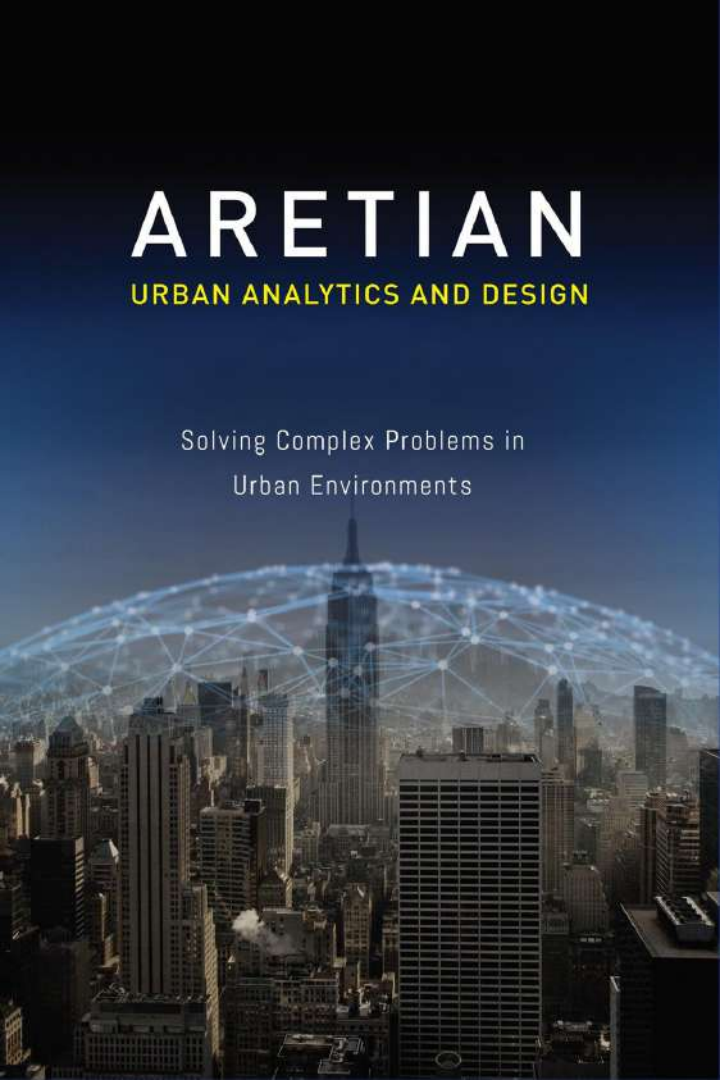
A New Science of Cities

The Atlas of Innovation Districts

JEREMY BURKE | RAMON GRAS
ARETIAN | HARVARD UNIVERSITY

SMART CITY EXPO WORLD CONGRESS

NOVEMBER 21ST, 2019



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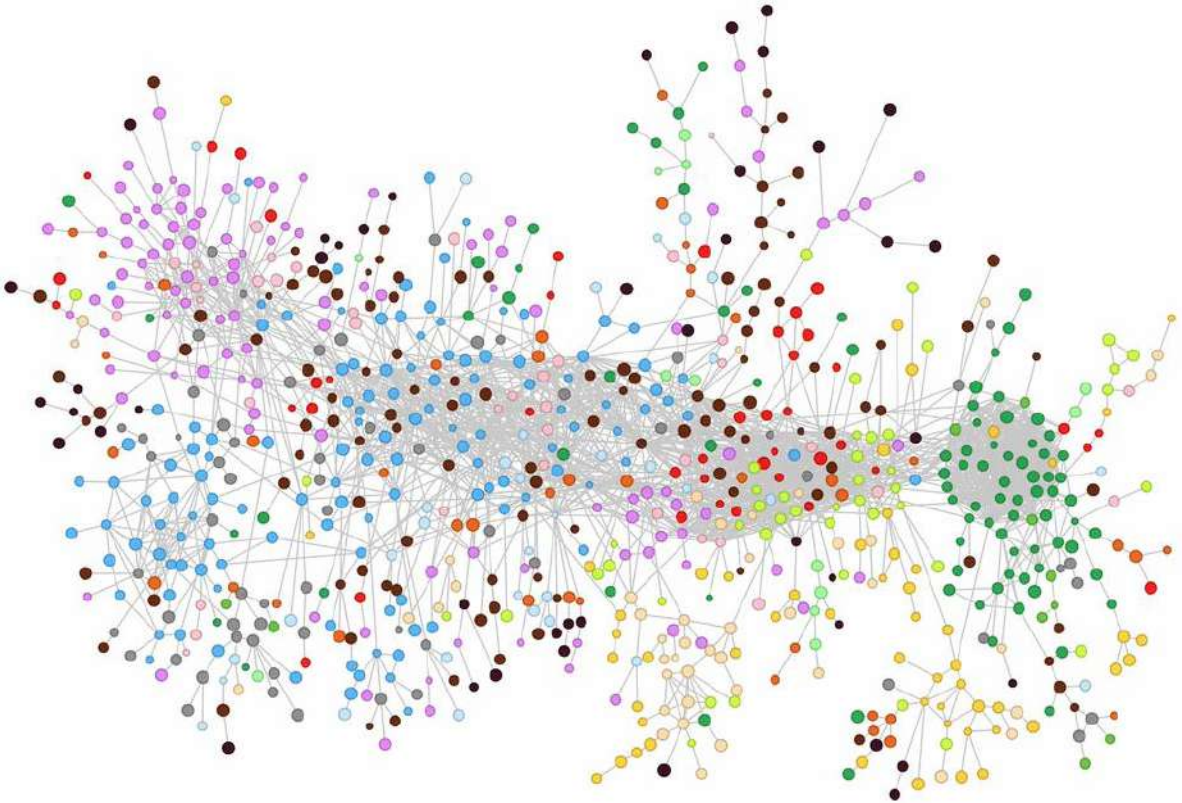
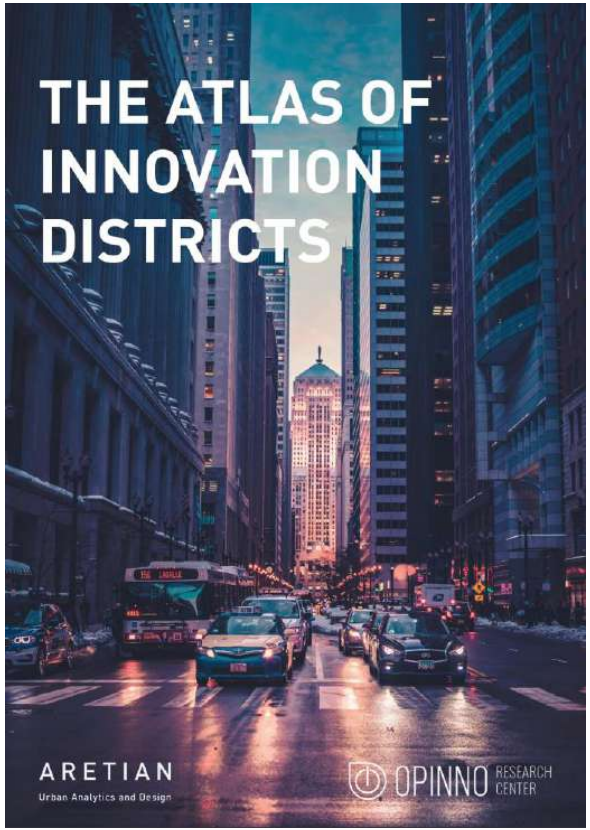
ECONOMIC COMPLEXITY OF AN URBAN REGION



How do innovation districts contribute to propel distributed prosperity?

