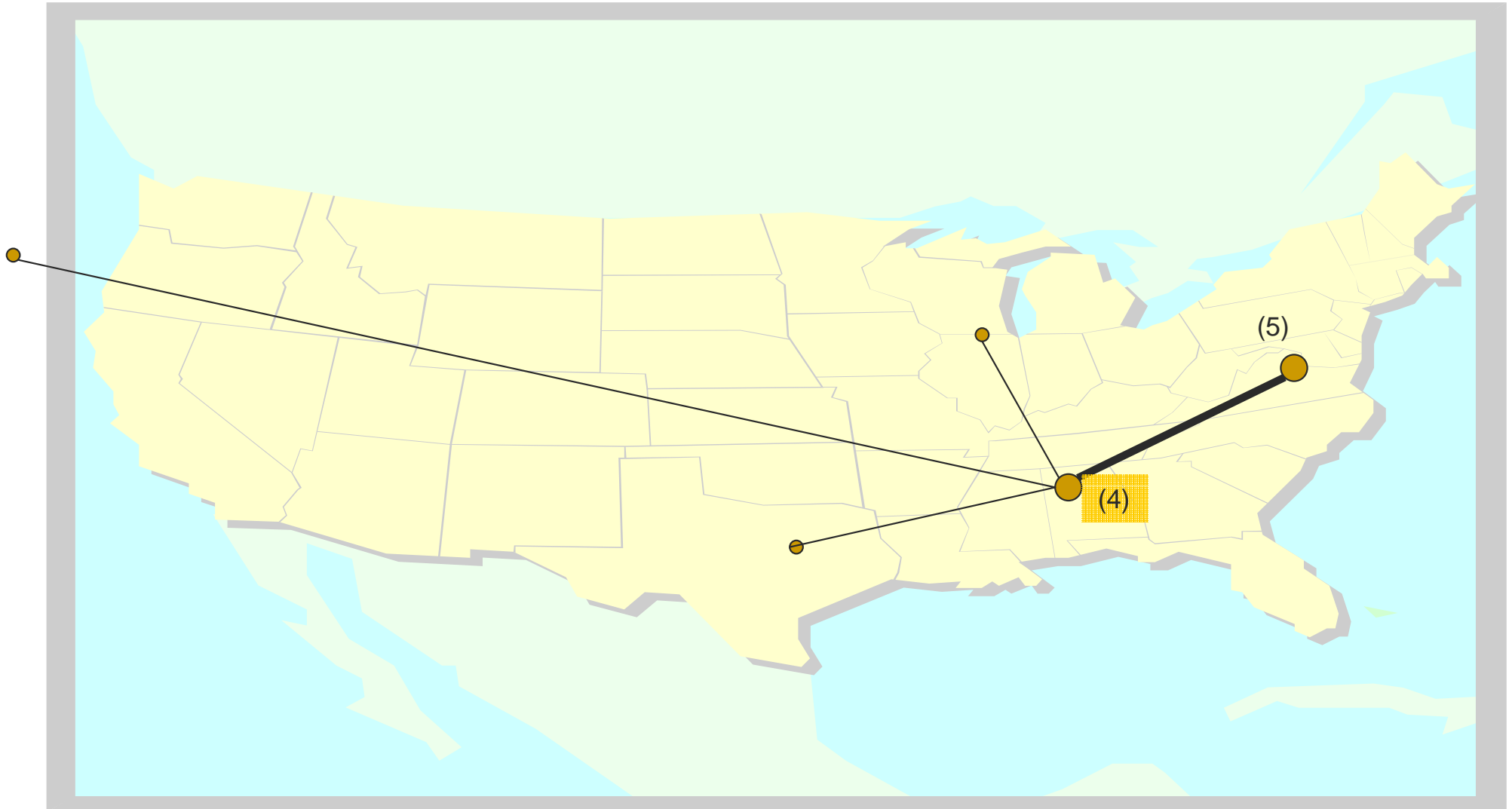
HBCU: STHC Patterns

- Single dominant PI
 - PhD Nuclear Physics, MIT
 - Two older colleagues began collaboration at edge of retirement
 - Very strong academic entrepreneur
 - Strong local position in the university
 - “Inherited” a particle accelerator from a government agency
- Two main PhD students
 - Foreign recruits
 - Continued with Postdoc
 - Main carriers of experimental tacit knowledge
- Loose collaborations with colleagues in Physics department
- Very weak representation of African-Americans
 - Except undergraduate students

