



Compete.

Council on
Competitiveness

2021 National Competitiveness Forum

Summary Report
December 16, 2021

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Table of Contents

State of the Council	2
2021: A Year of Impact and Engagement	2
The Future of Sustainability	5
National Competitiveness Forum	
Future Focused	8
The Future of Energy, Food, and Water	8
The Future of Learning, Skills, and Work (Panel 1)	11
The Future of Learning, Skills, and Work (Panel 2)	14
The Future of Research	17
The Future of Healthspans	19
The Future of Placed-Based Innovation—Expanding Access and Enhancing Diversity	22
Tech Talks	
The Future of U.S. Leadership in Disruptive Technology	24
The Digital Transformation of Manufacturing	25
Energy Is Transforming	26
Cybersecurity Vital for Resilience	27
Economic Leadership Linked to Semiconductors	28
Shaping Living for Sustainability	29
Call to Action	31
Acknowledgements	33
Council on Competitiveness Members, Fellows and Staff	34

State of the Council

2021: A Year of Impact and Engagement



The Honorable Deborah L. Wince-Smith

President and CEO, Council on Competitiveness

National Commission
Co-chair

On December 16, the Council on Competitiveness and National Commission on Innovation and Competitiveness Frontiers convened the 2021 National Competitiveness Forum (NCF) on *Competing in the Next Economy: Future Focused*.

The NCF is a premiere assembly of our Nation's leaders from business, government, academia, labor, national laboratories and other stakeholders who come together to explore the most important domestic and global competitiveness issues of the day; consider the challenges of tomorrow emerging on the horizon; and identify new pathways to greater economic growth, productivity, and prosperity for all Americans.

Due to the continuing challenge of coping with the COVID-19 pandemic's impact across industry, academia, government, the workforce, and society, hundreds of NCF participants again came together virtually in 2021. The Forum included keynote addresses by leaders from Congress, the Biden Administration Cabinet, and American corporations; panels in which important issues were discussed by key representatives of business, labor, education, and government; and future-oriented tech "chats" with Council members and representatives.

In the year since the National Commission on Innovation and Competitiveness Frontiers released its first report—*Competing in the Next Economy*—the Council and Commissioners stepped up outreach, engagement and communications with the new Administration, Congress, other leaders and policy-makers to advance the report's recommendations for addressing the competitiveness challenges we face and capturing the opportunities of a new age of discovery and innovation.

That report, building off the deliberations of hundreds of leaders across the nation, focused on four key themes—Developing and Deploying at Scale

Disruptive Technologies; Exploring the Future of Sustainable Production and Consumption; Optimizing the Environment for National Innovation Systems; Unleashing Capabilities for Work and Entrepreneurship—argued that to compete in the next economy, requires playing a new innovation game, one whose goal is to boost U.S. innovation tenfold.

10x

- Increasing Leadership around and National Strategies for Innovation
- Increasing the Number of Innovations Developed in and Deployed by the United States
- Increasing the Speed at Which the United States Innovates
- Increasing the Number and Diversity of Americans Engaged in Innovation

Engaging National Government Leaders to Shape the National Innovation and Competitiveness Agenda

The Council was called upon by Biden Administration transition teams, senior Members of Congress and their staffs, and worked with the staffs of Senators Schumer and Young in developing the bipartisan U.S. Innovation and Competition Act (USICA). USICA would create a new National Science Foundation Directorate for Technology and Innovation and authorizes \$29 billion over five years for R&D, innovation centers, academic technology transfer, test beds, scholarships, and fellowships.

The Council engaged with other leaders on the Hill virtually including House Majority Leader Steny Hoyer, and Senators Tim Scott, Chris Coons, Mark Warner, and their personal and Committee staff. These efforts had an impact on legislation such as the National Science Foundation for the Future Act, and the Department of Energy Science for the Future Act.

The Council connected with President Biden's team as it developed and began implementing new policies to strengthen American innovation and competitiveness. Dr. Eric Lander, the President's Science Advisor and Director of the White House Office of Science and Technology Policy welcomed the Council's and Commission's input. Council Chairman, and Chairman and CEO of Bank of America, Brian Moynihan hosted Secretary of Energy Granholm and Secretary of Commerce Raimondo at the summer meeting of the Council's Executive Committee and National Commissioners. The Secretaries outlined the Biden Administration's initiatives to leverage innovation to mitigate climate change, and boost U.S. competitiveness through talent cultivation, R&D investment, and expanding the U.S. innovation ecosystem. Secretary Granholm urged the Council's leaders to continue to educate Congress on the importance of infrastructure and the work of our national laboratories.