THE ATLAS OF INNOVATION DISTRICTS



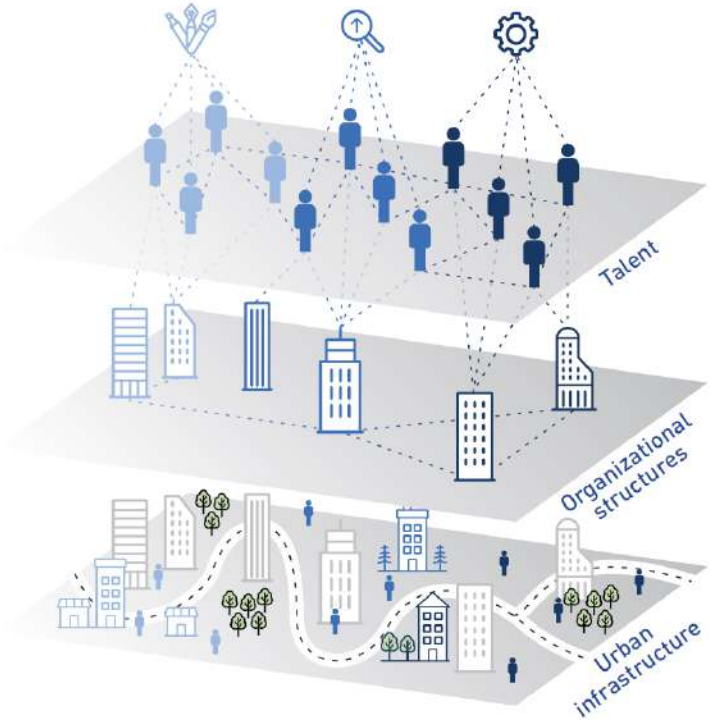
MIT Technology Review

Aretian has developed the very first Atlas of Innovation Districts.

"We welcome academic studies and methodologies that help us to better inform strategic decisions that accelerate innovation."

Israel Ruiz | Executive Vice President of MIT

NETWORK ANALYSIS OF URBAN ENVIRONMENTS



IF WE CAN MODEL THE NETWORKS

THAT CREATE INNOVATION

WE WILL BE ABLE TO BETTER UNDERSTAND

HOW TO PROVIDE SUPPORT TO INNOVATION NETWORKS

AT 3 FUNDAMENTAL SCALES

LEARNING FROM BEST PRACTICES AND MALPRACTICE

Boston Seaport

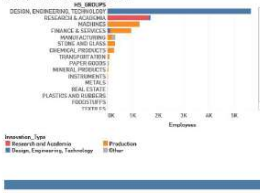
Boston, MA | 42.34375, -71.04344

ID Type: Local Government

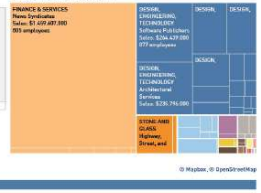
INNOVATION INTENSITY	48,638 Employees	10,505 Employees in innovation	23.71% Max (%) of knowledge-intensive job concentration	21.60% Innovation Intensity (%) innovative employment	12.07% Tech Transfer Innovation Focus
INNOVATION PERFORMANCE	30.89% Percent of sales from innovation	3.42% Percent of sales from R&D (estimate)	57.23% Percent of sales from patents (estimate)	13.45% Percent of sales from new products (estimate)	44.49% Percent of sales from new services (estimate)
INNOVATION IMPACT	$8,014,473 Total Sales from Innovation per resident ($)	$192,461 Total Sales From Innovation per employee ($)	1.9% Unemployment Rate (%)	52,525 Induced Jobs (additional support jobs created in the economy)	0.45 Meritocracy Index: Avg Household Income/Avg Net Worth

The Boston Seaport Innovation District was launched in 2010 by then-Mayor Thomas Menino with a vision of creating a hub for knowledge workers and creative jobs. In this vision, the city of Boston itself was to play host to a dense cluster of innovators, entrepreneurs, accelerators, and related services. Based on the example of 22@, the first innovation district conceived in Barcelona Spain, the Seaport development has already led to the creation of over 5,000 new jobs, 200 new companies, and over a thousand new housing units in the area.

Employment: Phases of Innovation



Sales: Industry Breakdown



Silicon Alley, NY

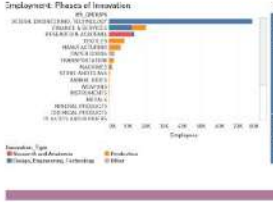
New York, NY | 40.75070, -73.98884

ID Type: Entrepreneurial

INNOVATION INTENSITY	681,472 Employees	134,152 Employees in innovation	67.26% Max (%) of knowledge-intensive job concentration	19.69% Innovation Intensity (%) innovative employment	13.51% Tech Transfer Innovation Focus
INNOVATION PERFORMANCE	17.07% Percent of sales from innovation	2.52% Percent of sales from R&D (estimate)	44.67% Percent of sales from patents (estimate)	9.71% Percent of sales from new products (estimate)	34.09% Percent of sales from new services (estimate)
INNOVATION IMPACT	$5,575,890 Total Sales from Innovation per resident ($)	$240,726 Total Sales From Innovation per employee ($)	2.3% Unemployment Rate (%)	670,760 Induced Jobs (additional support jobs created in the economy)	0.34 Meritocracy Index: Avg Household Income/Avg Net Worth

The dot-com boom fueled rapid growth of tech companies in the 1990's. The following bust and recession slowed this growth but New York's vision to be an innovation hub remained. In 2011 the city invested $2 billion to reinforce it's homegrown applied research capabilities. Key industry investments followed when Google built it's 2nd largest office and Verizon finished a $3 billion upgrade to the city's fiber optic infrastructure. Silicon Alley is a thriving entrepreneurial hub with a large tech workforce and billions in venture capital.

Employment: Phases of Innovation



Sales: Industry Breakdown

Pittsburgh Innovation District

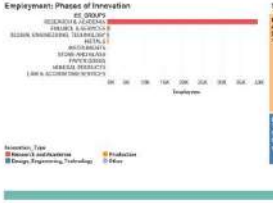
Pittsburg, PA | 40.44201, -79.95129

ID Type: Research & Academia

INNOVATION INTENSITY	85,603 Employees	40,999 Employees in innovation	90.57% Max (%) of knowledge-intensive job concentration	47.89% Innovation Intensity (%) innovative employment	45.90% Research & Academia Innovation Focus
INNOVATION PERFORMANCE	5.99% Percent of sales from innovation	2.34% Percent of sales from R&D (estimate)	37.98% Percent of sales from patents (estimate)	10.19% Percent of sales from new products (estimate)	30.08% Percent of sales from new services (estimate)
INNOVATION IMPACT	$239,205 Total Sales from Innovation per resident ($)	$38,339 Total Sales From Innovation per employee ($)	8.5% Unemployment Rate (%)	204,995 Induced Jobs (additional support jobs created in the economy)	0.40 Meritocracy Index: Avg Household Income/Avg Net Worth

The Pittsburgh Innovation District has its roots in the city's industrial past as a center of the US steel manufacturing industry. With deep industrial know-how and a strong academic anchor institution in Carnegie Mellon University and the University of Pittsburgh, Pittsburgh has built itself into a leading innovator in robotics and hub for major technology companies. Following the collapse of the steel industry in the late 1970s and early 1980s, Pittsburgh's economic resurgence can be credited in part to the city's systematic efforts to support an innovation ecosystem.

