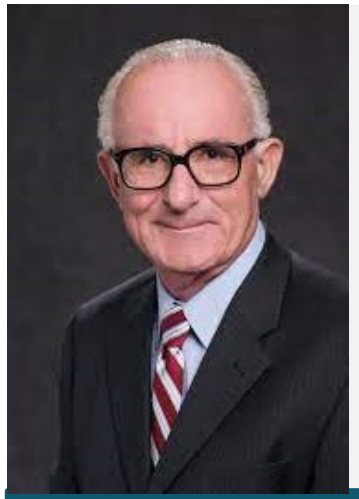

SERC Talks: *"How Can States Develop a Trained Technical Workforce?"*

November 9, 2022 | 1:00 PM ET

John V. Lombardi, Ph.D,
Professor Emeritus, University of Massachusetts Amherst and
Michael Gargano, Jr., Ed.D,
CEO, The Education Think Tank

INNOVATING STEM READINESS

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SERC TALKS

SERC Talks: *"How Can States Develop a Trained Technical Workforce?"*

John V. Lombardi, Ph.D,
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and
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Moderator: Dr. William Rouse
SERC Research Council Member; Senior Fellow, Office of the Senior Vice President for Research, McCourt School of Public Policy, Georgetown University

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How Can States Develop a Trained Technical Workforce?

The challenge of identifying, recruiting, and training a technically capable workforce for industrial firms

- Introduction: Dr. William B. Rouse, Senior Fellow, Office of Sr. Vice President for Research, McCourt School of Public Policy, Georgetown University
- Context: The Traditional Higher Education Environment: Dr. John V. Lombardi, Professor Emeritus, UMass Amherst

The Challenge

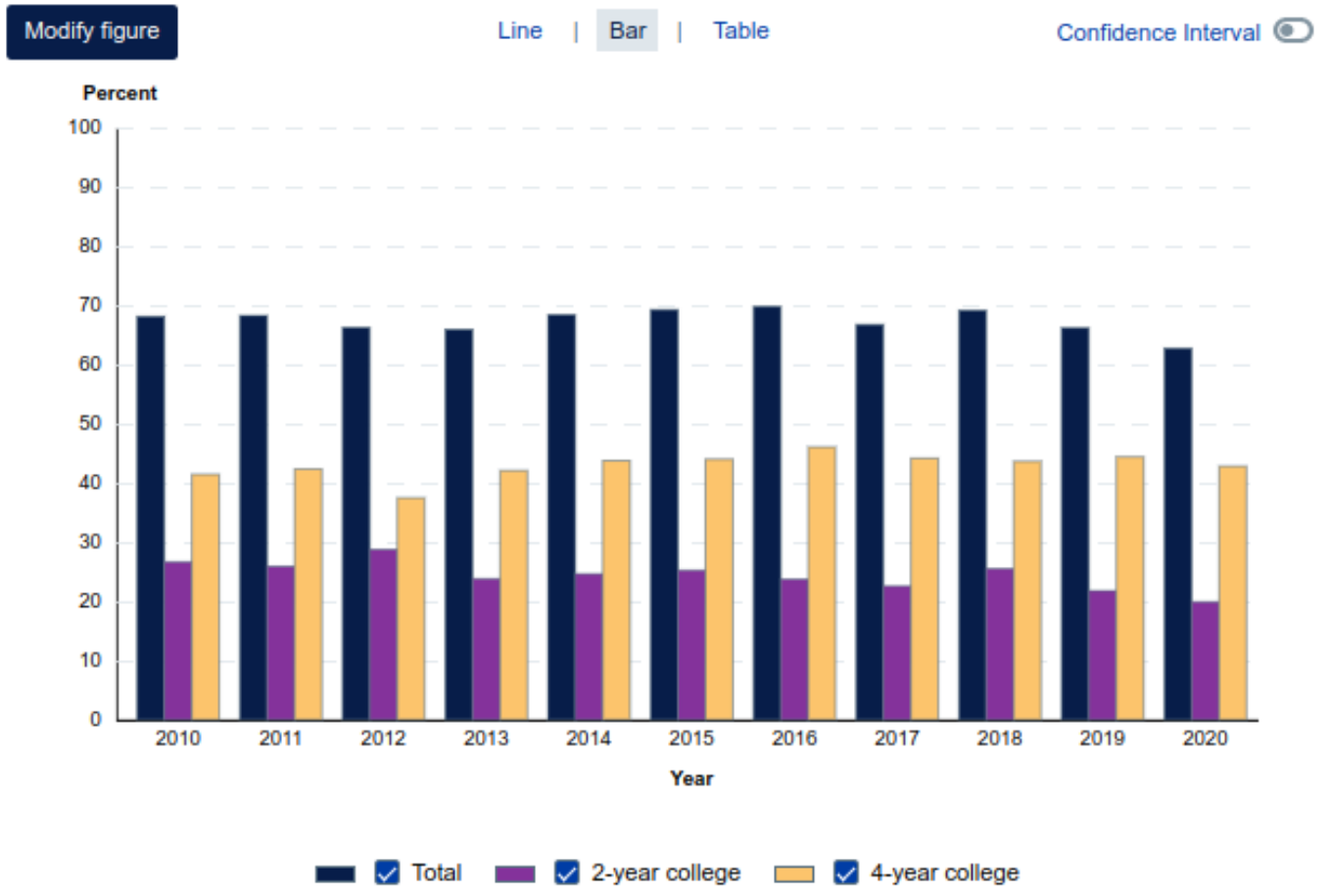
The Critical Structure and Operation of State-sponsored Technical Training Collaboration with Industrial Partners

