Smart Specialization in the U.S: Growing New York's Nano-Cluster

How it was Built,
Its Strategic and Economic Value,
and What is Needed to Sustain it

September 26, 2018

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Leading Countries and Regions are Responding to the Global Competitiveness Challenge

- They are providing:
  - High-level Focus on Growth and National Strength—not consumer choice…
  - Sustained Support for Universities
  - Rapidly Growing Funding for Research
  - Support for Innovative Small Businesses
  - Government-Industry Partnerships to bring new products and services to market
  - Substantial resources to create Innovation Clusters
    - Source: NRC, "Rising to the Challenge, U.S. Innovation Policy for the Global Economy."

What are Clusters?

- Geographic concentrations of knowledge and skills. In 1890, Marshall called them "agglomerations" that co-locate tacit knowledge or know-how, that also:
  - Make available skilled labor & capitalize on lower transport costs
  - Share high fixed cost resources, eg, a lab or university, and
  - Enable rapid learning from competitors

What is an Innovation Cluster?

- 100 years later (1992), Michael Porter noted, clusters are "Geographic concentrations of interconnected companies and institutions in a particular field."
- A self-reinforcing innovation system includes the "holy grail" of:
  - Linked industries, specialized services, connected universities, vocational training centers, research facilities, and supportive public and private organizations.
  - The Tech Valley complex has created a unique cluster that increasingly is achieving these synergies.

The Albany Model: A Focus on Learning from Others, and Now a Growing Success Story

The Albany-Malta corridor is a powerful policy model that draws on elements of both U.S. and foreign experience. Importantly, it reflects a long-term commitment at the state and regional level.

The Tech Valley Vision was never assured and it lived with an Abundance of Naysayers

"Albany is just the umpteenth community trying to package itself as the next (or new and up-and-coming) Silicon Valley, like many of the others it has long way to go"

– Wall Street Journal, 1999

The Crucial Role of Universities

"Industry is finding that, for activities involving a high level of scientific and technological creativity, a location in a center of brains, is more important than a location near markets, raw materials, transportation or factory labor."

- Fred Terman, Stanford University, "The Father of Silicon Valley"

The New York Capital Region is exceptionally rich in higher education resources with 11 major institutions graduation over 10,000 STEM majors per year.

New York State Investments in education, infrastructure, and applied research had a massive return!

New York's Rich Higher Education Resources

Students Enrolled in STEM Majors at Capital Region Colleges and Universities

Institutions	STEM Enrollment
Rensselaer Polytechnic Institute	4,541
SUNY Albany	2,391
Albany Medical College	840
Union College	793
SUNY Empire State College	699
Siena College	588
SUNY Polytechnic Institute	321
The Sage College	220
The College of Saint Rose	193
Union Graduate College	181
Skidmore College	149
Total	10,916

SOURCE: Upstate Revitalization Initiative *Capital 20.20* (2015) based on U.S. Department of Education Statistics.

Public Investments Leveraged Greater Levels of Private Sector Investment with New York in the Lead

Nano College Research Spending by Source (Millions of Dollars)

Year	Industry	New York State	Federal	Foundation/ Nonprofit	Total
2010-2011	80.8	107.9	9.9	10.0	208.6
2011-2012	82.9	113.7	17.3	4.0	217.9
2012-2013	201.6	96.3	24.1	2.3	324.3
2013-2014	170.1	170.4	21.2	2.6	364.3
2014-2015	187.2	27.5	14.6	26.4	255.7
2015-2016	183.7	76.6	17.4	13.1	290.8
2016-2017	141.0	27.6	38.2	5.0	211.8
Total	**1,047.3**	**620.0**	**142.7**	**63.4**	**1,873.4**

NOTE: Totals may not add due to rounding.

SOURCE: National Science Foundation, Higher Education R&D Survey.

Early Success: “We have to be in Albany” -- Nanotech's Gravitational Pull

Albany is known worldwide as a leader in the (development) of nanotech and nanoscience, as evidenced by the companies who have centered here – it is the center of the universe as it is now in nanotechnology.

— Alan Audoorian, of the Austrian company **M+W Zander**, explaining his company’s decision to relocate its headquarter to Albany

Key Features of this Successful Nano Cluster

- **CNSE--POLY TECH:** NY created an industry-oriented university, guided by entrepreneurial leadership, which provided reputation, researchers, & resources, while serving as a neutral site for applied research.
- **Cutting Edge Equipment:** The construction of a state-of-the-art, 300mm fab in a university setting was unprecedented. It allowed for research, testing, and training on cutting-edge manufacturing equipment, attracted by the presence of a modern commercial scale fab.

Key Features of this Successful Nano Cluster

- **A strong corporate partner**: IBM brought reputation, resources and commitment to be an anchor tenant under the leadership of VP for Research John Kelly.
- **New Investment:** The arrival of GlobalFoundries in Malta brought the region to a new level with one of the world's largest and most modern fabs.
- **Regional Dynamism:** The Malta fab created large-scale employment, drew in specialized suppliers, and significantly enhanced the region's reputation as a center of advanced manufacturing, further contributing to regional growth and employment.

