"Tech Emergence" Indicators – to inform Management Of Technology

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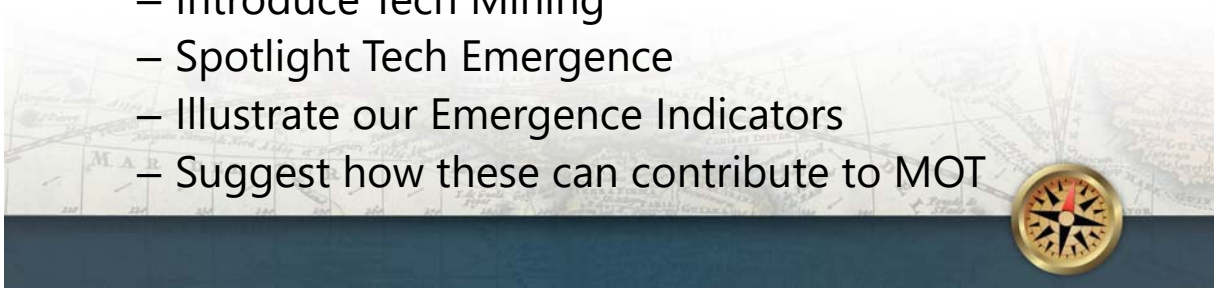
Agenda

- MOT can gain from empirical analyses
- Tech Mining
- Tech Emergence Indicators

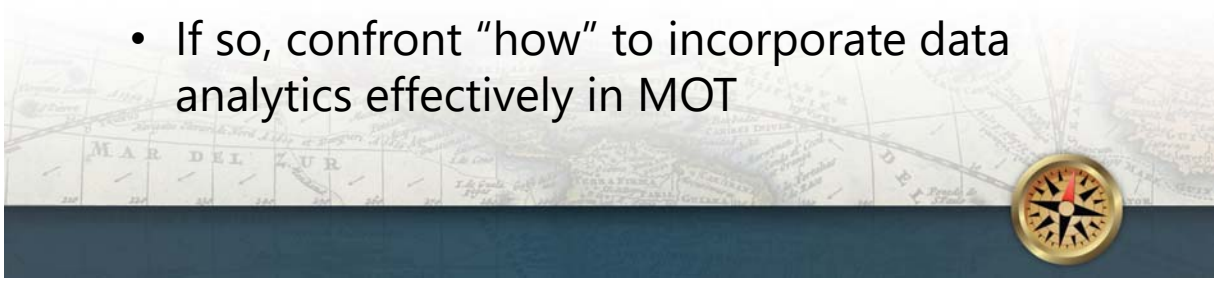
Management of Technology (MOT) -- Much to gain from empirical analyses?

- Last Year, I
  - Griped that MOT lags many other management domains in exploiting information resources
  - Presented our "Forecasting Innovation Pathways" approach, building upon "Tech Mining"
  - Shared our "Big Data Analytics" R&D landscape
- This Year, I'd like to
  - Introduce Tech Mining
  - Spotlight Tech Emergence
  - Illustrate our Emergence Indicators
  - Suggest how these can contribute to MOT



Is "Empirical" Good?

- For the Good
  - Past decade – "Big Data" explosion
  - Data Science on the rise
- For the Bad
  - Political climate – disdain for data
- Where are we?
  - Decide if we want "evidence-based" MOT??
  - If so, confront "how" to incorporate data analytics effectively in MOT