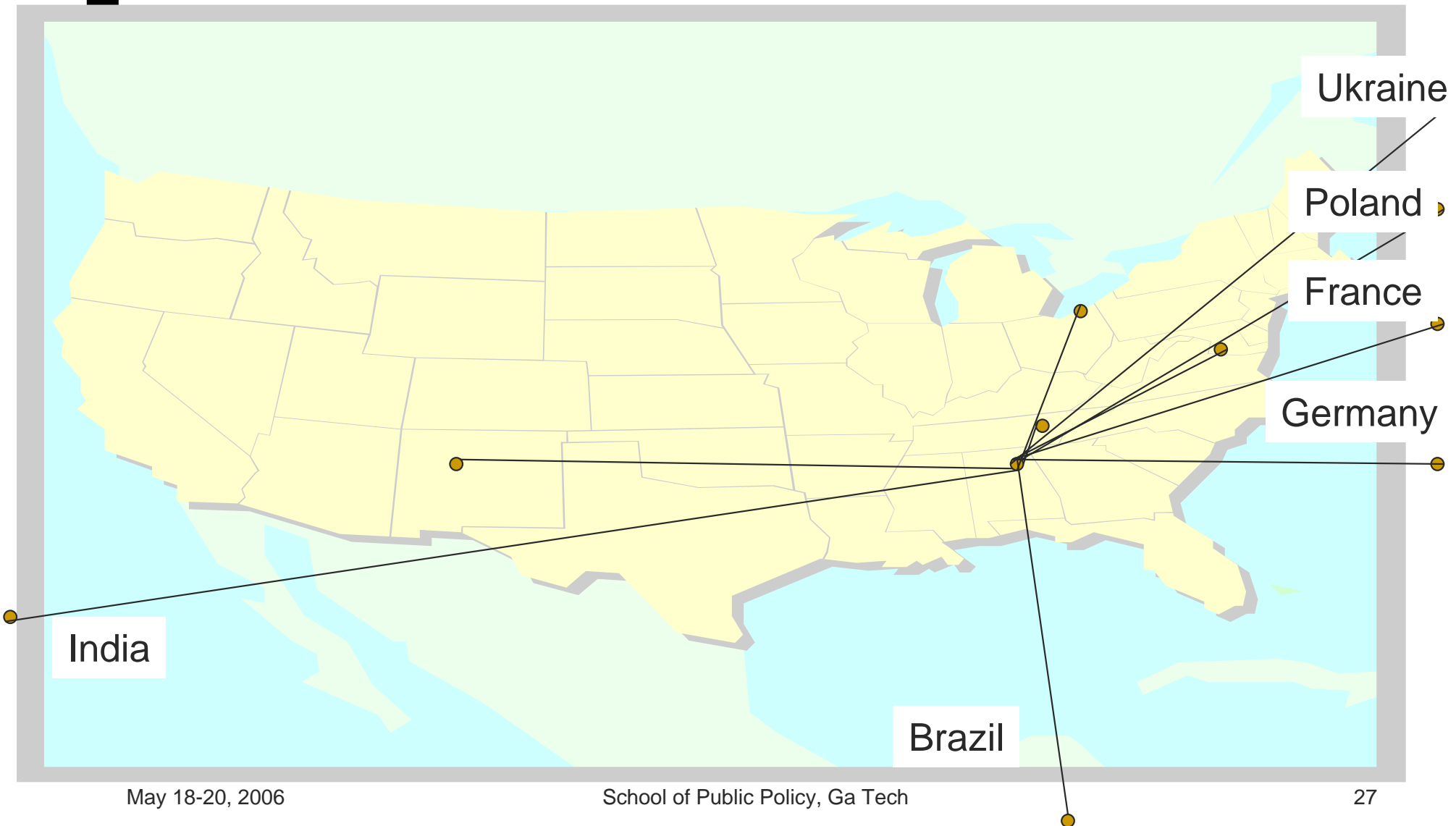
[HBCU Human Capital (II)]

