



**Higher Education Innovation and Entrepreneurship Working Group Meeting
Middlesex Community College | Chapman Hall
100 Training Hill Road, Middletown, CT
Tuesday, February 14, 2017
2:00 – 3:30 PM**

Agenda

- 2:00 pm **Welcome and Brief Introductions**
Dr. Anna Wasescha, President, Middlesex Community College
- Introductory Remarks from the Co-Chairs**
Mark Ojakian, President, Connecticut State Colleges and Universities System
& Joanne Berger-Sweeney, President, Trinity College
- 2:10 p.m. **Review of CT Higher Education Innovation & Entrepreneurship Ecosystem**
- **Implications of Global, National and Local Trends**
 - **Higher Ed Assets: Issues, Strengths, Weaknesses**
 - **Brainstorming: Collaboration Opportunities**
- Facilitated Discussion led by Dr. Eugenie Birch
- 3:20 p.m. **Summary**
- 3:25 p.m. **Closing Remarks & Next Steps**
Glendowly Thames, Executive Director of CTNext

SAVE THE DATE | Next Meetings:

March 27, 2017 | 2:00 – 3:30 PM: Quinnipiac University, Hamden, CT

April 10, 2017 | 2:00 – 3:30 PM: Southern CT State University, New Haven, CT

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HIGHLIGHTS: TRENDS AFFECTING THE CONNECTICUT E&I ECOSYSTEM

The following is a selection of national, state, and entrepreneurial trends that could affect current and future opportunities and challenges facing higher education institutions role in the state's E&I ecosystem.

80% of entrepreneurs in the U.S. have a college degree or higher level of education¹

Global/National Trends

The U.S. R&D lead is closing. Increase of R&D budgets by competing nations means the U.S. advantage on technology infrastructure, talent development, and access to funding is closing. From 1991 to 2013, Chinese investment increased from \$13.5 billion to \$316.3 billion (2,242 percent) while U.S. investment went from \$236.8 billion to \$432.6 billion (82.7 percent).ⁱ Countries with the highest intensity of R&D (per GDP) are South Korea, Japan, Taiwan, Germany, France and the U.S.ⁱⁱ

Government funded R&D is shifting. According to the OECD, part of the decline, or plateau, of publicly funded R&D is a policy shift towards tax incentives, signaling a shift in the policy mix towards firms.ⁱⁱⁱ Other reasons include budgetary shifts towards health, pensions and social services. However, the OECD also emphasizes that basic research is needed because it leads to transformative 'frontier technologies' that tackle global challenges.

Non-state actors

- Cities and regions will become increasingly significant public funders of research and innovation.
- Governments will increasingly partner with businesses, NGOs and philanthropists to support STI, which will influence public research agendas.

Venture Capital is globalizing. Formerly U.S. centric capital markets are becoming global with multiple hubs, particularly in Asia due to the growth of the Chinese markets. Meanwhile, U.S. markets see an increase in crowdfunding and angel investing.

Figure 1. OECD, Megatrends affecting science, technology and innovation

- The number of angel groups in the US increased by more than 30% from 2009-2013, and individual angel investors increased by 22% over the same period.^{iv}
- Crowdfunding levels have grown at an annual rate of more than 110% to almost \$70Billion in 2015 in six categories: Marketplace, Equity, Donation, Reward, Real Estate, and Royalty. Most of the "crowd" in crowdfunding is actually institution investors.
- However, few U.S. entrepreneurs are international; Since 2009, only 11% - 13% of entrepreneurs report 25% or more international customers^v

Knowledge is driving today's markets. In 2016, intangible assets - patents, trademarks, brands, research and software - represented almost 80% of the S&P 500 Index. By contrast, in 1980, tangible assets like buildings, equipment and inventory made up 80% of the index.^{vi}

The academic ecosystem is growing more interconnected. Academic R&D is increasingly collaborative. Although most collaboration is not international, the trend is reflected in the shift from *science diplomacy* to *innovation diplomacy*. Innovation diplomacy includes influence through

Global Networks

Germany's international network of Fraunhofer Institutes, of which UConn is partner, is called out in the Global Innovation Index's 2016 Report, (Chapter 4) as a rare example of publicly funded institutional networks.