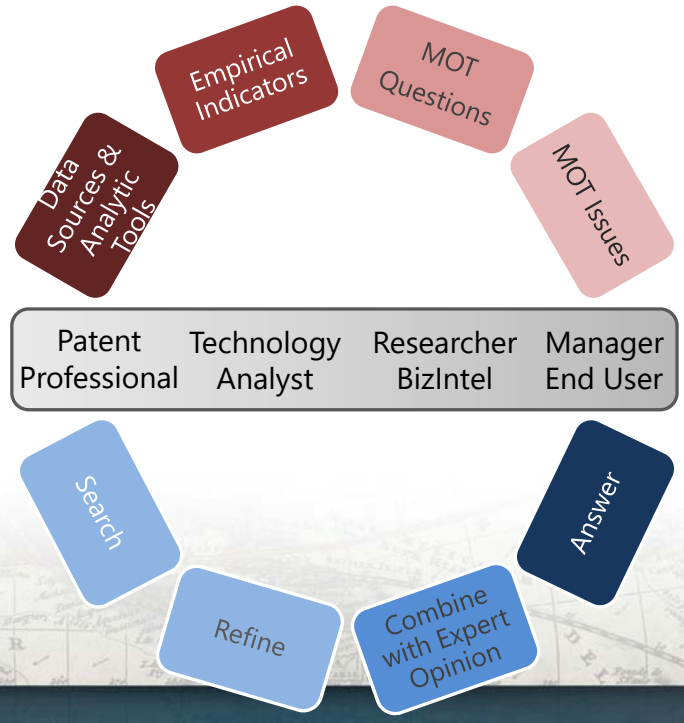
Tech Mining

- Shorthand for text analyses of Science, Technology & Innovation (ST&I) data resources
- Extends "bibliometrics" – exploiting meta-data of compilations of abstract records of R&D publications or patents

Empirical Intelligence to be Garnered

- R&D "Intel"
- Competitiveness/National Security Intel
- Open Innovation Intel
- Intel for Tech Forecasting

