Connected Entrepreneurs in Ecosystem:
Draft Ideas for a Book

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Outline

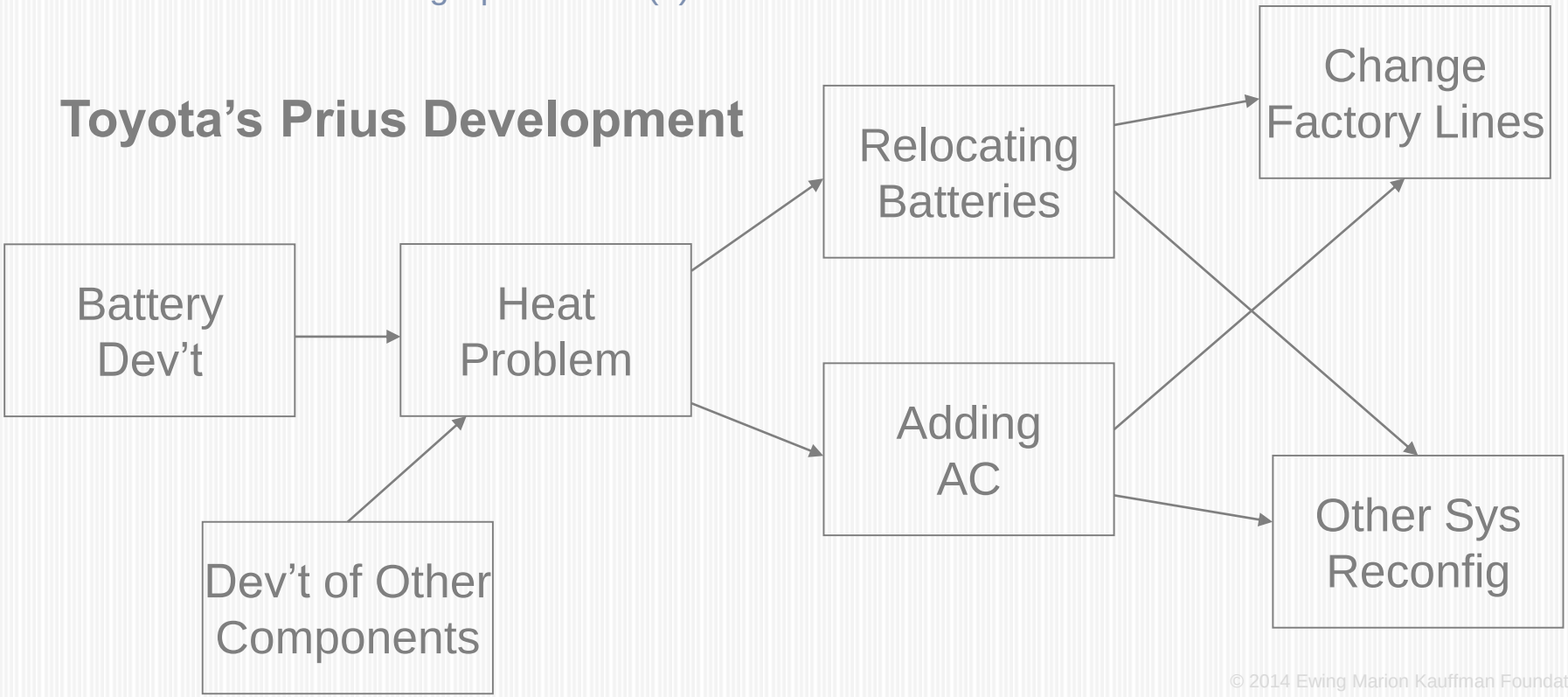
- My research background
- Preface
- Book ideas by chapters