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the attractiveness of national or regional innovation hubs; developing early-stage partnerships between businesses, or between businesses and universities; creating conditions for regional and global innovation partnerships to flourish; and encouraging and enabling collaborations between public, private, and non-governmental actors.^{vii}

- The OECD identifies ‘open science’ – or open access data and citizen contributions – as a growing trend that will require deep changes in academic culture.^{viii} The 2013 U.S. federal mandate ‘*Increasing Access to the Results of Federally Funded Scientific Research*’ required increasing public access to scientific publications and digital data resulting from federally-funded research.
- Academic R&D is increasingly collaborative, both domestically and internationally. Increased collaboration rates between the United States and Canada and Asia reflect, in part, ties formed through growing numbers of international students.
- In the U.S., R&D funds passed through universities to other universities or to non-academic institutions grew more rapidly than total academic R&D funding. (Between FY 2000 and FY 2009, pass-through funds grew by 171% while overall academic R&D expenditures grew by 82%)^{ix}
- Education Attainment trends also reflect the interconnections: One-fifth of all U.S. citizens or permanent residents who received a doctoral degree from 2007 to 2011 earned some college credit from a community or 2-year college.

Entrepreneurial Education. In 1995, only 400 universities across the U.S. offered EET classes. In 2012, 2,000 universities offered EET programs (two-thirds of the total) *. New minor and majors are offered across the state of Connecticut every year.

Degree Production in S&E. According to the National Science Foundation, the proportion of Science and Engineering (S&E) degrees compared to the general pool of bachelors, graduate and PhD degrees has remained roughly constant over the last twenty years. Despite this general trend, Connecticut has outperformed the national average in the number of S&E graduate students and percentage of S&E occupations per capita.

“Silver Tsunami”. According to the [Census](#), more than one in five (twenty per cent) Americans will be over the age of 65 by 2030. This poses unique challenges and opportunities for Main Street entrepreneurs (small business owners). In Connecticut, small businesses make up 69% of companies (1-50 employees) and 6.5% of the adult population owns their own business. Existing small business owners need to plan for succession as they retire, which means younger people need to know how to run small businesses. In contrast, ‘Encore Entrepreneurs’ (a term for people over 50 who want to start new businesses) is a growing demographic with lifelong hobbies or professional skills that can be turned into small businesses.

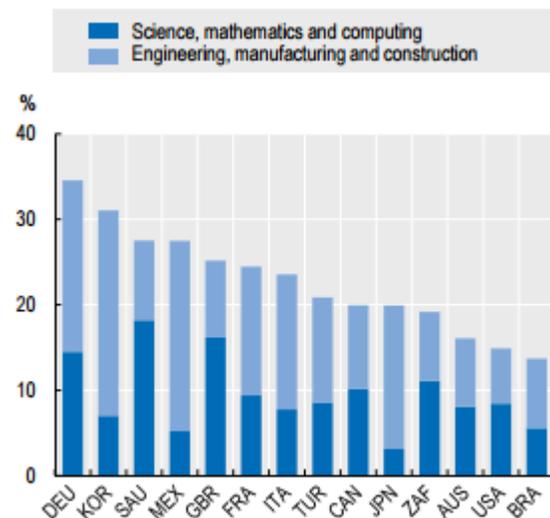


Figure 2. OECD Countries, Tertiary education graduates, S&E, 2013

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Industry Trends

Innovation Trends. Industry clusters in the State of Connecticut that are already primed to capitalize on U.S. and Global industry and innovation trends, including Healthcare/BioScience, Advanced Manufacturing, Digital Media, and Green Technology.^{xi} In 2015, U.S. Council on Competitiveness interviewed hundreds of executives to develop a list of Most Promising Trends. ‘Predictive Analytics,’ ‘Internet-of-Things’ and ‘Advanced Materials’ are considered the most promising in the United States. The top 10 is listed in the table on the right with anticipated market growth.

