Advancing Innovation in North Carolina

An Innovation Framework for Competing and Prospering in the Interconnected Global Economy

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NC BOARD OF SCIENCE & TECHNOLOGY

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Chapter 1

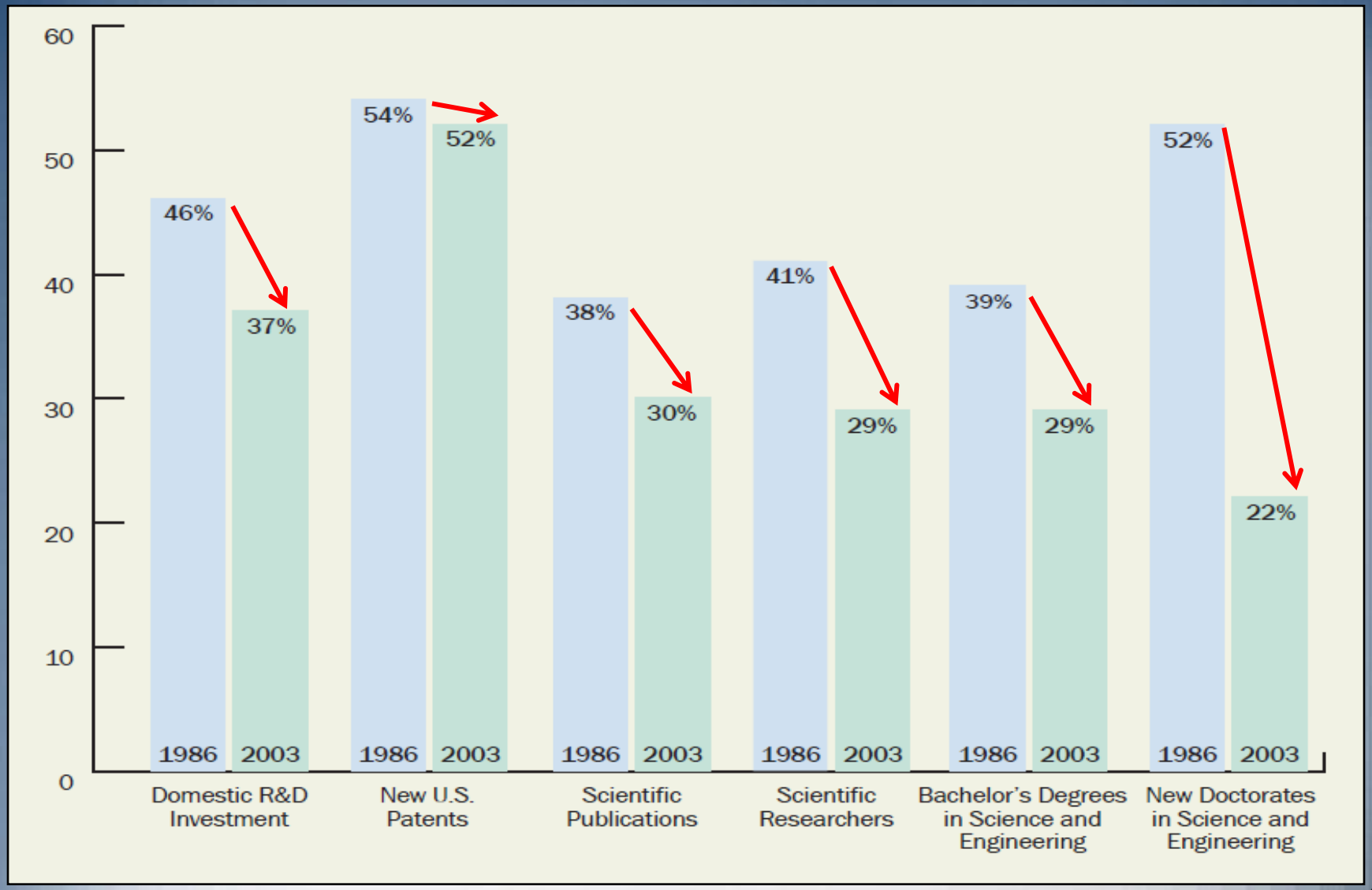
Change, Competition, Challenges, & Opportunities

U.S. Economy is Changing

20th Century vs. 21st Century

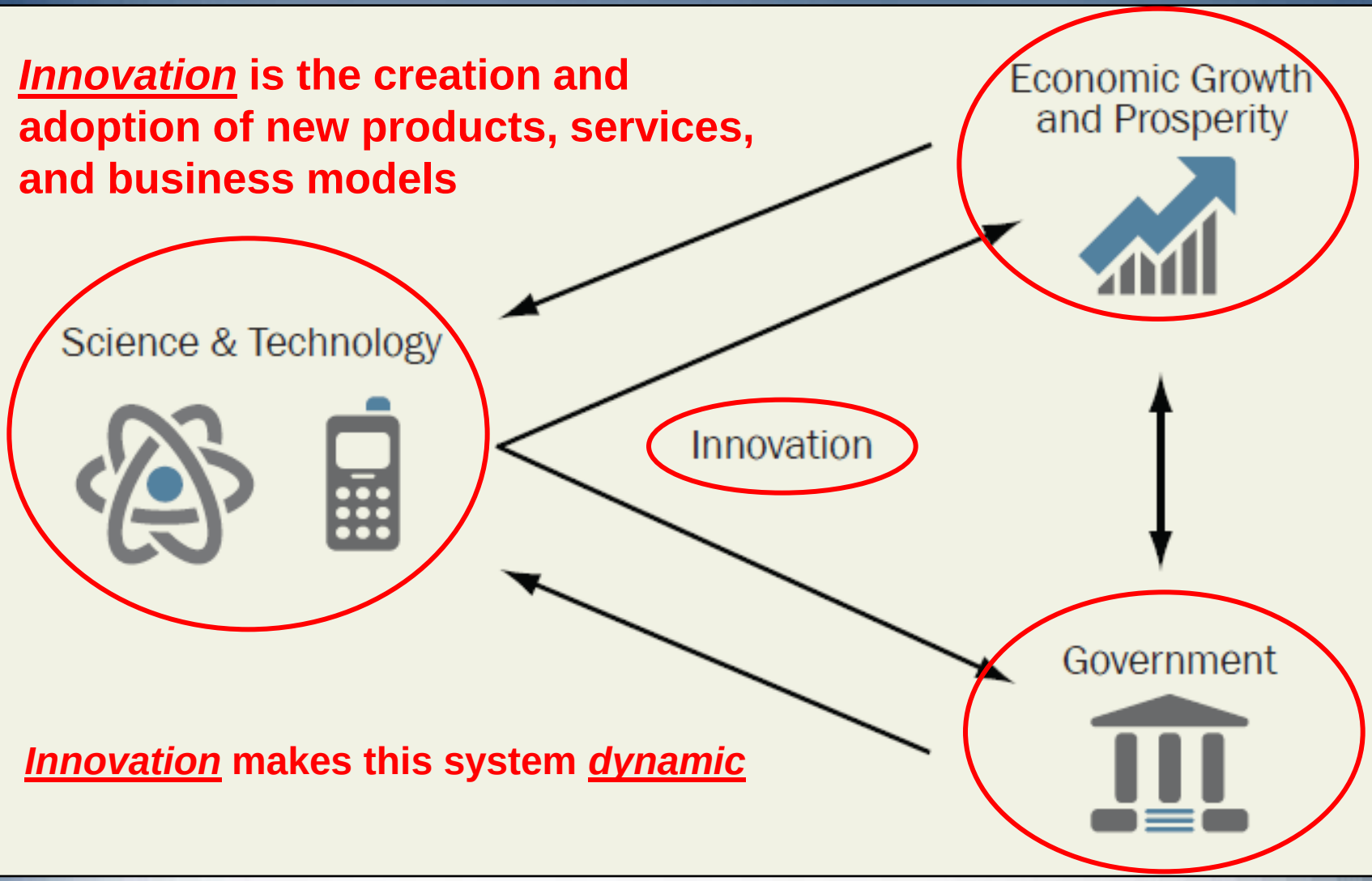
Indicator	1960	21st Century
Composition of workforce		
College graduates	7.7%	27%
Managerial, professional, technical workers	22.1%	34.8%
Production workers, handlers, laborers	44.4%	27.1%
Women	32.3%	46.3%
Technology development and application		
Manufacturing productivity (1992 = 100)	34.1	173.8
R&D expenditures (2000, $millions)	$51,382	$298,862
Industry contribution	33.0%	71.%
Scientists and engineers in industry (thousands)	300.0	997.9
Patents issued	47,169	183,187
Economic and social well-being		
Per capita income	$10,386	$36,714
Average annual earnings per worker	$18,124	$40,690
Infant mortality (per 1,000 live births)	26.0	6.3
New single-family home, median square footage	1,385	2,237

