

Elevate.

Optimizing the Role of Higher Education in the Emerging
Innovation Landscape



Compete.

Council on
Competitiveness

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Setting the Stage

Since the Council's founding in 1986, U.S. college and university leaders have played a central role alongside their corporate, labor and national lab peers in developing and championing critical federal and state policies to drive regional and national economic development, leadership in basic and applied research, technology commercialization and skilled job creation. Council Founder John Young, the CEO of Hewlett Packard, recognized from the start the critical role universities and colleges play in driving and enhancing U.S. competitiveness and technological leadership as core to ensuring the nation's future prosperity and national security.

A look back over the Council's history in this space must begin with the groundbreaking Clusters of Innovation work in the late 1990s, done in partnership with Professor Michael Porter of Harvard Business School, that explored regions anchored by higher education assets in cities like Atlanta, Wichita and San Diego. In 1999, we co-created the *Innovation Index*, which eventually led the Department of Commerce to support Professor Porter in developing the first-ever SIC/NAICS cross-walk, allowing for the quantification of traceable clusters.

Regional innovation and the critical role of higher education in this ecosystem have been the bedrock of the Council's policy work ever since. Over the years, we have led extensive partnerships with the Departments of Commerce, Labor and Energy, as well as the National Governors Association. And much of our recent work, including two National Science Foundation supported grants – the Exploring Innovation Frontiers Initiative and the Building Industry-University-Laboratory Dialogue (BUILD) for Advanced Computing – and a multi-year Department of Energy partnership on advanced computing, has featured important regional innovation components, many times engaging the Council's universities and colleges as key facilitators. Highlights of these efforts include:

- In recognition of the central role of innovation to economic and national security, the president of MIT hosted the Council's first innovation summit in 1998 setting the stage a few years later for the Council's groundbreaking National Innovation Initiative co-chaired by the president of Georgia Tech and the CEO of IBM.

This multi-year effort to define the scope of the opportunity in U.S. leadership as the world's innovator culminated in the release of *Innovate America* and spurred multiple national and international efforts to embrace innovation as the core driver of regional and national economic growth. Most notably, the bipartisan America COMPETES Act of 2008 traces its lineage directly to the Council's report.

- *Innovate America* highlighted the central role of U.S. colleges and universities in spearheading multidisciplinary education, working on the edge of technological innovation and partnering with public and private sector stakeholders to maximize value from our investments in people and ideas.
- Following the 2006 *Innovate America* report, the Council partnered with the National Governors Association on a major regional innovation initiative that included a co-branded report, *Cluster-Based Strategies for Growing State Economies*.
- Further leveraging the insights of *Innovate America* and the support of the Department of Commerce's Economic Development Administration and the Department of Labor, the Council developed a series of guides for academic, government and industry stakeholders to implement key strategies to develop regional assets. These included, *Regional Innovation*, *National Prosperity* and

Engage (a guide to recruiting business leaders into regional growth strategies).

- Also, coming out of the Council's earlier innovation work was a major partnership with the Department of Labor that linked federal workforce and economic development efforts for greater impact at the state/regional level. The Workforce Innovation for Regional Economic Development (WIRED) program was a first of its kind effort to maximize and coordinate the federal investment in these areas driven by bottom up, state-driven initiatives.
- More recently,, the National Science Foundation supported two major Council initiatives to explore the changing nature of U.S. innovation capacity and new public-private partnerships to support advanced computing. The Exploring Innovation Frontiers Initiative put forth an agenda to capture the opportunity in the democratization and diversity across the innovation landscape. The Building Industry-University-Laboratory Dialogue (BUILD) for Advanced Computing is identifying new partnerships to leverage U.S. leadership at the forefront of supercomputing. Both efforts engaged the Council's college and university members as conveners, subject matter experts and leaders in regional economic development.

- For over fifteen years and across three administrations, the Council has partnered with the Department of Energy and other government institutions to mobilize senior leaders across industry, academia, labor and the national labs to make the case for leveraging federal investments in advanced computing to create competitive advantage and opportunities for U.S. industry. Most recently, the Council brought regional leaders in New York, California, Ohio and Tennessee together with the broader S&T community around critical opportunities in advanced computing.
- The pinnacle of the Council's work with the Department of Energy was the three-year American Energy and Manufacturing Competitiveness (AEMC) Partnership. The AEMC launched following the release of a major research report by the Council on public-private partnership models, *The Power of Partnerships*. Over the course of our work with DoE, the Council hosted nine regional dialogues and four national summits and obtained insights from industry, academia, national laboratories and government to drive U.S. competitiveness in new production models, energy efficiency and advanced manufacturing.
- Concurrent with the AEMC, the Council launched the privately funded Energy & Manufacturing Competitiveness Partnership (EMCP), a three-year effort to explore the economic opportunity at the nexus of energy and manufacturing in the United States. The EMCP engaged university, national lab and corporate members to host sector specific dialogues designed to call out cross-cutting policy issues affecting diverse interests, technologies and industries.
- And for a decade, the Council's Technology Leadership and Strategy Initiative, comprising 50 CTOs, deputy national laboratory directors and heads of research from America's universities and colleges, has helped define the competitiveness opportunity at the intersection of university-business-government partnerships that can pave the way for new products, businesses and high skilled jobs.