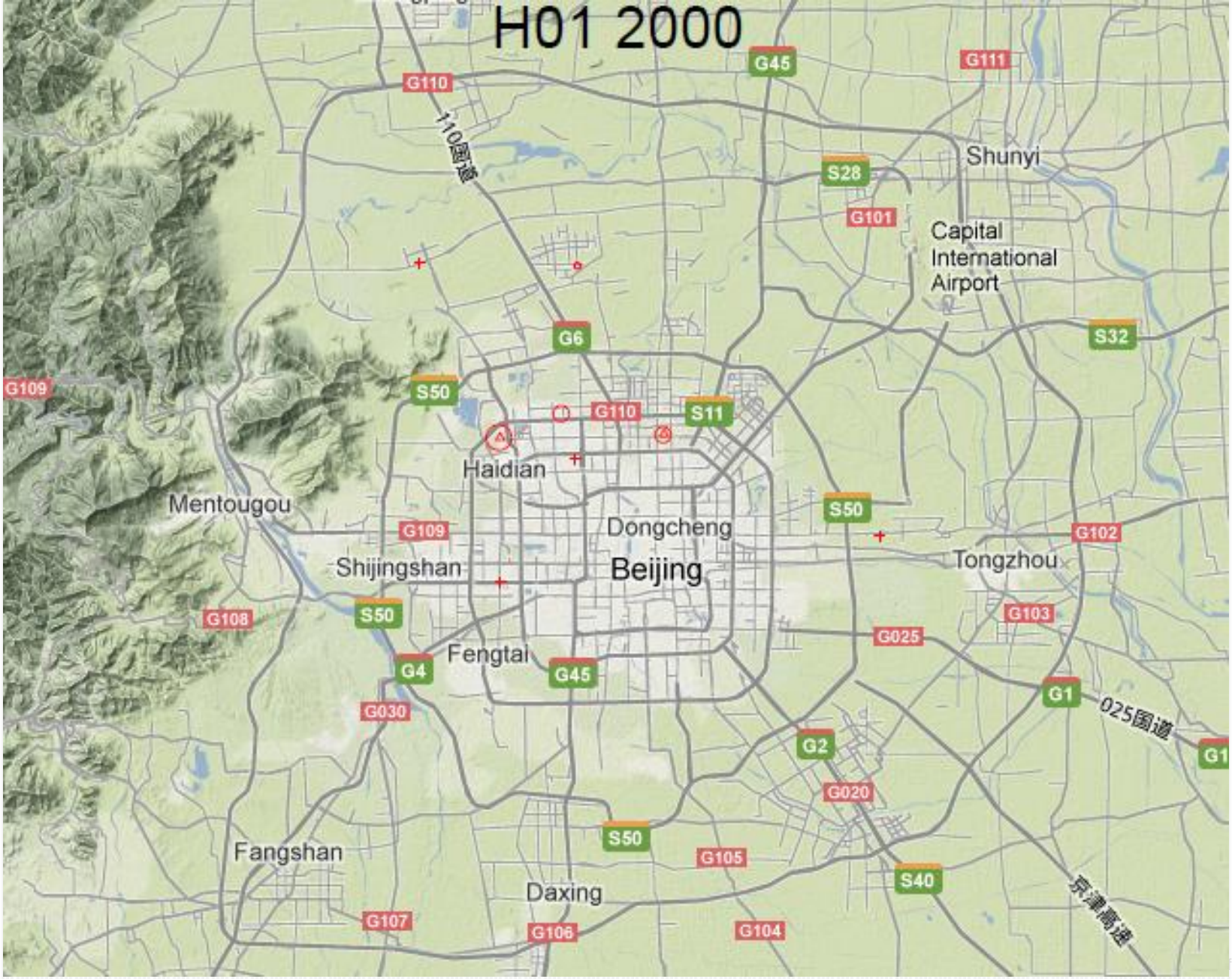


Product Development by Multinational Firms

- Motoyama. 2012. Global companies, local innovations: Surrey, UK: Ashgate.
  - Cohen, Di Minin, Motoyama, Palmberg. 2009. Persistence of home bias for important R&D. Review of Policy Research 26 (1-2):55-76.
  - Motoyama. 2011. "Location of innovation: A case study of Sony's Vaio laptop." Journal of Industrial Geographer no. 8 (1):1-25.