U.S. Shares of Global S&T are Falling; Global Competition is Increasing



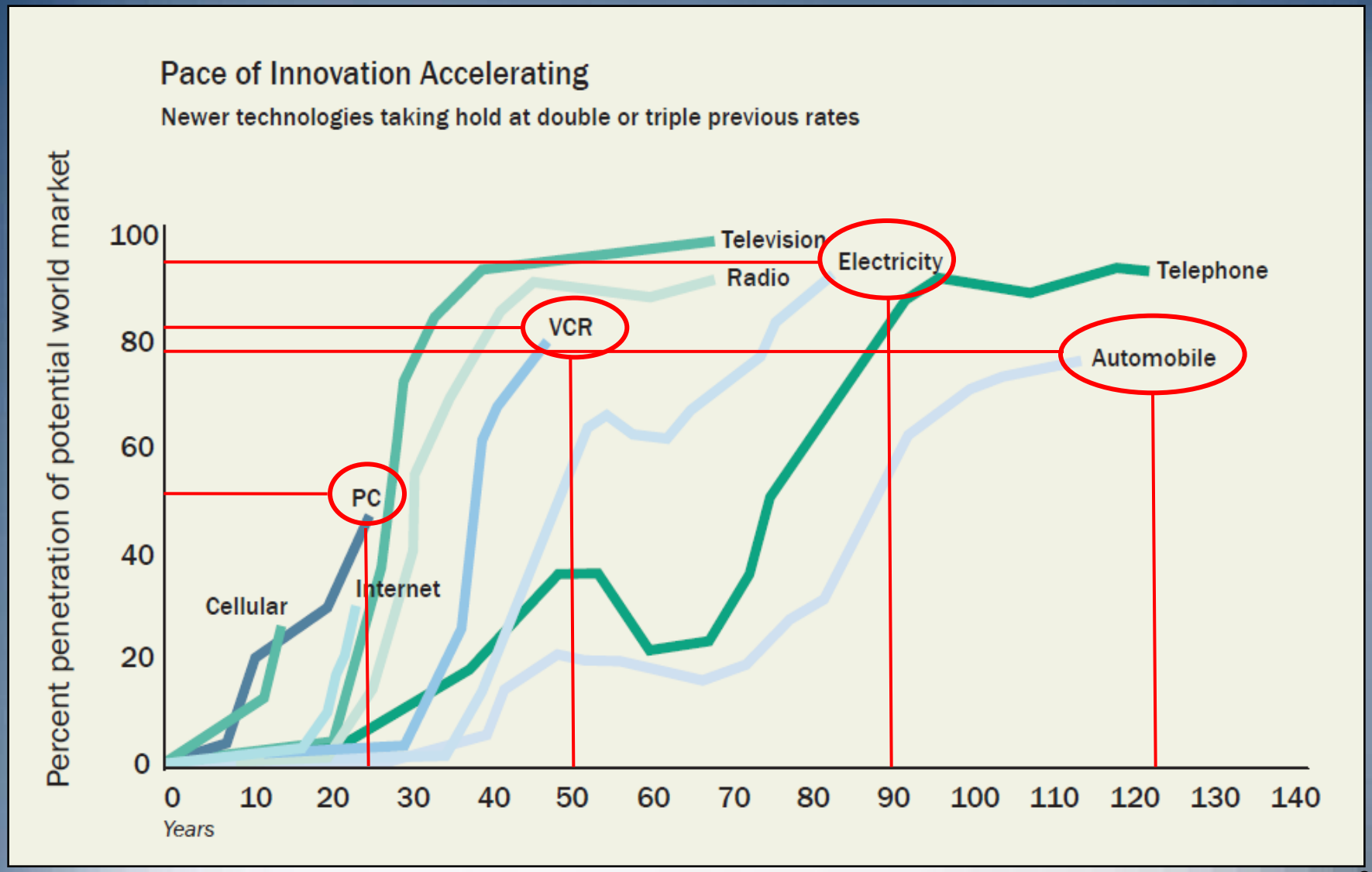
Dynamic, Self-Reinforcing System of S&T, Innovation, the Economy, & Govt.

Innovation **is the creation and adoption of new products, services, and business models**



Innovation **makes this system** ***dynamic***

Pace of Innovation is Accelerating



Innovation is Changing the Economy

Characteristics of the Old and New Economies

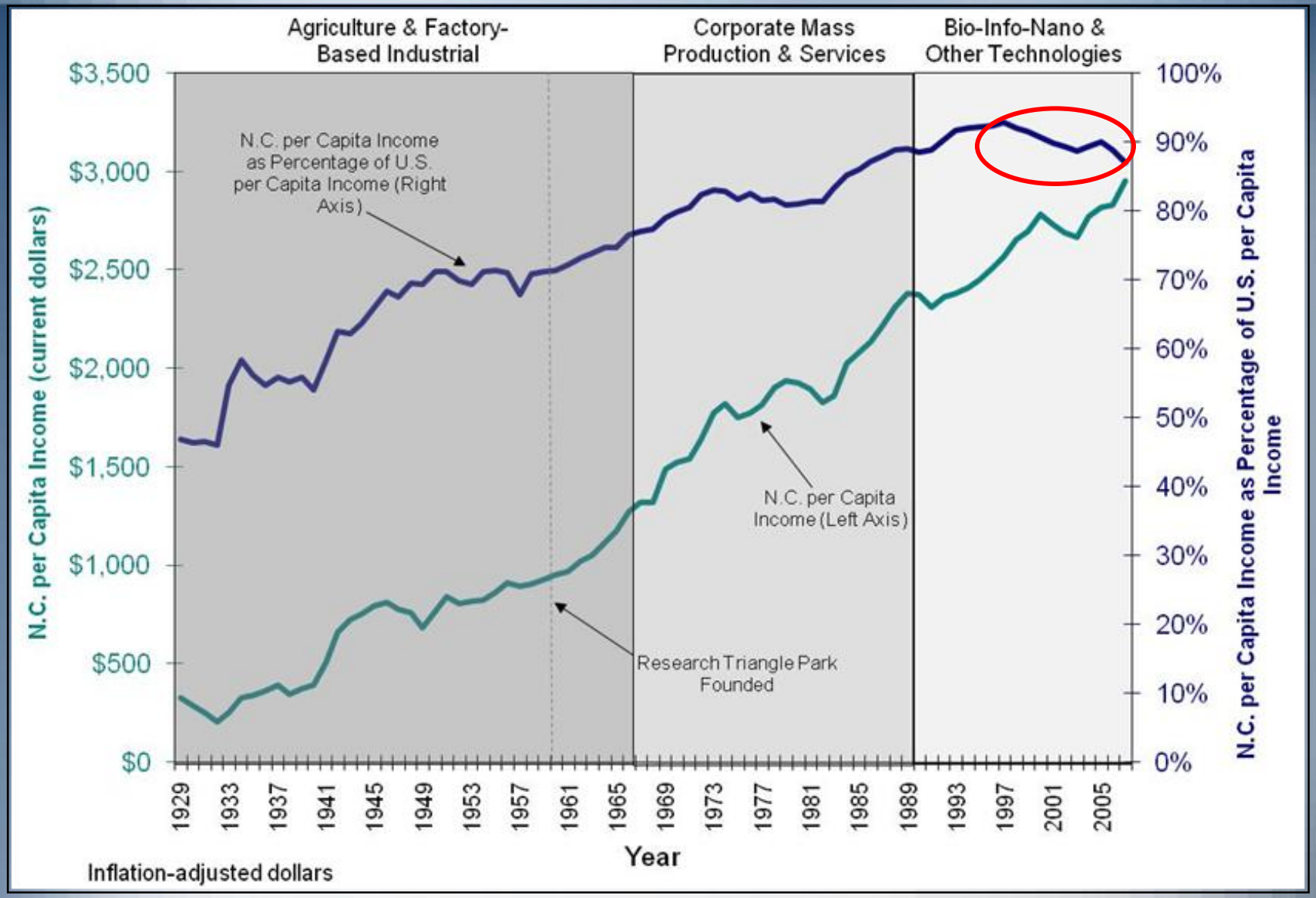
Issue	Old Economy	21st Century Economy
Markets	Stable	Dynamic
Scope of competition	National	Global
Competitive edge	Economies of scale	Innovation/quality
Relations between orgs	Go it alone	Strategic partnerships
Skill	Job-specific (trained)	Broad/changing (versatile)

Innovation is Changing Government

The Old and New Government Approaches

Issue	Old Government	21st Century Government
Organizational form	Top-down control	Bottom-up complex systems
Nature of information	Bureaucratically controlled	Freely available
Source of policy solutions	Bureaucracy	Markets
Determinant of behavior	Compliance with rules	Accountability for results