The Council's college and university leaders have been central to our focus on national innovation capacity and the passage of the bipartisan America COMPETES Act in the early 2000s, through to current leadership on energy, manufacturing, enterprise resilience and technology policy. In short, they have helped set the agenda for U.S. competitiveness in Washington and across the country. And, in 2019, the Council will launch the National Commission on Innovation and Competitiveness Frontiers to confront and overcome critical challenges facing the U.S. innovation engine and to create momentum in the United States to pick up the pace of innovation.

The Commission will bring together a set of national leaders from industry, academia, the national labs and labor to put forth a national agenda to create momentum in the United States to outpace the rest of the world in innovation capacity, capability and competitiveness; to build on the Council's history of work in defining, articulating and activating America's innovation movement; and to develop new partnerships and

efforts to launch and scale innovation-based research, businesses and ventures.

Through the University Leadership Forum, the Council is ensuring colleges and universities will continue to play a vital and necessary role in setting the Council's policy agenda and supporting the long-term competitiveness of the United States. On behalf of the Council's Board and Executive Committee, we thank the members for their support and critical input to this new initiative.

Sincerely,



A handwritten signature in black ink that reads "Michael Crow". The signature is written in a cursive, flowing style.

Michael M. Crow
President
Arizona State University, and
University Vice-chair
Council on Competitiveness



A handwritten signature in black ink that reads "Deborah L. Wince-Smith". The signature is written in a cursive, flowing style.

Deborah L. Wince-Smith
President & CEO
Council on Competitiveness

Letter from the Co-chairs

In order to meet the challenges of an interconnected, rapidly developing 21st century global innovation ecosystem, the college and university members of the Council on Competitiveness are proud to launch the University Leadership Forum.

Institutions of higher education from community colleges and liberal arts colleges to public and private undergraduate and graduate research universities play a pivotal role in competitiveness and economic growth. They are critical components of innovation ecosystems and serve as wellsprings of new knowledge and technology that function as the building blocks for new products, services, systems and processes. They develop the talent needed for discovery and investment and feed the pipeline of creative entrepreneurs who drive new business formation. It is not surprising then, that when looking at a global map of industry clusters and thriving startup zones, it is clear that the most innovative cities and regions in the nation are anchored by America's academic institutions.

In this era of transformation, colleges and universities are embracing and re-imagining their pivotal roles in enabling economic development. They are responding to rapidly changing knowledge and skill demands and supporting communities of learners who are connected across cultures and geographies. They are making greater efforts than ever before to harness their unique capabilities to stimulate regional economic growth and to build multi-stakeholder partnerships to accelerate technology development and its commercialization at scale – a trend that is accelerating globally as well as nationally.

New learning models that move beyond the status quo and correspond with the transformational shifts in jobs and skills are imperative for competitiveness in the 21st century. The University Leadership Forum enables leaders from America's top academic institutions to join forces with each other and with Council members from industry, labor and the national laboratories to understand the changing innovation landscape and to develop solutions to current and future challenges to U.S. competitiveness. While academia will lead this initiative, industry and other stakeholders, such as national laboratories, will play important roles to highlight and inform best practices on collaborative models and to explore new mutually beneficial relationships to drive inclusive innovation.

The University Leadership Forum is focused on understanding how colleges and universities contribute to the competitiveness of the United States, maximize the value these institutions add to the U.S. economy and enhance prosperity for all Americans.

For its initial work plan, the University Leadership Forum will address the challenges and opportunities in three broad areas:

- Extreme Innovation;
- University-Industry-Government Partnerships; and
- The Fusion of STEM & Liberal Arts Disciplines

The University Leadership Forum will formally launch at a meeting in Washington, DC on June 18, 2019. Members will have the opportunity to discuss and advance the three work streams and to set the agenda for moving forward. Subsequent task force meetings will take deeper dives into their respective issues and engage outside expertise from among the Council membership and other stakeholders, including policymakers at the federal and state levels.

