Benchmarking Competitiveness:

How QWI can be used to identify areas with high concentrations of high technology employment and to assess the competitiveness of a region.

Local Employment Dynamics

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Why Define High Technology

- **Innovation is crucial to the economic competitiveness of firms, industries, regions, and the nation as a whole**

- **The empirical assessment of industrial innovative capacity is an essential tool necessary to benchmark competitiveness in the knowledge economy**

Defining High Technology Occupations and Industries

Patent Filings by Industry

- Patent-based assessment of innovative capacity assumes innovation to be based on marketable outcomes

Product Output by Industry

- Product approach requires expert assessment of comparable technical advantages of product attributes and performance
- Difficulty in reproducing ranking or measurement of differences in attributes

R&D Expenditure by industry

- Difficult to parse out the costs specific to R&D.

Technology-Oriented Occupations and Industries

- Publicly available data on occupations nationally and by industry
- Difficulty in linking work directly to technology embedded in processes or embodied in products.

Resources for

Technology Oriented Occupations:

- Richie, Ricard W., Daniel Hecker, and John Burgan. “High technology today and tomorrow: a small slice of the employment pie”. Monthly Labor Review. 1983
- Identified High Technology SOC categories focused on scientists, engineers and technicians

Technology-Oriented Occupations by Industry:

- Hecker, Daniel. “High-Technology Employment: A NAICS-Based Update” Monthly Labor Review. 2005.
- Update on Technology-Oriented Occupations as basis for identifying High Tech Industries

Workforce Based Criteria of High Tech Industries

The Dynamic Nature of a Workforce Based Definition:

- Occupational composition of industries identified as high technology changes over time
- Percentage of employment in technology-oriented occupations will decline as products and processes move through a typical product cycle

Technology-Oriented Occupations

- Hecker identified occupations consistently involved in developing and applying technology
  - computer and mathematical sciences; architecture and engineering; life, physical and social science technicians; and selected management occupations.

Revision of Hecker's Occupational Definition

- Original 72 technology-oriented occupations
- Amended with 5 additional occupations
  - health care practitioners and technicians with comparable educational requirements

Methods and Datasets:

Occupational Employment Statistics (OES):

- 2009 OES basis for the national employment in technology-oriented occupations across all industries
- **The percentage of total employment in technology-oriented occupations across all industries was 5.4% across all industries**

Occupational Employment Statistics Cross Industry National Employment Matrix (CINEM) :

- 2009 CINEM to identify high technology industries - defined as those industries with 2x or higher proportion of employment in technology-oriented occupations
- 35 industries had a percentage employment of technology oriented occupations greater than twice the national average

Quarterly Workforce Indicators:

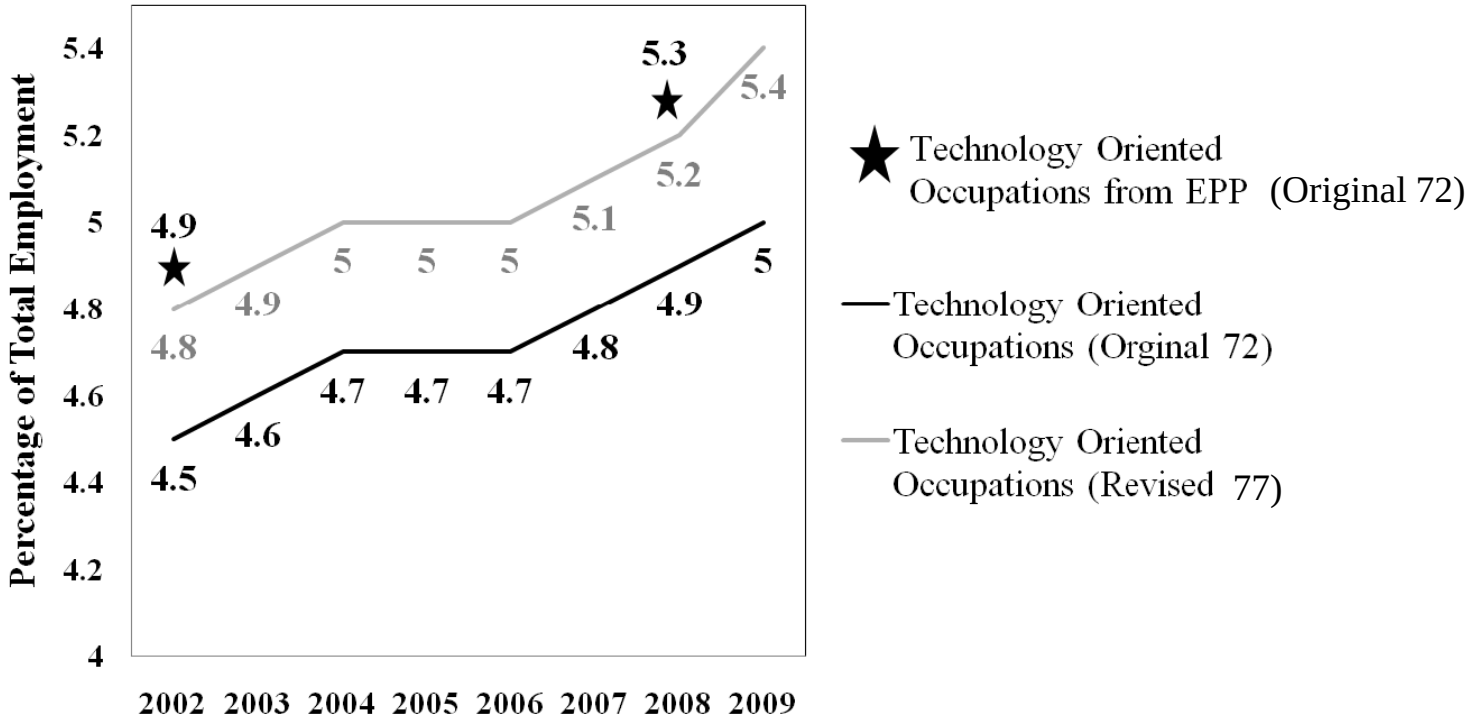
- Q4 2009 Used to identify counties with high concentrations of employment in high technology industries

National Technology-Oriented Employment

- Total % employed in Hecker original 72 occupations compared to amended 77 occupations using OES CINEM data, 2002-2009

- Total % employed using Employment Projection Program (EPP)

- EPP uses OES occupational composition and applies to additional self-employed workforce (EPP is not annual, excludes some industries, and does not archive data)