- Components of center HC:
 - Self teaching in theoretical areas where courses are not offered locally
 - Communication and team work
 - Skills to bypass limitations of university administration
 - Operation of specialized instrumentation: hands on mechanical and electronic

HBCU Social Capital: Non-Intellectual Contact Network



HBCU Social Capital: Co-Authorship Collaboration Network



HBCU Publication Patterns

- Average publication rate
 - Concentrated in niche journal on instrumentation
 - Few in related fields
 - Journals of choice have average impact factor of the field
- Fairly good presence in the subfield

HBCU Remarks

- Initiated as “User Facility”
- Striking difference in nominated and co-authorship collaboration networks
 - Probably related to use of the specialized instrument
- Niche presence in publication patterns
- Not truly multi-disciplinary
- Question about integration with the rest of the university

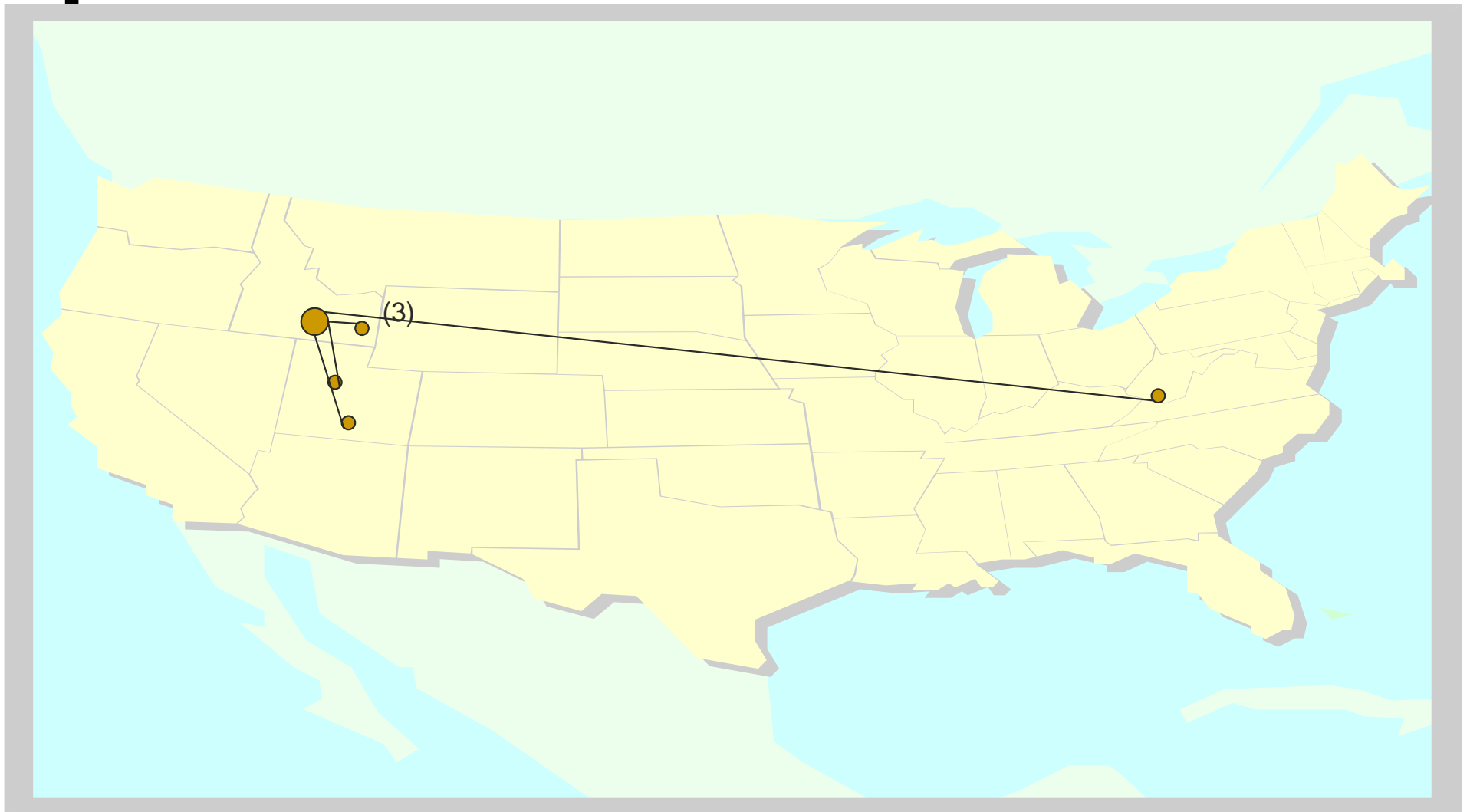
EPSCoR Human Capital and Knowledge Flows