Dr. Michael Gargano, Jr., Ed.D, CEO, The Education Think Tank

CONTEXT: THE TRADITIONAL HIGHER EDUCATION ENVIRONMENT:

John V. Lombardi

Figure 1: Immediate college enrollment rate of high school completers, by level of institution: 2010 through 2020

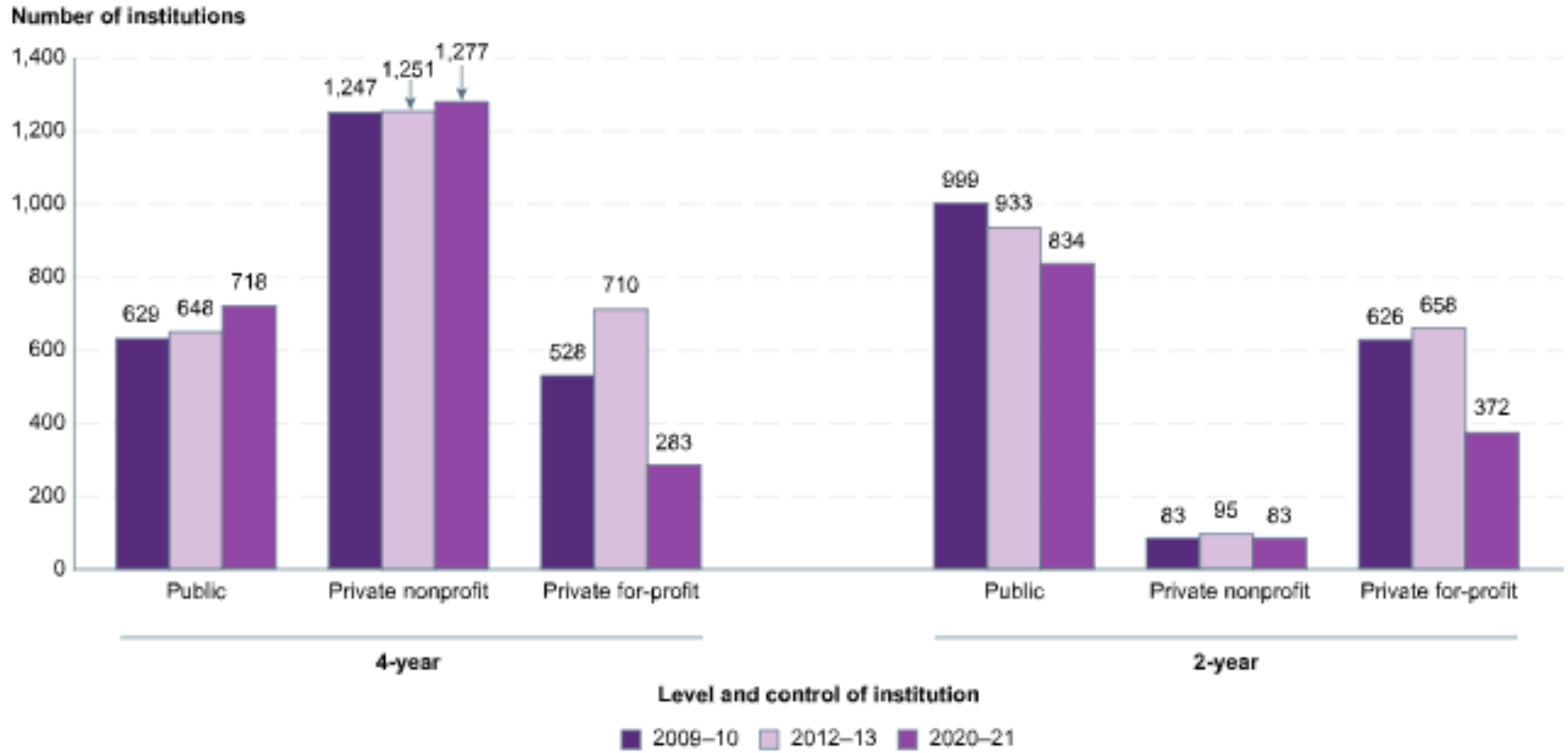


NOTE: *Immediate college enrollment rate* is defined as the annual percentage of high school completers who are enrolled in 2- or 4-year institutions in the October immediately following high school completion. High school completers include 16- to 24-year-olds who graduated with a high school diploma as well as those who completed a GED or other high school equivalency credential.

SOURCE: U.S. Department of Commerce, Census Bureau, Current Population Survey (CPS), October Supplement, 2010 through 2020. See *Digest of Education Statistics 2021*, tab 302.10.