Employment: Phases of Innovation



Sales: Industry Breakdown

INNOVATION DISTRICT SUMMARY

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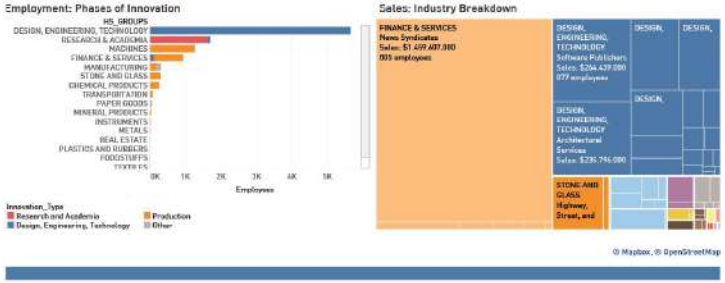

NETWORK OF URBAN INFRASTRUCTURE

- Urban Design characteristics
- Network topology, morphology, entropy
- Accessibility, desirability, amenities

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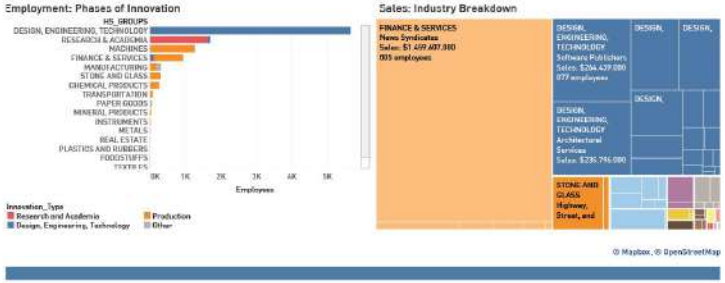

NETWORK OF TALENT

Innovation Intensity: knowledge-intensive jobs

Innovation Performance: tangible outcome

Innovation Impact: societal benefits

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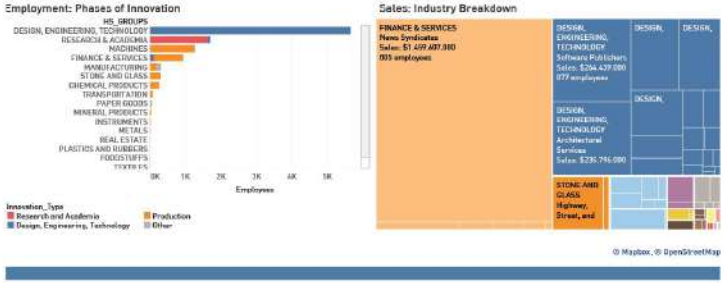