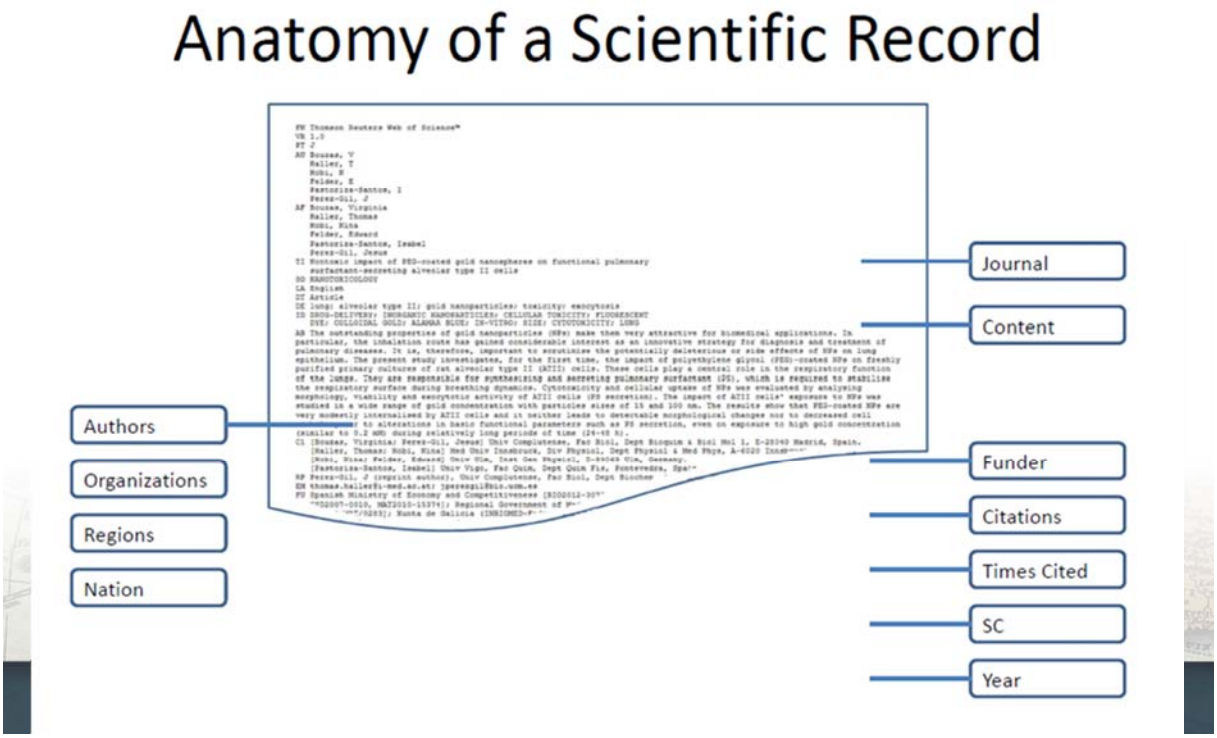
The Tech Mining Process



Core of our Empirical Analyses: Tech Mining

- Exploit global R&D (+!) abstract record compilations
  - e.g., Georgia Tech Library licenses ~200 such Databases
- Recent Exploration with Librarians – some "Fav's" – each covering ~10's of millions of papers or patents
  - Web of Science [11,396] vs. Scopus [8,514]
  - INSPEC & EI Compendex [combined = 12,145]
  - PUBMED (MEDLINE) [1,972]
  - Google Scholar [~30,000 (not comparable search)]
  - Derwent Innovation Index (patents) [484] vs. PatStat
- We explored a "tiny" topic – nanoribbons
  [hit counts above for 2002-2017]
  ["nanoribbon*" in Title, Abstract, or Keywords]

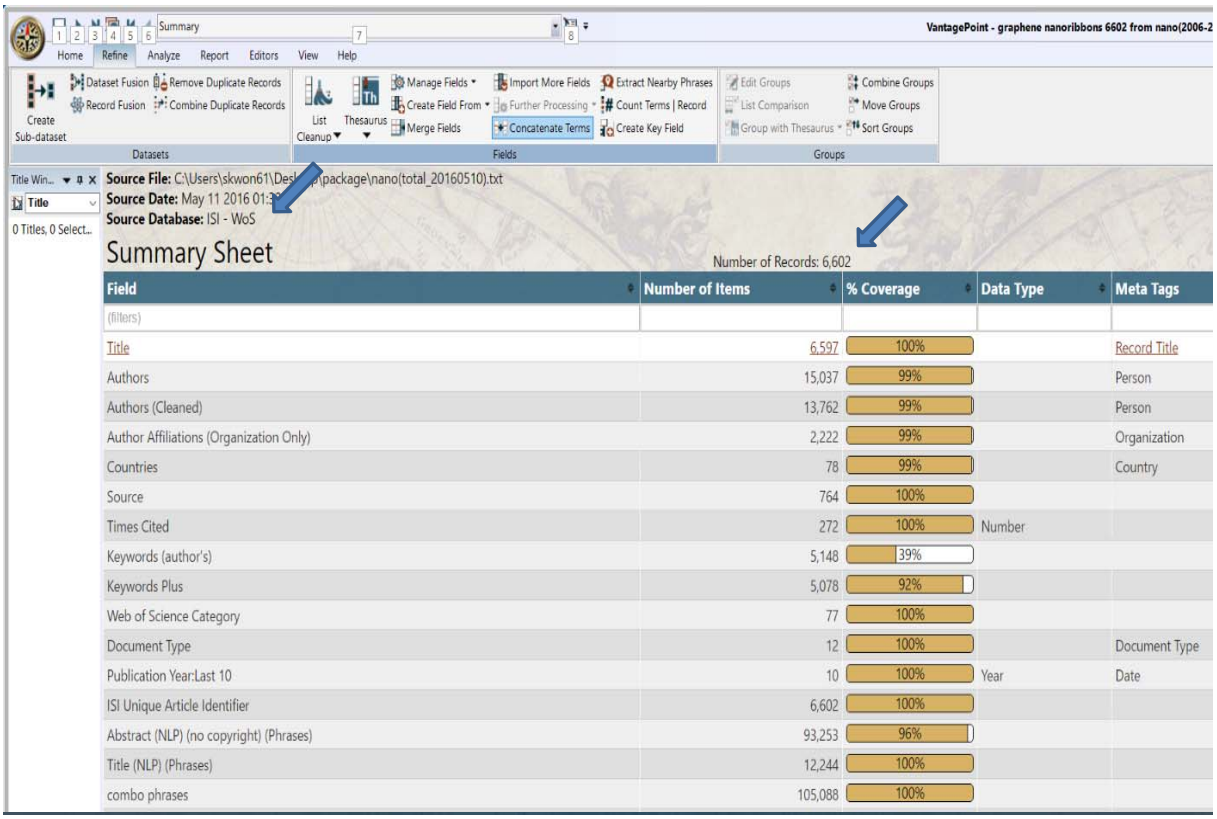
Textual "large data" – scientific discourse found in scholarly articles, patents, CVs, websites, etc.



University Librarian [as analyst!]: Request -- What's my dissertation potential for: "Nanoribbons"?