In every year from 2010 to 2020, higher percentages of high school completers immediately enrolled in 4-year institutions than in 2-year institutions. In 2020, about 43 percent of high school completers immediately enrolled in 4-year institutions and 20 percent immediately enrolled in 2-year institutions. The immediate college enrollment rate for 4-year institutions in 2020 was not measurabl different from the rate in 2010. However, the rate for 2-year institutions decreased between 2010 (27 percent) and 2020.

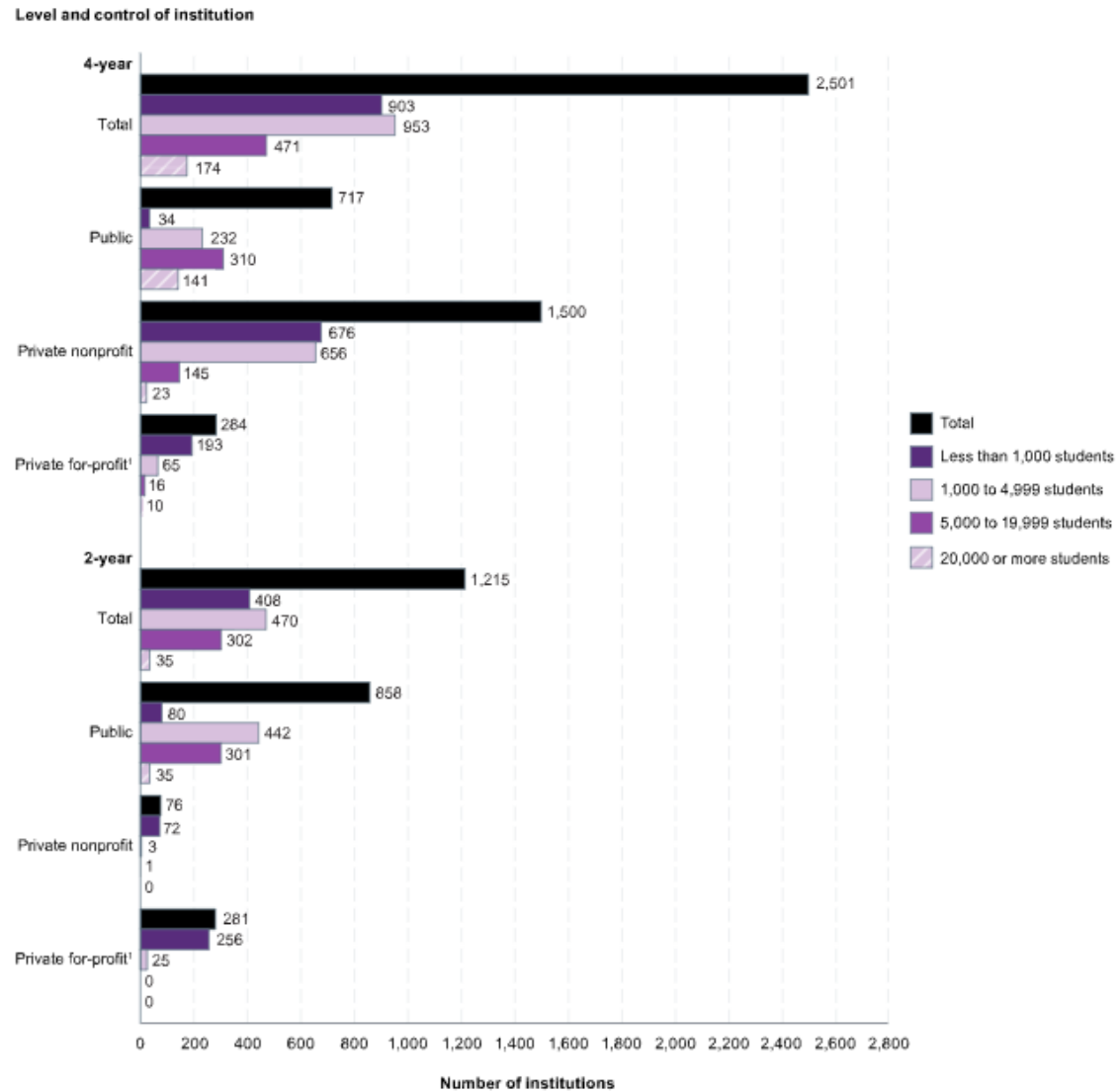
Figure 1: Number of degree-granting postsecondary institutions with first-year undergraduates, by level and control of institution: Academic years 2009–10, 2012–13, and 2020–21