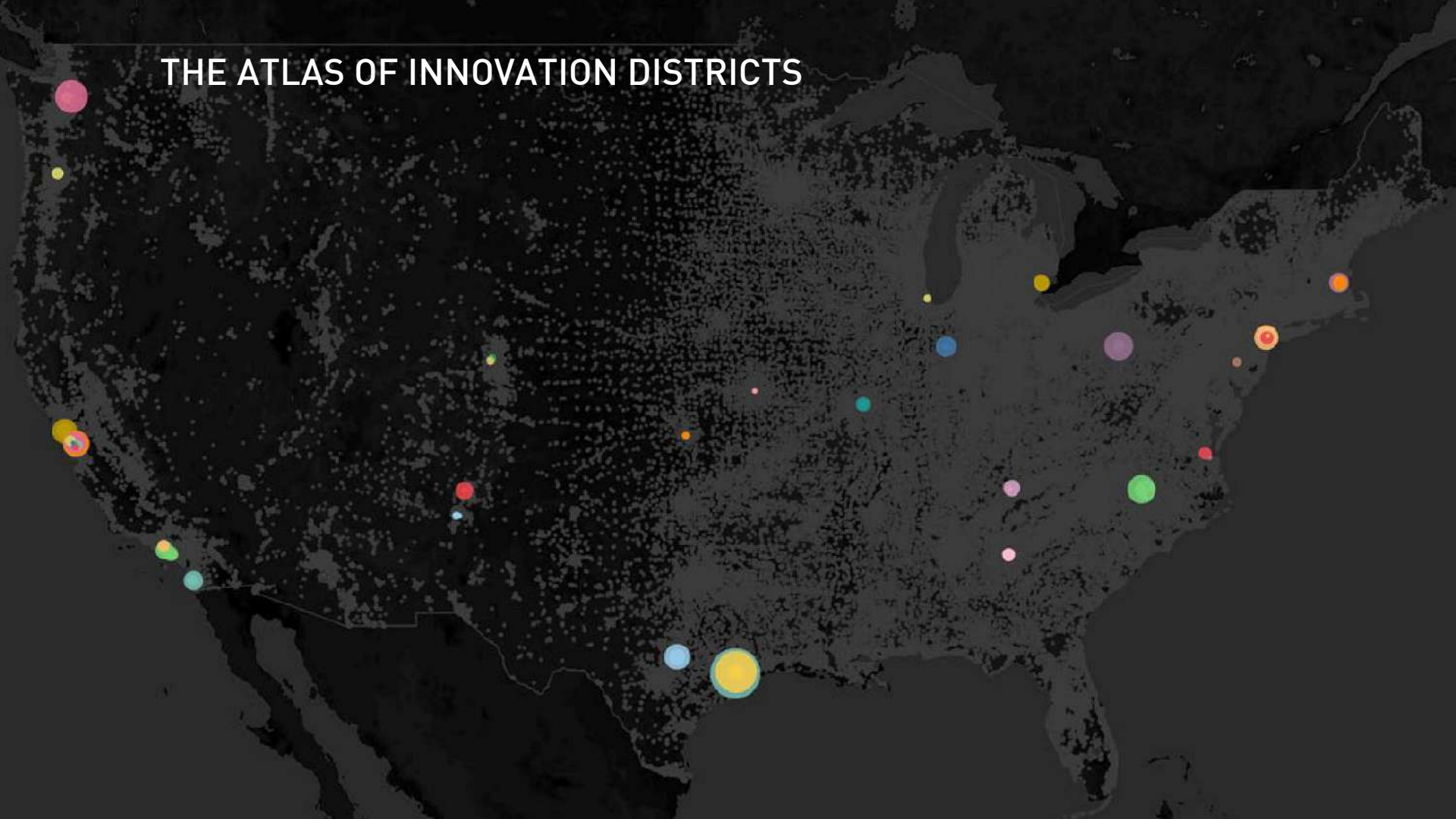
NETWORK OF INDUSTRIES

Industry Concentration – competitiveness

Industry Sophistication – comparative advantage

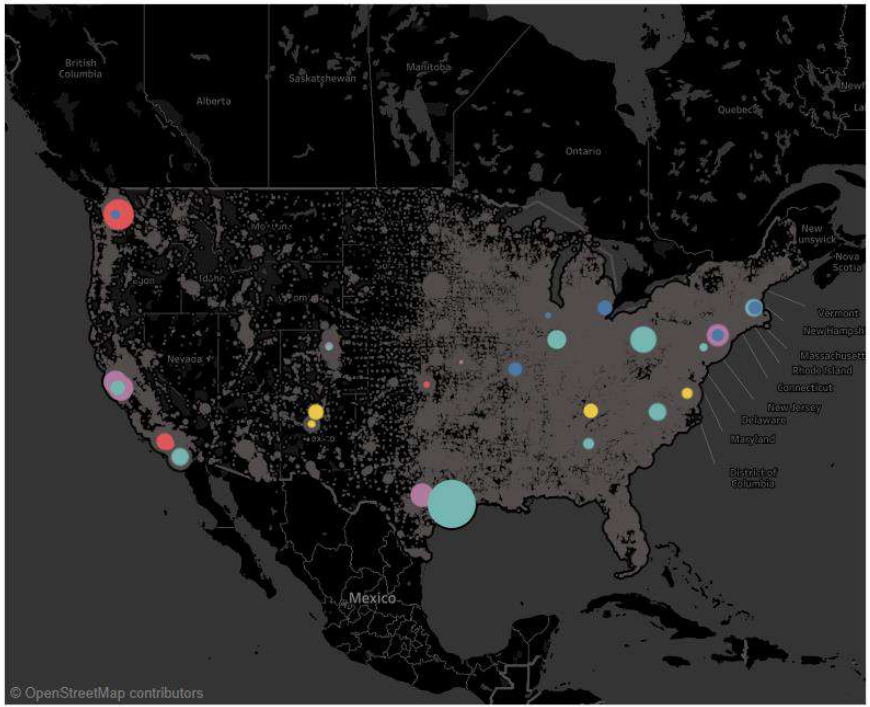
Industry Relatedness – growth opportunities

THE ATLAS OF INNOVATION DISTRICTS

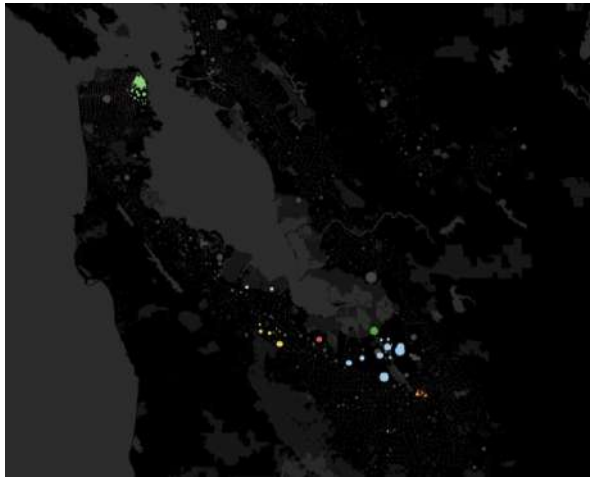


DISCOVERIES FROM ANALYZING INNOVATION DISTRICTS

Atlas of Innovation Districts | Clusterting: 5 Anchor Institutions | USA



ID_Type
- CityGovernment
- ResearchAcademicAnchor
- BottomUp
- IndustryCluster
- StrategicGovernmental
- Regular



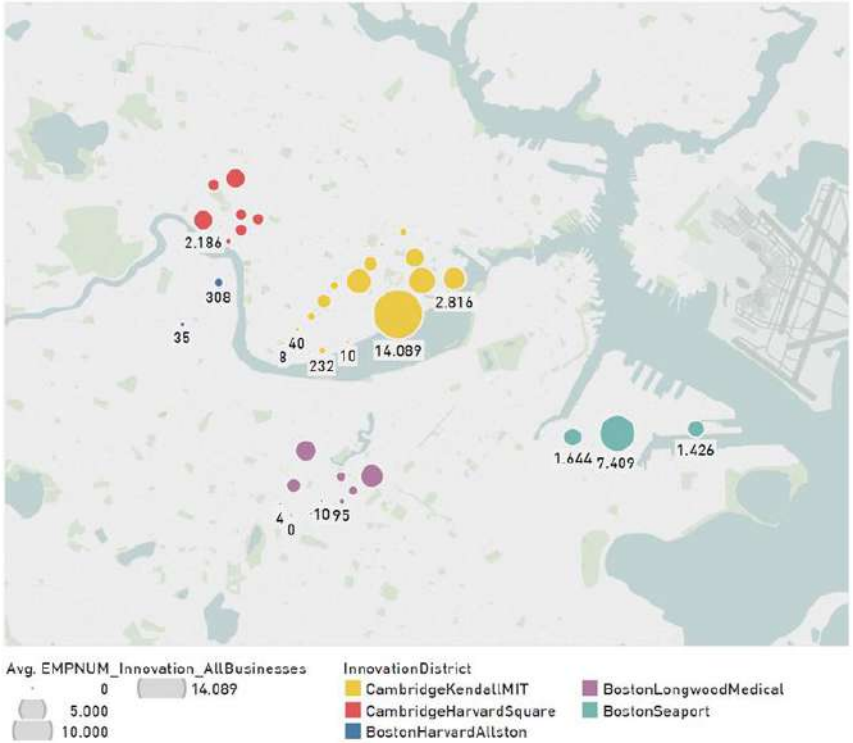
HIGH PERFORMANCE
Innovation Districts generate:

Per employee:
~ 3.4x more innovations

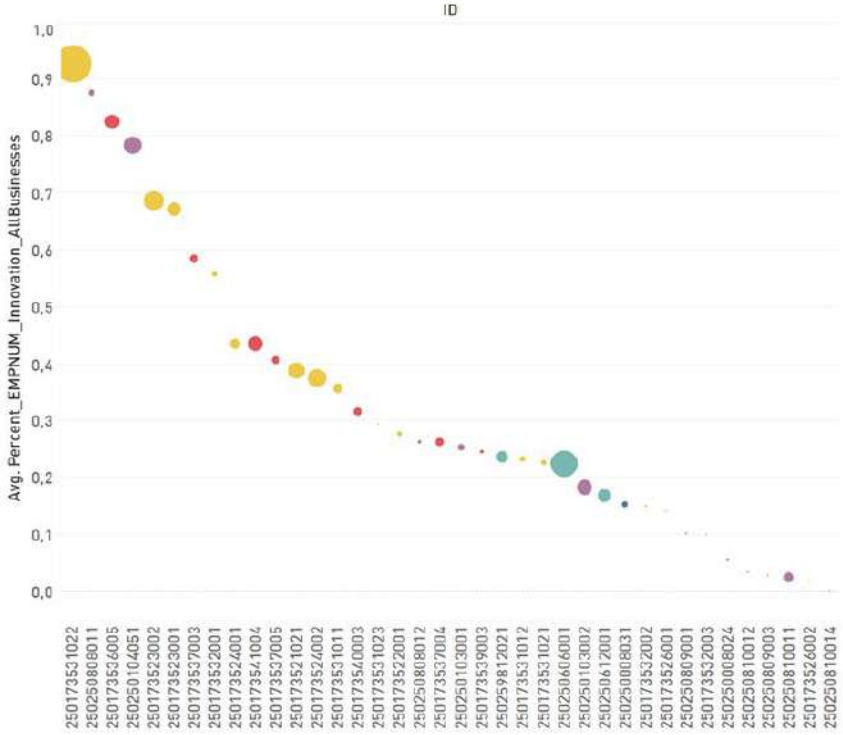
Per resident:
~9x more employment per resident
~ 15x more knowledge-intensive employment
~ 20x more wealth per citizen and induce
~ 5x support job creation