The Council's Technology Leadership and Strategy Initiative, chaired by Jahmy Hindman, Chief Technology Officer at John Deere, launched a dialogue with new leaders of the Federal R&D enterprise including Dr. Victoria Coleman, Chief Scientist of the United States Air Force; Dr. Vanessa Chan, the Department of Energy's Chief Commercialization Officer; and Dr. Heidi Shyu, Chief Technology Officer and Under Secretary of Defense for Research and Engineering. These leaders emphasized the evolving strategic challenge the United States faces, and the urgent need to accelerate U.S. technology development and deployment.

The Commission's report set forth a new vision for U.S. technology statecraft, to amplify the U.S. voice and advance U.S. interests in the international institutions and deliberations developing rules for the global technology-driven economy. Secretary of State Blinken recognized this need in his 2021 Global Technology Summit speech and, in late October, committed to establishing a new State Department bureau for cyberspace and digital policy headed by an ambassador-at-large, naming a new special envoy for critical and emerging technology, and bringing more STEM expertise to the department and across the Foreign and Civil Service.

Exploring U.S. Leadership in Technology

In partnership with Lockheed Martin and the National Commission, the Council convened a series of webinars on cutting-edge topics that pushed the boundaries of the Commission's original recommendation set, teeing up concepts for the next phase of the Commission's work. Themes explored included:

- Sustainability—Pursuing Innovation with Purpose;
- Beyond Digital Manufacturing, which examined the benefits of scaling digital manufacturing; and
- The Future of Technology, which looked at potential implications of technologies now beginning to scale and those on the horizon.

Strengthening University Innovation

The Council's University Leadership Forum issued a major statement outlining steps colleges and universities can take to address research security and inviting the Federal government to be a partner in this effort. This statement was welcomed by the Deputy Director of the White House Office of Science and Technology Policy, and the Department of Justice team working on academic security and foreign influence. Also, with planned boosts in STEM education and training, the Forum is developing a video campaign on the importance of merging STEM and the Arts.

“We’re weaving cyber and technology diplomacy into our work across the board. Nothing is more consequential to our competitiveness, to our security, and ultimately, to our democracy.”

Secretary of State Blinken

Shaping the Debate and Engaging the Public Through New Platforms

The Council launched a new, monthly e-newsletter, Compete Connect, which highlights members and their activities, and upcoming programs and events. The National Commission launched a social media campaign to highlight key competitiveness themes, findings, and recommendations for action. To further amplify the voice of the Council and National Commission—and bring popular attention to competitiveness and technology issues—Council President and CEO Deborah Wince-Smith began penning a monthly Forbes.com column. Tens of thousands of viewers have pored over columns on topics such as the need to invest in the Nation's innovation infrastructure, the urgent need to secure U.S. access to advanced microelectronics, how the economy reorganizes when disruptive technologies scale, and the need for a new U.S. global technology statecraft.

Looking to the Future

In 2022, the National Commission will launch a “phase 2”—articulating a new set of goals, and convening refreshed working groups to explore critical issues such as: the future of sustainability, U.S. leadership in advanced microelectronics, place-based innovation, and the future of work. Going forward, the Council's and Commission's work will be informed by what has been learned about resilience, speed, and agility during the pandemic's turbulence and disruption that we may apply those lessons for competing in the next economy and winning a more prosperous future for us all.

The Future of Sustainability



Mr. Brian Moynihan
Chairman and CEO,
Bank of America
Council Chairman
National Commission
Co-chair



Mr. Charles O. Holliday Jr.
Council Chair Emeritus
National Commissioner

Key Takeaways

- All nations, the public and private sector, and all companies must address sustainability quickly.
- Sustainability is rising as a priority for customers, shareholders, and employees, driving a change in attitudes in the private sector and investment community.
- Many businesses have stepped up their commitments to improve the sustainability of their products and services, and how they are produced, but broad-based action has not matched these commitments or the need.
- The private sector must take the lead in meeting the sustainability challenge, driving research, technology development, and commercialization; workforce training; and deploying more sustainable systems and transforming company operations.

Attitudes About Sustainability Are Changing

Companies and investors are hearing from customers, shareholders, and employees that sustainability is a priority and companies must act. Attitudes in the private sector and investment community are changing, interest in sustainability investment is rising, companies are making commitments and efforts to improve the sustainability of the products and services they offer and how they are produced. A new generation of energy companies is forming and developing sustainability solutions. However, markets and incentives must move faster, and multilateral banks must act in developing and emerging economies to ensure a “just transition” to more sustainable systems and net zero economies and societies.