Internationally, trends are similar. The OECD Science Technology and Innovation Outlook (2016) lists the top ten growth technologies as:

1. Additive Manufacturing
2. Advanced Energy Storage Technologies
3. Artificial Intelligence
4. Neuro-technologies
5. Nanomaterials
6. Micro and Nano Satellites
7. Synthetic Biology
8. Internet of Things
9. Blockchain
10. Big Data Analytics

U.S. Council on Competitiveness		
	Market Size, 2013	Future Market Size, 2019
1. Internet of Things (IoT)	\$1,928 billion	\$5,649 billion
2. Energy Efficiency	\$261.2 billion	\$445.3 billion
3. Materials, Alloys and Metals	\$112.8 billion	\$138.2 billion
4. Ceramics & Composites	\$26.0 billion	\$56.1 billion
5. Advanced Robotics	\$28.1 billion	\$38.1 billion
6. AI and Machine Learning	\$0.9 billion	\$36.0 billion
7. 3D Printing	\$5.1 billion	\$20.4 billion
8. Critical Materials (clean energy)	\$6.9 billion	\$10.1 billion
9. Bio-Based Polymers	\$1.2 billion	\$3.3 billion
10. Virtual design, Prototyping, Augmented Reality	\$0.6 billion	\$1.3 billion

CT Industry Cluster Examples
<ul style="list-style-type: none"> • <i>Advanced Manufacturing: The UConn Fraunhofer Center for Energy Innovation and UTAS Center for Advanced Materials; UHart’s Center for Manufacturing Metrology Lab and Engineering Applications Center; CSCU Advanced Manufacturing Centers</i> • <i>BioSciences: UConn Health Farmington Campus; Yale Center for Biomedical and Interventional Technology; Biomedical Engineering Alliance & Consortium (UHart, UConn, Trinity)</i>

STEM Educated Workforce Needs. President’s Council of Advisors on Science and Technology in 2014 estimated that the U.S. will need approximately 1 million more STEM professionals than the U.S. will produce (at the current rate) over the next decade to retain competitiveness in science in technology.^{xii}

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‘Beyond STEM’ Workforce. In ‘*Revisiting the STEM Workforce*’, the National Science Foundation emphasized the critical need for a broad STEM pathways approach to education in the U.S. that can adapt to rapidly evolving workforce needs.

“Innovation is not the sole province of R&D workers. Although companies engaged in R&D activities report a higher incidence of innovation, most of the innovation in the U.S. occurs in firms that are not significantly engaged in R&D. Adoption and diffusion of innovation commonly requires organizations to rely on workers with STEM competencies to learn, adapt, install, debug, train, and maintain new processes or technologies”^{xiii}

U.S Entrepreneurism Trends

- **Social mission is a growing force in U.S. entrepreneurial activity.** Nationally, 8% of Americans are leading a social enterprise, and 7% are trying to start one. The majority are less than three years old. Government funding is the most common funding source.
 - *Wesleyan’s Patricelli Center for Social Entrepreneurship mission makes social entrepreneurship a reality for students by teaching practical skills, building a community of changemakers, and forging pathways for student entrepreneurs and innovators.*
- **Entrepreneurship peaks among 35 to 44 year olds at 17%.** This age group is likely to have accumulated experience, credentials, relevant networks and other resources they can leverage.
- **Gender disparity.** Women make up 52% of economy in US but the rate of men’s entrepreneurship trends at one and a half times that of women since 2001.
- **Business Skills Training.** People who believe they have the business skills and competencies to launch a venture are more likely to plan to start a business. Nationally, 62% of men believe they are capable compared to 50% of women.^{xiv} The latest data on business degree attainment shows that of the 10,148 degrees awarded in Connecticut in 2015, only 37% went to women^{xv}.
- **Online Resources.** The internet has transformed the E&I landscape, reducing barriers by increasing access to market information, financing, education, and other services for potential entrepreneurs.
- **“Preferred” Start-Up Businesses.** Entrepreneurship in the U.S. economy consists of primarily (80%+) consumer-oriented and business-services.^{xvi}