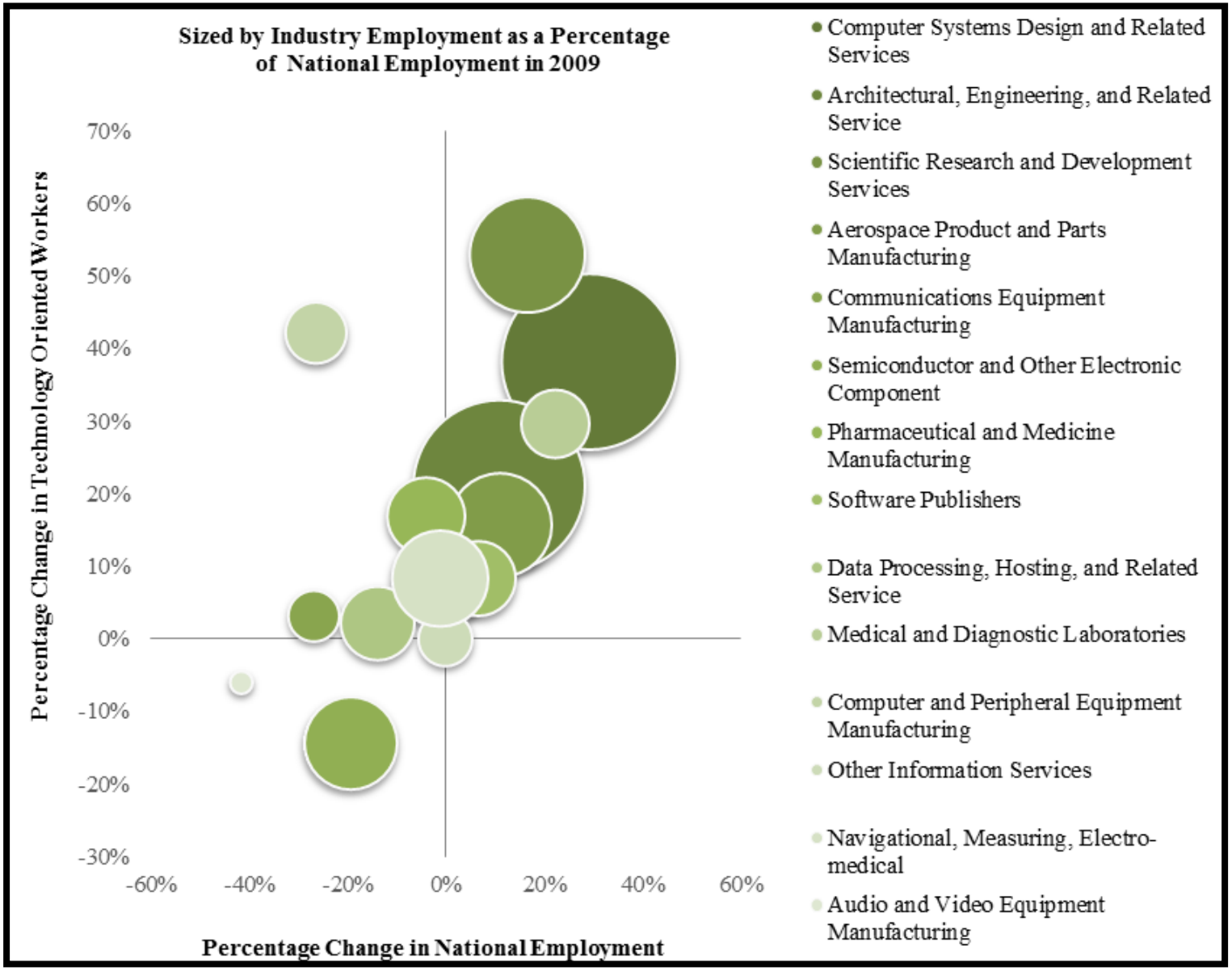


High-Technology Level 1 Industries in 2009

NAICS	Industry Description	Percent of Employment in Technology Oriented Occupations
5415	Computer Systems Design	61
5112	Software Publishers	54
5413	Architectural and Engineering Service	51
3341	Computer and Peripheral Equipment Mfg	50
5417	Scientific Research and Development	48
5182	Data Processing and Hosting	37
3342	Communications Equipment Mfg	36
3345	Navigational, Measuring, Electro-medical	34
3254	Pharmaceutical and Medicine Mfg	30
6215	Medical and Diagnostic Laboratories	30
3344	Semiconductor Component Mfg	28
3364	Aerospace Product and Parts Mfg	26
5191	Other Information Services	25
3343	Audio and Video Equipment Mfg	24

- **Level 1 industries had more than four times (>22%) the national average of percentage employment in technology-oriented occupations**

High Technology Level 1 Growth 2002-2009



High-Technology Level 2 in 2009

NAICS	Industry Description	Percent of Employment in Technology Oriented Occupations
5179	Other Telecommunications	22
2111	Oil and Gas Extraction	20
5416	Management and Scientific Consultants	18
4234	Commercial Equipment and Suppliers	18
5171	Wired Telecommunications Carriers	18
5211	Monetary Authorities Central Bank	17
3251	Basic Chemical Mfg	17
3332	Industrial Machinery Mfg	17
5172	Wireless Telecommunications Carriers	17
3333	Commercial Machinery Mfg	17