Innovations Drive Growth and Prosperity in NC's Economy



Advancing Innovation is a Challenge, an Imperative & an Opportunity

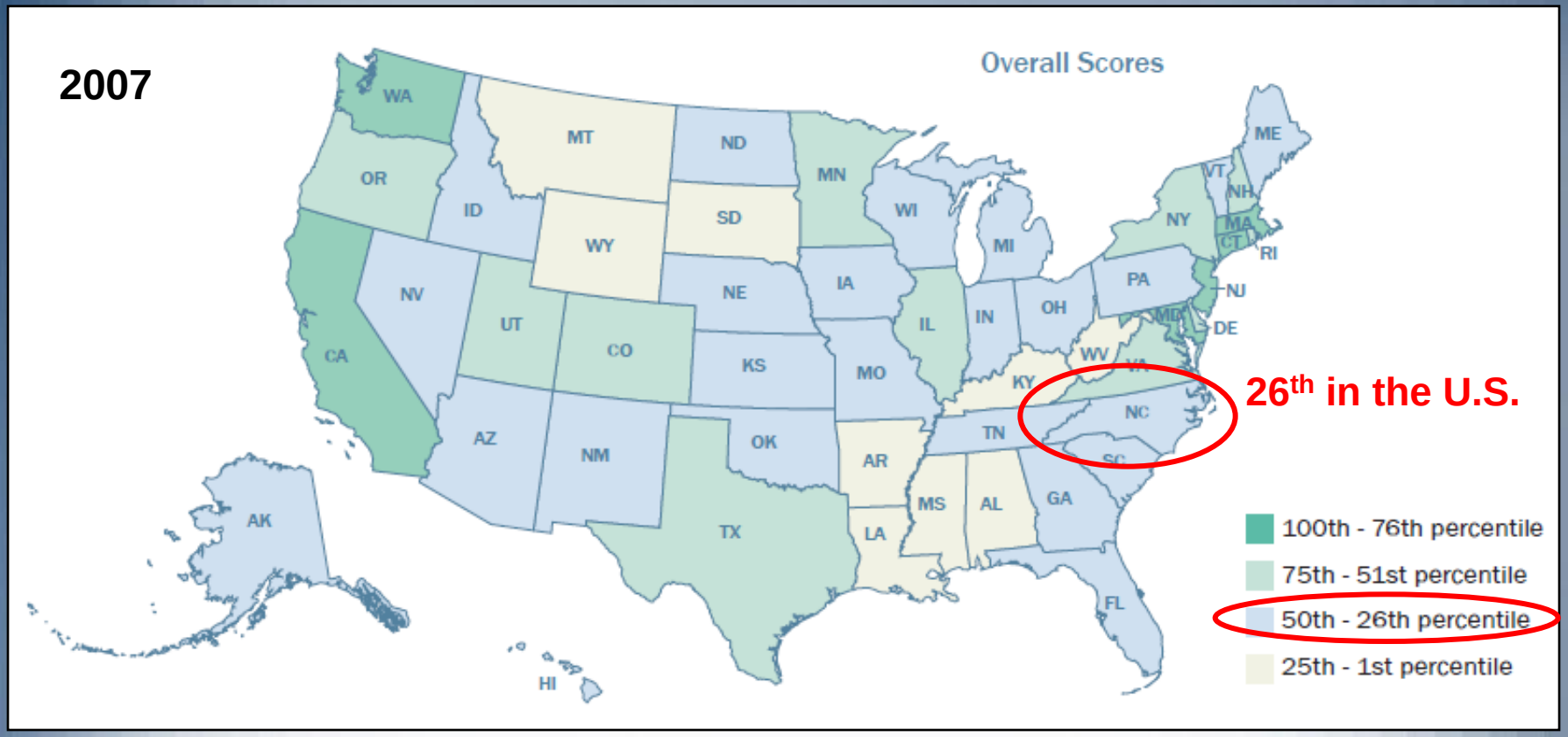
"No amount of savings and investment, no policy of macroeconomic fine-tuning, no set of tax and spending can generate sustained economic growth unless it is accompanied by the countless large and small discoveries that are required to create more value from a fixed set of natural resources."

Paul Romer, Economist 1993

Chapter 2

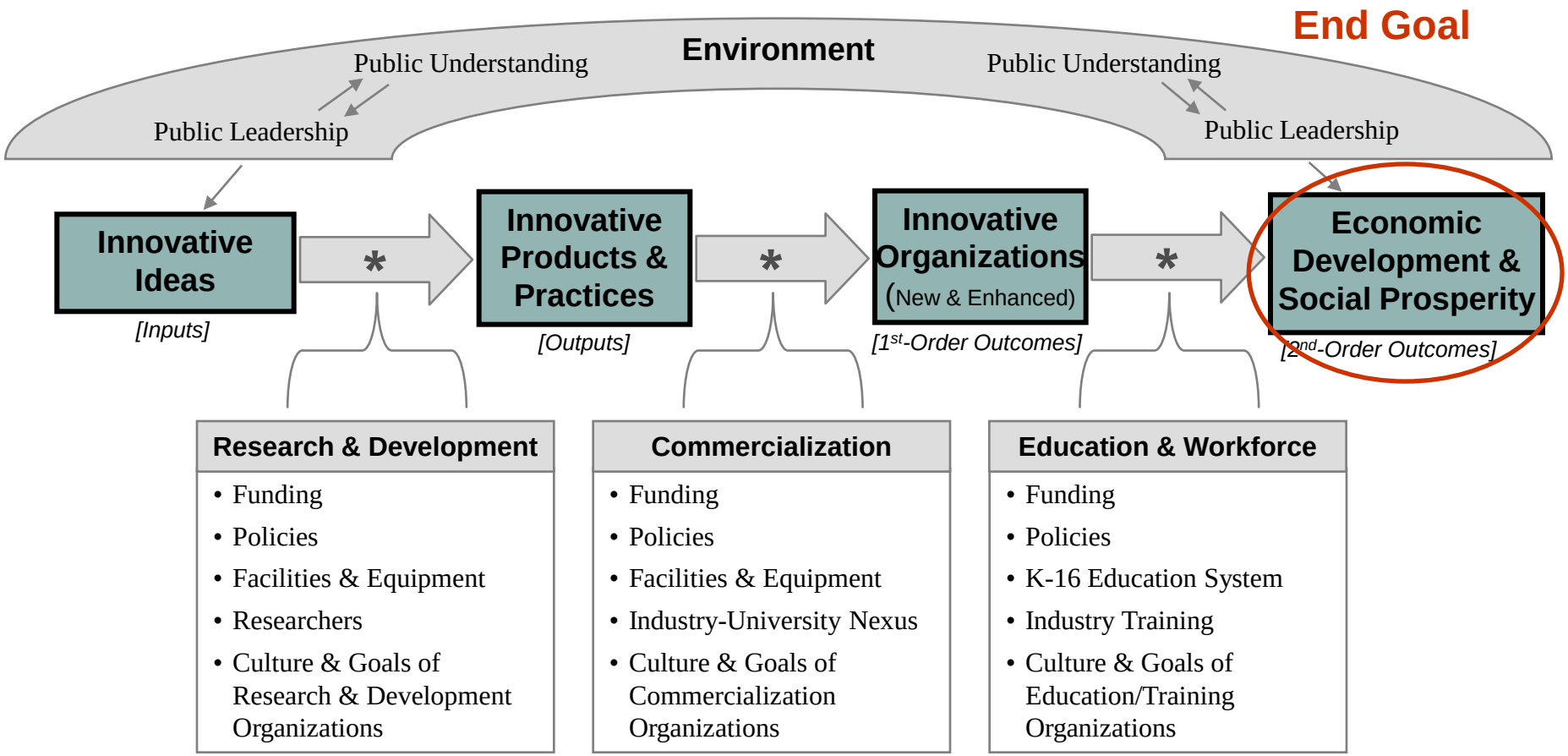
North Carolina’s Current Innovation Performance

NC's Rank in the Innovation Economy



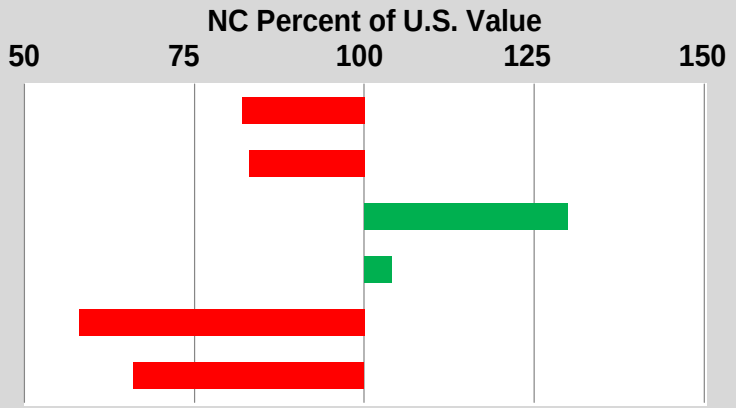
Reproduced from the Information Technology and Innovation Foundation's *2007 New State Economy Index*

Innovation Ecosystem – Areas to Examine in Detail



NC's R&D Indicators Compared to Other States and U.S.