As university and college leaders come together, discussions will focus on sharing best practices, developing new concepts and formulating policy recommendations across the three work-streams. The Forum is intended both as an internal think tank to the Council on the critical role of higher education in shaping U.S.

competitiveness, and as an impact player in state and federal policymaking, building the work force of the future.

We thank the members of the University Leadership Forum for their support and contributions and look forward to working together to co-develop a robust national policy agenda for a more prosperous and productive nation.

Sincerely,



A handwritten signature in black ink that reads "Michael R. Lovell".

Michael R. Lovell
President
Marquette University



A handwritten signature in black ink that reads "Jere W. Morehead".

Jere W. Morehead
President
University of Georgia

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Initiative Overview

Colleges and universities are critical components of the U.S. innovation ecosystem and are being called upon to play ever-evolving roles in research, economic development, skills training and life-long learning.

They are essential for building talent; achieving scientific breakthroughs; creating new technologies, products, companies and organizations; and contributing to the local and national economies. Budgetary constraints and rapid technological change are spurring the evolution of new business models targeted at challenges such as higher operating costs, student access and affordability. In short, colleges and universities are as susceptible to disruption as every other sector of the economy. How they manage portfolios of intellectual property, attract the best and brightest from around the globe while ensuring affordable access to U.S. students and navigate shrinking financial support from the public sector are key questions that will define higher education's role in America's future competitiveness.

Massive structural transformations underway in the United States, such as the ongoing digitization of the economy, including the way people work, shop and play; the impact of emerging technologies on societal norms and ethics; and diverse, ever changing expectations for the workforce of the future – are forcing

colleges and universities to reevaluate their roles in this ecosystem. However, these challenges also provide exciting opportunities for innovation, and businesses, research entities, government and labor stand ready to work with higher education to explore and implement new models for success.

Understanding, anticipating and promoting change in the current models for higher education is imperative for competitiveness in the 21st century. The University Leadership Forum will enable leaders from America's top academic institutions to work in concert with each other and as part of the broader Council membership, including CEOs, labor union leaders and the directors of national laboratories to: understand how innovation is changing; consider actions institutions might take; mobilize to lower or eliminate shared barriers; and identify potential innovation partners. While the focus will be on academia, industry and other stakeholders will participate and share best practices on cooperation to continue building relationships that foster innovation.

This initiative will bring together college and university leaders from a variety of institutions and backgrounds. Participants will set the innovation agenda for university leadership now and into the future through the lens of U.S. competitiveness.

The Forum will meet bi-annually and each task force will meet separately hosted by Forum members throughout the country. The groups will also convene regularly through scheduled teleconferences designed to advance the conversation and develop learnings and best practices. Council members from industry, labor and the national laboratories will be invited to participate on an ad hoc basis to contribute to the work of the Forum.

Throughout the work of the Forum, policymakers at the federal and state levels will also be engaged through direct participation and through outreach by Council members and staff. The work of the Forum will inform the Council's overall policy agenda, including the newly launched National Commission on Innovation and Competitiveness Frontiers, as it seeks to leverage the critical role of higher education in America's innovation ecosystem and its dual impacts upon shaping national prosperity and security.

TASK FORCES

The University Leadership Forum will initially concentrate its work agenda around three interconnected institutional challenges and opportunities that collectively will better optimize the pivotal role and measurable impact of America's colleges and universities on U.S. competitiveness. The Forum will explore higher education's role in the nation's advanced research and development enterprise, in equipping the next generation of Americans with the skills and learning required to thrive and prosper in an ever-transforming global economy, and in supporting regional economic development and national economic growth through

enhanced academic, industry and government collaboration and strategic partnerships.

Extreme Innovation

With digitization and the convergence of sectors ranging from manufacturing to biotechnology, extreme innovation projects drive discovery and human progress, result in new business models to meet social needs, mold the future of work and sow the seeds for economic growth and job creation. For example, last year a McKinsey Global Institute paper estimated that AI techniques could create between \$3.5T and \$5.8T in value annually across nine business functions in 19 industries.¹

America's academic enterprise has played an essential role in the research, design and execution of extreme innovation projects. Colleges and universities across the country are leading in the development of cutting-edge technologies, spanning the spectrum from quantum computing to artificial intelligence to gene editing.