Business Skills
Higher Ed examples: <i>UConn School of Business’ Accelerate Program; CCEE Undergrad Shared Curriculum; UHart’s Entrepreneurism for Engineers; Quinnipiac Center for Innovation and Entrepreneurship; Small Business Development Centers; Gateway Community College Degree in Entrepreneur Studies</i>

University E&I Ecosystems

A 2014 benchmarking study out of the MIT/Skoltech Program^{xvii} surveyed global mix of university E&I ecosystems and identified two main methods used for building E&I ecosystems.

Model A: Bottom-up and community-led. Usually led by students, alumni and entrepreneurs in the regional economy with a desire to stimulate regional economic growth and create jobs, this model looks for university support through the local entrepreneurial ecosystem. The model focused on regional rather than institutional capacity.

Model B: ‘top-down’ and university-led. This model focuses on realizing income from university research, with the agenda driven by and focused on a strong technology transfer office. Building on

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university research strengths, this model focuses on university policies, budgets, incentives, and curriculum.

The study suggests that there are often deep disconnects between the agenda of the two models, but they can be overcome. A few key insights from the report include:

- The need for **strong relationships of trust** between universities and the regional E&I community
- Expand metrics to **measure culture, capacity and connectivity** in addition to university-focused outputs.
- The power of **strong grassroots and student entrepreneurial movements**; they make strong connections with local and international networks.
- **Reduce isolation and leverage resources**; Many universities appear to be working in isolation from each other and from the community of which they are part, each struggling to build capacity within their own distinctive environments

NSF and NIH have models to overcome disconnects and bring together the talents of students, faculty inventors and industry experts. An example is the NSF I-Corps program, which fosters entrepreneurship that will lead to the commercialization of technology that has been supported previously by NSF-funded research.

In a 2015 report, the Kaufman Center suggested that a dense networked bottom-up approach “suited to the experiential and collaborative process that characterizes entrepreneurship” is a stronger ecosystem approach than top-down support of traditional incubators and venture funds.

Recommendations including supporting “catalytic events” like Start-Up weekends that go beyond informal networking towards common objectives that inspire action and collaboration, turning incubators into referral service centers, and strengthening local university/college alumni networks.^{xviii}

TIP Incubator

UConn's TIP Incubator in Farmington and Storrs offers space and business services on site for university (40%) and regional start-ups including access to UConn resources for business and R&D needs as well as legal advice, accounting, business marketing, entrepreneur-in-residences, access to investors, and interns.

HIGHLIGHTS: HIGHER ED E&I ASSETS IN CT

This section highlights statewide assets. In addition to an ongoing survey (30% response rate as of this writing), supplementary information is provided through interviews and research. Interviews continue through the week of 06-10 February 2017.

Entrepreneurial Degrees

- 12 out of 21 four-year schools in both the private and public sectors currently offer specific Entrepreneur Concentrations/Minors, including UConn.
- Of the 12 undergraduate schools offering such programs only two institutions have Entrepreneur Studies specific degrees (UHART and Quinnipiac)
- Eight (8) of the 13 Community Colleges either have an Entrepreneur Certificate or Small Business Concentration

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- Yale, UCONN, UHART & UB all offer graduate degrees through their business schools. The undergraduate programs offer various courses and approaches, traditionally a Business Administration Bachelor's Degree with elective entrepreneurship curriculum under the umbrella of their BS/BA in Business or Management.

E&I faculty and staff

Institutions with dedicated schools of business generally have staff or faculty dedicated to E&I.