Research Question	Tech Mining Indicator
Is this a research domain?	A) Size of dataset
How hot is this research domain?	B) Publication trend
Where do you find nanoribbon publications?	C) Top sources
Where, geographically, do you find nanoribbon research?	D) World map
Who's researching graphene nanoribbons?	E) Leading organizations – publications? emergence?
Who's most active at the research frontier?	F) Cutting edge U.S. researchers
Who's researching graphene nanoribbons at Georgia Tech?	G) Sub-dataset GaTech, collaboration map
What are the "hottest" topics in the domain?	H) Topical emergence

Tech Mining Indicator A (activity scale?)



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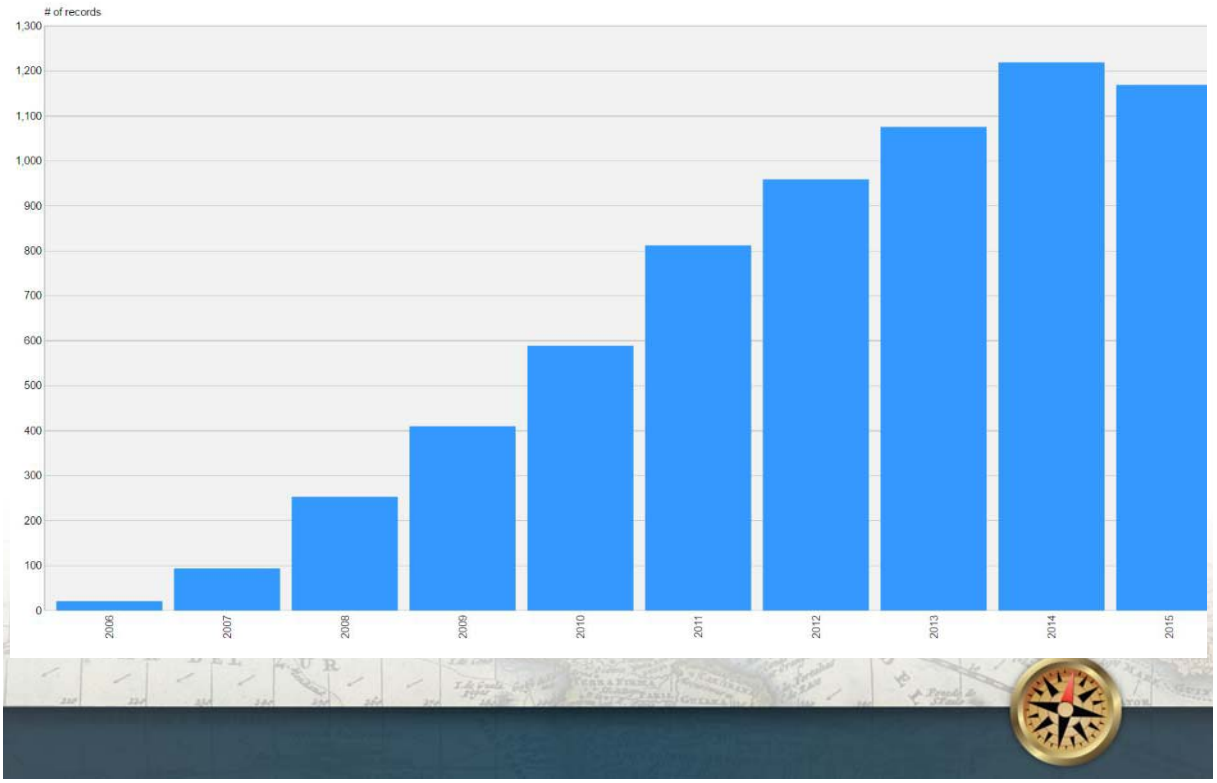
(filters)				
Title	6,597	100%		Record Title
Authors	15,037	99%		Person
Authors (Cleaned)	13,762	99%		Person
Author Affiliations (Organization Only)	2,222	99%		Organization
Countries	78	99%		Country
Source	764	100%		
Times Cited	272	100%	Number	
Keywords (author's)	5,148	39%		
Keywords Plus	5,078	92%		
Web of Science Category	77	100%		
Document Type	12	100%		Document Type
Publication Year:Last 10	10	100%	Year	Date
ISI Unique Article Identifier	6,602	100%		
Abstract (NLP) (no copyright) (Phrases)	93,253	96%		
Title (NLP) (Phrases)	12,244	100%		
combo phrases	105,088	100%		

