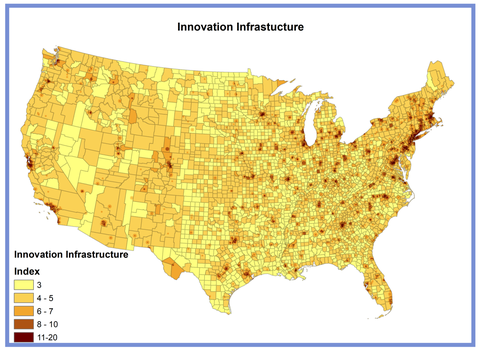
Put Your Thinking Clusters On:

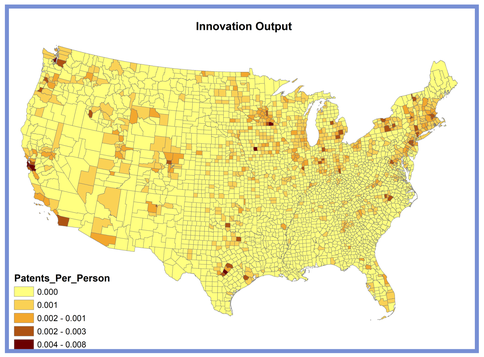
Identifying Regional Opportunities for Innovation Investment

Introduction

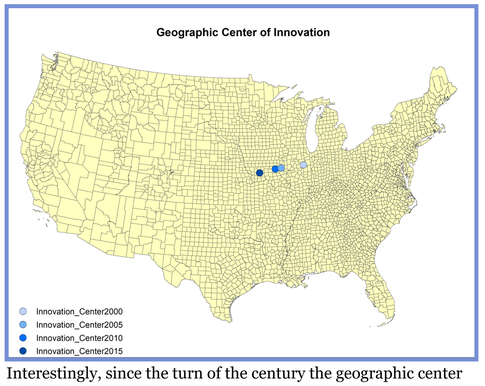
Innovation is a complex process. Successful innovation is the secret sauce of all strong economies. The raw creation of knowledge isn't enough, it must be applied. When looking at national innovation systems it is customary to look at research budgets and the like, but so long as humans are the creative power, place will loom large over the process. Michel Callon, *et al* (1994) argued that true innovation requires the overlap of expertise, or in other words, the scientist needs to run into the engineer, and the engineer into the entrepreneur. This poster explores the geography of innovation.



Above is a map of National Innovation Infrastructure. Fortune 1000 firms and Universities are given influence that diminishes with distance. To these ingredients is added Graduate Degree density. Dark areas correspond to innovation infrastructure rich environments.



Judging the success of a cluster requires a way to quantify innovation. No proxy is perfect but Utility Patents are a useful guide. Above is a national county map of per person patent output. Productive patent areas seem to correspond to regions with high innovation infrastructure index values.

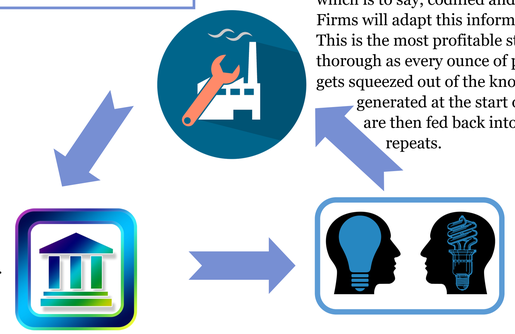


Interestingly, since the turn of the century the geographic center of American Innovation as measured by patents has shifted west.

Tufts

Cartographer: Sean Hogan
Produced: May 8, 2018
Intro. to GIS
Projections: NAD 1983-2011 USA Albers Equal Area, NAD 1983-2011 Massachusetts State Plane Lambert Conformal Conic

The Innovation Cycle



#1: Knowledge is created. This is the first and most open-ended phase of the Innovation cycle. Areas with high University density are well prepared for this phase.