NOTE: Data in this table represent the 50 states and the District of Columbia. Degree-granting institutions grant associate's or higher degrees and participate in Title IV federal financial aid programs. Excludes institutions not enrolling any first-time degree/certificate-seeking undergraduates.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Integrated Postsecondary Education Data System (IPEDS), Fall 2009 and 2012, Institutional Characteristics component; and Winter 2020–21, Admissions component. See *Digest of Education Statistics 2011*, table 342; *Digest of Education Statistics 2013*, table 305.30; and *Digest of Education Statistics 2021*, table 305.30.

Figure 3: Number of degree-granting postsecondary institutions, by level and control of institution and enrollment size: Fall 2020

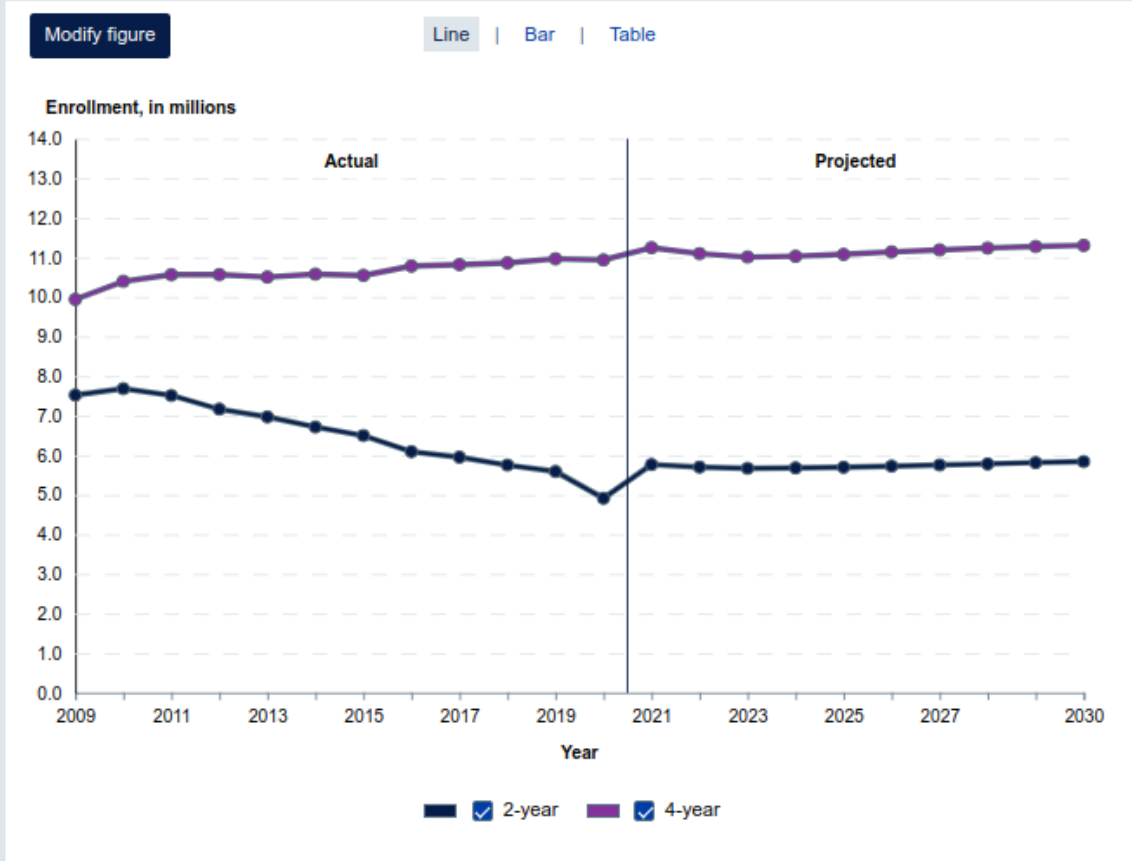


[1] Private for-profit institutions are categorized as 2-year or 4-year based on the level of institution as defined by the Integrated Postsecondary Education Data System, which may occasionally differ from the Carnegie classification's definition of 2-year institutions.