The Effort benefited from Full Regional Collaboration: State, Regional and Local Economic Development Organizations Collaborated to Attract a Semiconductor Fab

Organization	Scope
Empire State Development (ESD)	Statewide
Center for Economic Growth (CEG)	11-County Capital Region
Saratoga Economic Development Corporation (SEDC)	Saratoga County
Luther Forest Technology Campus Economic Development Corp. (LFTCEDC)	Luther Forest Technology Campus (LFTC), a nascent science/ industrial park

The Importance of a Strong Regional Approach to Development

- The role of the **Center for Economic Growth** (CEG), an umbrella group of businesses and regional leaders, was key in helping to brand the region, advocate for investments, share information, and finance studies.

- CEG's ability to work above the fragmented political units of the region was a key contribution. This is an important model for other states such as Ohio and Pennsylvania that have many small jurisdictions. Pittsburgh has 410 local jurisdictions, the state of Pennsylvania has over 3000!

Lessons from Tech Valley: The Importance of Professional Proposals

- The **Saratoga Economic Development Commission (SEDC)** focused on attracting a semiconductor plant to tiny Malta, basically trying to land a whale from a rowboat!

- This effort was aided by the attractiveness of the region, the outstanding geology of the Luther Forest site, and the presence of the CNSE research complex and the IBM fabs.

Lessons from Albany: The Importance of Professional Proposals

- **Quality Proposal**: SEDC assembled a first-class engineering project team of planners, engineers, and technical experts to create a proposal that resonated with semiconductor executives.
- **Luck Goes to the Diligent**: One of the planners knew Hector Ruiz, the CEO of AMD, and further help was provided by the SARS epidemic, the Taiwanese earthquakes, and the growing awareness of the management cost of locations in East Asia.

Winning the Competition

- **CEG, National Grid, & SEDC supported the entire process**, identifying and addressing roadblocks.
- **Crucial aid** was provided by supporters in the State Assembly to fund studies and infrastructure development.
- **Pre-permitting** enabled the region to present companies with a shovel-ready site.
- **A Robust Incentives Package**: The package was seen as too much by some, but fortunately, it was more than the competition from Dresden.

New York's Incentives Package for the AMD/GlobalFoundries Investment

AMD – New York's Successful Incentives Package

Item	Amount ($million)
State grant for buildings and equipment	$ 500
State grant for R&D	150
Empire Zone tax credits/incentives	250 est.
Infrastructure (includes some federal funds)	300 est.
Total	$1,200

AMD Commitment: Create 1,205 jobs by 2014
-Maintain 1,205 jobs for 7 years

Source: "New York's Big Subsidies Bolster Upstate's Winning Bid for AMD's $3.2-Billion 300-mm Fab," *Site Selection* (July 10, 2006)

- The region realized the necessity of competing on a global scale.

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A Key Factor: The Infrastructure was on time due to cooperation and coordination

- Coordination to ensure Timely Regulatory Approvals were undertaken across the region with then Rep. Gillibrand's Congressional office taking the lead to identify and resolve potential "show stoppers".
- Major Investments in Infrastructure to support the Global Foundries Fab were completed on time.
  - New Water Lines from the Hudson to Malta
  - High Quality Power built out by National Grid
  - Roads created with Federal, State and local funding
  - New Sewers systems able to accommodate Growth
- Infrastructure work went forward in parallel with the build out of Global Foundries Fab 8 and was completed on time!

New York Attracts a Semiconductor Fab:
Through A Long-Term Bipartisan Commitment

1997 – Center for Economic Growth begins effort to lure chip fab. “Chip Fab '98” launched.

1999 – North Greenbush **rejects** pre-permitting of a chip fab.

2002 – Saratoga Economic Development Corporation sponsors visits by local leaders to chip fabs to improve knowledge of advantages and operations and applies for approval of Planned Development District for semiconductor manufacturing in Malta/Stillwater.

2004 – Towns of Malta and Stillwater issue generic permits for chip fab in Luther Forest Infrastructure planning begins.

2006 – Advanced Micro Devices (AMD) announces plan for chip fab in Luther Forest.

2009 – GlobalFoundries formed. AMD's commitment is adopted by GlobalFoundries and construction of Fab 8 begins.

2012 – Construction on expansion of Fab 8 begins. Plans for R&D Center at site announced. Test production runs of small-volume wafers conducted.

2013 – GlobalFoundries large-scale operations begin.

Global Foundries Fab 8: one of the largest construction projects in U.S. history

- Scope and Scale of the investments in the Fab were significantly expanded in the course of the construction.
- Expansion meant **3,000+ construction jobs** during the worst recession since the Great Depression—employment in Capital region remained robust.
- An Innovative **Project Labor Agreement** provided for Union scale wages and ensured labor peace.
- Strong Regional engineering & construction capabilities enabled timely completion of huge project–the largest in the U.S. at the time.
- Well paid construction jobs of very long duration were well beyond expectations.

So what was the impact of the investments?