- Single dominant PI
 - Long collaboration with one junior colleague
 - New junior colleague replaced previous one
 - Weak position of PI and department in the university
 - Center represents almost all research done by the institution in the field
 - Center initiated as a strategy to strengthen position of the field in the university and state
- Heavy teaching loads limit faculty participation

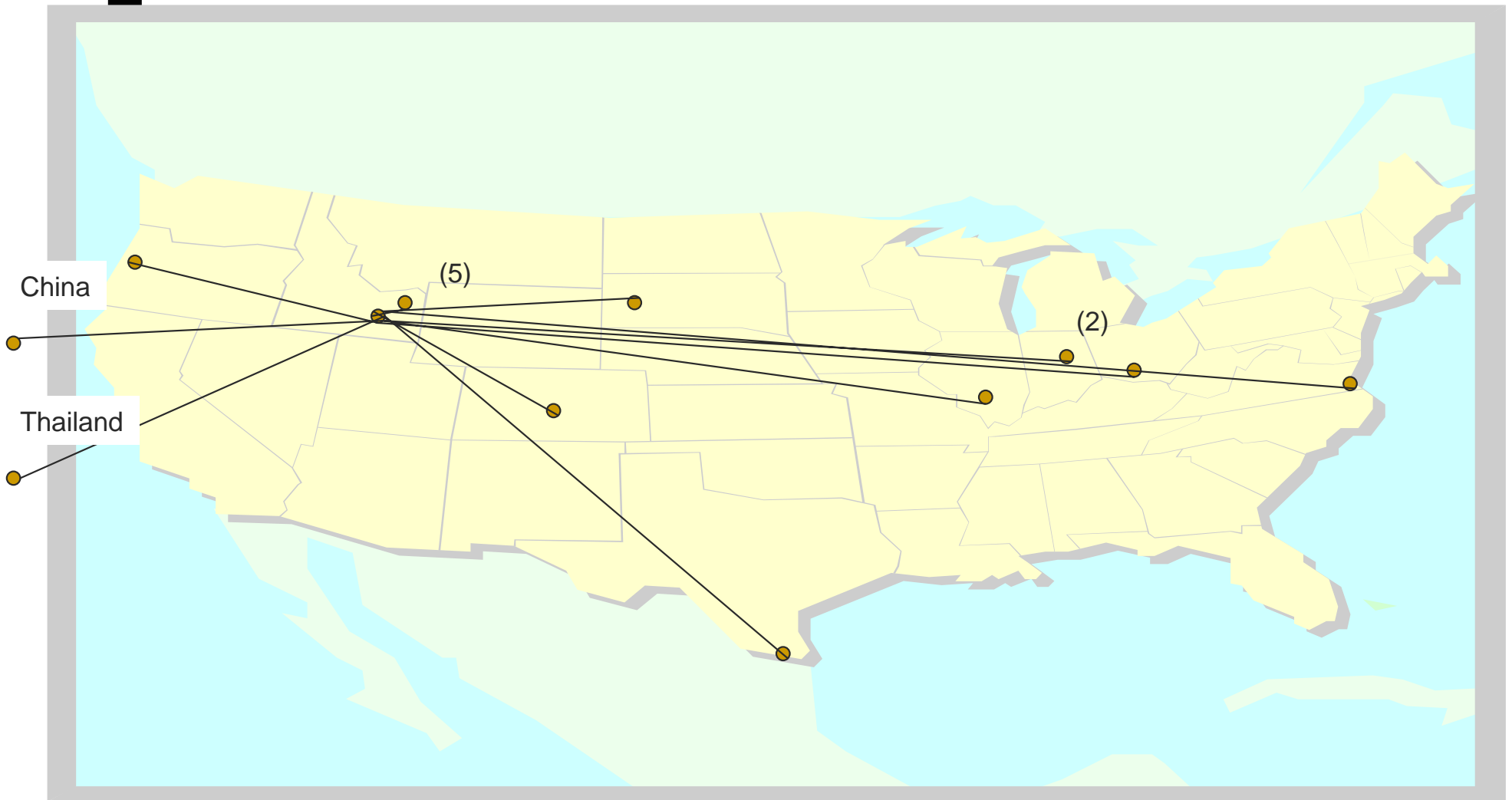
EPSCoR Human Capital Patterns (II)