- There are 14 dedicated Business Schools in the state and most of the Entrepreneur curriculum and support services are handled within these schools.
- Fourteen 4-year institutions in the state have dedicated business schools
- UConn School of Business has the Wolff Family Chair in Strategic Entrepreneurship, and the Connecticut Center for Entrepreneurship and Innovation, as well as many campus wide collaborations that promote entrepreneurship and innovation
- Nearly every institution (responded to the survey) has listed that they employ at least one staff member that is currently or formerly a small business owner.
- UConn and Yale have dedicated Offices and Research with Technology Transfer Offices that support extensive commercialization and entrepreneurship programs for faculty and students.

Institutes, Incubators and Centers

- There are 12 traditional incubator centers, 5 social entrepreneurship centers and approximately 6 experimental classrooms in CT higher education institutions.
- Eleven (11) of the 14 institutions with dedicated business schools also have traditional incubator centers that are available for all students to access, and in some cases the local community.
- Wesleyan, Yale and Conn. College (institutions without undergraduate business schools) house three of the five social entrepreneurship centers.
- UConn hosts the Technology Incubation Program (YIP), Entrepreneurship Bootcamp for Veterans with Disabilities (EBV); Innovation Quest; and Accelerate UConn among other programs.

Experimental Classrooms

Some non-traditional/experimental classrooms of note include Trinity's Investment Club, Fairfield's Business Simulator (BEST) Classroom and the Ancell Learning Commons at WCSU. Recently Yale opened Center for Teaching and Learning which hopes to gather students from all disciplines together to collaborate. Gateway Community College is also the only institution that houses the local SCORE center on its campus, an interesting example of a private and public collaboration of education and business support services.

Mentor Programs

Most mentor programs are managed through the Schools of Business. Some programs start as soon as students enter their first year while other institutions offer mandated internships or fellowships as part of their degree programs. University of Bridgeport and Connecticut College both have intensive four-year programs designed to link students with mentors at the very start of their college career.

- Fourteen (14) schools have dedicated programs designed to link students to either a faculty member or someone in the local community
- Nearly all institutions offer some means to seek out a mentor, even if they do not have E&I programs. (predominately Career Services)
- Entrepreneur-In-Residence and other mentor programs are available at UConn and Yale.

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Some Community Colleges also offer some nontraditional approaches to obtaining mentors for students.

- Northwestern Community College sent out a survey to the local business community seeking involvement in their newly developed entrepreneur program and incubator center.
- Tunxis Community College offers Job Shadowing/Mentoring services through their Business Administration degree program.

University Hosted Events

Twelve institutions host events specifically designed to foster entrepreneurial spirit on campus.

- Six (6) schools host Start-Up Weekends. Participation is a mix of exclusive host-campus events and mixed school weekends.
- Many institutions also participate in competitions such as the Elevator Pitch Contest and New Venture Challenge, which unites institutions and students
- Sacred Heart has a program where students of their Intro to Business course must all participate. Students must team up and work on a business plan and present to a panel of judges. Top groups present their plan to local entrepreneurs and business leaders.

Student-run Programs

- Twenty-eight (28) institutions have student run organizations that focus on business
- Thirteen (13) of the 28 are explicitly Entrepreneur Clubs
 - Tunxis Community College's Business Club manages a significant portion of entrepreneur-focused events on campus.
 - SCSU recently opened CT's first chapter of Conscious Capitalism a national organization, *"that helps companies become more conscious with transformational experiences that inspire, educate and empower them to elevate humanity through business."*

Examples of E&I related Partnerships by CT Institutions of Higher Education (other institutions and industry)

- Innovation Destination: Hartford (Various Institutions)
- Entrepreneurs' Organization Connecticut
 - The Global Student Entrepreneur Awards (Various Institutions)
- Connecticut New Venture Challenge (Various Institutions)
- Connecticut Bioscience Innovation Fund (Various Institutions)
- CT Manufacturing Simulation Center (UConn)
- Engineering Dean's Council (CCIC members)
- [CT Skills Challenge](#) (Various Institutions)
- Connecticut Technology Council (Various Institutions)
- CURE (Various Institutions)
- Regenerative Medicine Research Fund (Various Institutions)
- American Association of University Women's CT Chapter (Trinity)