Jobs, Jobs, and More Jobs
And large Scale Tax Revenue

Tech Valley Semiconductor R&D and Manufacturing Jobs Impact

	Direct Employment (2015)	Estimated Indirect Employment (2015) based on:		
		ESD Multiplier (2.25)	SIA Multiplier (4.89)	Moretti Multiplier (5.00)
GF	3,538	7,960	17,300	17,690
Malta/Stillwater				
GF E. Fishkill	2,085	4,691	10,196	10,425
CNSE Albany	4,000	9,492	19,560	20,000
Totals	**9,623**	**22,143**	**47,056**	48,115

Benefits to the Region from Advanced Manufacturing & New Needs

Jobs of this quality and this salary level drive economic activity across the region in hotels, restaurants, housing, automobiles, healthcare, and a broad range of retail. An annual 360 million payroll has to go somewhere!

- **The supply chain** jobs stretch across the region from specialized cleaning services to business products with inward investment by specialized suppliers.
- **Construction** and its jobs continue at GlobalFoundries, way beyond initial estimates.
- **Regional assets in education and research and infrastructure need to be upgraded to capture further benefits.** For example, GlobalFoundries will need more power and more people (currently need is for 300 new employees per year!) Advocacy of novel, positive-sum solutions to power and educational needs offer a path forward.

Returns in the Form of Substantial Tax Revenue and Investments

- **GlobalFoundries' investments have generated and continue to generate substantial state and Federal tax receipts.**
- In total, between 2010 and 2016 these investments generated approximately $2.3 billion in state and Federal taxes.
- Total state taxes generated for 2010-2016 were $992 million, growing from less than $50 million in 2010 to $257 million in 2016 alone.
- These tax revenues more than compensate the initial state investment without including the receipts from enhanced economic activity across the region.

Reputational Benefits

- The Benefits to the Capital Region of being known globally as a high-tech center of nanotechnology research, its applications, and the world's most advanced large-scale manufacturing are critically important for the Region's future. It facilitates new investment and the recruitment of top talent for manufacturing, research and education. It creates a virtuous, upward circle.
- **Two crucial challenges** remain to be to be addressed:
  - First, **ensure effective, industry oriented leadership in the SUNY Poly, and the Community Colleges** and,
  - Second**, maintain a competitive environment in power supply, training, and incentives for semiconductor manufacturing, the region's flagship industry**.

The Positive Results of Long-Term Investment with a Coherent Regional Strategy

- **Creation of a nano-cluster** with nearly 10,000 new, well-paying manufacturing jobs and tens of thousands of indirect and Induced jobs in research, manufacturing, and the supply chain as well as induced economic activity in the region.
- **Continuation of a "trusted" manufacturing base** on US soil for chips forming the core of US defense systems and platforms, accomplished without significant federal support.
- **Ongoing upgrading of educational institutions**: K-12 Community Colleges through postgraduate.
- **Major improvements to Regional Infrastructure** with widespread benefits with federal and state cooperation.

Very Substantial Progress in Albany, but Real Challenges Remain

- **Sectoral concentration**: Tech Valley has achieved great progress in a fast growing, hi pay sector, but it remains highly concentrated in semiconductors, a volatile sector, subject to strong global competition.
- **Funding for talent creation?**: Regional universities and community colleges face ongoing financial pressures.
- **Startup culture is emerging slowly**: Better access to SBIR, angel, and VC funds backed by incubators and accelerators is needed.
- **Pressure for diversification** of state development resources has grown: This understandable but it is important it not detract from the resources needed to sustain the continued development and growth of Tech Valley.
- **Continued Committed Leadership?** : Governors, State Assembly, University, and Corporate–all need to remain committed to a common goal.
- **Global Challenges**: Innovation-based economic development can collapse under assault by state-supported firms unrestrained by normal market competition or timely enforcement of international trade agreements.

A Success –
So What are the Lessons?

Summary of Best Practices for Clustering from the New York Nanocluster

- **Leadership able to focus on new technological opportunities** and, as necessary, create new institutions or virtual organizations to exploit them.
- **Maintain policy continuity** from government across administrations and election cycles.
- Rely on active, **well-led regional development organizations** able to develop professional bids and carry-out pre-permitting while building local consensus.
- **Ensure industry participation** as a partner, a co-funder, and a reputational anchor.
- **Develop metrics** that are shared by the participants.

Summary of Best Practices for Clustering from the New York Nanocluster

- **Provide substantial and sustained funding** to develop facilities not available elsewhere and provide incentives to attract investment.
- **Make parallel investments** to develop industry-oriented universities and researchers incentivized to work on applied research questions with industry and able to accept industry support.
- Encourage multiple **adaptable public-private partnerships to facilitate this cooperation.**
- Create cooperative programs to **develop a skilled workforce** with "stackable" certificates and training directly relevant to industry needs.

A Key Lesson: The Primacy of Place

The new institutions, the investments, the supply chains, the workforce training all need to be nurtured in a local ecosystem, even as they interact nationally and globally.

The Most Important Lesson

State and Regional investments in partnership with universities and industry can transform a region and the lives of those who live there.

Success requires
Commitment, Continuity, Cooperation and Investment at Scale.

Thank You