- **Level 2 industries had more than three times (>16.5%) the national average of the percentage employment in technology-oriented occupations**

High Technology Level 3 in 2009

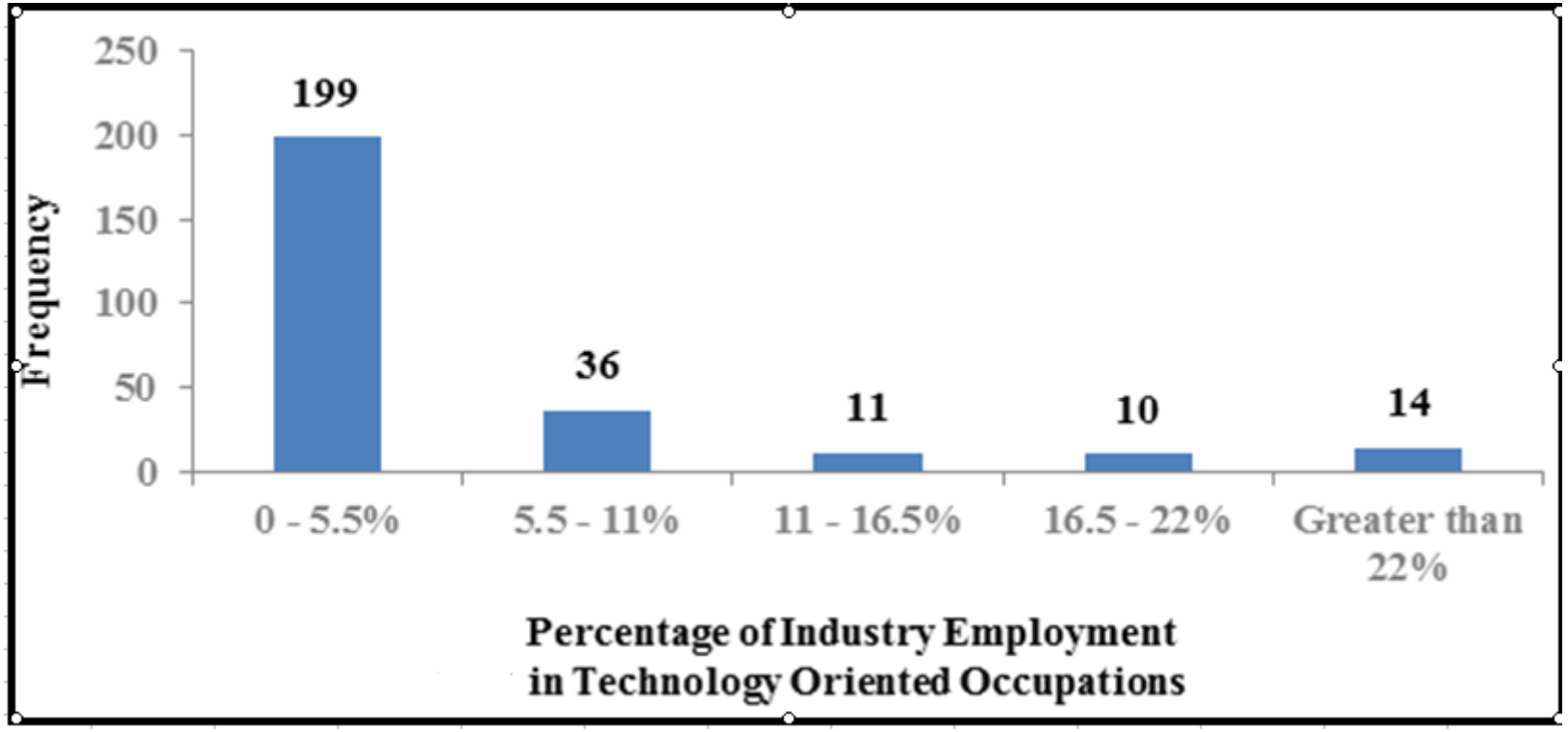
NAICS	Industry Description	Percent of Employment in Technology Oriented Occupations
5174	Satellite Telecommunications	15
5232	Securities and Commodity Exchanges	14
3252	Resin and Synthetic Rubber	14
5511	Management of Companies and Enterprises	14
3353	Electrical Equipment Mfg	14
2211	Electric Power Generation	13
4862	Pipeline Transportation of Natural Gas	13
3336	Engine, Turbine, and Power Equipment	13
3346	Mfg and Reproducing Magnetic	12
3255	Paint, Coating, and Adhesive Mfg	12
3339	Other General Purpose Machinery Mfg	12