NOTE: Data in this table represent the 50 states and the District of Columbia. Degree-granting institutions grant associate's or higher degrees and participate in Title IV federal financial aid programs. Excludes institutions with no enrollment reported separately from the enrollment of an associated main campus.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Integrated Postsecondary Education Data System (IPEDS), Spring 2021, Fall Enrollment component. See *Digest of Education Statistics 2021*, table 317.40.

Figure 5: Actual and projected undergraduate enrollment in degree-granting postsecondary institutions, by level of institution: Fall 2009 through fall 2030



NOTE: Data are for the 50 states and the District of Columbia. Degree-granting institutions grant associate's or higher degrees and participate in Title IV federal financial aid programs. Projections were calculated after the onset of the coronavirus pandemic and take into account the expected impacts of the pandemic. Some data have been revised from previously published figures.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Integrated Postsecondary Education Data System (IPEDS), Spring 2010 through Spring 2021, Fall Enrollment component. Enrollment in Degree-Granting Institutions Projection Model, through 2030. See *Digest of Education Statistics 2021*, table 303.70.

In fall 2020, the 10.9 million students enrolled in 4-year institutions made up 69 percent of total undergraduate enrollment; the remaining 31 percent (4.9 million students) were enrolled in 2-year institutions. Between 2009 and 2020, enrollment increased by 10 percent at 4-year institutions (from 9.9 million to 10.9 million students), while enrollment decreased by 35 percent at 2-year institutions (from 7.5 million to 4.9 million students). The annual percentage change in 2-year enrollments ranged from 2 percent to 6 percent between 2009 and 2019. In comparison, 2-year enrollment was 12 percent lower in fall 2020 than in fall 2019, marking the largest single-year decline between 2009 and 2020. Between 2020 and 2030, undergraduate enrollment in 4-year institutions is projected to increase by 3 percent (from 10.9 to 11.3 million students) and enrollment in 2-year institutions is projected to increase by 19 percent (from 4.9 million to 5.8 million students). For 2-year institutions, most of the increase by 2030 is projected to come from a 17 percent rebound between 2020 and 2021.

The Challenge

The Critical Structure and Operation of State-sponsored Technical Training Collaboration with Industrial Partners

Michael Gargano, Jr.

SYSTEMS ENGINEERING RESEARCH CENTER

Connecticut Advanced Manufacturing Skilled Technical Workforce

Establishing a Collaborative Ecosystem for a Skilled Technical Workforce

August 24, 2022

BACKGROUND

- Connecticut is the home base for major defense contractors including Electric Boat, Pratt & Whitney, Sikorsky and Collins Aerospace Systems.
- Defense contractors were awarded more than $238 billion in government contracts from 2000 to 2020.
- There are approximately 3,500 Connecticut manufacturers providing parts and services to the defense industry. As a general standard, 60% of the work must be completed in-state for Connecticut defense contractors awarded government contracts.
- The Connecticut State College and University System, comprised of 12 community colleges, 4 four-year regional universities and one online college have the primary responsibility to provide the skilled technical workforce to the manufacturing sector.

ESTABLISH FOUNDATION ELEMENTS FOR SKILLED TECHNICAL WORKFORCE—SIX KEY ELEMENTS

- **Establish collaborative ecosystem.** The collaborative eco-system must create the governance and structure model for the program that defines the roles and responsibilities for state government, business and industry, education providers, and economic agencies that clarifies their roles as they collaborate on an occupational workforce training program.
- **Establish a consistent funding model.** Occupational workforce training programs are expensive. Although states provide different models of workforce development programs funded through federal, state, and private partnerships, successful workforce programs require a consistent and reliable source of funds to support the training, equipment, and technology. These elements must ensure that students will train and use equipment and technology equivalent to what is required once they are employed. Consistent funding is needed at a scale capable of developing additional or expanded occupational workforce training programs as additional industry sectors become involved.
- **Establish critical relationships.** Although money will always be a central asset in developing occupational training workforce programs, the most important linkage for success is between the education providers and the business and industry employers. We believe key stakeholders must be close collaborators. Overall, the role of business and industry is to establish workforce skills and competencies and the role of educators is to establish the student learning outcomes that, embedded in the curriculum, internships and apprenticeships, lead to student skill, competency, and work readiness. This relationship is based on mutual respect with an understanding that flexibility is critical. For example, a successful skilled technical workforce training program will provide business and industry the opportunity to participate in the education providers' curricular development, normally a domain closed to all but education provider staff. Education providers will seek support from employers to understand goals beyond immediate employment so they can provide students with reasonable career and advancement expectations as well as the additional training.