MEASURING INNOVATION INTENSITY, PERFORMANCE, IMPACT

USA | Innovation Campuses | Innovation Employees per Building Block | Boston Area

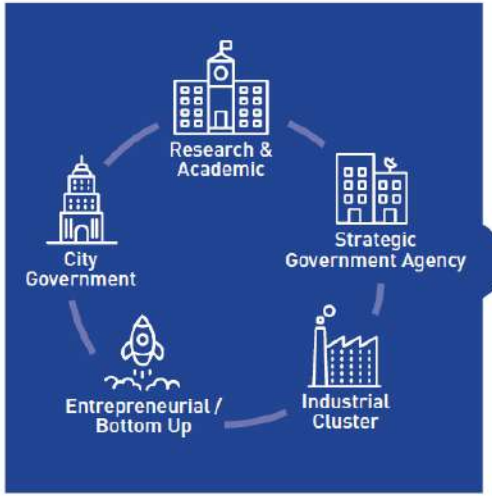


USA | Innovation Campuses | Percent of Innovation Employees per Building Block | Boston Area



INSIGHTS: CAUSE-AND-EFFECT RELATIONSHIPS

Anchor District



Urban Design

Urban Design

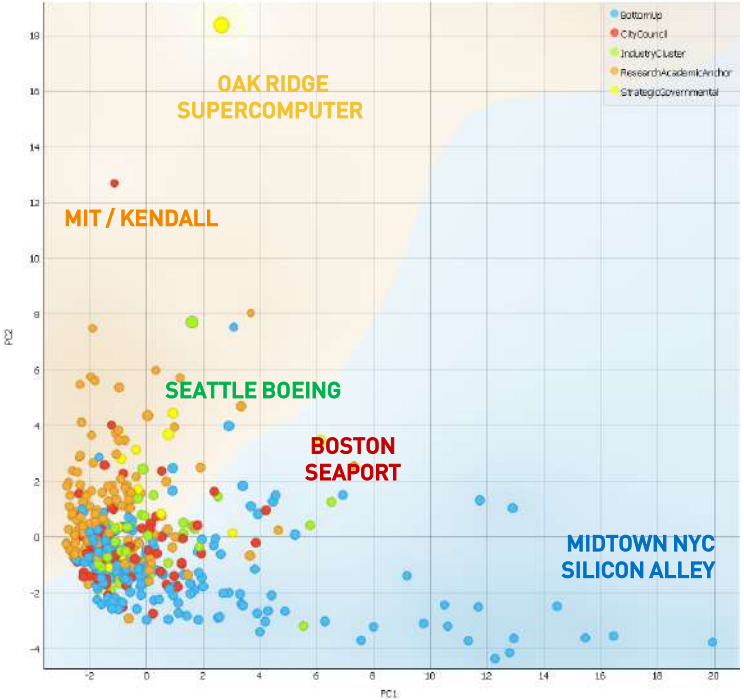
- What amenities are there?
- How attractive is the space?
- How accessible is the · district to other parts of the city?
- How dense is the district?

Geospatial Effects

Geospatial

- What are the outflow consequences at the regional, district, and architectural level?
- What are the benefits?
- What are the negative externalities?

INSIGHTS: KEY DRIVER IS THE ANCHOR INSTITUTION



CITY GOVERNMENT - TOP DOWN

- HIGH DESIRABILITY / LIVEABILITY
- BALANCE BETWEEN EMPLOYMENT & HOUSING

ACADEMIC ANCHOR - TECH TRANSFER

- HIGHER % IN NEW PRODUCTS, SERVICES
- PATENTS, INCOME FROM PATENTS

ENTREPRENEURIAL - BOTTOM UP

- HIGHER WAGES, HIGHER INCOME INEQUALITY
- URBAN PLANNING CHAOS

INDUSTRY CLUSTER

- STRONG INDUSTRY CONCENTRATION / CLUSTERING
- HIGHER EMPLOYMENT GENERATION

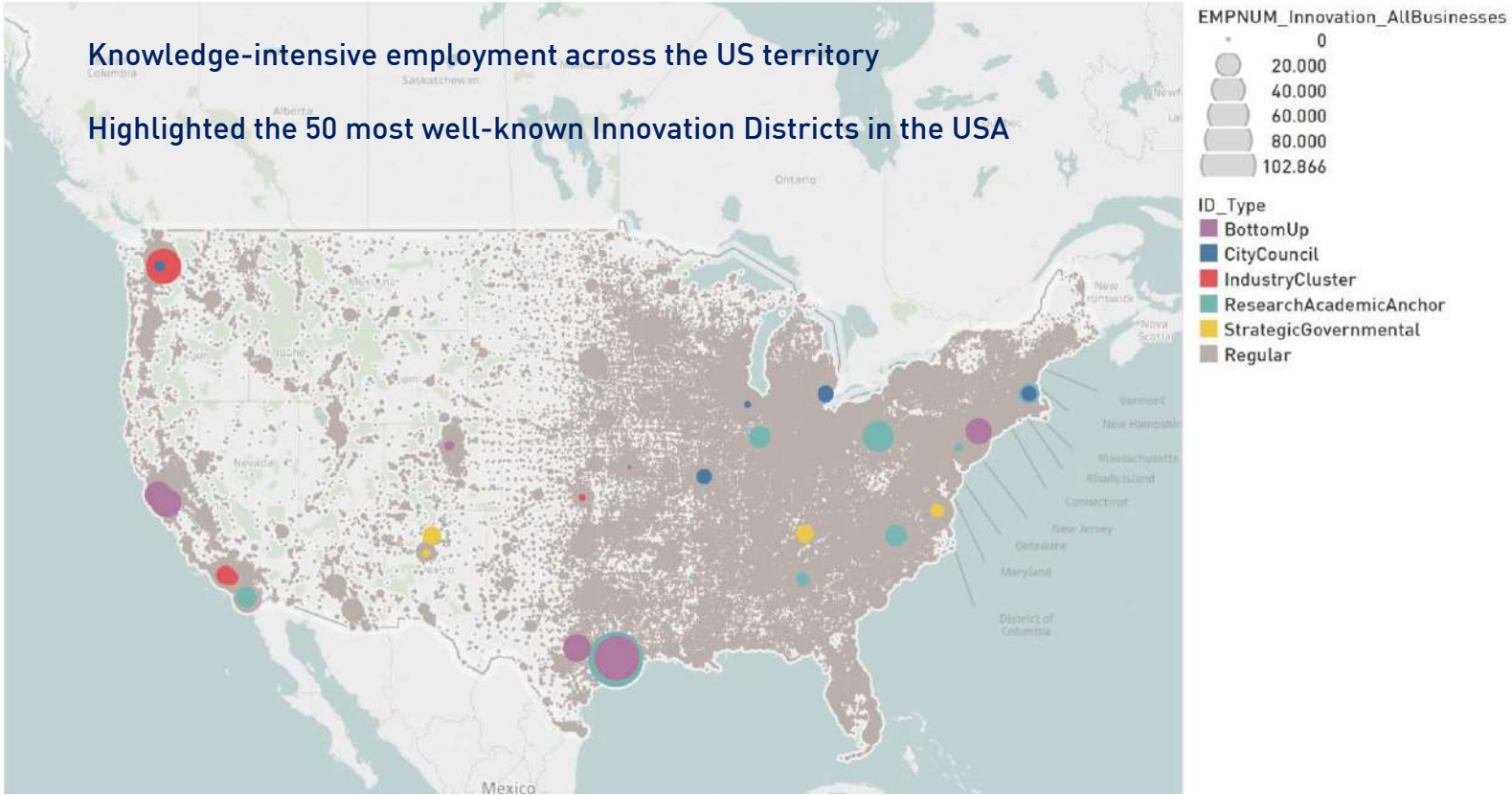
STRATEGIC GOVERNMENTAL AGENCIES

- ULTRA FOCUSED HIGH PERFORMANCE
- HIGHER ISOLATION, LESS DESIRABILITY, LESS COMMUNITY

The anchor institution shapes the type of innovation district and its characteristics