Toyota's Prius Development

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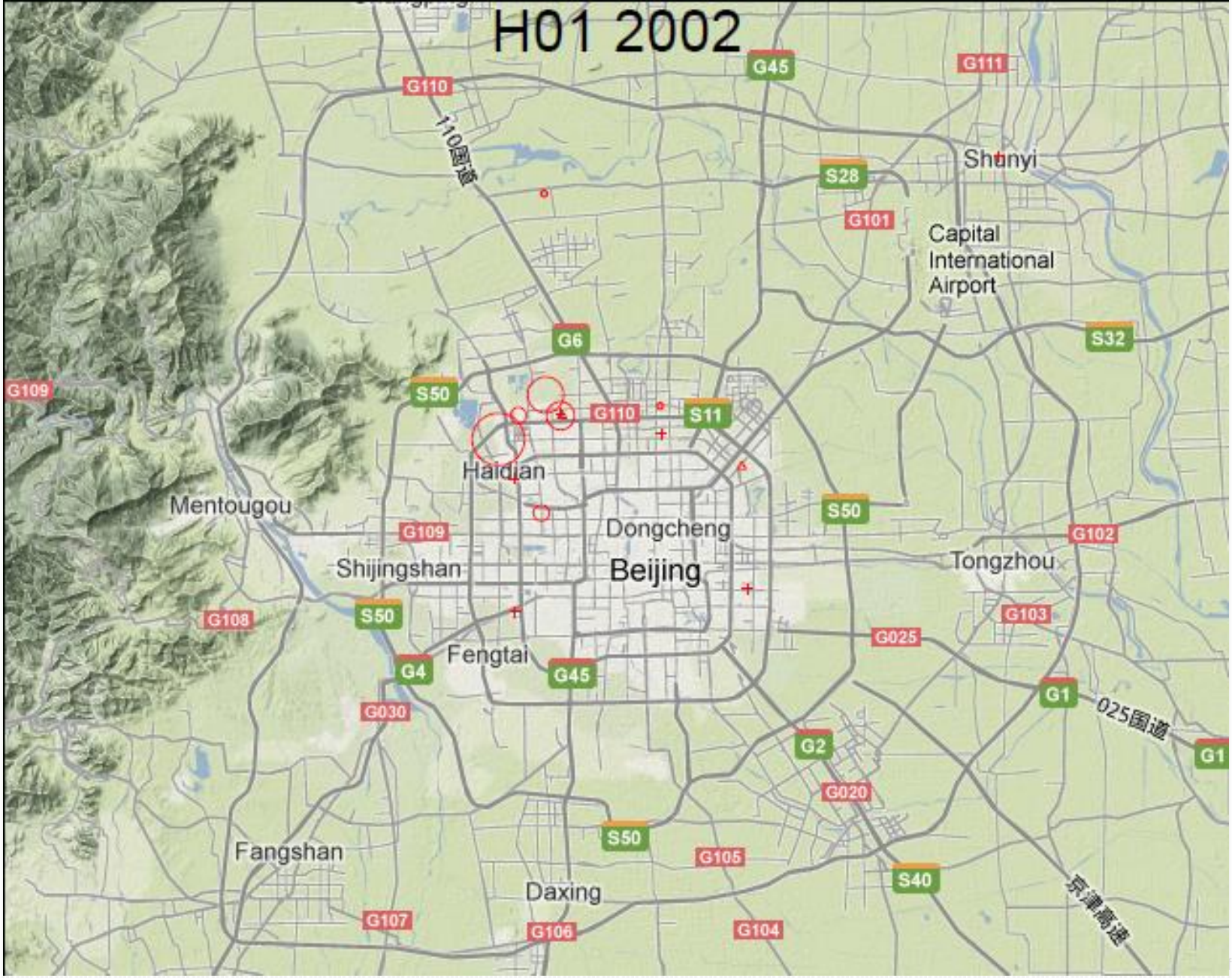
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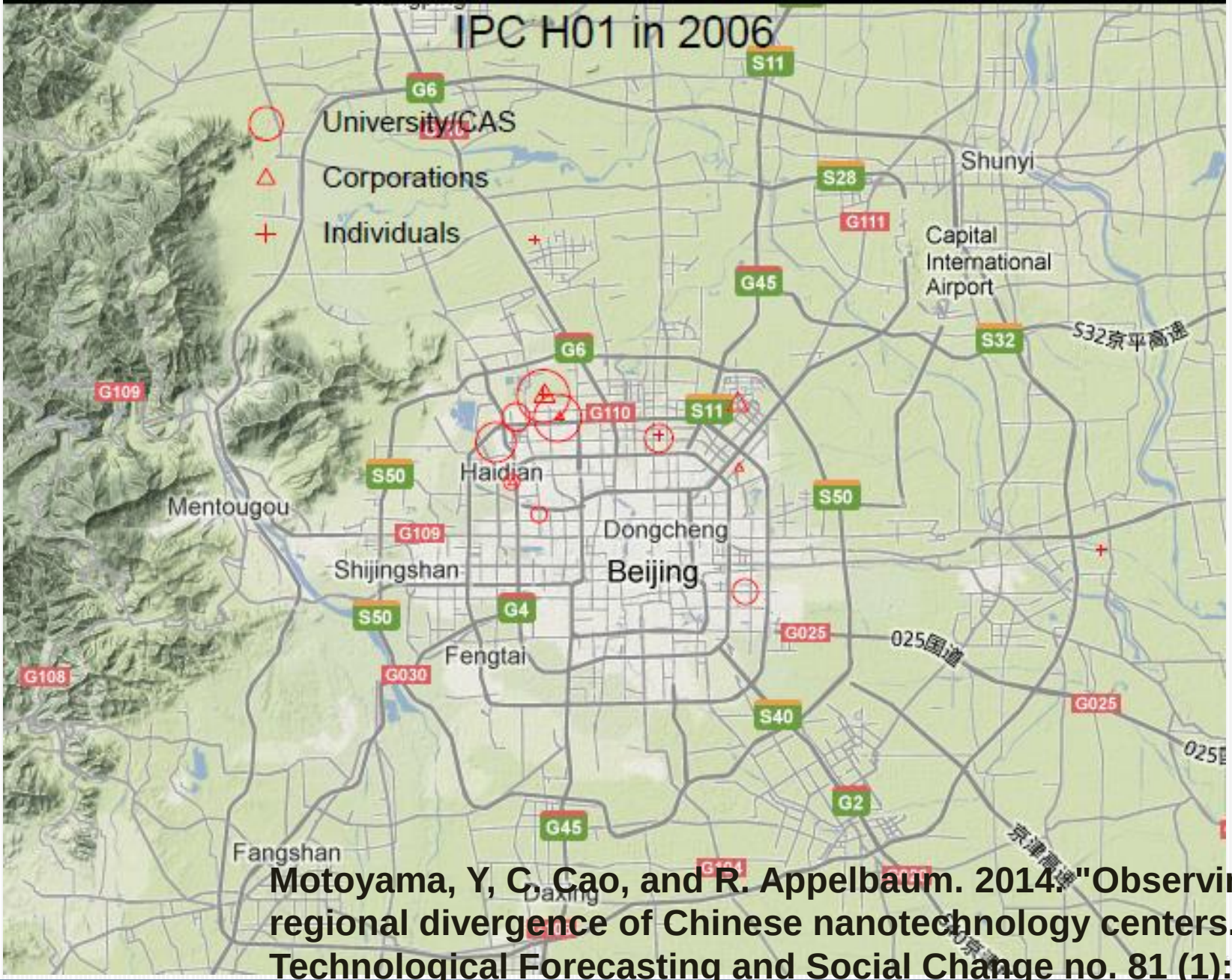


Motoyama, Y, C. Cao, and R. Appelbaum. 2014. "Observing regional divergence of Chinese nanotechnology centers." Technological Forecasting and Social Change no. 81 (1):11-21.