- Selection of center focus to appeal to most fields of engineering and other natural sciences
- All members are engineers with a focus on automatic control
- Agenda is a broad scatter of small projects
- Special Skills:
 - Good knowledge of specialized software (seek students with this skill)
 - Good mathematical ability
 - Lab equipment set up and operation: hands on mechanical and electronics (also students)
 - No mention of negotiation/communication skills

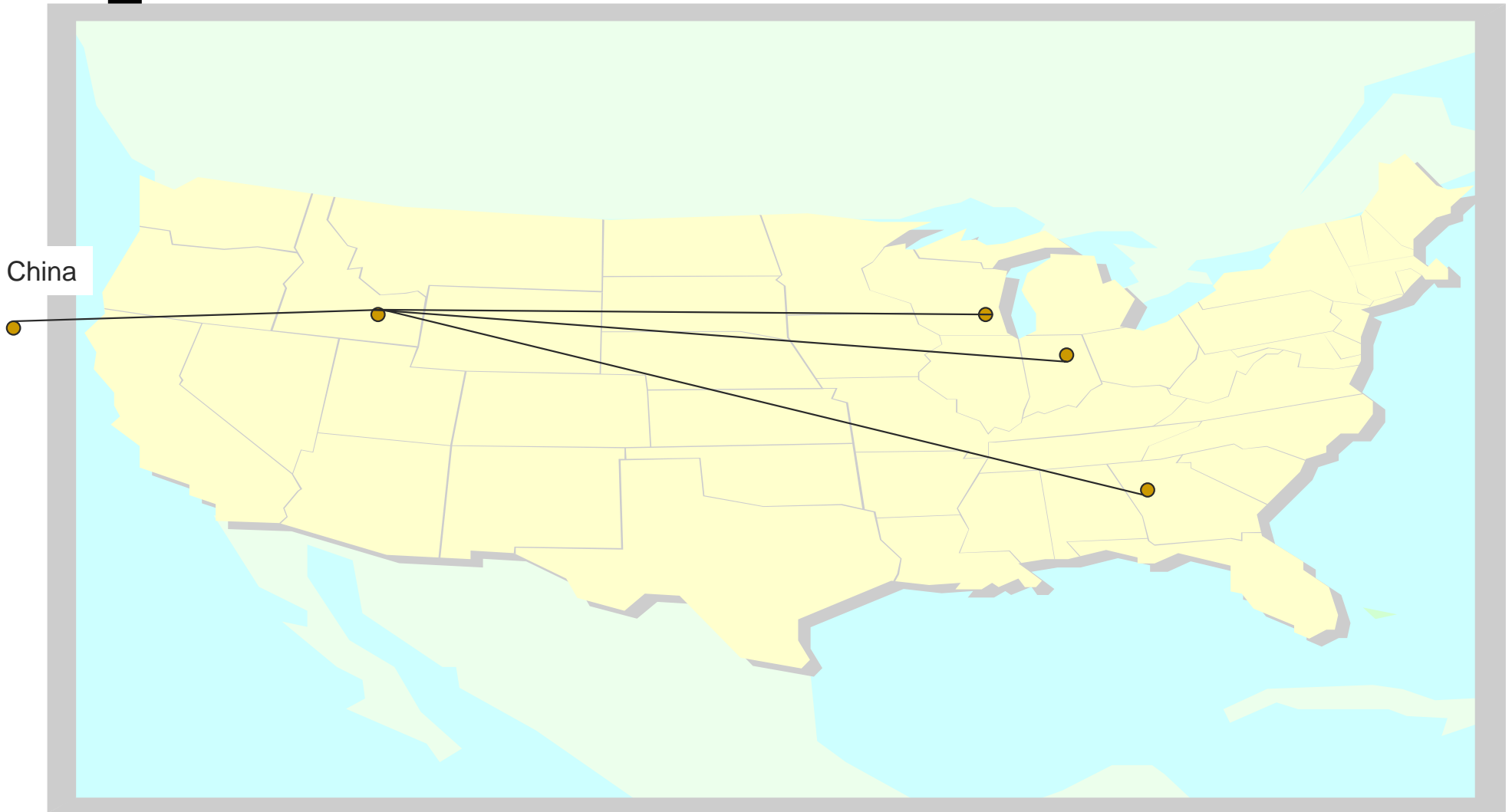
EPSCoR Social Capital: Non-Intellectual Contact Network