#2: Knowledge is the absorbed by the workforce and begins to be applied. Areas rich in educated workers are better able to absorb and apply the knowledge generated at the University level.

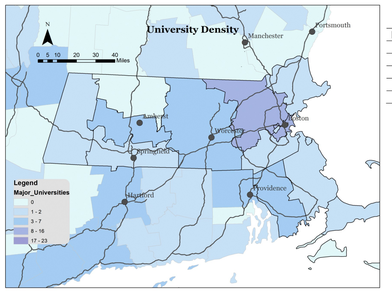
#3: Knowledge becomes information, large scale application and commercialization begins. Knowledge is more likely to become "information", which is to say, codified and easily transmissible. Firms will adapt this information, and build on it. This is the most profitable stage, and the most thorough as every ounce of productive possibility gets squeezed out of the knowledge that was generated at the start of the cycle. The fruits are then fed back into phase one and the cycle repeats.

Method

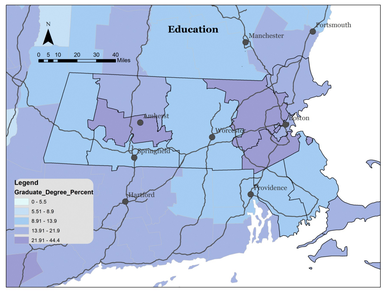
Innovation Cycle Stage	Stage Proxy
Knowledge Created	Universities, Geocoded
Knowledge Absorbed	Graduate Degree Percent, County Level
Knowledge Codified and Applied	Fortune 1000 Firms, Geocoded
Resulting Innovation	Utility Patents, 2015 County Level

Below are three maps of Massachusetts for each of the Innovation Proxies. For ease of comparability, locational data of Firms and Universities have been converted to county level densities.

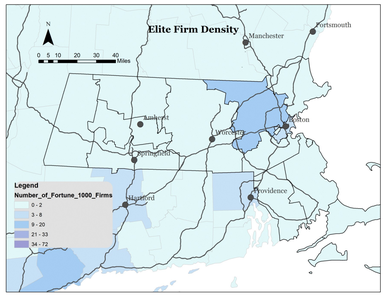
To create the final maps, distance radii for Universities and Schools were calculated. Each of the three proxies was then converted to a raster format and reclassified. Paired with each map is the reclassification scheme that would ultimately produce the Innovation Infrastructure Index.