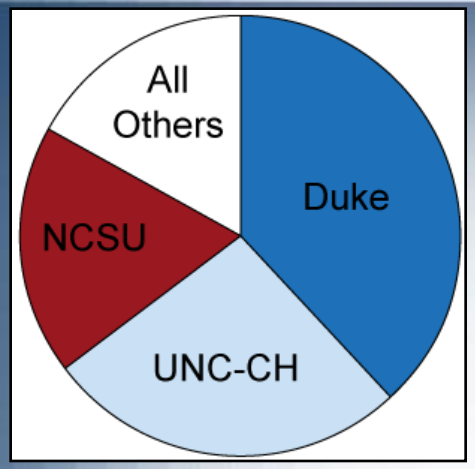
R&D Activity Indicators	NC Rank
Total R&D as Share of Gross State Product (2004)	23
Industry-Performed R&D as Share of Private-Industry Output (2005)	19
Academic R&D per $1,000 of Gross State Product (2005)	10
Academic Article per 1,000 S&E Doctorate Holders in Academia (2006)	15
Federal R&D Obligations per Civilian Worker (2005)	24
Federal R&D Obligations per Individual in S&E Occupation (2005)	27



Source: National Science Board, *2008 Science and Engineering Indicators*

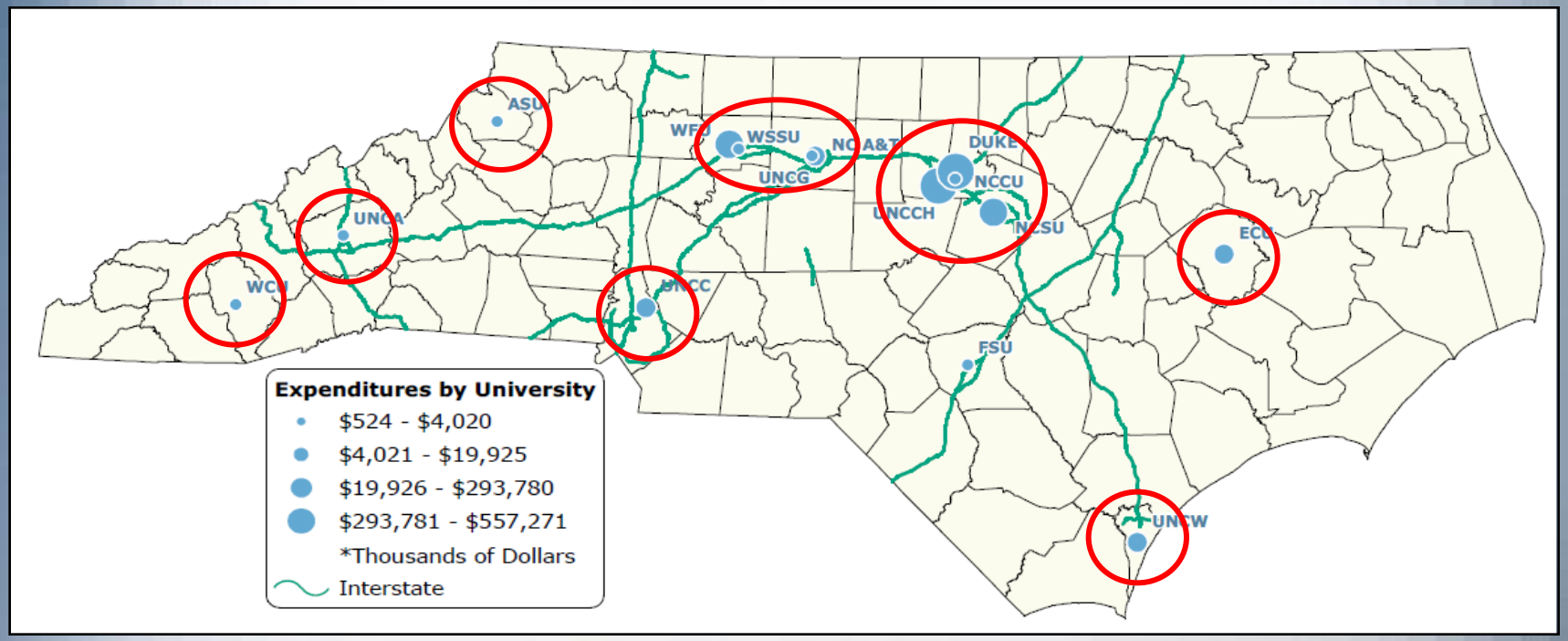
- NC ranks below average on most types of R&D
- NC ranks above average only on academic R&D
- Academic R&D represents a small minority (<20%) of total R&D

Academic R&D Activity within NC

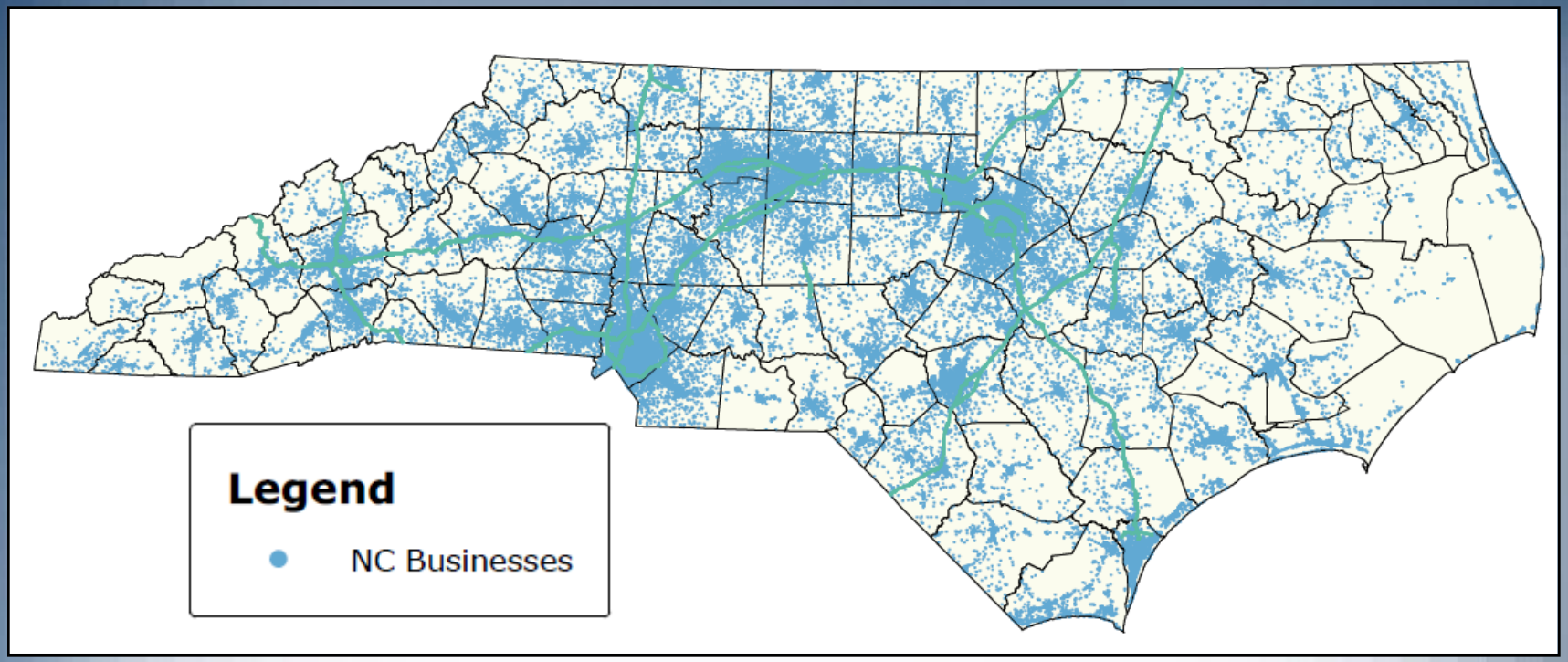


- Duke, UNC-CH, and NCSU perform more than 80 percent of NC's academic research
- University R&D expenditures are concentrated in the RT region, but sizable activity also exists at other universities throughout the state

Source: National Science Foundation, *2008 Science and Engineering Indicators*



Industry R&D Activity within NC

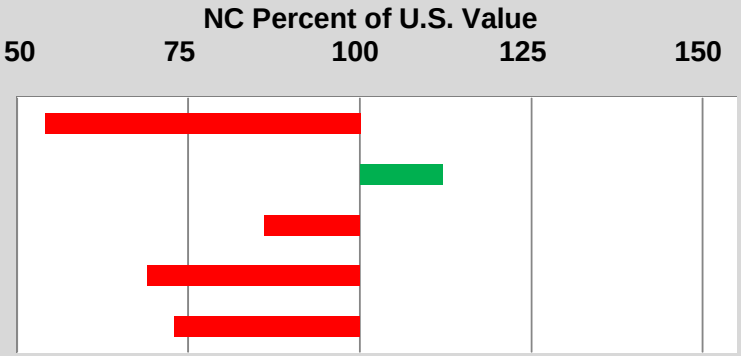


- Industry R&D is most concentrated in metropolitan regions

Source: *Harris Selectory Online*, accessed August 2008

NC's Commercialization Indicators Compared to Other States and U.S.