In Transition . . .

- Coming to Kauffman (2011)
- Foundation to promote entrepreneurship
- High interaction with entrepreneurs, supporters, and policymakers
- How does the government R&D funding and university research translate into commercialization?



Chapter 1: Reviewing Theories & Questions

Past theories on innovations

- Systems of innovations
  - Lundvall (1992); Nelson (1993)
- Regional systems of innovation
  - Cooke et al. (1997); Braczyk, Cooke, and Heidenreich (1998)
- Triple Helix
  - Etzkovitz & Leydesdorff (2000); Etzkovitz (2008)
- Knowledge spillover
  - Jaffe et al. (1993); Feldman (1994); Audretsch and Feldman (1996)



My Critiques of Past Innovation Studies

- Focused on high-tech-based innovations
  - Or high-tech sectors are innovations?
- Based on linear model of development (Godin 2006)
  - Basic research => Applied research => Commercialization
  - Government funding => University research => Commercialization
- Need of alternative measure for the driver of economy



Measures of Innovation

Types	Measure	Literature
Inputs	R&D expenditure	Feldman and Lichtenberg (1998); Adams (2002)
	R&D personnel	Porter and Stern (1999); Zucker, Darby, Brewer (1994)
	R&D employment	Fingleton, Igliori, Moore (2003); Malecki (1985); Maggioni (2002)
	Venture capital	Zook (2002); Kenney and Patton (2005)
	SBIR awards	Wallsten (2001)
Outputs	Patents	Guerrero and Sero (1997); Co (2002); O hUallachain and Leslie (2005); Sonn and Park (2010)
	Innovation counts	Feldman (1994); Audretsch and Feldman (1996); Acs et al. (2002)

Modified from Ratanawaraha and Polenske (2003, 32–34) and Acs et al. (2002, 1069).

- Measuring innovations is difficult
- Measuring innovations (output) by inputs?

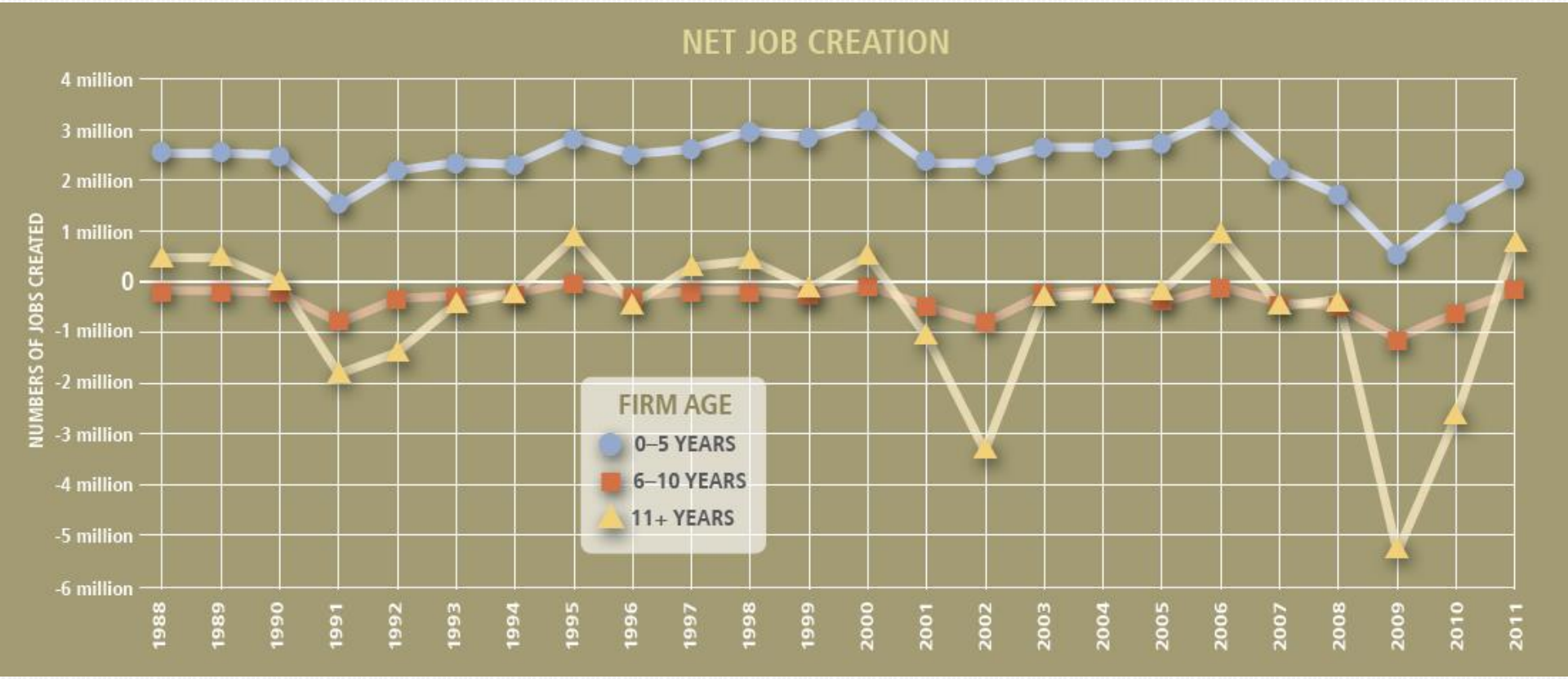
- From correlation to causality?
  - "innovation in the late twentieth century is unusually dependent on an area's underlying technological infrastructure. Having beyond the confines of the organizational boundaries of an individual firm, innovation is increasingly dependent on a geographically defined infrastructure that is capable of mobilizing technical resources, knowledge, and other inputs essential to the innovation process. … [And such technological infrastructure] is defined in terms of the agglomeration of four indicators: 1) firms in related industries; 2) university R&D; 3) industrial R&D; and 4) business-service firms" (Feldman and Florida 1994, p.210).