Universities	
Distance (km)	Index
1	5
5	4
10	3
20	2
>20	1

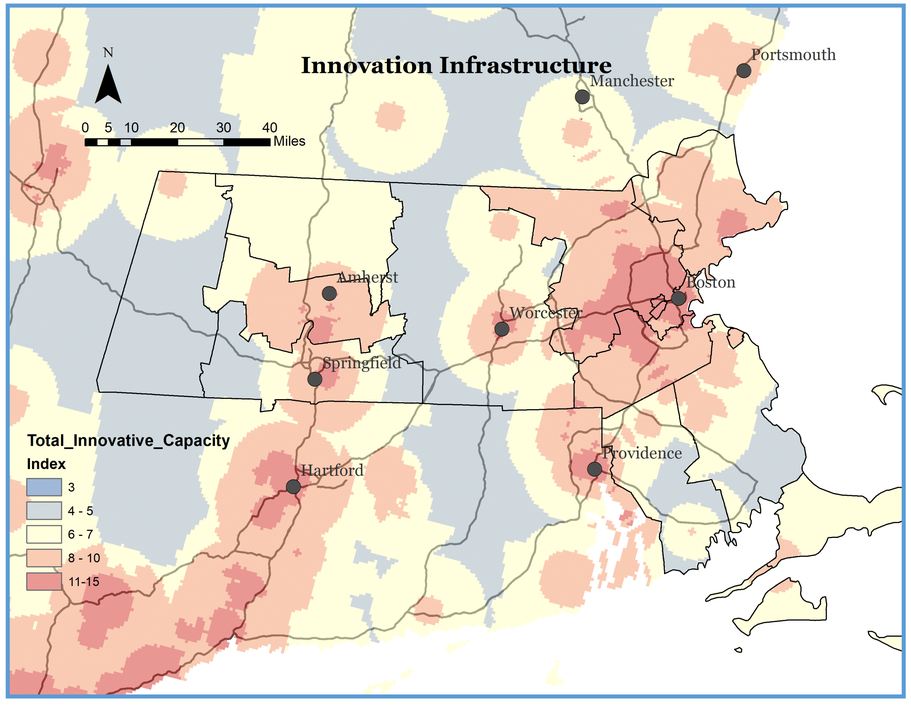


Grad Degree Holders	
Percent	Index
25	5
20	4
15	3
10	2
5	1

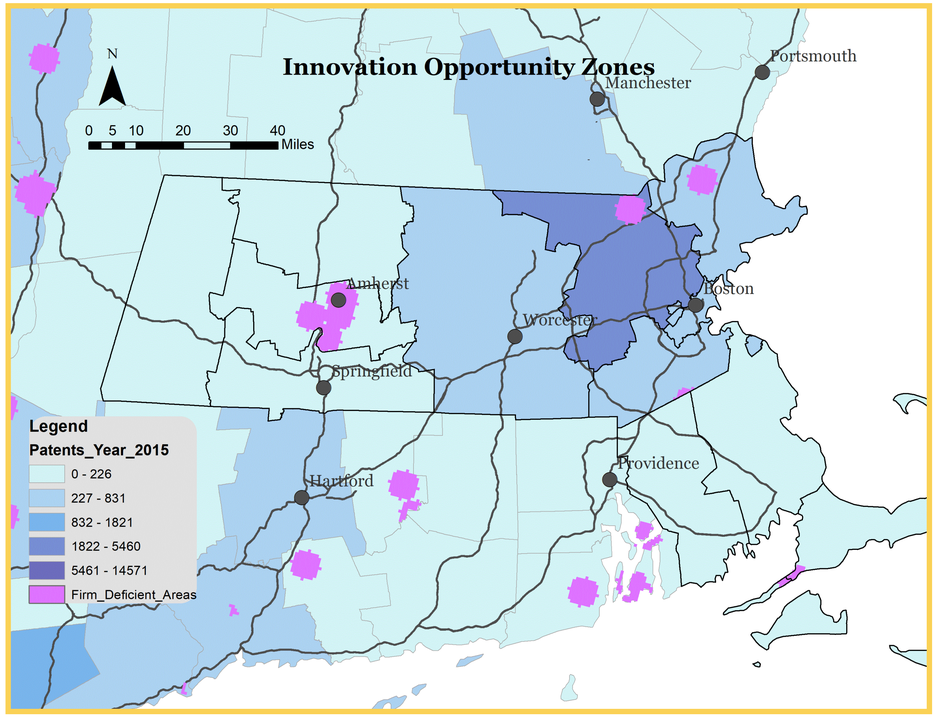


Fortune 1000s	
Distance (km)	Index
1	5
5	4
10	3
20	2
>20	1

Combined Assessment of Innovative Areas



Results & Discussion



The map above highlights areas that are rich in all but one of the ingredients (Firms) in a successful innovation cluster.

Firms, in some ways, are the most mobile of the three. Policy makers interested in attracting firms to Massachusetts, would get the greatest innovative returns by encouraging major companies to locate to the highlighted areas, like adding fuel to a fire.

Data Sources

US Counties	This is a simple polygon layer of US counties	Tiger 2015
Education Institutions	A point map of Educational Institutions in the US	USGS 2010 National Science Foundation University R&D Rankings
Patents	Patents filed by county	USPTO 2000-2015
Demographic Data	Demographics by county from the census	American Fact Finder 2015
Firm Data	Firm size by number of people employed	American Fact Finder 2015 Fortune 1000

Selected References

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