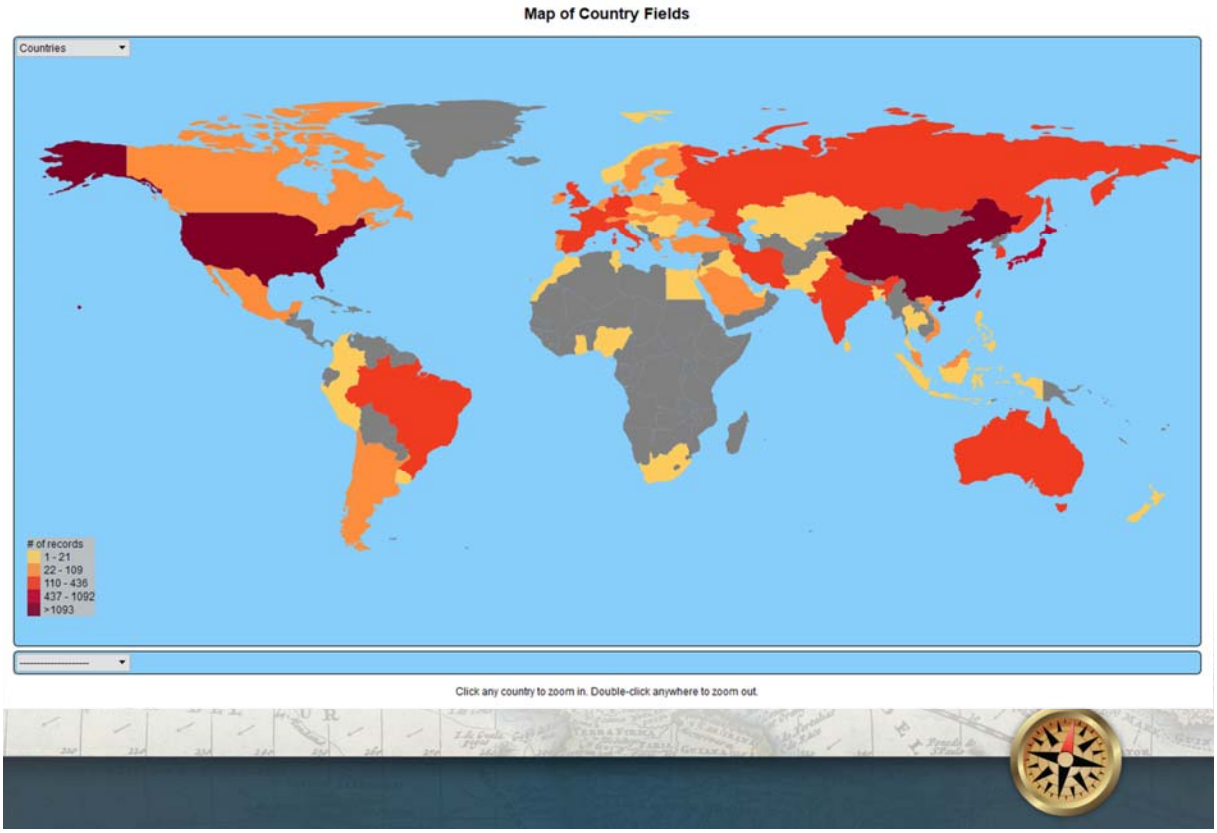
Tech Mining Indicator B (Trend?)



Tech Mining Indicator C (Top Sources?)

	# Records	# Instances	Source - Top 10
1	697	697	PHYSICAL REVIEW B
2	364	364	APPLIED PHYSICS LETTERS
3	272	272	JOURNAL OF PHYSICAL CHEMISTRY C
4	239	239	JOURNAL OF APPLIED PHYSICS
5	195	195	ACS NANO
6	180	180	NANO LETTERS
7	161	161	CARBON
8	136	136	PHYSICAL CHEMISTRY CHEMICAL PHYSICS
9	133	133	NANOSCALE
10	118	118	JOURNAL OF PHYSICS-CONDENSED MATTER