Many are concerned about the costs of sustainability efforts and reaching net zero. But nations and companies can take approaches that will enhance their sustainability and drive, rather than reduce, their economic growth and competitiveness.

Private Sector Plays Critical Role in Sustainability.

The private sector must take the lead in meeting the sustainability and net zero challenge, driving research and technology development, commercializing new innovations and more sustainable products, training the workforce, deploying more sustainable systems, and transforming company operations. For example, 300 global business leaders form part of the “Coalition of the Willing” convened by The Prince of Wales as part of the Sustainable Markets Initiative to accelerate investments in sustainable markets and decarbonization through a dramatic shift in business models, an aligned financial system, and an enabling environment that attracts investment and encourages action. At the recent UN Climate Change Conference in Glasgow (COP 26), 28 companies pledged to accelerate their use of decarbonized hydrogen. Bank of America committed to achieving net zero CO₂ emissions in its financing activities, operations, and supply chain before 2050, and pledged \$1 trillion by 2030 for its Environmental Business Initiative

to accelerate the transition to a low-carbon, sustainable economy. While private sector commitment has risen to a 7 or 8 on a ten-point scale, broad-based actions remain at the level of 1 or 2.

The Council on Competitiveness is well positioned to lead sustainability efforts. Sustainability is a multi-dimensional challenge, and the Council's structure and members—spanning companies, national laboratories, universities, and labor—can mount the required multi-sector efforts. The Council was founded to answer the competitive challenge from Japan in the 1980s. Our problems have changed, but the players needed to address them are the same.

2021
National
Competitiveness
Forum

Future Focused

The Future of Energy, Food, and Water

Keynote



The Honorable Jennifer Granholm

U.S. Secretary of Energy

Clean Energy is a Golden Opportunity

Secretary Granholm spoke of the enormous potential clean energy offers for job creation and economic growth. The market for decarbonizing technologies will reach \$23 trillion by the end of the decade, and we have work to do to establish U.S. leadership, compete globally, capture the prosperity that market is generating, and make the world more sustainable.

Biden Administration Clean Energy Agenda

She highlighted the Biden Administration's clean energy goals and plans, including reaching a net zero emissions economy by 2050 and carbon pollution-free electricity by 2035, modernizing the electric grid and making it more resilient, incentives for renewable energy supply chains and deployment, the Hydrogen

Shot to reduce the cost of clean hydrogen to \$1 per 1 kilogram in one decade, and accelerating adoption of electric vehicles through greater purchasing incentives and a national network of 500,000 electric vehicle chargers along highways and within communities.

Progress is Being Made

The bipartisan Infrastructure Investment and Jobs Act makes a major investment toward achieving these goals. The Department of Energy's national laboratories are developing numerous clean energy technologies. There are new partnerships and new companies focused on clean energy, and new clean energy investments being made in the United States. She encouraged companies and other stakeholders to compete for clean energy grants and loans, and to take advantage of clean energy tax credits.

Communities Impacted by the Energy Transition Need Support

As the United States shifts to clean energy, some communities will need to transition and transform. Recently, Secretary Granholm participated in a roundtable hosted by the Interagency Working Group on Coal and Power Plant Communities and Economic Revitalization Co-chairs (Climate Advisor Gina McCarthy and National Economic Council Director Brian Deese) with stakeholders from the private sector, philanthropy, labor and community-based organizations, Secretary of Commerce Raimondo, and Appalachian Regional Commission Federal Co-chair Gayle Manchin. The roundtable focused on private and public sector and philanthropic investments to

support economic revitalization in energy communities. This includes an initial \$300 million in Department of Commerce Economic Development Administration funding in Coal Communities Commitment to support economic revitalization, infrastructure investments, and quality jobs in coal communities with funding from the American Rescue Plan.