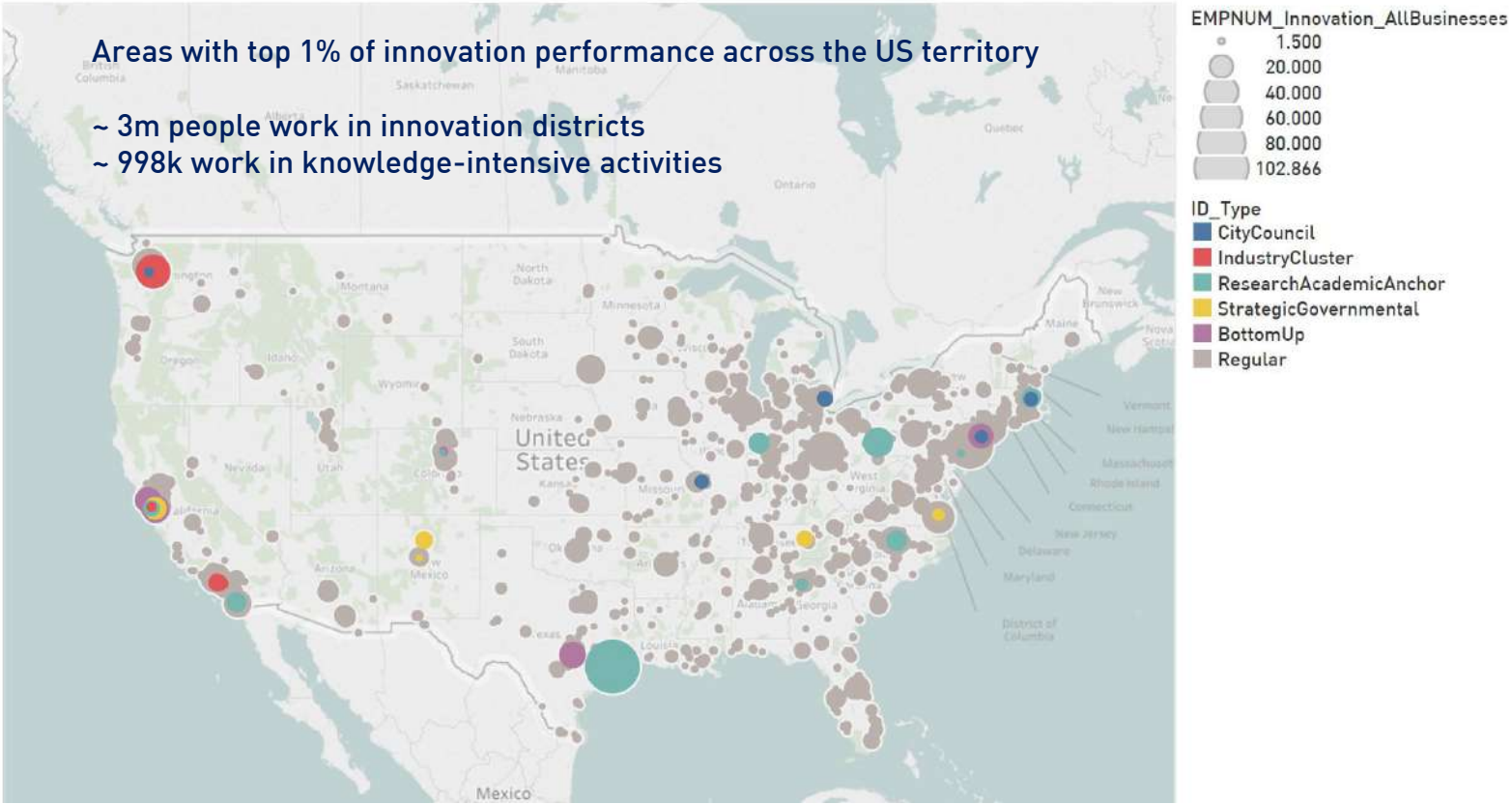
LOCATION INSIGHTS: IDENTIFY TOP 1% IN INNOVATION INTENSITY

Employees in Innovative Businesses

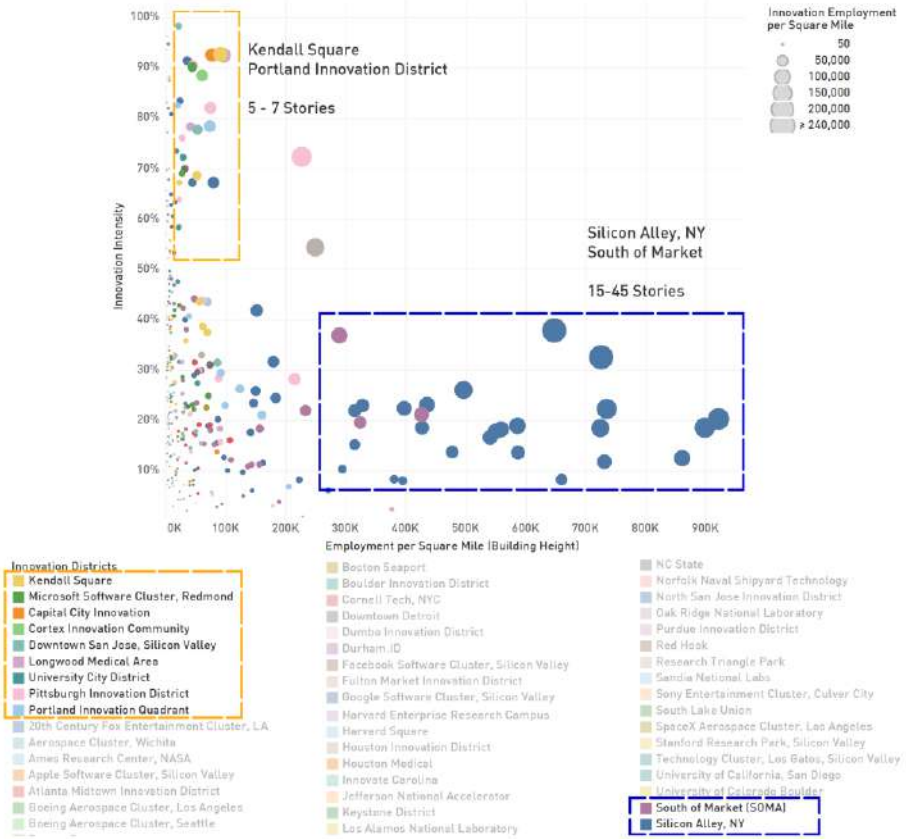


LOCATION INSIGHTS: IDENTIFY TOP 1% IN INNOVATION INTENSITY

Employees in Innovative Businesses | ID types |Innovation Impact Top 1%



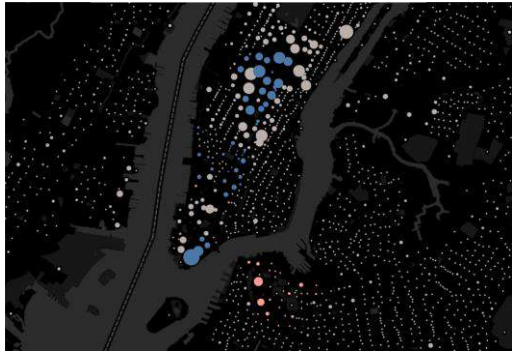
DESIGN INSIGHTS: URBAN DESIGN OPTIMIZATION CRITERIA



Innovation Intensity vs Building height
Optimal density 5-7 story buildings.