ESTABLISH FOUNDATION ELEMENTS FOR SKILLED TECHNICAL WORKFORCE:(CONTINUED)

- **Establish the strategic focus.** A successful workforce training program requires careful analysis to determine the specific requirements for the skills and capabilities needed by business and industry. Because workforce demand and supply are specific to business and industry requirements, industry must clearly define the types of jobs by classification, skills and competencies, number needed both currently and in the future, and the level of experience required whether entry level, mid-level, or above. At the same time education providers must be forthcoming in describing their capacity to produce the training needed to deliver a workforce that meets business and industry expectations and needs.
- **Establish a target workforce.** The example of high school programs offers the opportunity to insert industry-based skilled training and work preparation into the secondary system. For example, Connecticut has implemented an innovative program that enables high school students to simultaneously earn a high school diploma with an advanced manufacturing certificate offered by one of the 12 community colleges combined with on-the-job-training at an industry manufacturing facility. The result is a graduate that is job ready on day one.
- **Establish training evaluation measures.** Annual evaluation is critically important to evaluate success and make necessary mid-course corrections. Program evaluation should include appropriate metrics for state government investment and, likewise, performance and outcome metrics will need to be designed for business and industry, education providers and students including student mobility. We believe it is important to track program outcomes, such as changes in knowledge and skills of current and future workforce participants, and access to jobs or job opportunities that occur because of additional training and formal education.

KEY ELEMENT ONE:

Establish collaborative ecosystem for skilled technical workforce programs:

1. The collaborative eco-system must create the governance and structure model for the program that defines the roles and responsibilities for state government, business and industry, education providers, and economic agencies that clarifies their roles as they collaborate on an occupational workforce training program.

CONNECTICUT STATUTE TO INSTITUTIONALIZE THE COLLABORATIVE ECOSYSTEM:

Statutory Charge Section 10-21j(c) of the Connecticut General Statutes Sec. 10-21j.

Committee to coordinate education re careers in manufacturing. (a) The Commissioner of Education, in collaboration with the Board of Regents for Higher Education, shall establish a committee to coordinate the education of middle school and high school students about careers in manufacturing.

Such committee shall include, but not be limited to, (1) representatives from the Department of Economic and Community Development, the Labor Department, the Connecticut Center for Advanced Technology, the technical high school system, the advanced manufacturing centers at the regional community-technical colleges, independent institutions of higher education in the state that offer training in the field of manufacturing, the Connecticut Employment and Training Commission, manufacturing companies and employee organizations that represent manufacturing workers, and (2) middle and high school teachers and guidance counselors.

Establish a consistent funding model for skilled technical workforce programs:

2. Occupational workforce training programs are expensive. Although states provide different models of workforce development programs funded through federal, state, and private partnerships, successful workforce programs require a consistent and reliable source of funds to support the training, equipment, and technology. These elements must ensure that students will train and use equipment and technology equivalent to what is required once they are employed. Consistent funding is needed at a scale capable of developing additional or expanded occupational workforce training programs as additional industry sectors become involved.

Connecticut's Manufacturing Innovation Fund institutionalizes non-lapsing financial support for skilled technical workforce programs:

Connecticut's recurring $75 million Manufacturing Innovation Fund was specifically developed and codified in state statue to support the workforce needs of the manufacturing sector and defense contractors.

The State of Connecticut established the Manufacturing Innovation Fund (MIF) $75 million to support the growth, innovation and progress of Connecticut's advanced manufacturing sector. This funding is used to provide direct loans and/or grants as well as to support an array of initiatives, including:

- Encouraging company/university collaboration in research and development efforts;
- Providing vouchers to assist with business development and technical needs;
- Funding job training and educational programs that strengthen workforce skills; and
- Providing matching funds for federal grants.

A key focus of the state's economic growth strategy. Advanced manufacturing now generates nearly 11% of Connecticut's gross state product — and continues to be central to the state's strategic growth plans.