Panel



Dr. Robert Johnson
President, Western New
England University
[National Commissioner](#)



Dr. René Lammers
Executive Vice President
and Chief Science Officer,
PepsiCo, Inc.
[National Commissioner](#)



Mr. Chad Evans
Executive Vice President,
Council on Competitiveness
(Moderator)

Key Takeaways

- Saving energy and water to improve sustainability requires new solutions in agriculture, as demand for food grows with the rapidly expanding global population.
- New technologies and approaches are emerging and being deployed that can make dramatic improvements in the sustainability of agriculture, such as precision irrigation, new agricultural management systems, crop data and modeling tools, smart robots, and breeding for crop varieties with higher yield and that need less water.
- Layering these technologies and regional system approaches will create even greater impact.
- Wind and solar power, hydropower, ocean energy, and a shift to electric vehicles can advance the sustainability of energy and reduce CO₂ emissions. Artificial photosynthesis to produce fuels from sunlight, and carbon capture and storage have significant potential.
- More food science, and more industry collaboration and public-private partnerships are needed to drive innovation at the nexus of energy, food, and water.

Challenges at the Nexus of Energy, Food, and Water

One of our greatest challenges lies at the nexus of energy, food, and water. Due to population and economic growth, global energy use could soar nearly 50 percent by 2050, driving further rise in energy-related CO₂ emissions. By 2050 we may need to produce 60 percent more food to feed a world population of nine billion. Globally, 72 percent of all water withdrawals are for agriculture, but billions of people live in areas already experiencing water shortages and water stress.

The challenges of food and water scarcity ultimately reach countries and regions with abundant food production in the form of “virtual water.” In some countries and regions, people consume more food than can be produced using their own fresh water.

“A 25-gallon traditional gas tank has a water usage that could otherwise feed and grow food for one person for an entire year. It is evident what a tremendous opportunity the move away from fossil fuel in personal vehicles provides.”

Dr. Robert Johnson

President, Western New England University; National Commissioner

To meet their food needs, they import food that has been produced using the water from the exporting country or region. While this has provided a short-term solution for providing food to areas of the world that experience water scarcity, with continuing water stress and shortages, this will not be a long-term solution.

Innovation Can Drive Sustainability

New technologies and approaches are emerging at the intersection of energy, food, and water. In agriculture, precision irrigation, new agricultural management systems, and new crop management tools hold significant promise for water savings. For example, smart technologies can help producers better understand when inputs such as water are needed, and modeling can forecast how crops will develop over the growing cycle. Incorporating smart robots in agriculture will also be important.

After analyzing hundreds of crops and more than a million data points, an industry-university consortium developed Opti-Oat—the Quaker Oat Growth Guide. The guide enables growers to assess their oat crops against benchmarks and modify their management practices to improve yields and efficiency. PepsiCo's Quaker Oats Company has also been a leader in oat gene mapping, making information about important oat traits publicly available for oat breeding. Using smart breeding, PepsiCo developed a new potato with lower moisture content—perfect for potato

“I think innovations that are connected across a variety of production practices and farming systems are a powerful tool to move the needle from more to less.”

Dr. René Lammers

Executive Vice President and Chief Science Officer, PepsiCo; and National Commissioner

chips—which has higher yields, saves more than seven billion gallons of water annually, and reduces energy demands in the agricultural system.

Systemic Approaches Could Make Greater Progress

Layering these technologies in agricultural production will create even greater impact. There is also an opportunity to create regional systems that incorporate approaches to more efficient water use in both agriculture and energy. Building a successful ecosystem of local farmers that produce in a sustainable way can increase yield from 50-to-100 percent and consume significantly less water.

Key Leverage Points to Achieve Cleaner Energy

The Biden Administration is planning significant increases in clean energy investment. Wind and solar power, hydropower, and ocean energy are key leverage points in the transition to cleaner energy. In addition, there are large potential opportunities to improve energy sustainability through carbon capture and storage, a shift to electric vehicles, and artificial photosynthesis to create fuels such as hydrogen from sunlight.

New Partnerships are Needed

To increase sustainability at the nexus of food, energy and water, more investment in basic food science, many solutions, systems-level approaches, new supply models, and new partnerships are needed.

Pre-competitive industry collaboration and more public-private partnerships can drive innovation. For example, the Oat Growth Guide was produced by the Opti-Oat project, a PepsiCo-led consortium of industry and academic partners, with co-funding from Innovate UK and the Biotechnology and Biological Sciences Research Council.

The Future of Learning, Skills, and Work (Conversation 1)

Keynote



The Honorable Amy Klobuchar

United States Senator for Minnesota

Key Moment in History

Senator Klobuchar spoke of this critical moment, saying the decisions we make today will determine our place and competitiveness in the world of tomorrow. While we must address the impacts of the pandemic, we need a bold vision for sustained growth, big economic goals, and a competitiveness agenda for the future of a country that is strong in manufacturing, invention, and exports.