This is science at the edge often requiring long-term commitments and a global scope. Consider the recent publication of the first ever photograph of a black hole. Over five years of observation², researchers were able to gather vast amounts of data to assemble an image of a black hole using the Event Horizon Telescope (EHT). The EHT links telescopes across the globe using a radio signal, creating an earth-sized virtual telescope, allowing for higher resolution imaging.³ Over 200 scientists from countries such as France, the Netherlands and the United

States all worked together to sift through the vast amount of data before assembling the image.⁴ The process of compiling the image took months, as the equivalent of over 5,000 years of mp3 files was produced.⁵ From start to finish, the project lasted over 20 years, costing roughly \$19.3 million.⁶

Whether pushing the boundaries of what we can see at vast distances or at quantum scales, new technologies are disrupting industries, jobs and economies across the globe, as well as shaping how humans will progress and how society will advance. They are crucial drivers of productivity and economic growth, altering the patterns of society and many dimensions of everyday life. For academia, companies and countries, the ability to leverage these technologies for economic impact is fundamental to their competitiveness and economic success. In addition to their economic potential, these technologies could solve many of the world's critical challenges surrounding areas such as healthcare, energy and sustainability, clean water and the global food supply.

In addition to the research component, universities and colleges are ground zero for educating and training the next generation workforce to take advantage of these disruptions. A Council-Deloitte report on "Exponential Technologies" highlighted that as companies transition to an agile, technology-powered culture in an era defined more and more by exponential possibilities, companies will increasingly turn to one of their most important

assets—people—to achieve new levels of output and success. Individuals are quicker and more adept at adopting new innovations than businesses—and society—as a whole. The goal, therefore, when managing future talent-related opportunities and challenges is to encourage individuals to seek change rather than resist it. This is especially important as roles evolve from training on routine processes and tasks, to educating and retraining workers in new skill sets that focus on innovating and problem solving to unlock new forms of value in an ever-evolving ecosystem and economy.⁷

These issues have been a key part of discussion for the Council's Technology Leadership and Strategy Initiative (TLSI), which has served for the past decade as an internal technology policy think tank for the organization, as well as a public advocate for policies to leverage value from the cutting edge of technology. The TLSI's work has included task forces on priorities, such as "Accelerating Innovation for American Competitiveness," that laid the groundwork for recommendations to policymakers that have borne fruit over the years such as permanently extending the R&D tax credit, expanding the network on manufacturing hubs across the country and building on the success of the federal technology transfer laws enacted during the 1980s.⁸

What still remains to be determined is how exponential technologies and extreme innovation will impact higher education itself. The technologies being developed in America's universities will carry the country into a new era of extreme innovation. While these fields are researched and developed by colleges and universities, higher education itself will inevitably be shaped by these technologies as they introduce unique challenges that must be addressed.

University-Industry-Government Partnerships

Industry relies on colleges and universities to invest in early-stage technology, provide proof of concept for new processes and products, contribute academic expertise and educate and train students to successfully enter the workforce. The research and development for many innovations would not be possible without partnerships between industry and academia, and support from government. Given the Council's cross-sectoral membership representing industry, academia, national labs and labor, these partnerships are central to our mission and critical to the policy impact that the Council affects.

Beginning in 1980 with the passage of the Bayh-Dole Act, there was a tectonic shift in the U.S. approach to tech transfer and commercialization. Under this act, universities that receive federal funding, businesses, or non-profit organization, are able to pursue invention. By emphasizing patent management and patent licensing, the country began to see an increase in country-wide research and development. In 1986, Congress enacted the

Federal Technology Transfer Act (FTTA, to improve access to federal laboratories by non-federal organizations.⁹ Shortly after, in 1987, President Ronald Reagan issued Executive Order 12591 to ensure that federal laboratories transfer their technology knowledge and assist in the research and development of public universities and the private sector.¹⁰ The order reiterated themes that are found in both the Bayh-Doyle Act and the FTFA.

Several years later in 2000, Congress signed the Technology Transfer Commercialization Act to further improve the ability of Federal agencies to license federally owned inventions. The act stresses the importance of collaboration between federal labs, universities and industry for future economic prosperity in the United States.¹¹

University research and the transfer of knowledge continues to drive the innovation economy in the United States. Since the Bayh-Dole Act was enacted, the U.S. has developed over 200 vaccines and drugs through public-private partnerships, granted 80,000 patents and disclosed 380,000 inventions.¹²

Yet, even today, the United States is looking for ways to maximize the return on investment of the nation's research enterprise. The Council is not alone in undertaking efforts around the issue of technology transfer. In 2016, in recognition of the evolving role of public universities in the innovation landscape, the Association of Public Land Grant Universities (APLU) convened a working group on technology transfer evolution.