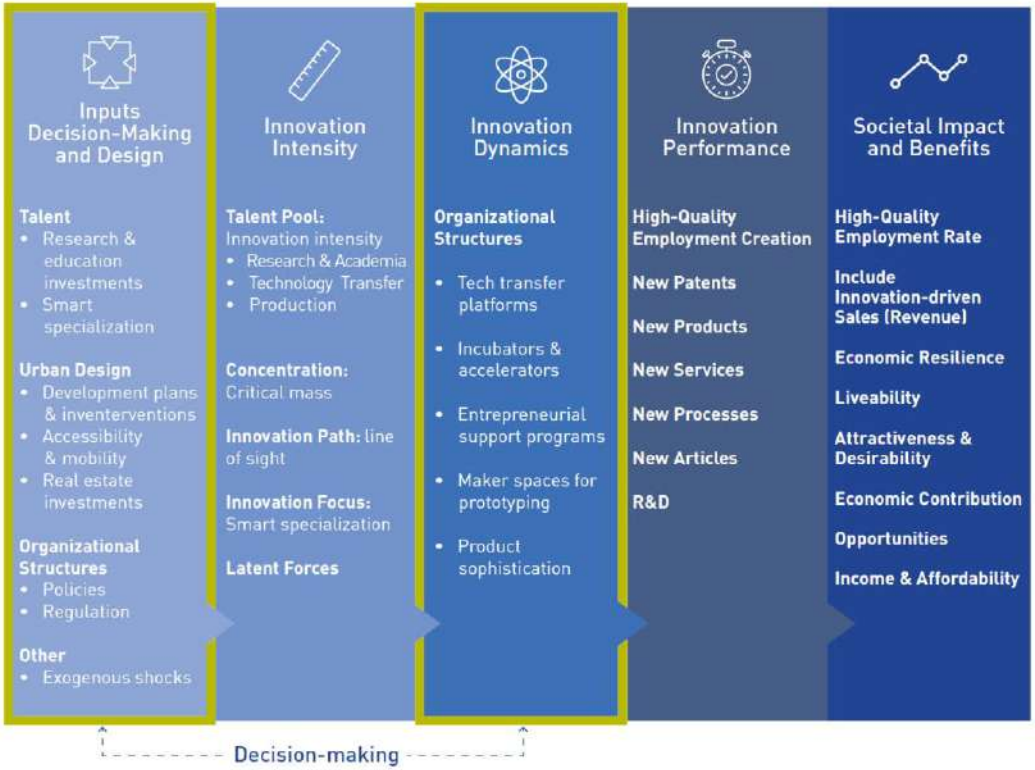
KENDALL / MIT

NY SILICON ALLEY



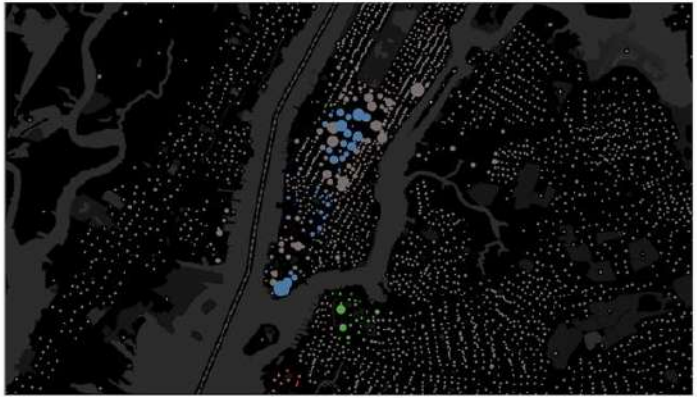
URBAN INNOVATION DISTRICTS: 5 PHASES FOR URBAN INNOVATION

CAUSAL RELATIONSHIPS BETWEEN DECISION-MAKING, INNOVATION PERFORMANCE AND SOCIETAL IMPACT

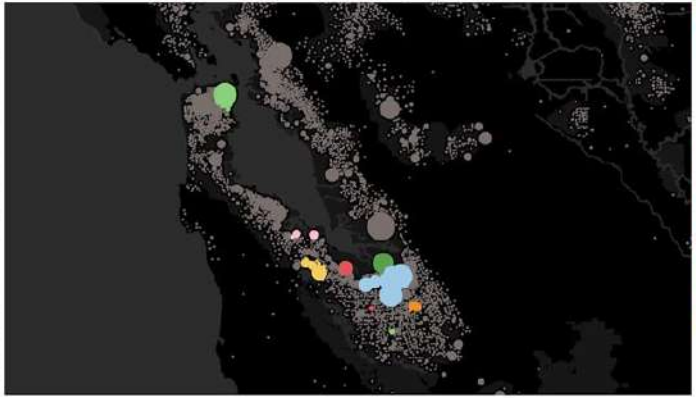


ANALOGOUS COMPARISONS BETWEEN URBAN AREAS

Innovation Campuses | New York Area



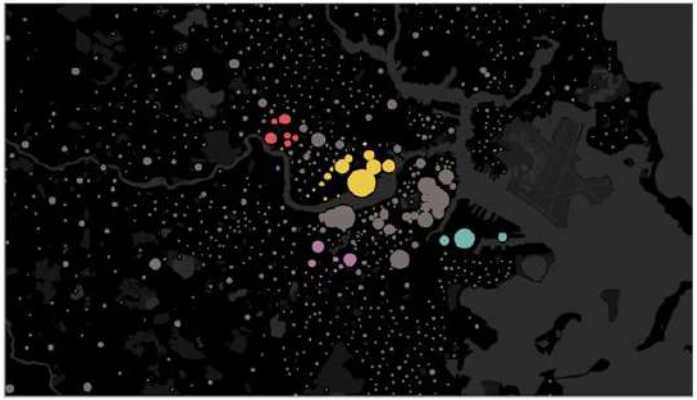
Innovation Campuses | San Francisco Bay Area