Focus on the Fundamentals

We must focus on the fundamentals such as innovation, infrastructure, and education. For example, early childhood education pays economic and competitiveness dividends, while improving child outcomes. A 2016 study from the University of Chicago found that high-quality early childhood development programs deliver a return on investment of 13 percent.

We need a modern infrastructure that meets the demands of our 21st century economy, including safe bridges, modern highways, ports and railroads that are essential for the movement of goods and exports, and high-speed Internet. Traffic congestion alone costs our country billions of dollars in wasted time and fuel. Passage of the bipartisan infrastructure law is a crucial step in infrastructure modernization, which could generate 1.5 million jobs per year for the next ten years. But we do not have enough workers with the skills to fill those jobs.

Skills Training is a Priority

We can help meet the demand for skilled workers in infrastructure and other good jobs—for example those in the trades, information technology, and health care—by expanding access to community college, apprenticeships, and high-quality training programs. One proven way to close the skills gap is registered apprenticeships. They combine on-the-job training with relevant academic instruction. A 2019 study by the Midwest Economic Policy Institute found that every dollar spent on apprenticeship programs in Minnesota increased the state's GDP by \$21. Senator Klobuchar introduced the American Apprenticeship Act with Senator Collins to provide funding to states to create or expand tuition assistance for participants in pre-apprenticeship and registered apprenticeship programs. She also introduced the American Apprenticeships to College Act with Senator Moran to establish an apprenticeship college consortium.

STEM Education for Innovation and a High-tech Workforce

We need greater investment in STEM education to meet the high and growing demand for computer and information technology workers. To continue U.S. global leadership in science, research, and technology, we must encourage American students to study math and science and provide them the best education and training to compete with students in growing economies around the world. Recently, the Senate passed the U.S. Innovation and Competition Act, which will increase investments in STEM education.

Immigration Reform to Support Industry and Strengthen the Workforce

We cannot afford to shut out the world's talent or drive it away, and we need to meet the demand for workers in specific sectors such as tourism and agriculture. Immigration reform is needed including legal status for immigrants so they do not fear deportation and can get work permits, and to establish a pathway to citizenship, including for immigrants now working in construction, health care, and other frontline jobs, often in rural and underserved urban areas.

Childcare is Essential to Get People Back to Work

As we focus on getting people back to work after the pandemic, lack and high cost of childcare are keeping workers out of the workforce. The Build Back Better agenda includes support for childcare and for those who must balance work with their responsibilities for children and the aging.

Panel 1



Ms. Joan T. A. Gabel
President, University
of Minnesota
Council Academic Vice-chair
[National Commissioner](#)



Mr. Lonnie Stephenson
International President,
International Brotherhood
of Electrical Workers
Council Labor Vice-chair
[National Commission
Co-chair](#)



Mr. Bill Bates
Senior Advisor, Council on
Competitiveness (Moderator)

Key Takeaways

- The landscape for jobs and skills is changing rapidly across the workforce spectrum. New types of skills are in demand, new industries will emerge, and work in existing industries is changing, for example, due to automation.
- To meet these changing needs, universities and training providers must deliver both specialized technical skills, as well as soft skills such as adaptability and critical thinking so workers can prepare for new jobs and ever-evolving industry across their careers.
- New technologies are providing new pathways for learning, for example, learning at different times of the day and across careers, providing access to information and data for informal learning, and through modeling and simulation that can create safer learning environments for the skilled trades.

Changing Workforce Landscape

Globalization and rapid advancements in revolutionary technologies are affecting the workforce, creating new opportunities for jobs but also hardships for some workers. Today, such impacts on the workforce come at rapid pace and are likely to accelerate in the years ahead. Individuals, companies, communities, educators, and trainers have less time to adapt and prepare than they have had in the past when technology life cycles were longer.

Structural changes in the labor market are accelerating as automation—such as robots, machines, sensors, and software—is increasingly capable of doing routine tasks that have made up jobs for millions of workers. As the cost of labor rises, and the cost of automation declines, it becomes more attractive to automate work. Moreover, widespread deployment of artificial intelligence in the years ahead could impact labor at every level of the economy—task, job, work organization, occupation, industry, and labor market.

Too many Americans lack the knowledge and skills to compete in the knowledge, high-tech economy. As the knowledge and technology intensity of economic activity increases, and automation and smart machines increasingly perform routine tasks, this lack of knowledge and skills threatens further economic inequality.