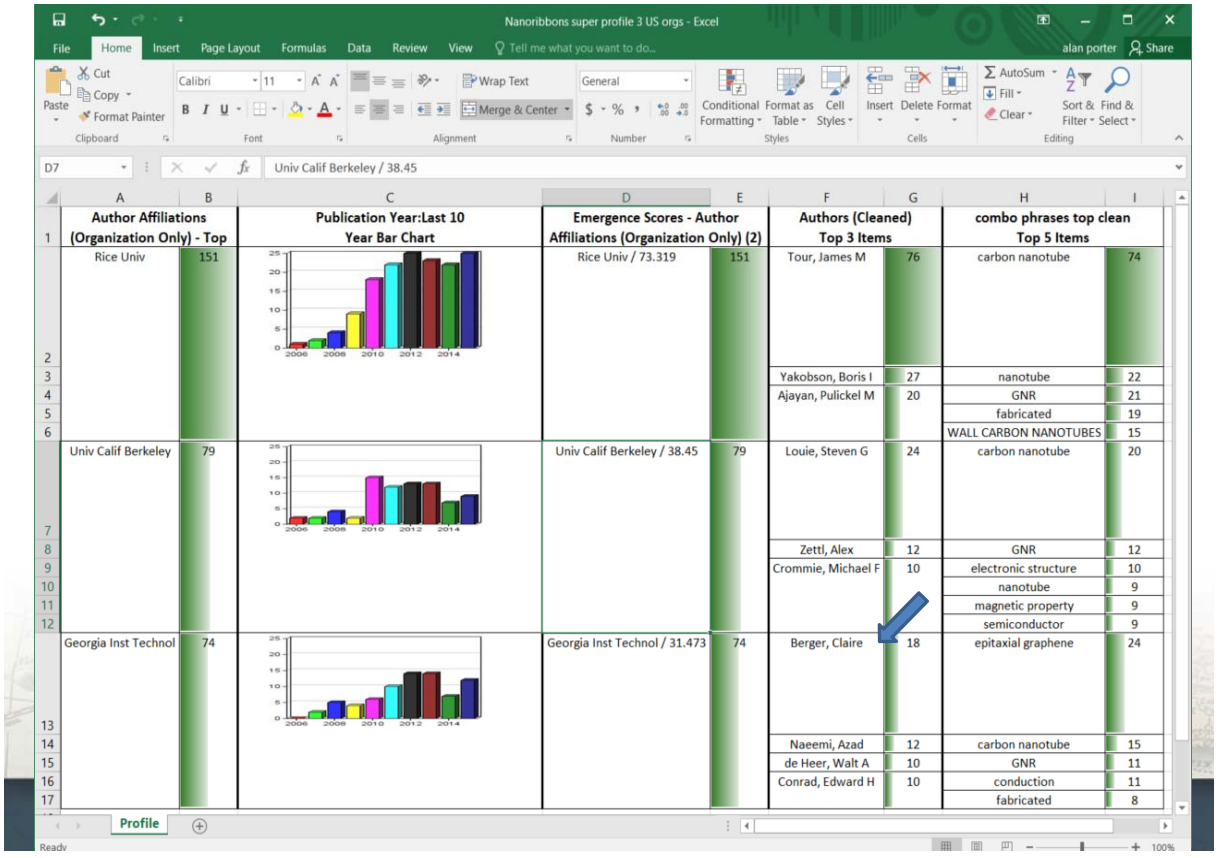
Tech Mining Indicator D (Where?)