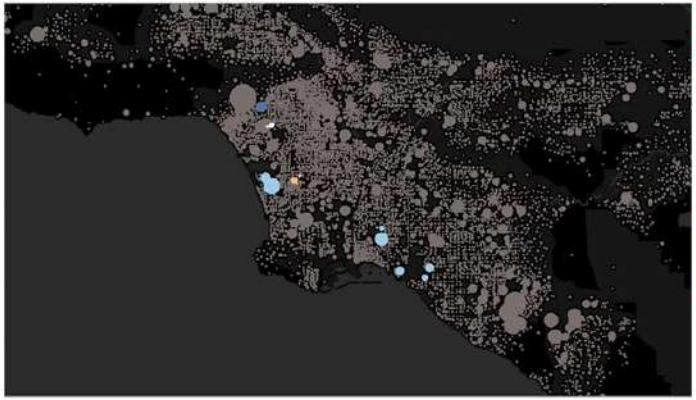
New York Area IDs
- NYCornellTech
- NYDumbo
- NYRedHook
- NYSiliconAlley
- Regular

SF Bay Area IDs
- Apple
- Facebook&Friends
- LosGatosTech
- SanJoseBoomerang
- SanJoseDowntown
- SF_NASA
- SF_SOMA
- SFGoogle
- StanfordTech
- Regular

Innovation Campuses | Boston Metropolitan Area



Innovation Campuses | Los Angeles Area



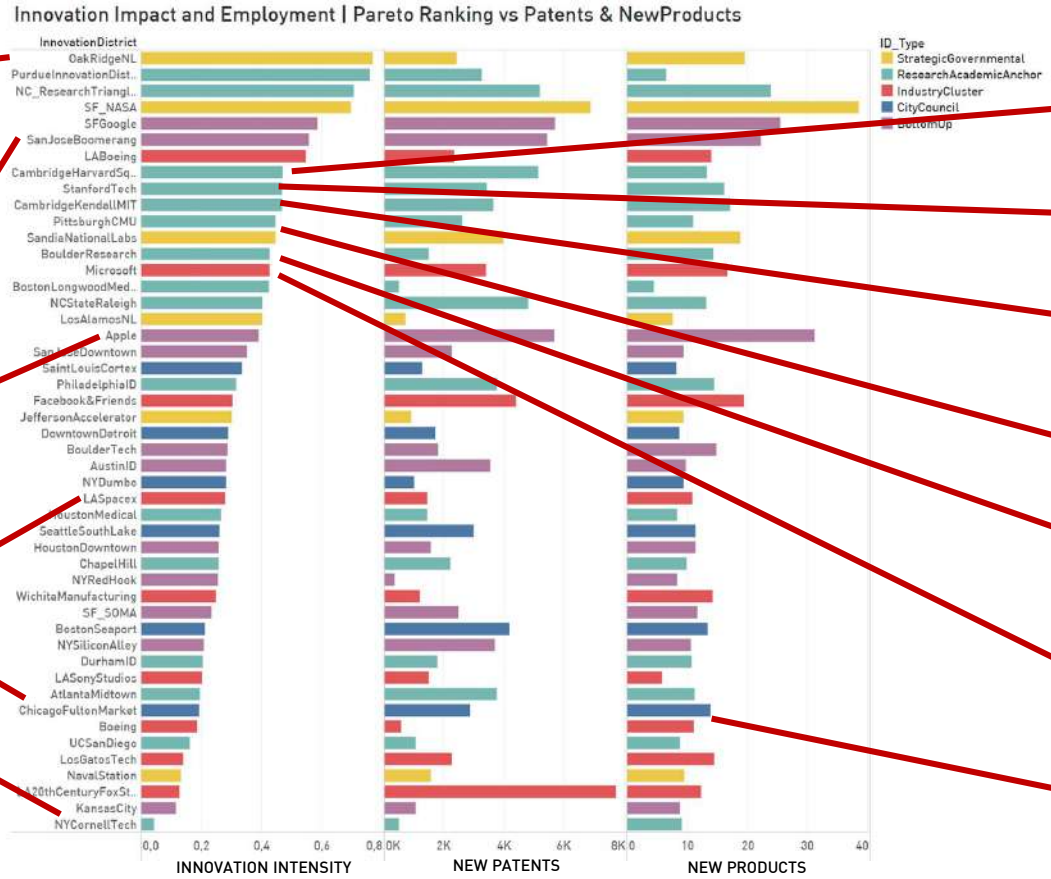
Boston Area IDs
- BostonHarvardAllston
- BostonLongwoodMedical
- BostonSeaport
- CambridgeHarvardSquare
- CambridgeKendallMIT
- Regular

Los Angeles Area IDs
- LA20thCenturyFoxStudio
- LABoeing
- LASonyStudios
- LASpacex
- UCSanDiego
- Regular

URBAN INNOVATION DISTRICTS: PHASING & NEEDS

HIERARCHY OF INNOVATION NEEDS: PHASING AND TIMING

INSIGHTS: PERFORMANCE OF INNOVATION DISTRICTS | USA



Oak Ridge National Laboratory

NASA

Google

SPACEX

FULTON MARKET DISTRICT

CORNELL TECH

HARVARD UNIVERSITY

Stanford University

Massachusetts Institute of Technology

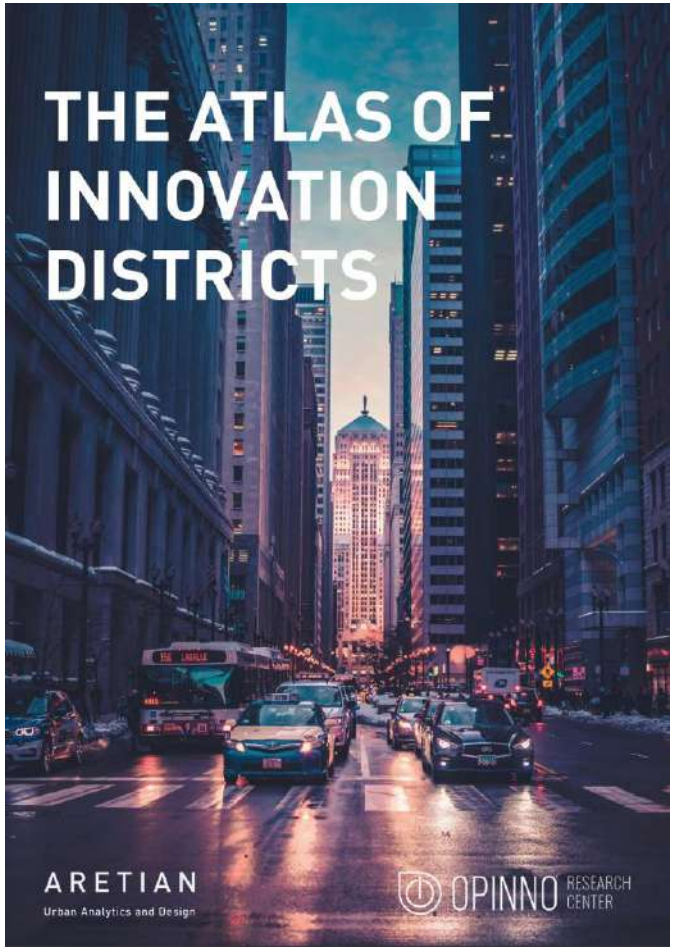
Carnegie Mellon University

Sandia National Laboratories

Microsoft

BOEING

OPPORTUNITIES TO APPLY THE LESSONS LEARNED

DISCUSSION, Q&A

THANKS!