New Skill Needs are Emerging

Higher education institutions are providing new technical skills, and broader skills such as critical thinking, soft skills, and ability to work with big data. Looking to the future, being educated means not just being prepared for today's jobs but being able to pivot for employment in new jobs and industries of the future, many of which do not exist today.

In addition, work in existing industries is changing and will be different in the future. In the electrician trade and other blue-collar jobs, the use of new materials and tools has changed some worker training in apprenticeships. Computer-related tasks in the trades were rare several decades ago, but much of electrical work has been upgraded to electronics work that involves computers, and some training now can be provided through simulation. For example, training line-workers to set-up and connect transformers can be done with a computer-based simulation, creating a safer environment for learning, where mistakes do not have the potential for health and safety threats.

Education Institutions and Training Providers are Working to Keep Pace with Change

Today's learners expect to access new knowledge and skills in their field over the course of their careers, rather than ending their education once they attain a degree. For technical skills development, universities are working to stay current, and rely heavily on partnerships with industry and unions to better understand the skills in demand. The new bipartisan infrastructure law will create millions of jobs, especially in construction, that will help ease some of the disruptive impacts of changing industries and sec-

tors. There has already been tremendous change for blue collar workers in the utility industry, and unions are updating the training and apprenticeships they provide to adapt to new technologies.

More Education Content is Being Delivered through Technology

Technology is changing both formal education, for example via virtual classrooms, and informal learning as students and workers now have access to a vast amount of information and data. Technology enables learning in ways previously not possible such as at different times of the day or a different time in a career. In formal education, the time savings generated from these technology advancements also allow students to spend more time in experiential work and industry engagement.

Prepare for Smart Automation

Companies, universities, and unions must prepare workers for smart automation. For example, in the construction trades, robots can lay block like a bricklayer, and more construction work is done off-site in a controlled environment, such as laying conduit in prefabricated building components. This makes work safer and creates an advantage for the customer.

Panel 2



Dr. David Kwabena Wilson
President, Morgan State University



Ms. Janet Foutty
Executive Chair of the Board,
Deloitte US
Council Business Vice-chair
[National Commissioner](#)



Ms. Randi Weingarten
President, American Federation of Teachers,
AFL-CIO



Mr. Bill Bates
Senior Advisor, Council on Competitiveness (Moderator)

Key Takeaways

- Developing all our human capital, and workforce diversity and inclusion are crucial for the United States to achieve its full economic, innovation, and global competitive potential.
- Recruiting, attracting, retaining, and developing talent is a top business priority.
- Business plays a crucial role in talent development—not only in training its own workforce, but also collaborating across the education ecosystem to nurture the workforce of the future, and ensure workers have the skills employers need.
- In today's business world of rapid change, workers need to be resilient and adaptable, and adopt a mindset of constant curiosity, re-skilling, and learning over a lifetime.
- Preparing students to enter the workforce should begin in junior and high school, for example, with career awareness, STEM and project-based learning, mentoring, and critical thinking and technical skills development.

Talent is a High Priority for Business

For businesses, talent is a top priority, including developing an equitable and inclusive workforce, especially racial and gender diversity.

Need for a Diverse and Inclusive Skilled Workforce

Morgan State University was one of the United States' first Historically Black Colleges and Universities (HBCUs). Its founders believed black Americans were capable of the most skilled work, and in a future of education and skills development open to all Americans, regardless of their race, religion, nationality, or gender. They set out to educate black students in the liberal arts. Since then, many institutions have embraced that goal, and this role has come to greater urgency during the pandemic to meet the demand for frontline workers.

Many institutions and individuals were caught off guard by the COVID-19 virus—and then ensuing arrivals of the Delta and Omicron variants—and were unprepared for the impact of a global pandemic. Universities and learning institutions were unprepared for the swift transition to online learning that was required for them to maintain their core education mission.

The impact of this unprecedented disruption and transition to online learning has been especially challenging for communities of color, a major demographic group from which Morgan State University draws its students. HBCUs have been underfunded compared to many education institutions in the United States. As a result, the stress of the pandemic has affected HBCU students more than others, and the education of many is in jeopardy. There is concern that HBCU students will have greater difficulty than other university students in catching up and developing key social skills after two years of disrupted and inconsistent learning experiences. Ensuring these students are equipped with the skills to continue to make the Nation competitive will be a key challenge.