- **Level 3 industries had more than three times (>11%) the national average of the percentage employment in technology oriented occupations**

Technology-Oriented Occupations by Industry 2009

Histogram of the 270 NAICS Industries (4-Digit)

- Nearly 54% of all employment in technology-oriented occupations are contained in the 35 industries that constitute Levels 1-3
- Levels 1-3 represent 9.5% of total national employment



Tools Used for Analysis

My SQL Community Server:

- A server side database installation

My SQL Work Bench:

- A client side database GUI with an SQL command line

Open Office Calc:

- A spread sheet program comparable but more flexible than Microsoft Excel

Weave software developed at UMass Lowell with the Open Indicators Consortium (OIC)

- High performance, highly interactive visualization environment for data exploration, advanced analysis and powerful dynamic presentation

For more information about the OIC see OpenIndicators.org
Regarding Weave contact Helen Lyons (helen_lyons@cs.uml.edu)

About Weave Software

The Fundamental Mission:

- Enable data visualization of any available data anywhere by anyone for any purpose with administrative and user control.

Web-Based Analysis and Visualization Environment (Weave):

- Increase access, distribution & use of public data
- Facilitate the understanding of complex patterns
- Support comparisons from micro to macro levels
- Foster collaboration to solve complex problems
- Encourage open innovation and creativity
- Enable transparency and accountability

Weave Software Levels of Access and Use

1) **General public:** Seeks summary information and narrative description

2) **Educators, planners, media:** Seeks more interaction and access to larger database

3) **Researchers, statisticians, experts:** Needs a high level of interactivity; explores the data by specifying parameters to configure "on the fly" data visualizations and maps; generates reports

4) **Expert users and web site developers:** Development of community & regional web sites for public use; collaborative planning, technical assistance, training

Location Quotient Defined

Location Quotient (LQ) measures the relative concentration of a certain industry or sector in a reference area

Employment LQ = ratio of the employment share between a sub-region's economy (e.g. county) and the reference region's economy (U.S. economy)