This working group was tasked with: examining the evolution of technology transfer in detail; calling out examples of the ways in which technology transfer is changing; identifying challenges and obstacles to the ongoing evolution; and making recommendations to help universities continue the evolution. Many other organizations including the Association of American Universities (AAU), Association of University Technology Managers (AUTM), the Council on Governmental Relations (COGR), SSTI and the University Industry Demonstration Partnership (UIDP), are looking at this issue as well with an eye towards building upon a U.S. strength.¹³

In December 2018, the U.S. Department of Commerce's National Institute of Standards and Technology (NIST) released a draft green paper detailing steps to modernize the U.S. system of technology transfer and innovation for the 21st century. The intent of the report and the actions it described are to maximize returns on the taxpayer investment in R&D through enhanced partnerships, streamlined regulations and simplified intellectual property paradigms.¹⁴

These university-industry-government collaborations have taken on a greater urgency in recent years as federal and state support for research has stagnated. Programs and projects that bring together higher education and industry allow for mutually beneficial outcomes that support academic research, enhance industry

capabilities and support local and regional economic development. Industry partners can also provide critical guidance on technological and economic trends including skill sets needed in the workforce, a critical indicator for new programs or degrees students can pursue. Yet, there are challenges to creating lasting, scalable partnerships between academia, industry and government that must be addressed.

The Fusion of STEM and Liberal Arts Disciplines

When engineers think like artists and artists think like engineers, new perspectives are created on the road to discovery. Through disciplines such as art, history, philosophy, ethics, language and music, scientists and engineers can push the boundaries of their disciplines often resulting in groundbreaking research. Large corporations are utilizing the liberal arts infusion to keep their employees thinking creatively and students must be prepared to apply both art and science skills to take maximum advantage of workforce opportunities.

The integration of arts with science, technology, engineering and math is not a new concept, but it has taken on new urgency as support for the arts has waned from K-12 to college. Small liberal arts colleges are closing, bachelor's degrees in the arts are declining and many colleges and universities are reducing their offerings in the arts.¹⁵ Yet, the

Council's 2016 report *Work* stated that for workers to succeed at the leading edge of innovation... it requires not only technical excellence, but also the pursuit of the leading edge of design, marketing, social media and building value for a diversity of customers. This goes beyond the need for technical skills, to include critical thinking, creativity, imagination and the understanding of people, societies, and what they need and want. Add to this a growing realization that the "ethics" of technology is central to understanding and managing many of the disruptors on the horizon such as AI and automation.¹⁶

In 2017, the National Academy of Sciences, Engineering and Medicine conducted a study to examine the role of liberal arts in STEM education. *The Integration of the Humanities and Arts with Sciences, Engineering, and Medicine in Higher Education*, published in 2018, examines the evidence behind the assertion that educational programs that mutually integrate learning experiences in the humanities and arts with science, technology, engineering, mathematics and medicine (STEMM) lead to improved educational and career outcomes for undergraduate and graduate students.¹⁷ The study found that, among other things, many of the learning outcomes associated with the integration of the humanities and arts with STEM—critical thinking, communications skills, the ability to work well in teams, content mastery, improved visuospatial skills and improved motivation and enjoyment of learning, for example—align with those that employers say they are looking for in recent graduates. Increasing enrollment in interdisciplinary courses and majors also suggests that students are interested in integration.

At the same time, researchers found that despite enthusiasm for interdisciplinary approaches in teaching and research, numerous challenges tend to discourage interdisciplinary integration—even within related fields. Rigid professional identities, disciplinary structures, and organizational and bureaucratic arrangements are interlinked in ways that tend to disincentivize interdisciplinary integration. Multidisciplinary education comprising fields such as biomimicry, computer graphics and a host of dual degree programs is a clear differentiator for U.S. students that will allow them to compete globally. This shift includes the integration of STEM education and the arts through a concept called STEAM (Science, Technology, Engineering, Arts and Math, which promotes greater interaction across fields.¹⁸

Looked at through the lens of competitiveness, this integration is a critical advantage for U.S. students, workers and industry. Aware of U.S. leadership in this area, foreign students continue to flock to U.S. advanced degree programs in STEM fields, far out pacing U.S. citizens in these programs.¹⁹ While attracting the best and brightest from around the world continues to be a priority for national competitiveness, balancing that with the need to prepare U.S. citizens with the tools to compete and prosper is a challenge for the higher education community and policymakers alike.

Extreme Innovation Task Force Charter

Co-chairs



Dr. James R. Johnsen
System President
University of Alaska



Dr. Laurie A. Leshin
President
Worcester
Polytechnic Institute

Goal

Understand the role of universities in translating extreme innovation into economic value.

Initial Task Force Questions to Address

To meet the goal, the task force will address the following questions:

- What are the key aspects of extreme innovation with respect to development, funding and governance?
- How can universities better position themselves to initiate, participate in or lead such projects?
- What are some of the emerging opportunities for universities to take part in extreme innovation?
- What are some examples of university- led projects in this area that could be replicable models?
- Are expectations for extreme innovation at universities matching the current reality for these technologies?