- Innovation ≈ R&D ≈ High-tech ≈ Patents??
  - Small portion of high-growth firms are in high-tech sectors
    - (Motoyama and Danley 2012; Piazza et al. 2016)
  - High-tech employment grew slower than rest of economy (Hecker 2005)



Importance of Entrepreneurship

- Young firms (0-5 years) created all net new jobs in US



Chapter 2: Regression Analysis

- Metro-level analysis (356 metros)
- 3 Dependent Variables related to entrepreneurship
  - 0-1 year old firms / all firms (BDS)
  - 0 year old firms in high-tech / all high-tech firms (NETS)
    - BLS's Hecker (2005) definition of high-tech
  - Inc high-growth firms (2,700-2,800 firms / year)



Input Elements for Innovations

1. High-tech sectors, especially R&D of (large) firms
2. R&D of university
3. Government labs or expenditure on R&D
4. Investing institutions
5. Patents



Regression Result: All Establishments by BDS

	Model 1		Model 2		Model 3		Model 4		Model 5	
(Intercept)	-29.931		-28.810		-29.094		-33.762		-22.096	
Log(Population)	10.582	***	10.434	***	10.484	***	9.671	***	9.734	***
Pop. Increase 2006-10	362.871	***	361.295	***	364.066	***	364.689	***	359.754	***
High-tech LQ	2.375		2.958		2.323		1.261		1.557	
SBIR	0.020				0.019		0.017		0.016	
NIH			0.001							
VC Investment	0.002		0.002		0.002		0.002		0.002	
Patents	0.000		0.000		0.001		0.000		0.000	
Research I	0.283		0.341							
Research I expenditure					0.432		-1.831		0.313	
College completion	0.335	**	0.314	**	0.311	**				
HS completion							0.087	*		
College attendance									-0.130	
DF	344		344		344		344		344	
F-stat	56.75		56.51		56.65		55.29		55.29	
Adj. R-sq	0.5589		0.5578		0.5584		0.5524		0.5524	



Regression results with Inc high-growth firms (Count Model)

	Model 1		Model 2		Model 3		Model 4		Model 5	
(Intercept)	0.0002		-0.0225		0.0255		-2.5816		-0.6586	
Log(Population)	0.1071	*	0.1027	*	0.1006	*	0.1970	**	0.2041	**
Pop. Increase 2006-10	3.4270	**	3.3122	**	3.5098	**	3.7478	**	3.7961	**
High-tech LQ	0.4198		0.4148		0.3738		0.4948		0.4943	
SBIR	0.0000				0.0008		0.0013		0.0014	
NIH			-0.0001							
VC Investment	0.0001		0.0001		0.0001		0.0001		0.0001	
Patents	-0.0001		-0.0001		-0.0001		0.0000		0.0000	
Research I	-0.0263		-0.0227							
Research I expenditure					-0.1814		0.0846		-0.0482	
College completion	0.0389	**	0.0425	**	0.0418	**				
HS completion							0.0251	**		
College attendance									0.0095	*
Theta	3.099		3.118		3.133		2.701		2.729	
# of iterations	37		36		39		32		37	
Lok-likelihood	-1074		-1074		-1073		-1088		-1088	



Summary of Regression Results

- Statistically insignificant
  - Venture Capital investment
  - Government R&D (NIH)
  - University R&D (also with faculty, research FTE, count of students)
  - Patents

- Statistically significant
  - Human capital related
    - High school completion rate
    - College completion rate
  - Large regions, growing regions

Chapter 3: Case of Kansas City

- Metro population of about 2 million (#30th in U.S.)
- Research institutes
  - University of Kansas (Very high research: $140 million R&D)
  - University of Kansas, Medical Center ($67 million R&D, 967 FTEs)
  - University of Missouri, Kansas City (High research)
  - Stowers Institute ($100 million, 22 PIs and 80 postdocs)
- Nationally competitive companies
  - Sprint, Garmin, Cerner, DST, BATS
- Moderately high entrepreneurship activity (BDS)
- Moderate + economic recovery
- All the right assets are there (in theory)



K1) Survey of High-Tech Firms

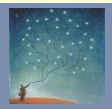
- With Heike Mayer of Univ. of Bern
- Conducted in late 2012-early 2013
- Targeted firms in high-tech sectors
- Distributed through various sources
  - Chamber of Commerce
  - Media: KC Star, KC Biz Journal, Silicon Prairie News
  - Kauffman's media connections, social media
- Valid response = 211 (employment & founding year)
- Median founding year = 2009



How important have the following been for your firm`s development?