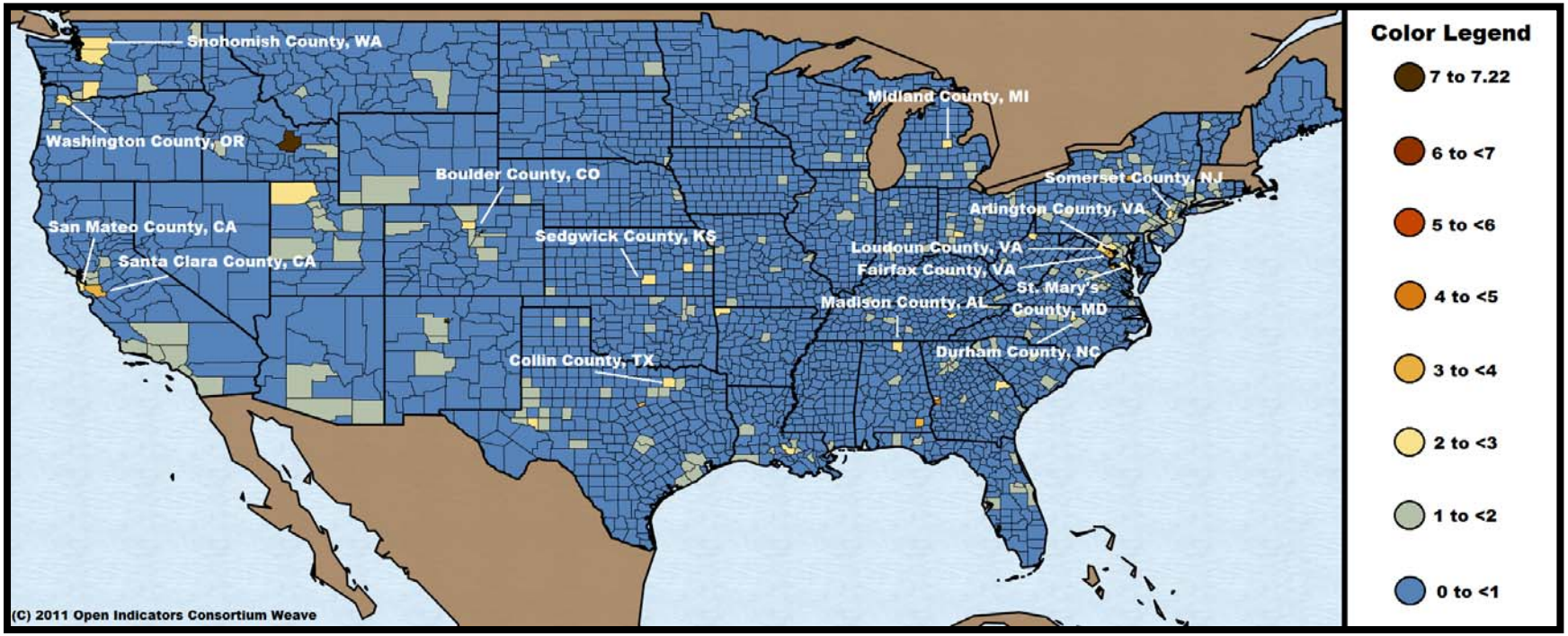
LQ =1 indicates the proportion of the employment share of an industry or sector is the same in the county and the country

A major limitation: LQ provides no information regarding the absolute scale of the industry in the sub-region

Employment in HT Levels 1-3 in 2009

- 15 urban counties with the largest location quotient of employment in Levels 1-3 constituted nearly 8% of national employment in these industries
- Employment in these counties constituted 2.8% of national employment across all industries
- Level 1-3 Employment in these counties constituted on average 25% local employment
- Average population of 250,000