Concept

The Council's 2018 *Clarion Call for Competitiveness* stated:

"At the same time that competition in technology and innovation is rising around the world and U.S. technology leadership is under threat, we are witnessing the unfolding and accelerated advancement of the greatest revolutions in science and technology: a new phase of the digital revolution characterized by vast deployment of sensors, the Internet of Things, artificial intelligence and the big data tsunami; biotechnology and gene editing; nanotechnology; and autonomous systems. Each of these technologies has numerous applications that cut across industry sectors, society and human activities. Each is revolutionary, each is game-changing in its own right. But they are now colliding and converging on the global economy and society simultaneously, with profound

implications for U.S. economic and national security."²⁰

Extreme innovation projects drive discovery and human progress, result in new business models to meet societal needs, mold the future of work and sow the seeds for economic growth and job creation. America's academic enterprise has played an essential role in the research, design and execution of extreme innovation projects. Colleges and universities across the country are leading in the development of cutting-edge technologies ranging from quantum computing to artificial intelligence to gene editing.

The Extreme Innovation task force will explore the critical role higher education plays in translating new, disruptive technologies from the lab to the marketplace. It will look at how America's academic institutions are managing questions around funding, ethics, technology transfer and other rising challenges—which will in turn determine the economic value these technologies create for the nation.

Deliverables

The task force will convene regular teleconferences and annual, in-person dialogues to advance the discussion on extreme innovation in America's colleges and universities.

Key findings will be synthesized into a comprehensive report detailing best practices in leveraging extreme innovation to create economic value and will include recommendations for scaling the development and implementation of extreme innovation.

A broad outreach plan will follow the release of the report and will include press events, Hill briefings, town halls and other opportunities to showcase the work of members and advance the recommendations identified by the group.

EXTREME INNOVATION: Worcester Polytechnic Institute

The Integrative Materials Design Center (iMdc) is a WPI-based research center dedicated to advancing the state-of-the-art-and-practice in sustainable materials-process-component design and manufacturing. Incorporating green processing procedures, students work with professors and professionals on researching and developing materials for a range of applications. The center brings together experts and provides research opportunities for students, creating interdisciplinary bridges between materials science, mechanical engineering, manufacturing and other related disciplines and establishing material-properties-performance correlations. The research also entails advanced design tools and strategies and road-maps for general use in all manufacturing industries and beyond.²¹

Participation and Time Commitment

Leaders from America's top academic institutions will be the main participants in all University Leadership Forum activities. They will guide the discussions and development of policy solutions.

Each member participating in the task force will be asked to designate a representative to participate in regularly scheduled virtual meetings, stand in for the member at meetings they are unable to attend and provide subject matter feedback on policy recommendations, white papers and other materials produced by the task force.

Council members from industry, labor and the national laboratories will also be invited to participate on an ad hoc basis and will contribute to the research and discussions.

Methodology

The task force will meet via regularly scheduled teleconferences to define the scope of its work, assign leaders to specific tasks and evaluate materials. Virtual meetings will be organized and managed by Council staff with the input and guidance of the task force leadership.

The June 18th in-person meeting for all members of the University Leadership Forum will formalize the task force goals, schedule and short-term deliverables and launch policy discussions aimed at tackling critical issues facing academia that relate to the task force's

EXTREME INNOVATION: Kansas State University

The Nanotechnology Innovation Center of Kansas State (NICKS), housed within the College of Veterinary Medicine, was founded to allow Kansas State University to take a leadership position in cutting-edge interdisciplinary research that would foster major advances in the broad field of nanotechnology. The Center builds upon the existing strengths of KSU faculty and encourages them to produce new applications for nanotechnology by building self-sustaining research and graduate training programs. NICKS actively engages faculty from the disciplines of physics, chemistry, agriculture, engineering, biology, computational medicine, veterinary medicine and other related sciences to globally impact the direction of nanoscience research by taking advantages of unique expertise available at KSU. In addition to strengthening KSU's existing nanotechnology research programs, it is the first nanotechnology research center housed at a veterinary college with an agricultural and comparative medicine focus.²²

mandate.

Each year at the Council's National Competitiveness Forum, key findings of the Forum will be presented by initiative and task force co-chairs.

The task force will convene for an annual, in-person dialogue hosted by one of the co-chairs in which external experts and potential partners will be brought in to contribute to the task force.

University-Industry-Government Partnerships Task Force Charter

Co-chairs



Dr. M. David Rudd
President
University of Memphis



Dr. Ruth V. Watkins
President
University of Utah

- What role do intellectual property agreements or equity arrangements play in either facilitating or inhibiting successful university–industry partnerships?
- What federal or state regulatory policies could be enacted to facilitate greater collaboration between industry and academia? What policies are roadblocks?
- How does reduced government support for research and increased private sector investment impact the nature of these partnerships?