Establish critical relationships to institutionalize skilled technical workforce programs:

3. Although money will always be a central asset in developing occupational training workforce programs, the most important linkage for success is between the education providers and the business and industry employers. We believe key stakeholders must be close collaborators. Overall, the role of business and industry is to establish workforce skills and competencies and the role of educators is to establish the student learning outcomes that, embedded in the curriculum, internships and apprenticeships, lead to student skill, competency, and work readiness. This relationship is based on mutual respect with an understanding that flexibility is critical. For example, a successful skilled technical workforce training program will provide business and industry the opportunity to participate in the education providers' curricular development, normally a domain closed to all but education provider staff. Education providers will seek support from employers to understand goals beyond immediate employment so they can provide students with reasonable career and advancement expectations as well as the additional training.

Connecticut's effort to institutionalize the critical relationships for skilled technical workforce programs:

- The Aerospace Components Manufacturing sector plays a major role in providing parts and supplies to defense contractors. In collaboration with the Connecticut State College and University System 12 community colleges, they have jointly developed a curriculum and apprenticeship program to train for entry level positions in advanced manufacturing.
- The 12 community colleges have state of the art advanced manufacturing centers that enable students to practice on the same type of equipment and technology they will experience at defense contractor manufacturing sites. In addition, the community colleges employ mid to senior level defense contractor manufacturer supervisors to help instruct the students.

Establish the strategic focus to institutionalize skilled technical workforce programs:

4. A successful workforce training program requires careful analysis to determine the specific requirements for the skills and capabilities needed by business and industry. Because workforce demand and supply are specific to business and industry requirements, industry must clearly define the types of jobs by classification, skills and competencies, number needed both currently and in the future, and the level of experience required whether entry level, mid-level, or above. At the same time education providers must be forthcoming in describing their capacity to produce the training needed to deliver a workforce that meets business and industry expectations and needs.

Connecticut's defense industry and educators have identified the high demand skilled technical workforce:

- Engineering Science
- Electronics Technician
- Electro Mechanic Maintenance
- Machine Technician
- Welding
- Additive Manufacturing
- Advanced Manufacturing Machine Technology
- CAD/CAM
- Advanced Welding
- Electrome Mechanical Maintenance
- Advanced Manufacturing Machine Technology
- Web Designer & Development
- Engineering Science
- Manufacturing Engineering Science
- Software Engineering
- Technological Studies
- Biotechnology
- Computer Software Hardware
- Computer Information Systems
- Construction Management
- Biomedical Engineer Technician
- Environmental Science
- Electrical Engineer Technician
- Mechanical Engineering Technician
- Solar Technology
- Quality Control
- Transportation & Logistics
- Water Management
- Computer Information Systems
- Biomolecular Science Technician
- Laser & Robotics Engineering Technician
- Nuclear Engineering Technician

Establish a target workforce to institutionalize skilled technical workforce programs:

5. The example of high school programs offers the opportunity to insert industry-based skilled training and work preparation into the secondary system. For example, Connecticut has implemented an innovative program that enables high school students to simultaneously earn a high school diploma with an advanced manufacturing certificate offered by one of the 12 community colleges combined with on-the-job-training at an industry manufacturing facility. The result is a graduate that is job ready on day one.

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COMMUNITY COLLEGE FAST FACTS:

- All 12 CSCU community colleges provide education through degree/certificate programs or non-credit through short-term or incumbent training programs.
- Community Colleges enroll around 3,000 students in advance manufacturing programs including engineering science program offered by the College of Technology.
- Community college annually graduate around 630 students in advance manufacturing programs.
- The three-year average graduation is 175 associate degrees and 460 certificates.
- The three-year average graduates does not include business & industry incumbent worker customized training programs or programs for non-credit that lead to industry recognized credentials.
- Community colleges averages around 125 additional graduates in computer information sciences fields.
- Approximately 73% of advanced manufacturing technology credentials are awarded as certificates.
- On average nearly 80% of the graduates are employed by the first to third quarter upon graduation.

Connecticut's efforts include the Voucher Program, Incumbent Worker Program and Young Manufacturers Academy:

- Over the past seven years, one of the most utilized initiatives the Manufacturer Innovation Fund has funded has been the Voucher Fund. The program offers matching grants from $5,000 to $50,000 for new equipment, software, technology, research and training.
- Incumbent Worker Program is administered by the CT Department of Labor. It is designed to help defray the cost of training employees on new technology and processes, the program provides manufacturing companies matching grants up to $50,000. The funding helps pay for training that keeps employee skills up to date and helps to develop the next generation of leadership.
- Young Manufacturing Academy. Focusing on grades 5-8, the program opens the minds of middle-school students across Connecticut to the world of possibilities in manufacturing-from CNC machining to engineering to factory design.