EPSCoR Social Capital: Nominated Collaboration Network



EPSCoR Social Capital: Co-Authorship Collaboration Network



EPSCoR Publication Patterns

- Low average publication rate across PIs
- Distributed in various subfields of engineering
- Field with low impact factor journals
- Minor presence in the field

[Remarks on EPSCoR Center]

- Low quality social capital correlates with insecure funding
- Center as an institutional “resistance” strategy (or “professional survival”)
- Center doesn’t seem to enhance productivity, *ceteris paribus*
- Not truly multi-disciplinary

RERC: Human Capital Patterns and Knowledge Flows

- Single dominant PI
 - Highly interdisciplinary background
 - Strong academic entrepreneur
 - Higher visibility in the field and funding agencies than in the university
- Several senior professionals direct projects
 - Loosely coupled actual collaboration (simple aggregation)
 - Many not on location
- High degree of inter-disciplinarity
 - Bio-engineering
 - Geriatrics
 - Industrial Design
 - Physical and Occupational Therapy
 - Mechanical Engineering
 - Education

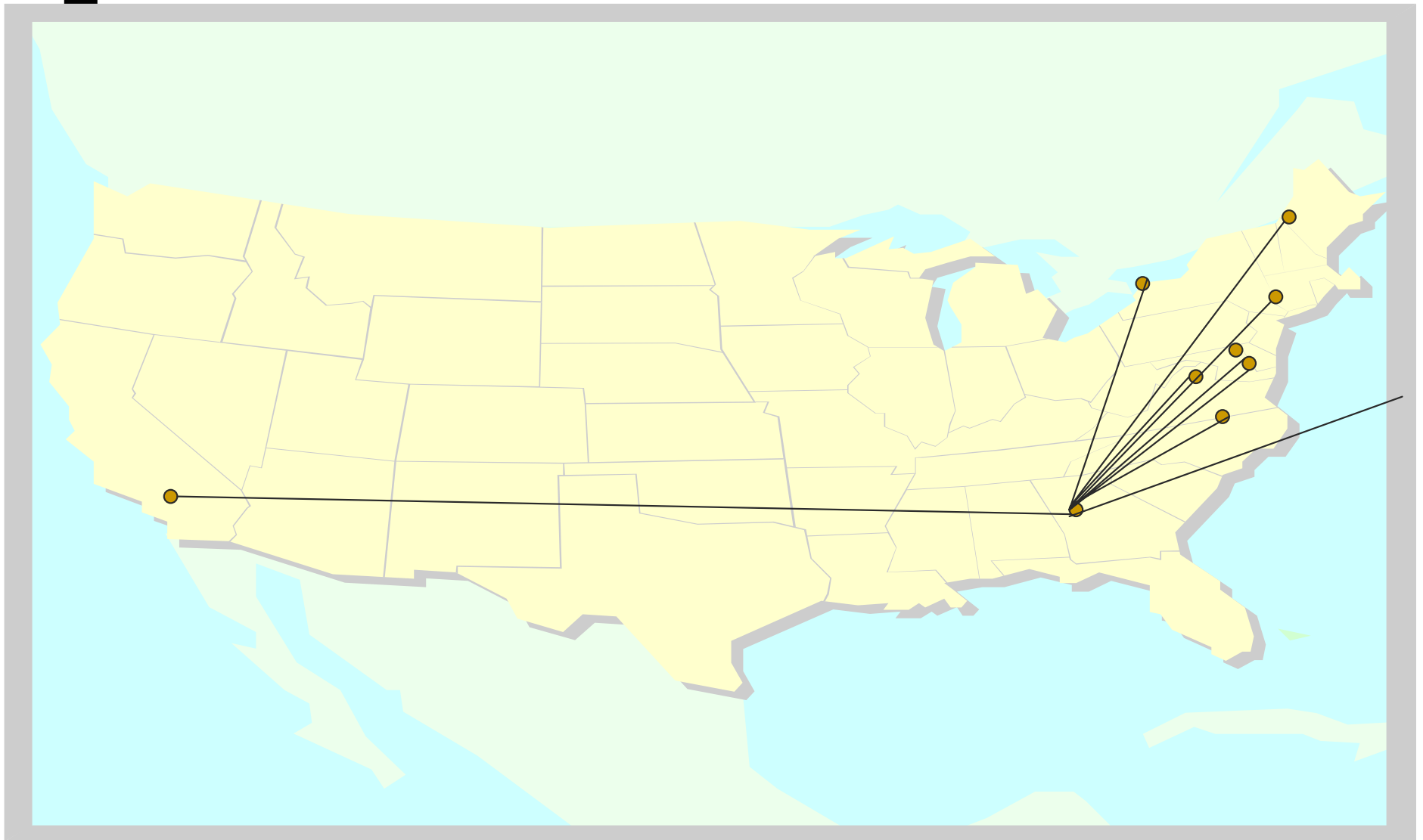
→ Represented in Human Capital Assets

RERC: Human Capital (II)