Important Factors	Mean Score
Informal local access to innovative people, ideas	4.15
Supportive local entrepreneurship organizations	4.01
Attractive local quality of life for staff & management	3.96
Access to local business services	3.73
Local availability of managerial/professional staff	3.64
Access to Midwestern markets	3.48
Proximity to local customers	3.38
Access to local sources of capital, finance	3.24
Supportive local training organizations	3.12
Proximity to local suppliers, subcontractors	2.99
Local shareholders	2.91
Research links with other firms in the region	2.82
Quality of local research staff	2.80
Research links with a university	2.66





What are sources of innovations and new ideas?

Mentors that give advice	52.5%
Customers and users	43.8%
Informal networks with other friends	42.0%
Internal R&D units	33.3%
Consultants	31.5%
Other firms in your industry	25.9%
Universities or higher education institutions	21.6%
Suppliers (materials, services, equip., etc.)	17.9%
Manufacturers	8.6%
Commercial labs or private R&D institutes	8.0%

- N = 162



K2) Interview of High-Growth Companies

- Interviewed 23/41 high-growth Inc firms since 2007
- IT, health & drugs, business services sectors

- Findings
- Business creation and growth based on market niche
  - Including focused and selective regional markets
- Prevalence of self-finance and bootstrapping
  - 2 firms had VC investment, but their growth induced VC investment
- Independent of local anchor firms or universities
- High use of mentors



K2) Examples of Market Niche

- Server and data maintenance in KC
- Development and maintenance of alumni database for educational institutions
- System to test drug-use for employment
- Comprehensive background check integrated with judicial and criminal data