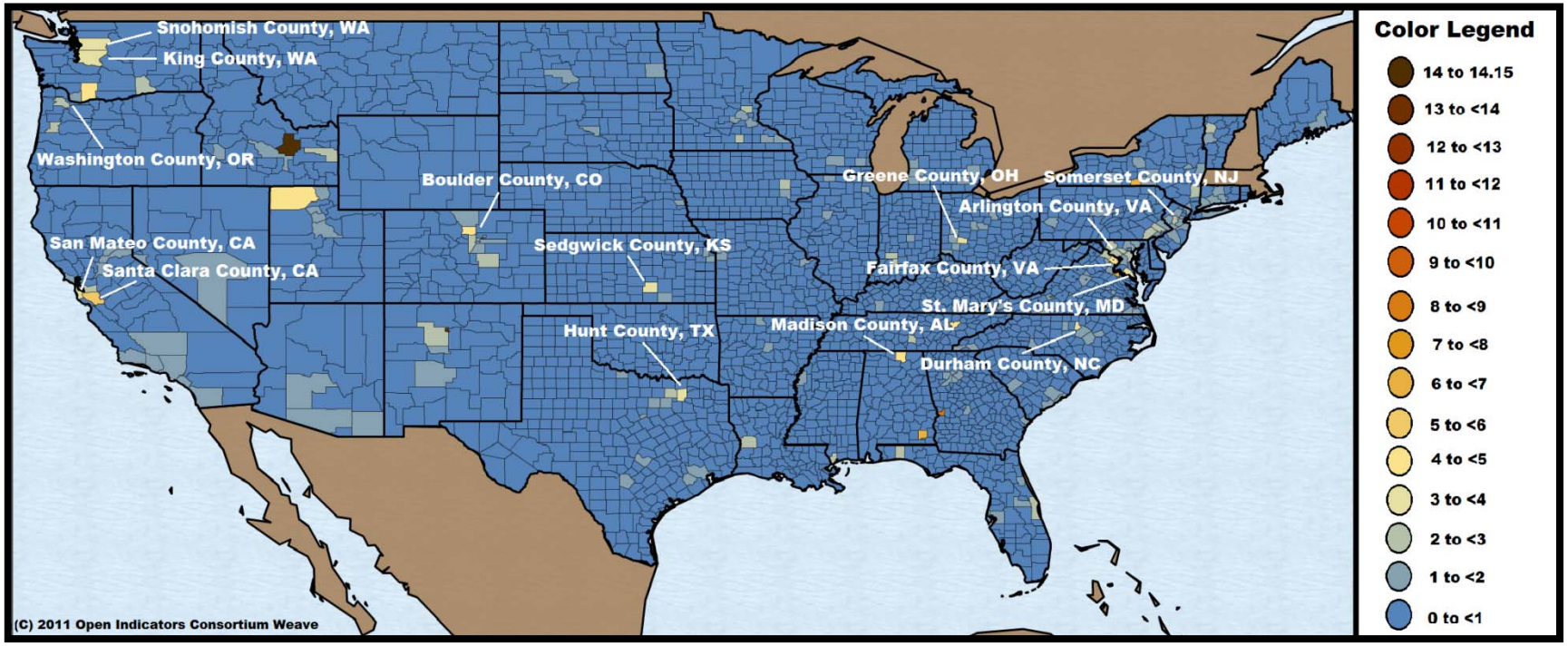
Urban	
Area Name	**LQ Level 1-3**
Fairfax County, VA	3.58
Santa Clara County, CA	3.36
Arlington County, VA	3.08
Madison County, AL	2.91
Midland County, MI	2.54
Somerset County, NJ	2.48
St. Mary's County, MD	2.44
Boulder County, CO	2.41
Durham County, NC	2.38
Snohomish County, WA	2.29
Loudoun County, VA	2.23
San Mateo County, CA	2.16
Sedgwick County, KS	2.11
Washington County, OR	2.11
Collin County, TX	2.11



Employment in HT Level 1 in 2009

- 15 urban counties with the largest location quotient of employment in Level 1 industries constituted nearly 7% of national employment in these industries
- Employment in these counties constituted 3.4% of national employment across all industries
- Level 1 Employment in these counties constituted on average 19% of local employment
- Average a population of 295,000