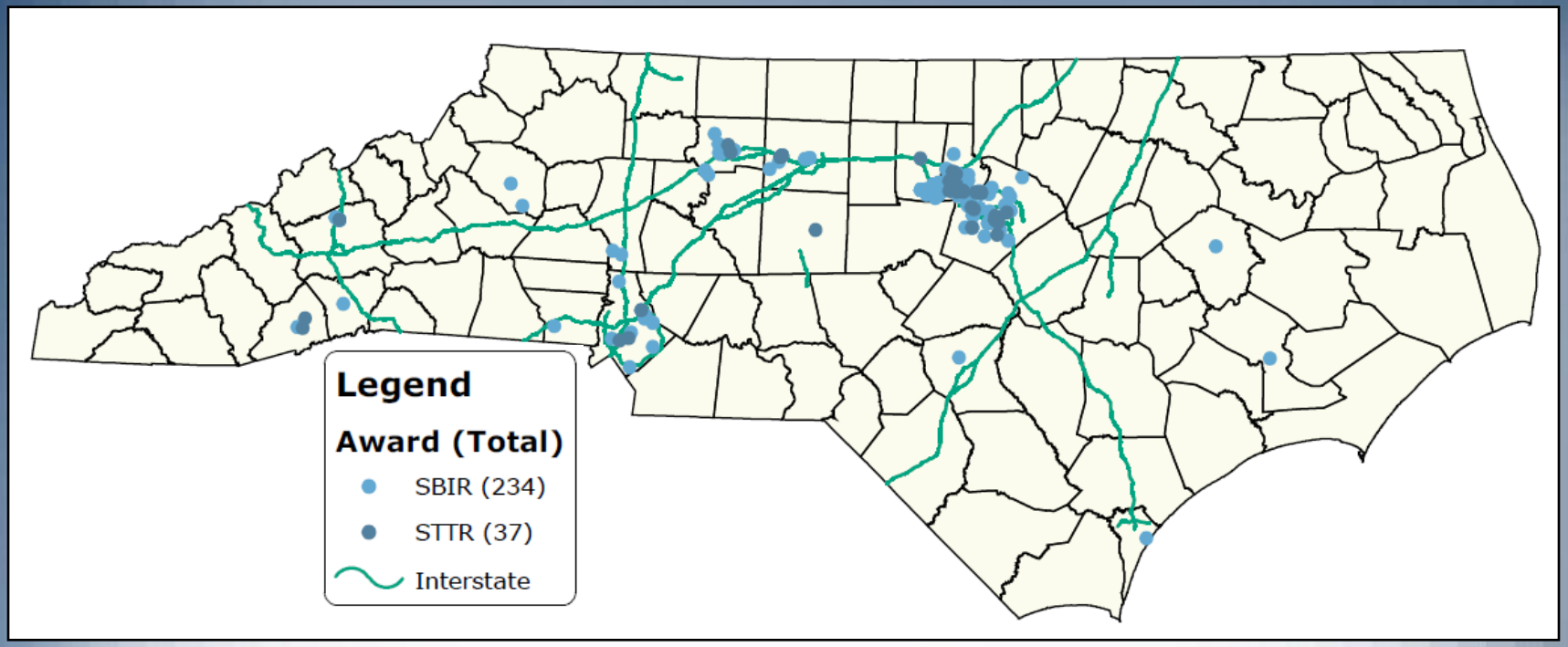
Commercialization Activity Indicators	NC Rank
Average Annual SBIR $ per $1 Million of Gross State Product (2003–05)	31
Academic Patents per 1,000 S&E Doctorate Holders in Academia (2006)	8
Patents per 1,000 Individuals in S&E Occupations (2006)	23
Venture Capital Disbursed per $1,000 of Gross State Product (2006)	10
Venture Capital Deals as Share of High-Tech Business Establishments (2004)	12



Source: National Science Board, *2008 Science and Engineering Indicators*

- NC ranks below average on most commercialization indicators
- NC ranks above average only on academic patents
- NC ranks high in venture capital (VC), but its percent of U.S. value is low because 60% of VC is concentrated in California and Massachusetts

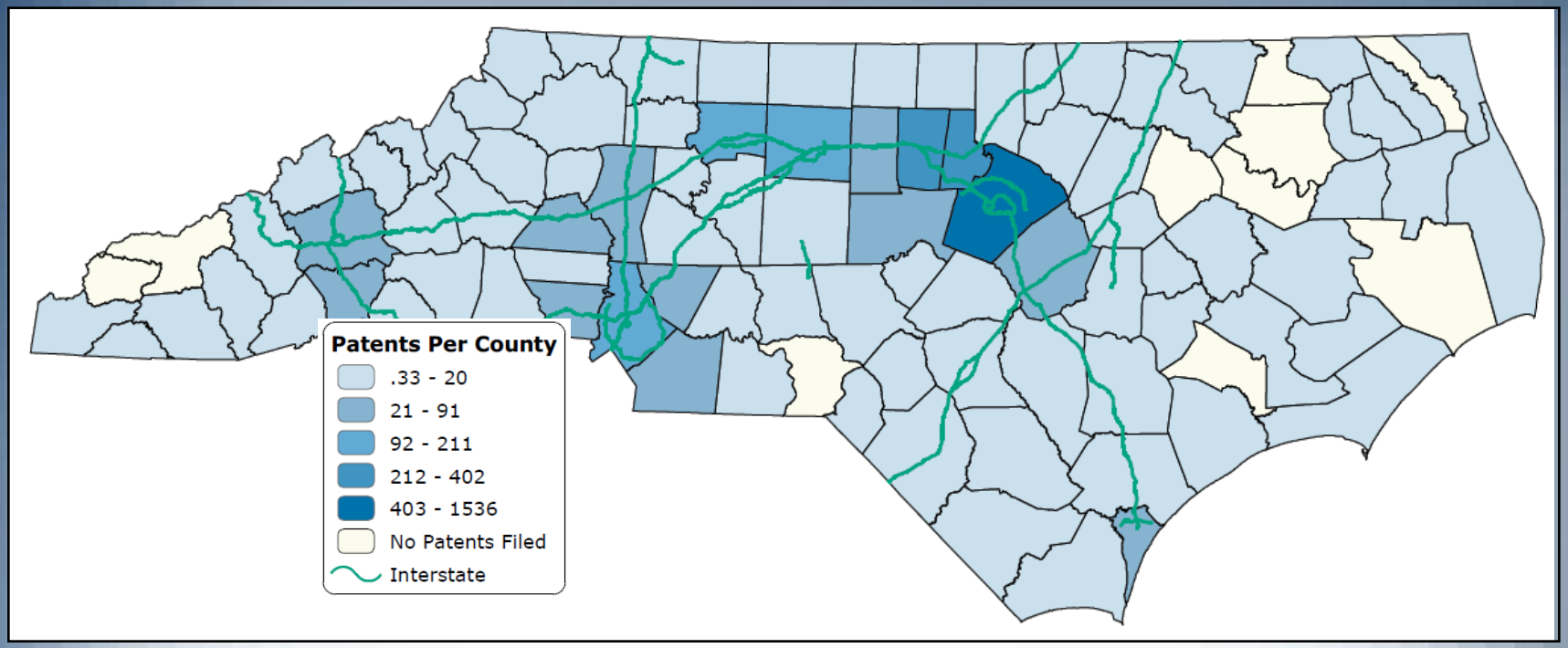
SBIR/STTR Awards within NC



- **SBIR and STTR awards** are most concentrated in the Research Triangle, Piedmont Triad, and Charlotte regions.

Source: *U.S. Small Business Administration, Tech-Net Database,* accessed May 2007

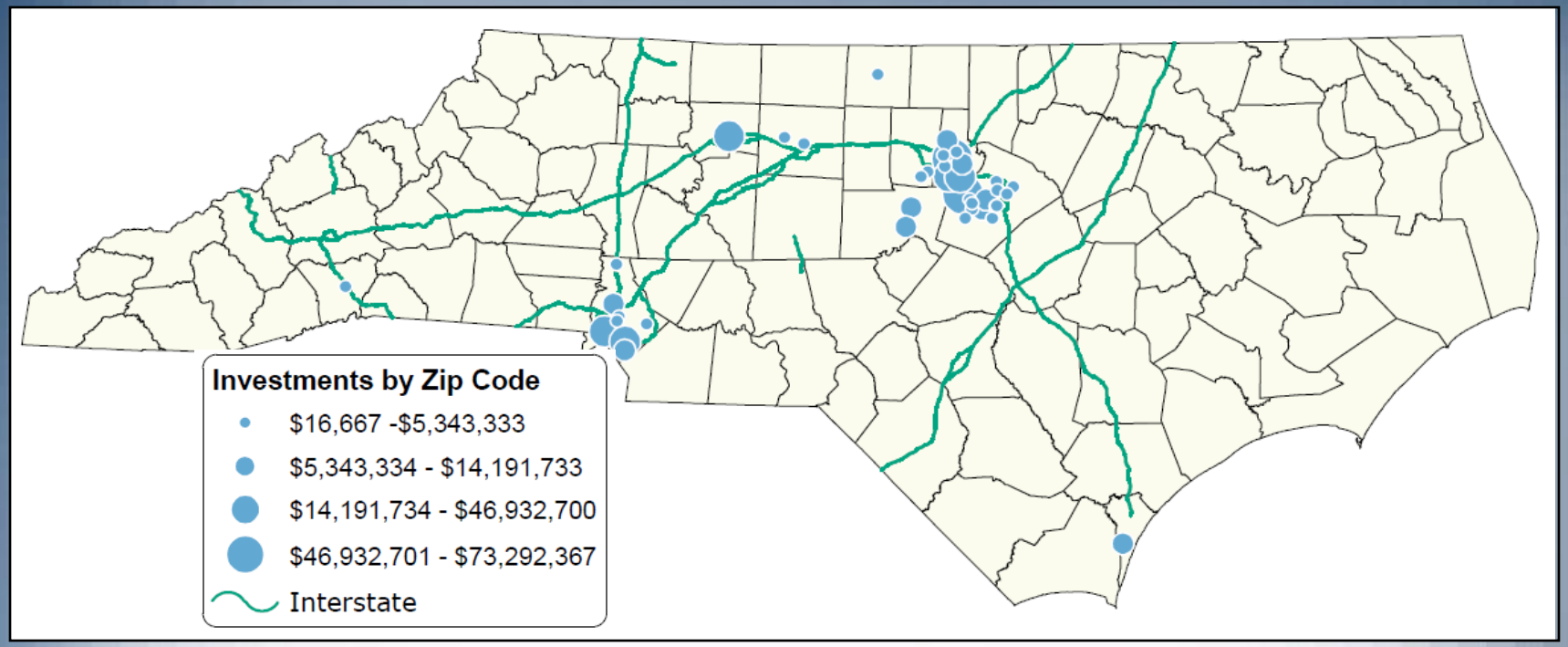
Patent Awards within NC



- **Patents** are most concentrated in the higher-population counties, particularly those near interstate highways

Source: *Decision Data Resources,* Accessed August 2008

Venture Capital Investments within NC

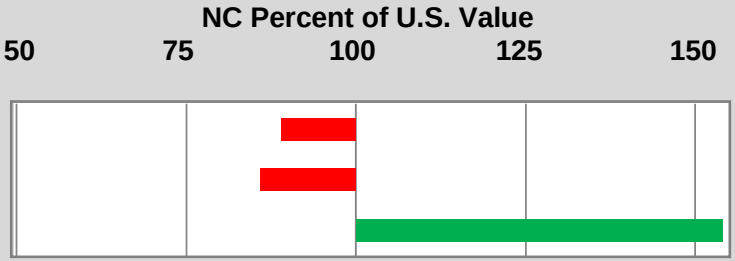


- **Venture capital investments** are most concentrated in the Research Triangle, Piedmont Triad, and Charlotte regions

Source: *PriceWaterhouseCoopers MoneyTree Report,* accessed August 2007

NC's High-Tech Econ. Activity Indicators Compared to Other States and U.S.