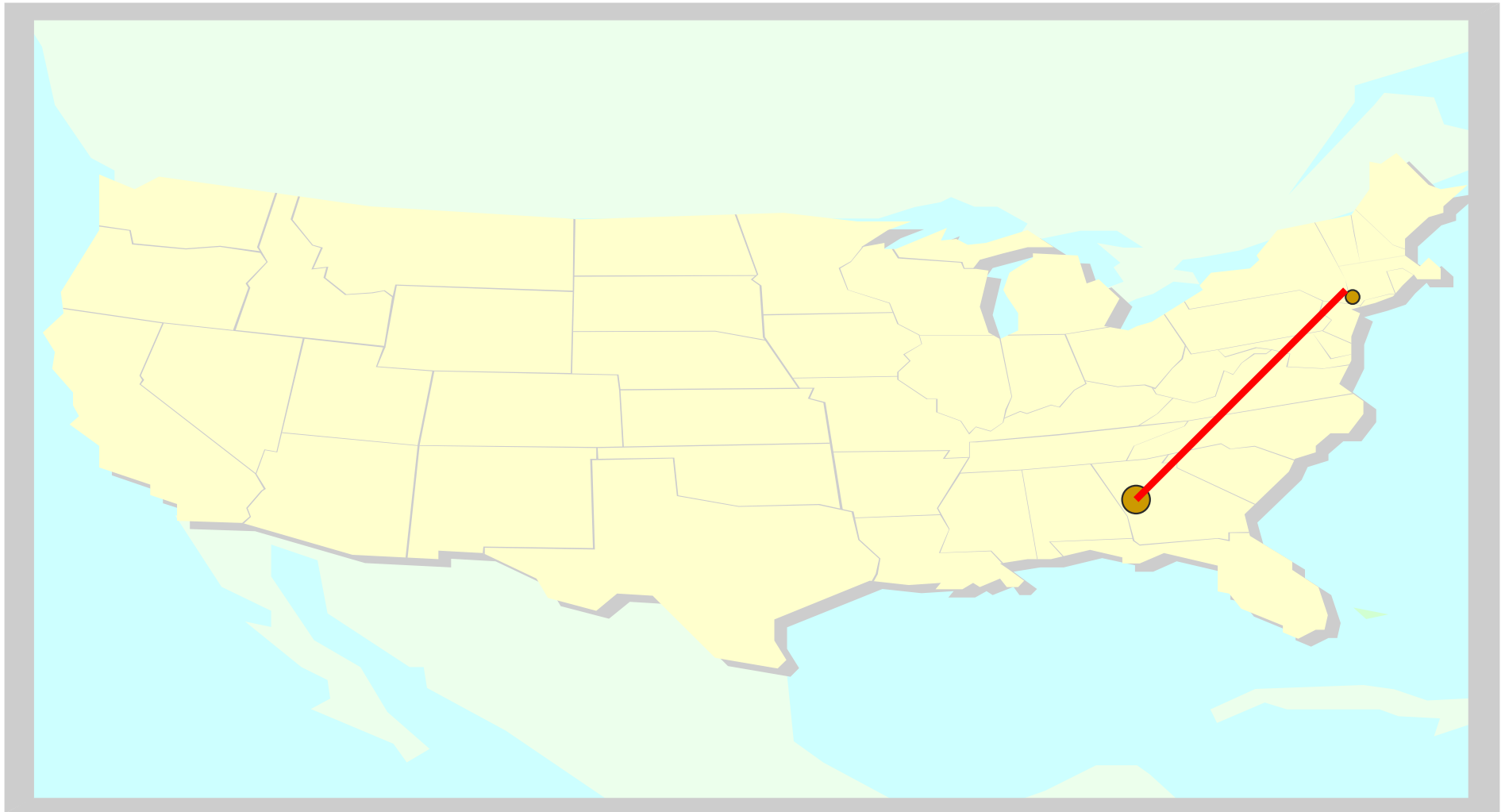
Variety of types of knowledge

- Theoretical in diverse fields
- Several dimensions of tacit knowledge
 - Mechanical/Experimental
 - Cross-disciplinary communication
 - Inter-organizational communication
- Pedagogical techniques
- Cross-sector partnerships
- Constituency needs
- Diversity of Collaboration Arrangements
 - The RERC is embedded in a very complicated KVC
 - Diversity/Variety is good, but how does it all hang together?

RERC Social Capital: Non-Intellectual Contact Network



RERC Social Capital: Co-Authorship Collaboration Network



[RERC Publication Patterns]

- Average publication rate for PI
- Publish in central journals in the field
- Higher impact factor than field average
- Significant presence in the field
- Well constituted “interdisciplinary” field

Remarks on RERC

- Striking difference in nominated and co-authorship collaboration networks
 - May have to do with access to patient data
- Diversity of fields, functions, collaborators and partners is much greater than other research centers
- People coming through are probably having pretty unique professional experiences
- Demands on human capital are very high for this type of center
- Snapshot reveals impacts in areas difficult to capture and measure with traditional approaches
- Enormous number of interfaces for few core people: is RERC policy sound?