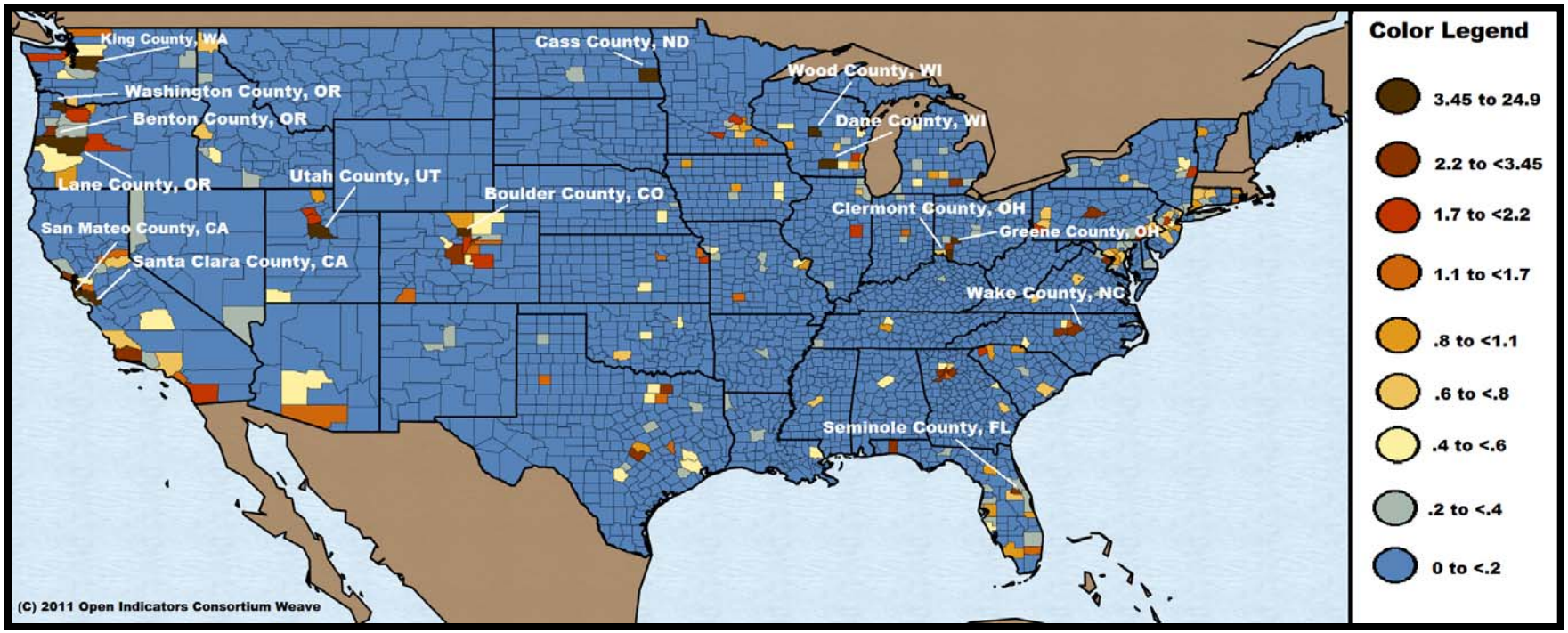
Urban	
Area Name	**LQ Level 1**
Santa Clara County, CA	5.31
Madison County, AL	4.96
Fairfax County, VA	4.35
Arlington County, VA	4.14
Boulder County, CO	4.07
St. Mary's County, MD	3.88
Durham County, NC	3.85
Snohomish County, WA	3.81
Greene County, OH	3.51
San Mateo County, CA	3.39
Hunt County, TX	3.3
Sedgwick County, KS	3.23
King County, WA	3.02
Washington County, OR	2.98
Somerset County, NJ	2.81



Employment in NAICS 5415 in 2009

- 15 urban counties with the largest location quotient in Computer Systems Design and Related Services (NAICS 5415) constituted nearly 7.1% of national employment in these industries
- Employment in these counties constituted 3.2% of national employment across all industries
- NAICS 5415 Employment in these counties constituted on average 1.9% local employment
- Average population of 427,000

Urban	
Area Name	**LQ NAICS 5415**
King County, WA	24.92
Boulder County, CO	17.96
San Mateo County, CA	13.21
Greene County, OH	11.32
Wood County, WI	9.03
Utah County, UT	8.09
Clermont County, OH	7.95
Cass County, ND	7.5
Dane County, WI	7.48
Santa Clara County, CA	7.25
Washington County, OR	6.58
Lane County, OR	5.84
Wake County, NC	5.44
Benton County, OR	5.1
Seminole County, FL	4.49



Dynamic Exploration of High Technology

Next:

Live demonstration of Weave software displaying high technology location quotients by county using QWI

QUESTIONS

And

DISCUSSION