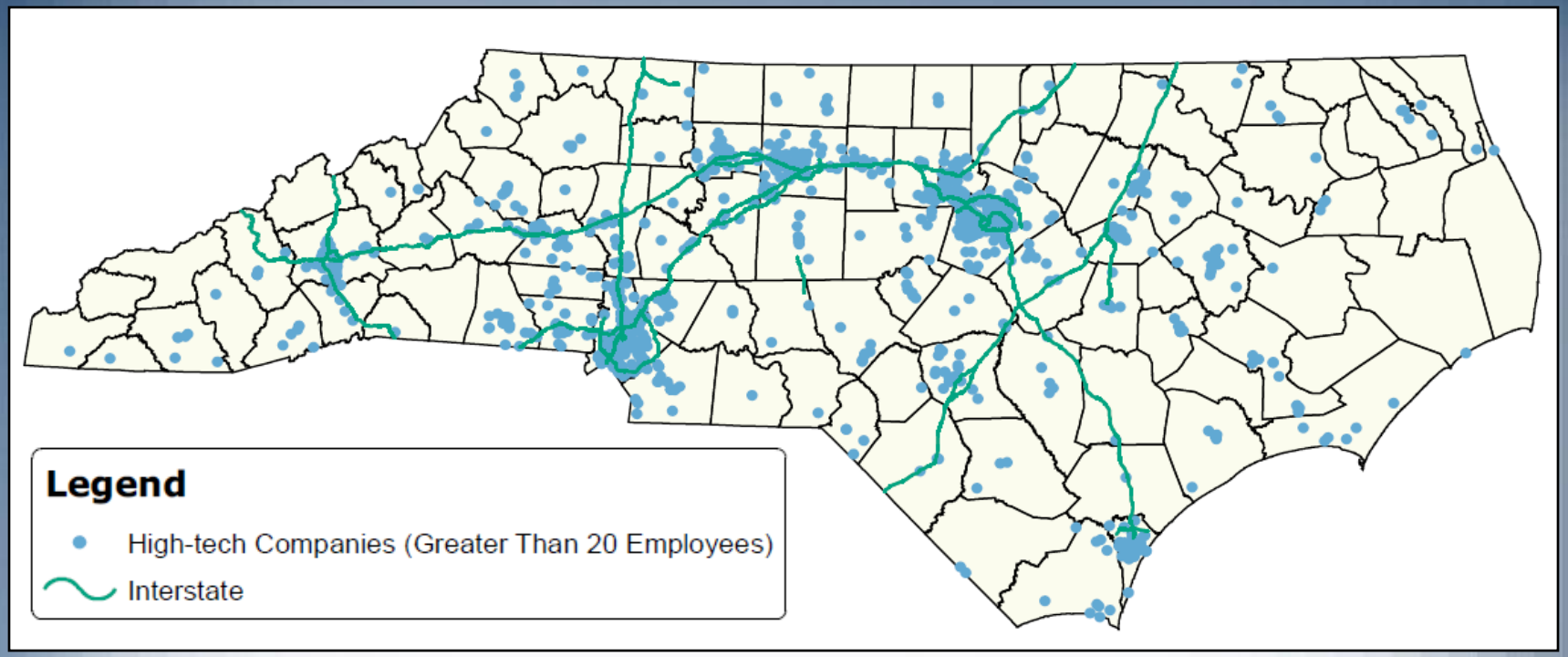
High-Tech Economic Activity Indicators	NC Rank
High-Tech Share of All Business Establishments (2004)	25
Employment in High-Tech Establishments as Share of All Employment (2004)	29
Net High-Tech Business Formations as Share of All Businesses (2004)	10



Source: National Science Board, *2008 Science and Engineering Indicators*

- NC ranks below average on measures of **existing** high-tech economic activity
- NC ranks above average on high-tech business **formations** as share of all businesses

High-Tech Companies within NC

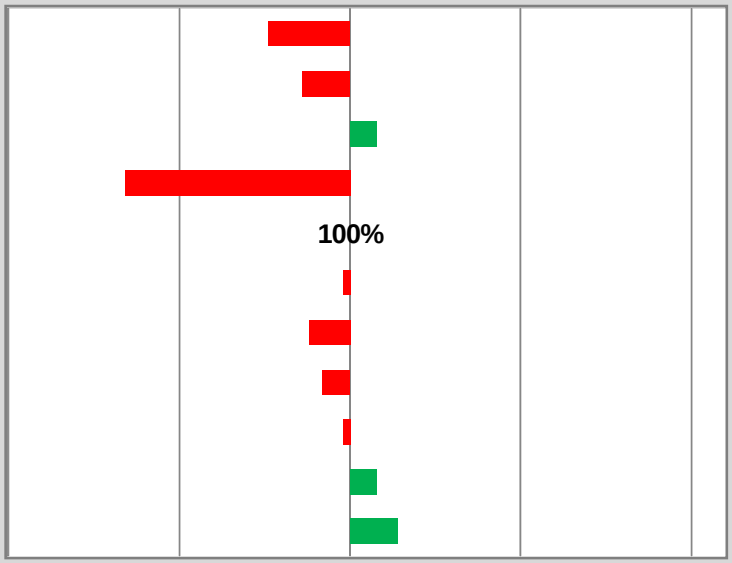


- **High-tech companies** are spread throughout NC but are concentrated in metropolitan areas or near higher-education institutions

Source: *Harris Selectory 2007; NC State Demographics 2005*

Workforce & Education Indicators Compared to Other States and U.S.

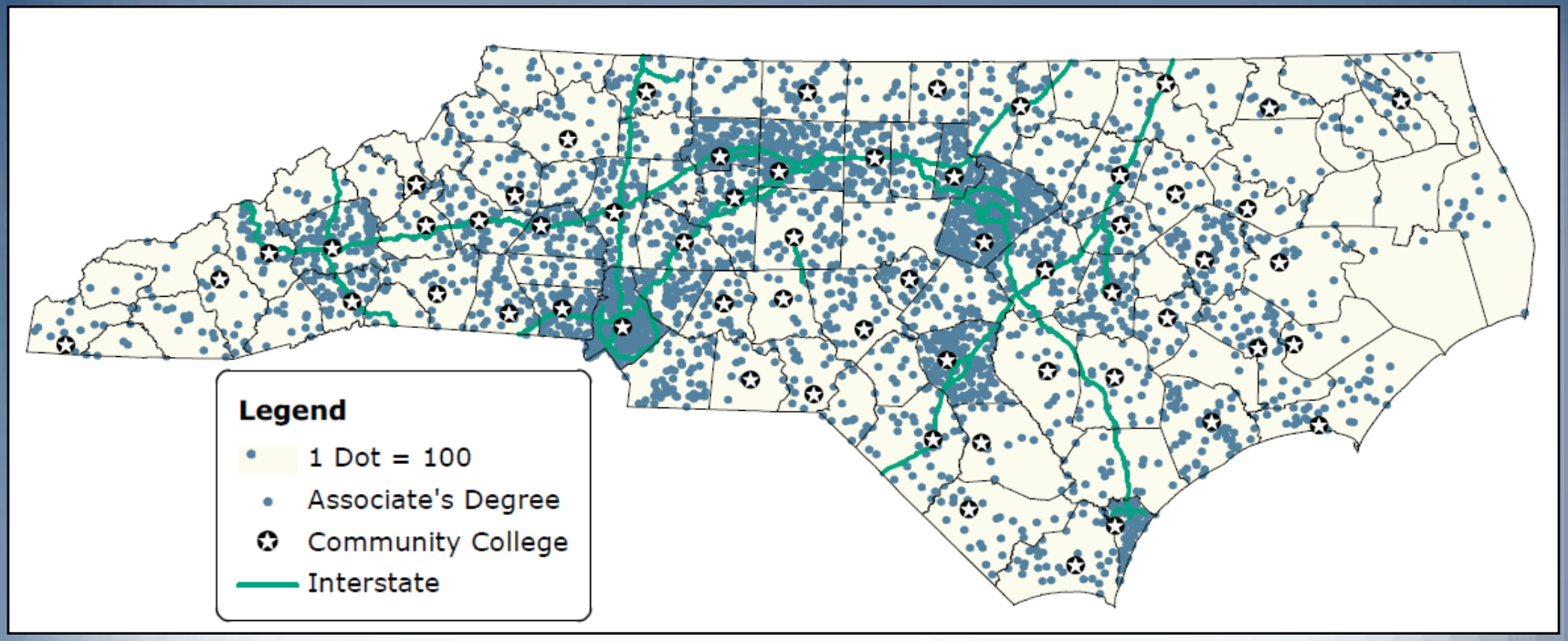
Human Capital Resource Indicators	NC Rank
Individuals in S&E Occupations as Share of Workforce (2006)	29
Computer Specialists as Share of Workforce (2006)	20
Employed S&E Doctorate Holders as Share of Workforce (2006)	17
Engineers as Share of Workforce (2006)	39
High School Graduates or Higher Among Individuals 25–44 Years Old (2005)	35
AA Degree Holders or Higher Among 25–44 Year Olds (2005)	23
BA Degree Holders Potentially in the Workforce (2005)	23
BA Degree Holders or Higher Among 25–44 Year Olds (2005)	26
BA Degrees Conferred per 1,000 18–24 Year Olds (2005)	29
BA in Natural Sci. and Eng. Conferred per 1,000 18–24 Year Olds (2005)	25
S&E Degrees as Share of Higher Education Degrees Conferred (2005)	16