Looking to the future, the world of 2050 will not only be more diverse, but there will also be many more transformational inventions and innovations driving rapid change from quantum computing and predictive ability from big data to 3D printed sustainable meats and robotic agriculture. It is vital for all the U.S. population to have the higher education and skills needed for the future of work in an economy driven by computing, embedded systems, cybersecurity, and the Internet of Things. If the United States fails to educate its workforce and invest in developing the potential of all its human capital, the country will not have workers with the tools needed to make the country globally competitive, or the innovators needed to create a thriving innovation-based economy.

Empowering Workers

Technical excellence alone is not enough. With the changing landscape of technology and production, the future is uncertain. Students and workers must have a mindset shift to constant curiosity, the need for re-skilling, and learning over a lifetime. Deloitte's 2021 Human Capital Trends Report has two key findings: first, companies that will thrive in the future, despite some of the uncertainties, are those that engage workers, which has not been core to how organizations work; and second, a movement towards worker empowerment is needed to unleash potential and build workforce resilience by creating worker adaptability. Workers need a voice and need agency. These needs are one of the reasons for renewed worker interest in unions.

To develop an empowered workforce, students and young adults need the confidence that allows them to fail and try again, along with critical thinking, life skills, and a sense of ingenuity. To teach those skills, school need to become places of joy so students develop the curiosity that drives learning. Project-based instruction, and career and technical education also play an important role.

Business has a Critical Role to Play

Business has a critical role in investing in the skills and training of the workforce, regardless of the Federal government's investments and programs. For example, Deloitte—a professional services organization—thinks of itself as a talent incubator. The Deloitte Foundation has a variety of programs for high school and higher education students, with a large focus on helping the economically disadvantaged and spurring interest in STEM education and careers, including grants to support college scholarships, STEM career exploration, mentoring, and a foundation-supported university center for business analytics. It was recommended that government should take over some of the training costs that businesses currently pay.

Italy developed global leadership in leather tanning, which was applied and scaled into shoe making, then into boot making, and then into plastic ski boot design. In the United States, this movement and scale up in related industries would not be considered traditional innovation, but it was.

Business has a strong role to play in collaborating across the broader ecosystem of education. For example, collaboration between business and education is needed to develop apprenticeships, certification programs, and associate degree programs that provide the skills businesses need, and to introduce those being trained to good jobs with benefits early on as they enter their careers. Developing this career awareness should begin in junior and high school. At modern technology and career-oriented schools, more than 95 percent of students graduate, with stable results across different economic and racial cohorts, and across different sectors and focus areas—from apprenticeship programs to coding, cyber security, and the food industry. Part of the Build Back Better agenda would create the funding opportunities to build-up these collaborations.

As we emerge into a transformed post-pandemic economy and into a future of constant change, this is a great moment for unions, businesses, and education institutions to collaborate with each other to reform education from K-12 to higher education.

The Future of Research



Dr. Kimberly Budil
Director, Lawrence Livermore
National Laboratory



Dr. Michael M. Crow
President, Arizona State
University
[National Commissioner](#)



Dr. Holden Thorp
Editor in Chief, Science
Magazine



Mr. Chad Evans
Executive Vice President,
Council on Competitiveness
(Moderator)

Key Takeaways

- During the pandemic, businesses, universities, and governments demonstrated a previously unimaginable level of speed and agility in innovation and organizational change that should become the standard for the United States.
- A mind-set shift about what constitutes innovation and who can be innovators is needed.
- Game-changing innovations can be created and accelerated by taking bigger risks.
- Venture capitalists need to expand the scope of their support to a broader set of innovators, industries, geographies, innovation ecosystems, and communities.
- With momentum building for generational legislation that would significantly increase Federal support for research and technology, now is the time to re-imagine the U.S. research enterprise which is currently operating on a 75-year-old vision conceived under technological and competitive conditions that radically changed in the 21st century.

Accelerating U.S. Innovation

During the pandemic, we learned that businesses, universities, and governments can create and scale new innovations, and make massive transformations on timelines faster than thought possible. This demonstration of unprecedented speed and agility prompted the Council's National Commission on Innovation and Competitiveness Frontiers to challenge the Nation to achieve a 10x increase in the rate of U.S. innovation. Accelerating innovation is vital for a future shaped by a whirlwind of change brought about by revolutionary technologies and hyper competition. The United States should strive to make a much higher level of speed and agility the standard for innovation. The time is ripe as Congress is deliberating on legislation that would significantly increase U.S. investment in research and technology development.