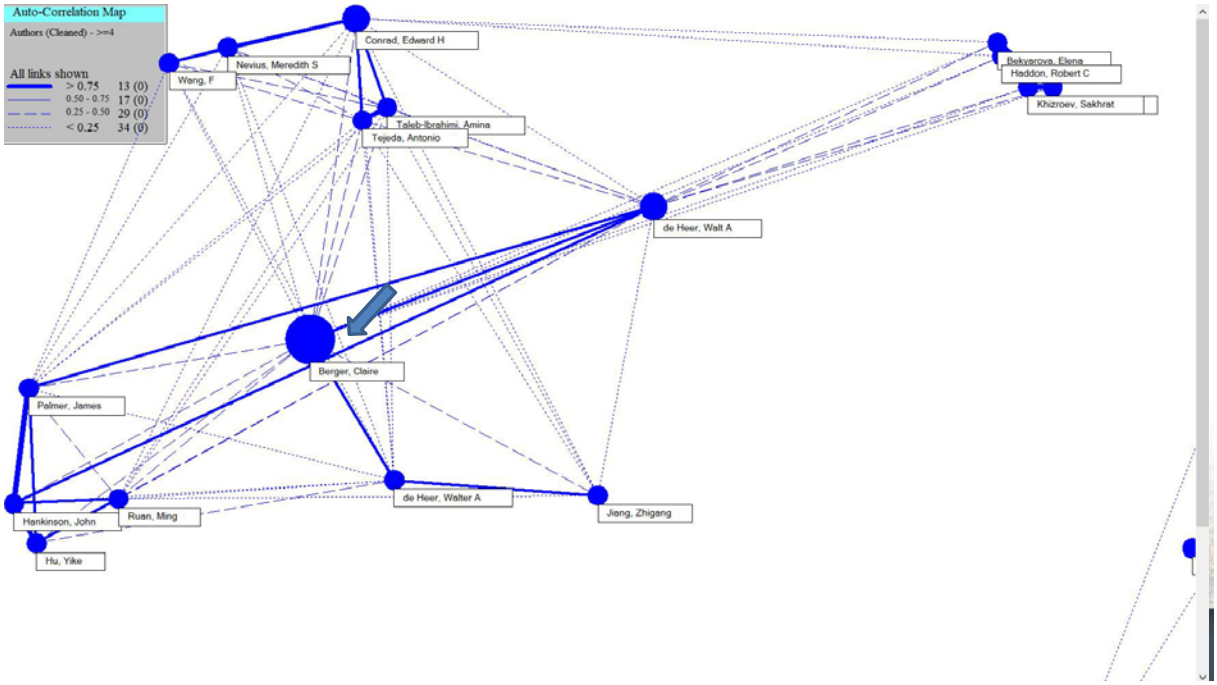
Tech Mining Indicator E (Leading R&D Organizations?)

	Author Affiliations	# Records	Emergence Scores
1	Chinese Acad Sci	289	91.3
2	Hunan Univ	86	73.3
3	Rice Univ	151	73.3
4	Cent S Univ	59	69.2
5	Shandong Univ	68	68.1
6	Nanyang Technol Univ	112	64.3
7	Univ Sci & Technol China	113	58.2
8	Tsinghua Univ	125	55.0
9	SASTRA Univ	9	54.5
10	Peking Univ	125	54.4

Tech Mining Indicator F (Cutting Edge U.S. Researchers?)



Tech Mining Indicator G
(Georgia Tech Research Teams?)



Tech Mining Indicator H
(High Emergence Topics?)

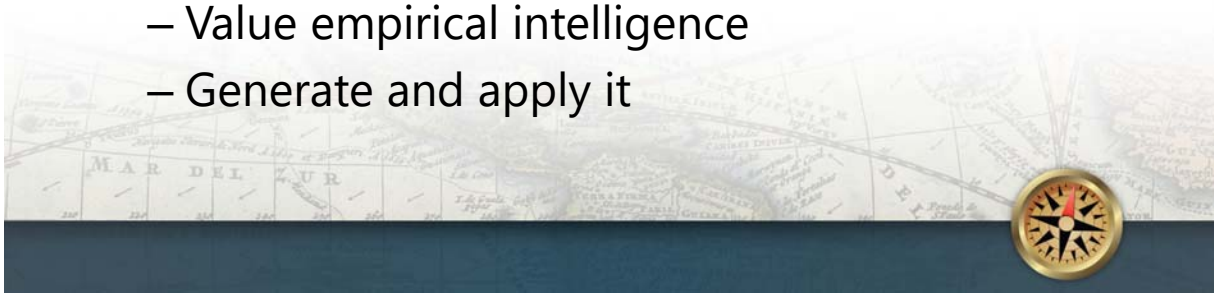
	Top 10 Terms	# Records	Emergence Scores
1	density function theory	505	33.1
2	nanosheet	225	15.8
3	potential application	195	14.4
4	fabricated	404	13.8
5	oxygen reduction reaction	54	12.9
6	semiconductor	368	12.2
7	multiwall carbon nanotube	83	11.3
8	heterostructure	95	10.7
9	negative differential resistance	77	10.7
10	electrodes	154	10.6

Data Science enhanced Library Target: Quick Tech Intelligence Profile (QTIP)

- Tune to meet user needs
  - Graduate student researcher
  - Faculty proposal development
- Deliver in 1 hour via Workbook
- Pathway to potent skill transition for librarians?
- Industry & Government MOT Competitive Technical Intelligence (CTI) parallels?