Establish skilled technical workforce training program evaluation measures:

6. Annual evaluation is critically important to evaluate success and make necessary mid-course corrections. Program evaluation should include appropriate metrics for state government investment and, likewise, performance and outcome metrics will need to be designed for business and industry, education providers and students including student mobility. We believe it is important to track program outcomes, such as changes in knowledge and skills of current and future workforce participants, and access to jobs or job opportunities that occur because of additional training and formal education.

Connecticut' effort to institutionalize effective evaluation measures:

- Primarily Connecticut's effort to evaluate the impact of its investment with skilled technical workforce programs has been on the impact to the state's economy.
- Not only does the advanced manufacturing sector in Connecticut employ hundreds of thousands of workers across the state, it accounts for nearly $30 billion of the state's GDP and generates nearly $380 million in state, corporate, sales and use taxes that can be used to fund other essential statewide initiatives.
- 153,00 in direct jobs and 3X in indirect jobs. Indirect creates another 459,000 jobs in other segments of the state's economy.
- $380 million annual tax revenues for the state. Advanced manufacturing companies contribute: $144.5 million in state corporate taxes and $235.5 million in state sales and use taxes.
- $29.7 billion of State's GDP and $13.8 billion in exports. The 3,500 manufacturing companies generate: 10% of the state's gross GDP and 92% of Connecticut's total exports.

SUMMARY OF THE SIX COMMON CHALLENGES TO SUSTAIN AND GROW SKILLED WORKFORCE TRAINING PROGRAMS:

1. Quantify workforce demand. This is generally calculated based on two factors: 1) Current and future business growth plus technology innovation that could displace some jobs; and 2) Projected employee retirement. A validated mechanism does not exist to capture these critical data points across industry.

2. Quantify workforce development program expansion expense. Primarily the expense is relative to the education providers to hire additional workforce programs directors and instructors, paid internships and apprenticeships, and to provide a stand-alone facilities with state-of-the-art equipment and technology for the students to train. Representatives also referenced the annual expense to continuously update equipment and the overall expense to maintain a training facility.
3. Identify reliable and consistent funding sources. All states annually allocate budgets to different state agencies that support education, training and reskilling of its citizenry. Limited funds scattered throughout the agencies reduces the potential to maximize workforce development efforts. Representatives would prefer a designated budget allocation for every industry sector in which a workforce development program is identified. In addition, representatives are concerned with the use of one-time America Recovery Act funds for use with workforce development programs, believing that when the funds no longer exist some initiatives will end.

SUMMARY OF THE SIX COMMON CHALLENGES TO SUSTAIN AND GROW SKILLED WORKFORCE TRAINING PROGRAMS: (CONTINUED)

4. Identify the expense associated with internships and apprenticeships. Business and industry consider internships and apprenticeships a critical education and training component to prepare the entry level workforce. A few challenges have emerged including: A) The majority of industries have limited capacity to host student interns, thereby limiting student training; B) Participating industry must identify a director to manage the internship program adding an additional expense; and C) The student travel expense to and from the work site is unaccounted for. In some cases students rely upon public transportation that may not run on a consistent schedule as the internship requires.

5. Reliable data collection. This critical item touches all aspects of workforce development program efforts. Ranging from calculating the state return on investment to industry hiring of the trained student educators, state representatives have all advocated for a centralized system and methodology to collect and interpret workforce supply and demand data. In addition, representatives have advocated for more information on student/employee mobility especially after additional upskilling and formal education.

6. Staff attrition. This issue was raised at both the state agency level and with industry. Representatives commented staff attrition causes delays with program implementation and sometimes new staff create a different agenda.

QUESTIONS AND DISCUSSION


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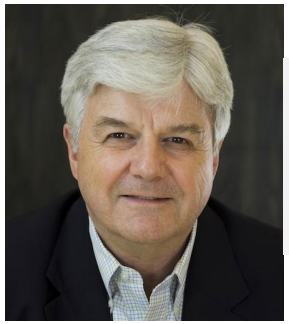
UPCOMING TALK: DECEMBER 7

SERC TALKS

Dr. Rita R. Colwell
Founder and Chair, CosmosID, Former Director, National Science Foundation
Wednesday, December 7, 2022 | 1PM ET



"Innovating for STEM Readiness" Series Moderator:

Dr. William Rouse, SERC Research Council Member, Georgetown University

CONTACT

Webinar Coordinator: Ms. Mimi Marcus, Stevens Institute of Technology – mmarcus@stevens.edu

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