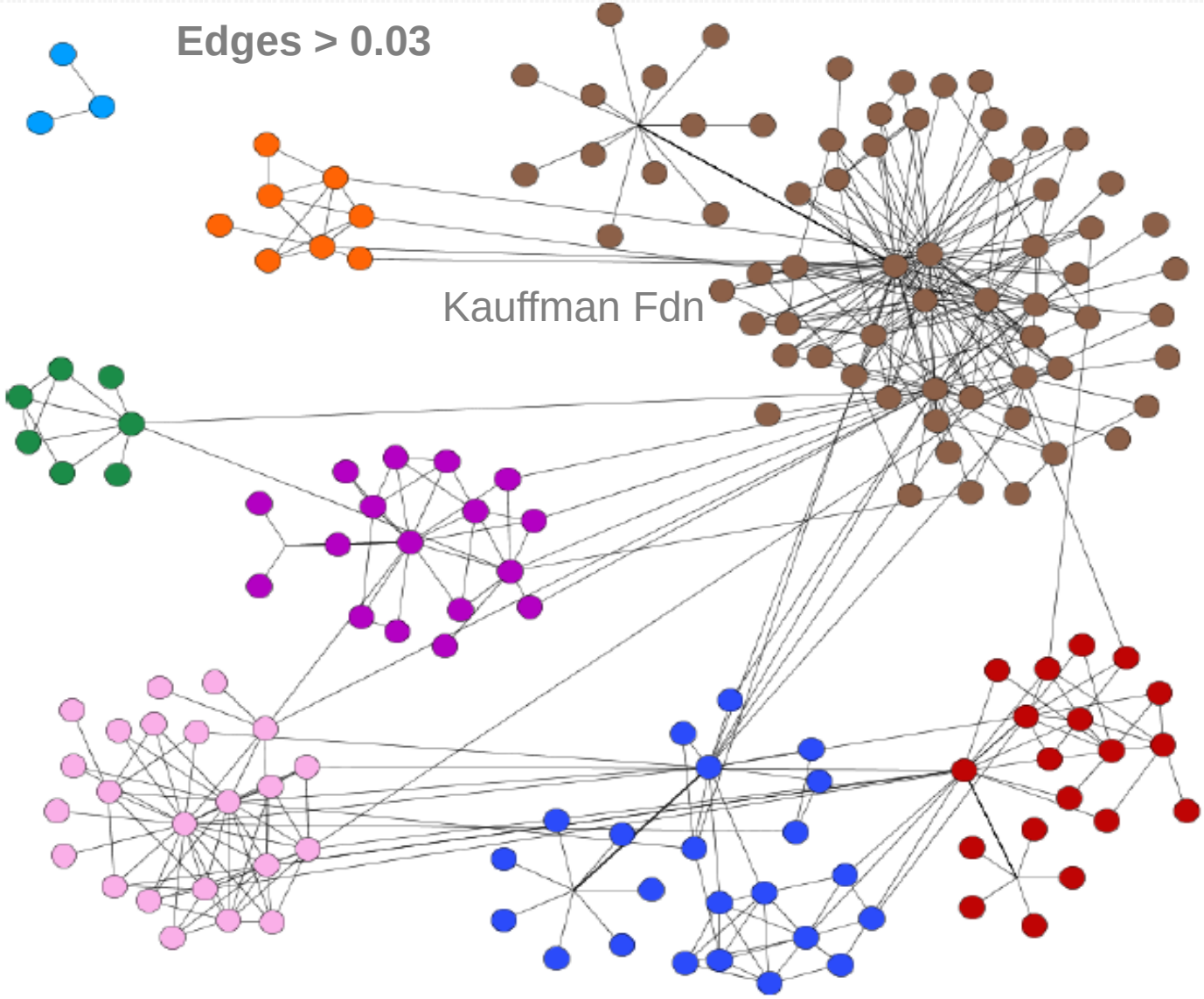
K3) Twitter Analysis

- Identified 168/319 entrepreneurship support orgs in KC
  - 531,888 followers
  - 61,439 edges
  - Including 12 university & units
- Analyze the extent and types of those followers in the broader entrepreneurship scenery
  - With Stephan Goetz and Yicheol Han of Penn State

- Reliance on entrepreneurs, support organizations
- Entrepreneurs do not follow local universities, high-tech firms, or research labs



K3) Twitter Analysis Sub-Example



1	Kauffman Fdn
2	500startups
3	davemmcclure
4	techstars
5	SteveCase
6	SBA STL
7	ericries
8	biz
9	msuster
10	Startup Wknd

Chapter 4: Case of St. Louis

- Metro population of 2.8 million (19th largest)
- Research institutions
  - Washington U in St. Louis ($550 mil R&D; ranked 6th in medical school)
  - St. Louis University
  - Univ. of Missouri, St. Louis
- The loss of anchor firms
  - Southern Bell relocated to San Antonio
  - McDonnell Douglas merged with Boeing
  - Anheuser-Busch purchased by InBev
- Emergence of Mosaic Project and Arch Grants
- Sharp recovery of startup rate since 2011



The Biggest Challenge of Most Ecosystems

(Brasunas, interview, December 10, 2012)

- The typical problem I saw with entrepreneurs five years ago was like this:
- “I do this business alone, and I don’t know other startups in town. I don’t know investors here, and there is only old money from big corporations in St. Louis, so I go to Silicon Valley to find an investor.”
- Then, if you talked to investors, they would say: “I don’t find any startups in St. Louis, and, in fact, there may not be any prospective startups here, so I go to Silicon Valley to find companies to invest.”
- So somehow, they might find each other in Silicon Valley, but not in St. Louis.



St. Louis Research Methods

1) 15 interviews of Inc. companies
   - With St. Louis Regional Chamber and ITEN
2) Twitter analysis: 87/190 support organizations/events

3) Interviewing Arch Grants recipients
   - With Karren Knowlton at UPenn

- Interviewed 43/55 firms of recipients 2012-14
- Interviewed 15 entrepreneurship support organizations
  - Not what is your system of entrepreneurship? Strength? Weakness?
  - But what are the challenges you faced? How did you solve? Who helped you? Who do you interact?
  - Motoyama and Knowlton. 2016. "From resource munificence to ecosystem integration: the case of government sponsorship in St. Louis." Entrepreneurship and Regional Development 28 (5-6):448-470.



Findings 1: Peer-Learning by Entrepreneurs

- “It’s a great environment. I had some questions about some of the frameworks that they [another recipient company] are using, and sometimes other people stop by and ask me things: what do you think about this idea?” (IT Firm A).

- “You’re doing completely different things. You’re all building something and that involves kind of the same thought process, I like to think. Different expertise, but definitely the same thought process” (Biotech Firm B).

Content of Peer-Learning

- Process learning
  - How to be an entrepreneur
  - Reformulating business ideas, types of funding to suit, interaction with pro-bono lawyers, selecting the first few employees, etc.

- Expertise acquisition
  - Passing on useful information specific for the other entrepreneur
  - Coding in software; Product change to appeal better to customers,