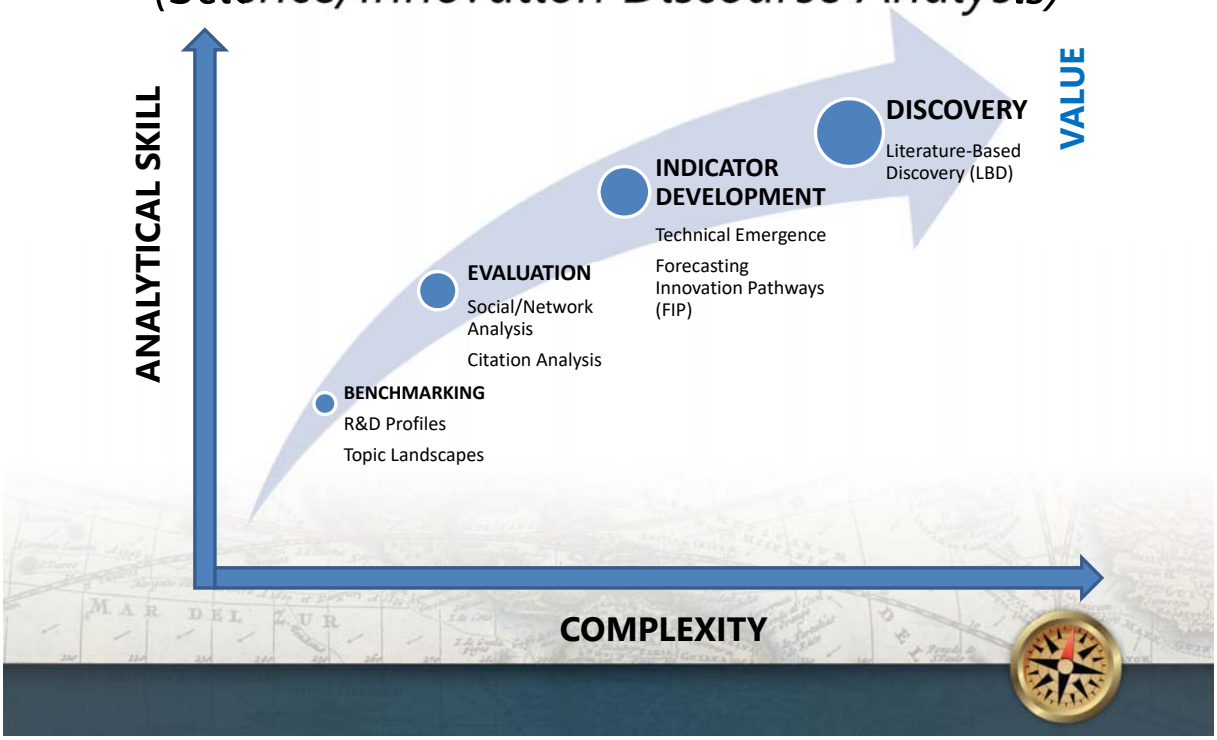
Librarian Futures? [MOT Futures?]

- Information Scientist
- Paper to Digital transition = radical!
- Role change: Searcher → Analyst/advisor
- Hard shift as the end users lack clear sense of what can help them
- Strong MOT parallels!
  - Value empirical intelligence
  - Generate and apply it



Value Chain of Tech Mining

(Science/Innovation Discourse Analysis)



Next?

- Today and Tomorrow –>"Indicators of Tech Emergence" (5 sessions)
  - #1: Tuesday, 10:30—12:00
- Here and Now – any information you want on Tech Mining or the software used, see Denise at our *VantagePoint* table
- After PICMET – pursue these topics (including a "patent analytics" theme) at the *Global Tech Mining* Conference, Oct. 9, Atlanta
- **Welcome your thoughts: How can Tech Mining and Emergence Indicators work for you??**