Goal

Identify replicable models and best practices in university-industry-government partnerships to maximize the value created by greater interaction between higher education and American industry.

Initial Task Force Questions to Address

To meet the goal, the task force will address the following questions:

- What are some examples of impactful university-industry-government partnerships that are replicable across geographies?

Concept

The Council's 2018 *Clarion Call* highlighted America's research enterprise as its "ace-in-the-hole" versus mounting global competition.²³

The United States is home to many of the world's top research universities and a distinctive set of crown jewel national laboratories, while other nations are working to strengthen their university-based research and industry engagement with research institutions. The United States is known for strong technology transfer policies and intellectual property ownership of technologies developed with government funding. Other nations' science, technology and innovation efforts are strongly guided by national strategic plans, and

many have high level ministries devoted to stimulating technology and innovation. Many countries have national research programs that target emerging technologies and fields. The strength of the start-up and entrepreneurial culture varies by country. In the United States, state and regional governments play a significant role, with a wide variety of programs designed to stimulate technology-based economic growth, such as accelerators, incubators for start-up firms and seed funds.

The research and development of many of the world's game-changing technologies would not be possible without partnerships between industry, academia and government. Programs and projects that bring together these stakeholders allow for mutually beneficial outcomes that support academic research, enhance industry capabilities and support local and regional economic development. Industry relies on colleges and universities for investment in early-stage technology, proof of concept for new processes and products, academic expertise, and the education and training of students to successfully enter the workforce. At the same time, industry partners can provide critical guidance on technological and economic trends, including skill-sets needed for students to thrive in the workforce. The University-Industry-Government Partnerships task force will identify, analyze and decode new and emerging models for university-industry partnerships, showcase best practices and identify the key structures, capabilities and functions needed to replicate successful partnerships.

UNIVERSITY-INDUSTRY-GOVERNMENT PARTNERSHIPS:

The University of Memphis

The University of Memphis formed a partnership with FedEx that brings research funding into the university across many departments while providing research and development for FedEx and training students for workforce development. The FedEx Institute of Technology is an advanced technology and research organization that functions as a catalyst for interdisciplinary research and innovation in emerging technologies by supporting cross-campus research innovation clusters. These clusters focus on areas such as intelligent systems, drones, cyber security testing, biologistics, autonomous vehicles, robotics, smart biomaterials, additive manufacturing and precision medicine. The Institute is also home to the university's intellectual property and patent repository, a focal point of technology transfer and licensing operations.²⁴

Deliverables

The task force will convene regular teleconferences and an annual, in-person dialogue to advance the discussion on university-industry-government partnerships. Key findings and recommendations will be synthesized into a comprehensive report showcasing best practices and identifying policies that can help prepare workers to compete in the global marketplace, while ensuring American industry has the talent it needs to succeed. A broad outreach plan will follow the release of the report and will include press events, Hill briefings, town halls and other opportunities to showcase the work

of members and advance the recommendations identified by the group.

Participation and Time Commitment

Leaders from America's top academic institutions will be the main participants in all University Leadership Forum activities. They will guide the discussions and development of policy solutions.

Each member participating in the task force will be asked to designate a representative to participate in regularly scheduled virtual meetings, stand in for the member at meetings they are unable to attend and provide subject matter feedback on policy recommendations, white papers and other materials produced by the task force. Council members from industry, labor and the national laboratories will be invited to participate on an ad hoc basis and will contribute to the research and discussions.

Methodology

The task force will meet via regularly scheduled teleconferences to define the scope of its work, assign leaders to specific tasks and evaluate materials. Virtual meetings will be organized and managed by Council staff with the input and guidance of the task force leadership.

The June 18th in-person meeting for all members of the University Leadership Forum will formalize the task force goals, schedule and short-term deliverables and launch policy discussions aimed at tackling critical issues facing academia that relate to the task force's

UNIVERSITY-INDUSTRY-GOVERNMENT PARTNERSHIPS: University of Utah

Utah has a strong entrepreneurial culture and an incentive system, making it attractive for research faculty and students alike. Its Technology and Venture Commercialization office is among the best in the nation in evaluating and minimizing risk, as well as aiding in the commercialization process. The Commercialization Engine Committee, a notable, unique asset, comprises of a network of external experts from a variety of fields who offer counsel and make the process highly efficient. From 2012 to 2015, Utah generated \$211.8 million in licensing income or \$135.8 thousand per million in research expenditure. The University of Utah has many different areas of focus for its research and commercialization efforts, but biomedical is a key priority, including the Center for Medical Innovation and Lassonde Entrepreneur Institute.²⁵

mandate.