Source: National Science Board, *2008 Science and Engineering Indicators*

- NC's performance on **workforce and education** indicators varies, but ranks below average on most indicators
- In general, **the more technical the degree or field, the better NC fares**

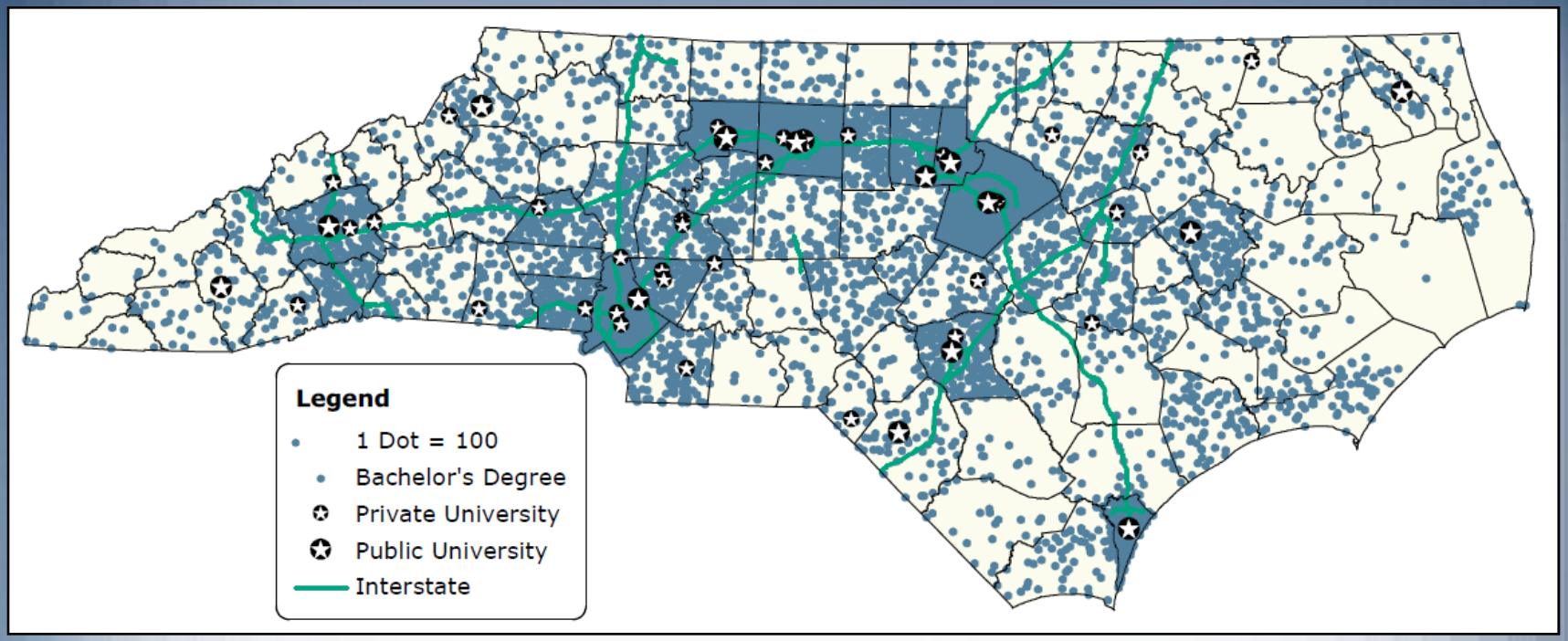
Associate's Degree Holders within NC



- **Associate's degree holders** are spread throughout NC, but they are heavily concentrated in larger metropolitan areas

Source: *NC Economic Security Commission, 2008*

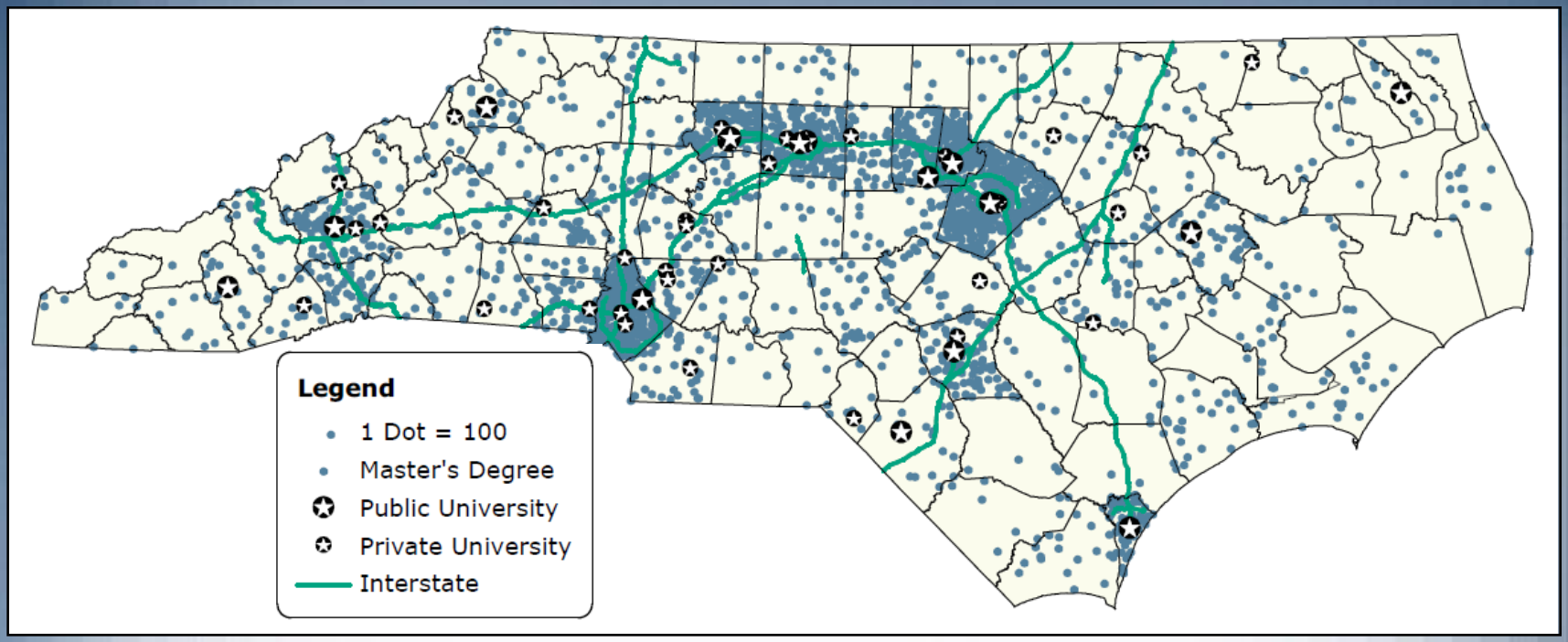
Bachelor's Degree Holders within NC



- **Bachelor's degree holders** are spread throughout NC, but they are heavily concentrated in larger metropolitan areas