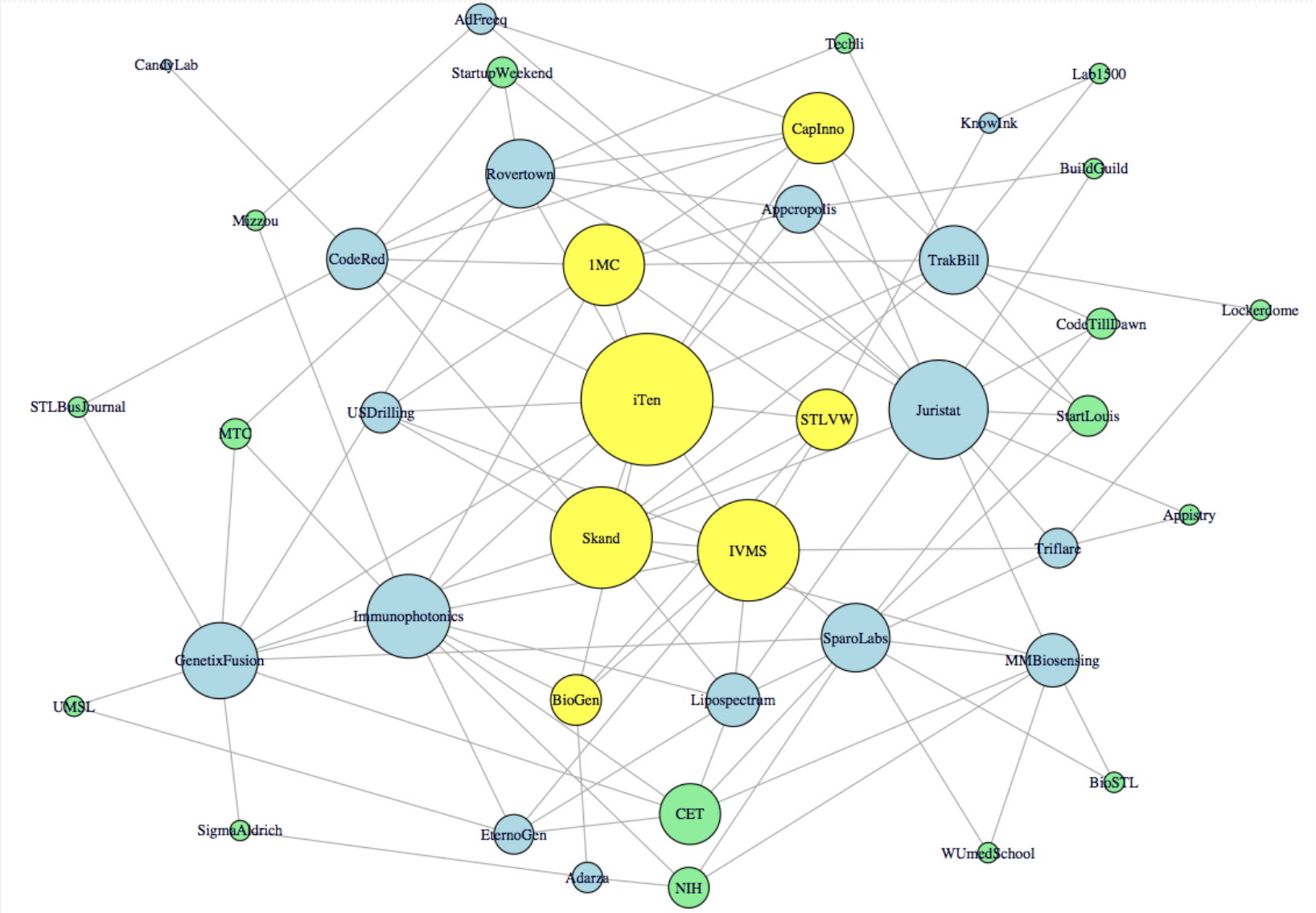


Entrepreneurs Need Multi-layers of Support

- “the Arch Grants got us to ITEN, which got us to a business journal, which put us in touch with some our client contacts. ITEN is a validity thing. They got us into the Startup Connection at the Science Center, where we won people’s choice [. . .] Then, ITEN put us in touch with Capital Innovators, which gives us practice in just pitching and selling, which is really valuable practice” (Other Firm C).



Level 2: Entrepreneurs, Support Orgs, Others



St. Louis: Other Key Findings

- Support organizations & events generate connectivity
- Entrepreneurs need to pivot by receiving feedback from peers, mentors, and serial entrepreneurs
- University plays a role by inspiring students & connecting with startups, not by transferring technology



Chapter 5: Conclusion 1

Individual-Firm Level

- Identifying the market niche is the most fundamental
  - Entrepreneurs will find technologies and methods to enable it

- Entrepreneurs have to learn
  - No business idea is complete and requires continuous iteration
  - A number of skills have to be acquired
  - Through experimental learning



Conclusion 2

Regional Ecosystem Level

- Entrepreneurs have to learn from others
  - Entrepreneurs have to be connected
  - With peers, experienced entrepreneurs, supporters,
- A cluster of support organizations to complement a wide range of supports
  - An entrepreneur goes through multiple supports and organizations
  - Through events, programs, mentorship, etc.
  - Different functions and stages
- Less formal training from universities or courses



Entrepreneurship vs. Innovation Models

Entrepreneurship Model

- Firm growth is based on a strong market niche
- Entrepreneurs have to learn and pivot (& fail fast)
- Peers, mentors, and supporters provide feedback

Current Innovation Model

- Scientific & technological novelty creates market
- Make a business plan & VC or gov't will fund (& prolong)
- Linkage with high-level institutions (univ, govt, industry)



Implications 1

- Revisit the linear model of innovation & development
  - Focusing on scientific knowledge and funding for ‘valley of death’
  - May still apply to a small fraction of capital-intensive sectors
- Reconsider the measures of innovation outputs
  - Patents and R&D inputs have little correlation with entrepreneurship
- From tech transfer to human transfer
  - AUTM’s focus: explicit and linear outputs: spinoffs, patents, licenses
  - 705 spinoffs = 3.5 spinoffs / univ = $368 million / spinoff
  - By creating flows of people and ideas b/w univ and local
  - By inspiring students and connecting to local startups



Implications 2

- Increase the connectivity with and for entrepreneurs
  - By connecting entrepreneurs to other entrepreneurs
  - By connecting entrepreneurs to support organizations
  - By coordinating support organizations
  - At the local level
- Avoid fulfilling the missing elements of ‘ecosystem’
  - Such as incubators, public venture funds, tech transfer centers