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- The Central European Institute and the Center for Innovation and Entrepreneurship at Quinnipiac (Quinnipiac)
- Conscious Capitalism (SCSU)
- Comradity - Shared Incubator Space in Bridgeport (Sacred Heart, UB)
- Connecticut Consortium Of Entrepreneur Educators (Various Institutions)
- Kern Entrepreneurial Engineering Network (KEEN) (UNH)
- ESUMS Engineering Science University Magnet School (UNH)
- Shared Live Client Experience Program (COB) (UNH)
- Entrepreneurship foundation with Mike Roer (SCSU)
- Innovation Places Program (Various Institutions)
- Middlesex and MidState Chambers of Commerce – Manchester Community College
- Viscogliosi Entrepreneurship Center Local Manchester Businesses
- SCORE New Haven – (Gateway)
- Entrepreneurial Center of Northwest Connecticut – (Northwestern Connecticut Community College)
- Charlie Yarish – Kelp Harvesting Company – (UConn and Norwalk Community College Culinary Department)
- Advanced Manufacturing Department at QVCC and Local Manufacturers

Examples of products or start-ups

- **Quinnipiac University:** Treatment for MVID, Check Samples system, Diagnosis system for pancreatic cancer, Cervical Incontinent product, a Game to help young women chose birth control method, etc
- **University of Bridgeport:** Patent -Bike Helmet with right and left signal blinkers, My Air Streamer, Cross Cultural Education, Yayci Nail Lacquer, Tuccipolo, Car Wash
- **University of New Haven:** Rapid detection technology for Lyme disease, Tri-sol (three-in-one) solar energy pane, Solar powered traffic lights, Rapid detection of health of HVAC ducts
- **UConn:** Holds over 500 patents, more than 75 active technology licenses with industry. Selected patented technology and startups can be found at this [link](#)
- **Yale:** A Venture list is found on the Office of Cooperative Research [site](#). The current cohort from the student Venture Creation program include HemoState, Shopthisfeed, Practice Portal, Grandma’s Choice, Forest Form, The Teaching Peace Initiative, AccurAid, and Assistive Labs.

ⁱ U.S. Council on Competitiveness, Clarion Call Report, 2016.

ⁱⁱ Deloitte analysis based on OECD data and UNESCO statistics, 2015

ⁱⁱⁱ OECD Science, Technology and Innovation Outlook, 2016

^{iv} World Economic Forum, Alternative Investments 2020 The Future of Capital for Entrepreneurs and SMEs, August, 2016

^v Global Entrepreneurship Monitor (GEM), 2015/16 U.S. Report

^{vi} US. Council on Competitiveness. Work. Thriving in a Turbulent, Technological and Transformed Global Society, 2016

^{vii} The Global Innovation Index, 2016 Report

^{viii} OECD Science, Technology and Innovation Outlook, 2016

^{ix} National Science Foundation, Science and Engineering Indicators Report, 2014.

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^x ' *Entrepreneurship Education and Training: What Works?*' Kauffman Institute
<http://www.kauffman.org/blogs/growthology/2015/07/entrepreneurship-education-and-training>

^{xi} Connecticut Economic Development Strategy, 2015

^{xii} President's Council of Advisors on Science and Technology, *Engage to excel: producing one million additional college graduates with degrees in science, technology, engineering, and mathematics*

^{xiii} ' *Revisiting the STEM Workforce, A Companion to Science and Engineering Indicators 2014*' National Science Foundation, 2015.

^{xiv} Global Entrepreneurship Monitor (GEM), 2015/2016 U.S. Report

^{xv} IPEDS database, accessed 2-1-2017

^{xvi} Global Entrepreneurship Monitor (GEM), 2015/2016 U.S. Report

^{xvii} Dr. Ruth Graham, *Creating University-based Entrepreneurial Ecosystems Evidence from Emerging World Leaders*, 2014

^{xviii} Yasuyuki Motoyama, Jason Wiens, ' *Guidelines for Local and State Governments to Promote Entrepreneurship, 2015*'
Kauffman Foundation