Source: *NC Economic Security Commission, 2008*

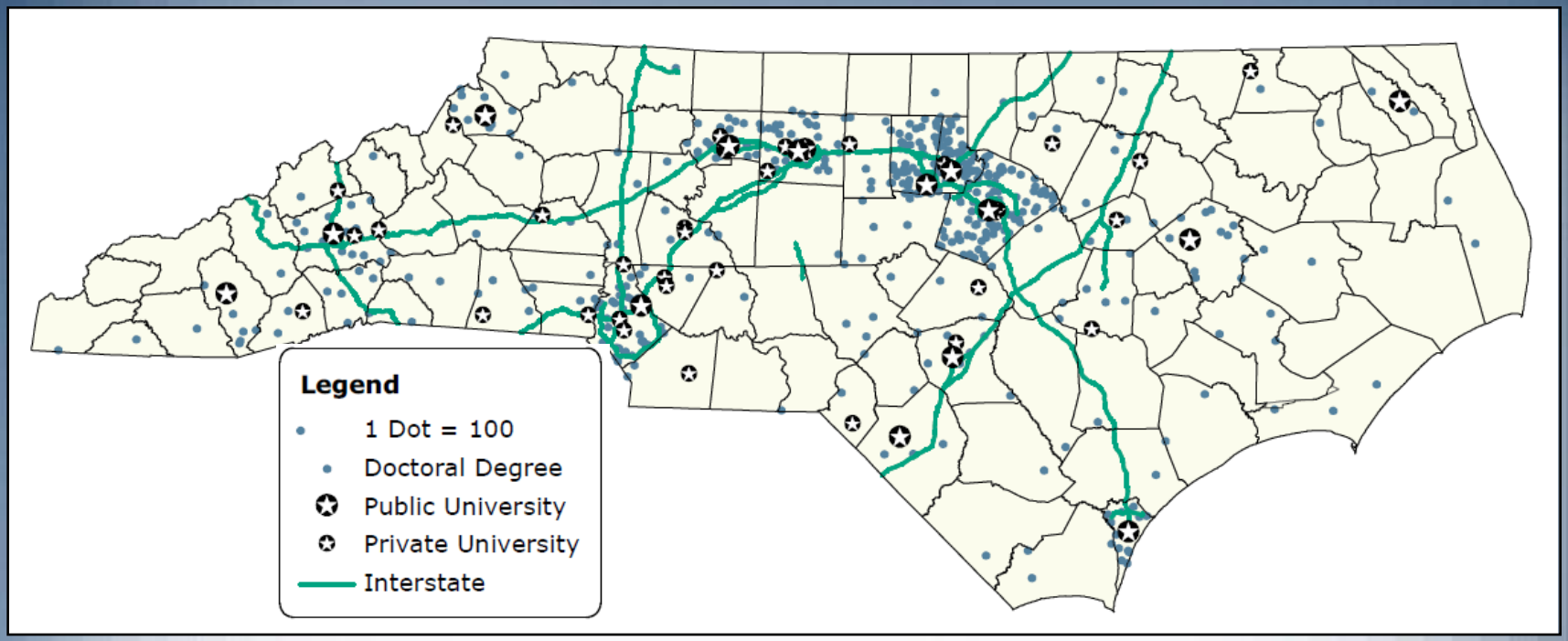
Master's Degree Holders within NC



- **Master's degree holders** are spread throughout NC, but they are heavily concentrated in larger metropolitan areas

Source: *NC Economic Security Commission, 2008*

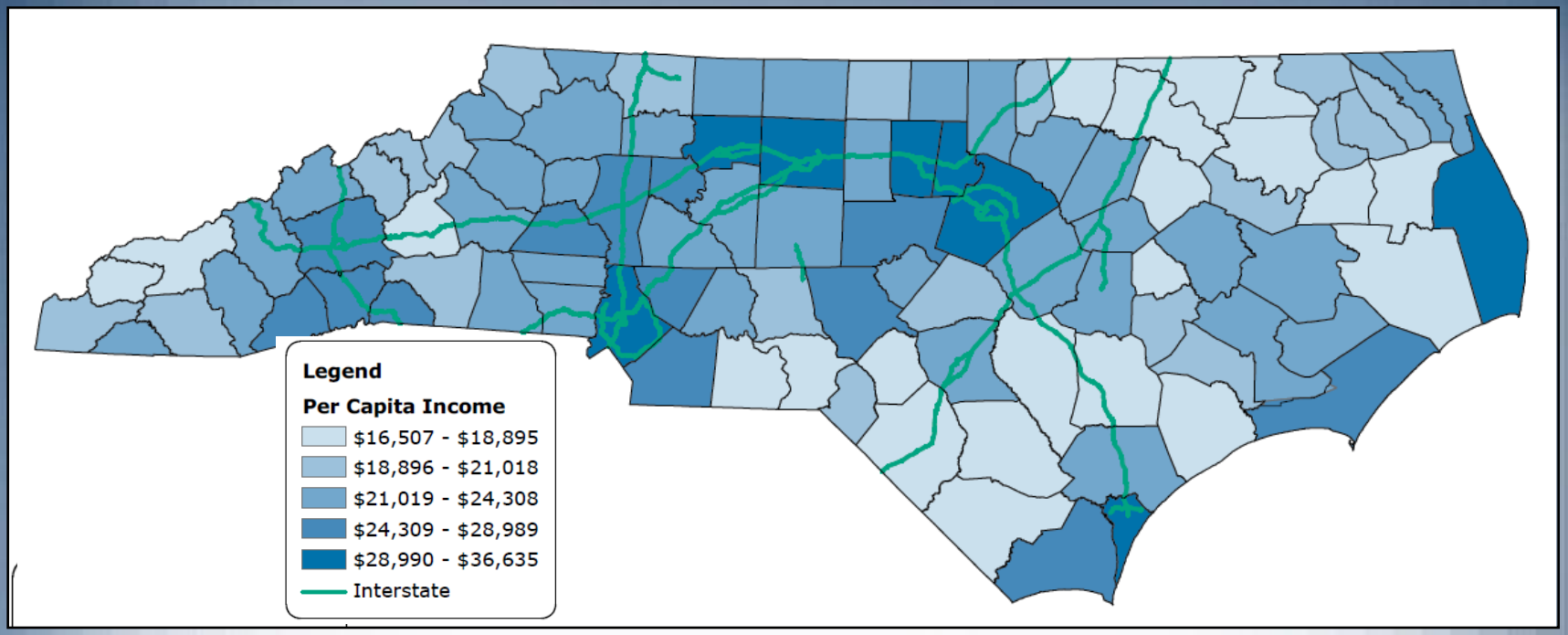
Doctoral Degree Holders within NC



- **Doctoral degree holders** are spread throughout NC, but they are heavily concentrated in larger metropolitan areas

Source: *NC Economic Security Commission, 2008*

Per Capita Income within NC



- **Per capita income** varies widely in North Carolina and typically is higher in urban areas

Source: *NC Economic Security Commission, 2008*

Chapter 3

An Innovation Framework for <u>all</u> of NC to Compete and Prosper

Strengths and Challenges Of NC's Innovation Ecosystem

Strengths

1. Substantial investment in academic R&D
2. Higher education system has substantial potential to support statewide innovation
3. Strong potential for commercialization and increased high-tech economic activity

Challenges

1. Relatively low investment in industrial R&D
2. Heavy dependency on a few geographic clusters for innovation
3. Weakness in converting innovation inputs into innovation outputs
4. Large variances in performance across regions within the state
5. Continuous need to educate and train human capital

Six Classic Market Imperfections Related to Innovation

1. Organizations produce less innovative activity than society needs
2. Private financing of R&D is shifting away from riskier early-stage activities to lower-risk later stage activities
3. R&D increasingly depends on collaboration between firms and universities, but the interests of the collaborators are not well aligned
4. Many organizations lag in adopting proven technologies
5. The innovation-producing benefits of clusters are under-realized
6. The interests of geographically mobile organizations in locating innovative activity may diverge from those of their area residents

Action is Needed
to Overcome Market Imperfections

Without action, the market may produce less innovation than our society needs.

In an interconnected globally competitive world, this is a limitation we can no longer afford.

The quality and timing of a government's innovation framework are increasingly becoming primary determinants of economic success.

Guiding Principles for NC's Innovation Framework

1. Take advantage of existing organizations and assets
2. Provide strong public vision and leadership
3. Communicate closely with private sector
4. Deploy a diverse and supportive tool kit
5. Target "new" activities
6. Measure with benchmarks and performance criteria
7. Enable flexibility across regions and time
8. Focus primarily on cross-cutting activities, not sectors
9. Emphasize information spillovers/demonstration effects
10. Embrace risk and change

Operationalizing
NC's Innovation Framework

Emphasize five fundamental roles for government that are uniquely in the hands of public leaders:

1. Champion and Communicator
2. Convener and Facilitator
3. Funder and Policymaker
4. Recruiter and Retainer
5. Evaluator and Advisor

Leading and Coordinating NC's Innovation Framework

Reinforce three existing institutions that have the requisite jurisdiction, authority, relationships, and experience:

1. **Enhance the NC Board of Science and Technology**
2. **Optimize the NC Science and Technology Advisor**
3. **Propose innovation-focused committees in the General Assembly**

These are low-cost options that can be implemented immediately

Suggested Policies and Programs For NC's Innovation Framework

1. **Champion innovation** by promoting innovation policy within NC, serving as an expert resource, and improving coordination

2. **Emphasize performance and accountability** by measuring and assessing programs and activities related to innovation

3. **Catalyze industry-academia R&D partnerships** through consortia, realigned technology-transfer activities, competitive R&D consortium grants, and/or expanded tax credits

4. **Expand regional innovation promotion** through competitive grants and/or tax credits for commercialization and entrepreneurial support

Suggested Policies and Programs For NC's Innovation Framework *(cont'd)*

5. **Encourage industry cluster development** through consortia, competitive regional cluster development grants, and/or tax credits

6. **Encourage technology adoption and innovation in firms** by enhancing programs such as the NC Industrial Extension Service and the Small Business Technology Development Center

7. **Invest in human capital** through continuing to enhance K-16 science, technology, engineering, and math (STEM) education efforts

Thank You!

Questions or Comments?