The task force will convene for an annual, in-person dialogue hosted by one of the co-chairs in which external experts and potential partners will be brought in to contribute to the task force. Each year at the Council's National Competitiveness Forum, key findings of the Forum will be presented by initiative and task force co-chairs.

The Fusion of STEM & Liberal Arts Disciplines Task Force Charter

Co-chairs



Mr. Jonathan R. Alger
President
James Madison
University



Dr. Adam S. Weinberg
President
Denison University

- How do we measure the success and long-term economic benefits of cross-disciplinary programs?
- What are examples of best practices in the integration of STEM and the liberal arts?
- What federal, state and institutional policies and practices can be put in place in the United States that further encourage the integration of STEM and the liberal arts?
- How must curricula change or adapt to facilitate and encourage the merger between art and science? What are the skills we need to teach?
- What role does/will ethics play in the development of cutting-edge technology such as AI and CRISPR?

Goal

Develop a comprehensive set of recommendations and policies to support the premise that competitive advantage is derived from the successful integration of STEM and the liberal arts.

Initial Task Force Questions to Address

To meet the goal, the task force will address the following questions:

- How can the intersection of STEM and the liberal arts in America's academic system create a competitive advantage for U.S. students and workers vis-a-vis rising global competition? How does it advantage companies and institutions when people with these skills work together?

Concept

Multidisciplinary education comprising fields such as biomimicry, computer graphics and a host of dual degree programs have become a difference-maker for U.S. students that will allow them to compete globally. This shift includes the integration of STEM education and the arts through a concept called STEAM (Science, Technology, Engineering, Arts and Math), which promotes greater interaction across fields.

The Fusion of STEM & Liberal Arts Disciplines task force will identify, analyze and decode new and emerging models for how colleges

and universities are bringing together the disciplines.

Liberal arts must provide critical insight, judgement and ethics to new exponential and disruptive technologies. Leading stakeholders, strategies and motivations in philanthropy, industry, government and research will also be identified.

Deliverables

The task force will convene regular teleconferences and an annual, in-person dialogue to advance the discussion on the integration of STEM and the liberal arts in America's universities. Key findings and recommendations will be synthesized into a comprehensive report showcasing best practices and identifying policies that should be put into place that further enable U.S. students and workers to gain and maintain a competitive advantage in the global economy. A broad outreach plan will follow the release of the report and will include press events, Hill briefings, town halls and other opportunities to showcase the work of members and advance the recommendations identified by the group.

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THE FUSION OF STEM & LIBERAL ARTS DISCIPLINES:

Denison University

The Red Frame Lab is Denison's center for design thinking, creative problem-solving and entrepreneurship. It provides students who have an idea or a problem to tackle with one-on-one coaching. The center brings together students of STEM and the liberal arts to address ways to improve the community. Leveraging liberal arts strengths and commitments to diversity, leadership development, social innovation, civic agency, entrepreneurship and design thinking, the hub is working on technical issues. Examples of challenges recently tackled include raising student awareness of international news headlines, making student organizations more inclusive and finding sustainable solutions to the end-of-year move out process. The center also provides lectures and networking opportunities with local and alumni entrepreneurs.²⁶

member at meetings they are unable to attend and provide subject matter feedback on policy recommendations, white papers and other materials produced by the task force.

Council members from industry, labor and the national laboratories will be invited to participate on an ad hoc basis and will contribute to the research and discussions.

The task force will meet via regularly

THE FUSION OF STEM & LIBERAL ARTS DISCIPLINES:

James Madison University

JMU X-Labs is a model of education specifically designed to teach innovation with intention. Its trans-disciplinary programming challenges students to take ownership of their education, pivot creatively, and tackle problems that resist easy solutions with confidence.

At a time when higher education is trying to keep pace with the rapidly changing needs in industry, it is increasingly important to provide students with skills that go beyond traditional expectations. With its trans-disciplinary courses, JMU X-Labs challenges students to investigate all aspects of a problem, collaborate with industry professionals and peers from different majors, iterate ideas and welcome meaningful failure to solve real problems. Courses are shared across departments and in collaboration with experts in various fields across the country.²⁷

scheduled teleconferences to define the scope of its work, assign leaders to specific tasks and evaluate materials. Virtual meetings will be organized and managed by Council staff with the input and guidance of the task force leadership.

The June 18th in-person meeting for all members of the University Leadership Forum will formalize the task force goals, schedule and short-term deliverables and launch policy discussions aimed at tackling critical issues

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