Create More Innovation by Expanding the Arena

A mind-set shift about what constitutes innovation and who can be innovators is needed. Innovation is more than just Silicon Valley. We need dramatic expansion of the research and innovation environments that spark creativity and can propel U.S. leadership forward in many different sectors, rather than only in niches such as microelectronics or in the defense industry. We need a hundred hubs, innovation ecosystems that touch every place, with thousands of innovating companies across all industries, and inventors, innovators and entrepreneurs pursuing a wide range of innovations. This will, in turn, fuel regional economic development. We must discard the idea that only research universities are part of the innovation ecosystem. Other universities, colleges and community colleges should be made a part of the innovation movement and scale up their opportunities. Creating linkages between technology and art can also fuel innovation.

Accelerating Game-Changing Innovation by Taking Bigger Risks.

The pandemic has shined a light on how we think about risk and how risk is measured against potential opportunity. When there is no pressure from an imminent crisis, it is easy to fall into a pattern of incremental innovation, rather than accepting the risk of bigger game-changing ideas and technology pathways with the potential for enormous future returns. When we minimize risk today, we are increasing risk for the future. Actions during the pandemic showed that assuming greater risk is needed to make bigger steps in innovation. In this regard, the way we encourage or discourage risk, and fund research is particularly important.

Venture Capitalists Need a New View.

Venture capitalists need to lose their bias about in which industries and in whom they will invest (which is largely based on personality). For example, there is belief in the idea of the “superhero CEO” such as Facebook’s Mark Zuckerberg, and the myth that he often portrays that not finishing college somehow made him a more innovative businessman.

Instead, investments should be based on the substance of the potential innovation. For example, mRNA vaccine technology has been around a long time based on research in chemistry, and a broader ecosystem working on creating a foundation for the vaccines. But one of the reasons the technology did not enter mainstream application was because it lacked a charismatic personality to take it there. The mRNA vaccines are classic examples of strong research and innovation endeavors at universities that were supported by government for years. There is also a mistaken belief that venture capitalists and the private sector alone are solving key problems and addressing grand challenges. In reality, that work is being done among the public sector, research universities, national laboratories, and others.

Transforming the Innovation Ecosystem

It is important to recognize that the same innovation system has been in place for 75 years and has been immensely successful until it is not, which is now. Congress needs greater awareness about what this system currently looks like, because some of the new ideas emerging on Capitol Hill are not informed on how the Federal government presently funds science. At this crucial moment, momentum is building to pass generational legislation to improve the U.S. research enterprise. Congress should determine the outcomes it seeks with this planned expansion of Federal support for research and develop models that can achieve those outcomes. New ideas, new models, and expansion of the role of the National Science Foundation are needed. The crown-jewel National Laboratories should be freed to connect and engage more with the broader innovation ecosystem of the United States. This is an opportunity to expand the U.S. innovation community by providing support to a fresh cadre of innovators and innovating organizations and laboratories. Government funding for research and technology development needs to flow to a wider set of people, with a stronger focus on diversity.

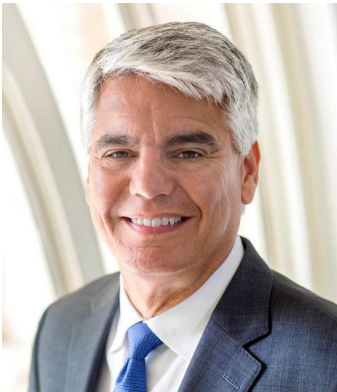
The Future of Healthspans



Dr. Mehmood Khan
Executive Chairman, Life
BioSciences Inc.
National Commission
Co-chair



Dr. Victor Dzau
President, National Academy
of Medicine
National Commissioner



Dr. Gregory Fenves
President, Emory University
National Commissioner



Dr. Wayne A.I. Frederick
President, Howard University
National Commissioner



Mr. Chad Evans
Executive Vice President,
Council on Competitiveness,
(Moderator)

Key Takeaways

- The aging population will have tremendous impact on everyday life, the economy, and society.
- Infrastructure, architecture, modes of transportation, and many products will need to change to accommodate the specific needs of an aging society. This creates an opportunity for new business growth from developing products and services to meet these needs.
- Expanding the healthspan—the period of life spent active and in good health—could have significant economic benefits, as people can stay in the workforce longer and the costs of treating age-related diseases and disabilities are reduced. However, societies must address disparities in the healthspan across racial and income groups.
- Emerging science is poised to deliver interventions that could address the maladies of aging, and new technologies—such as robotics, autonomous vehicles, artificial intelligence, and smart homes—have great potential to help the elderly stay active in their communities and stay in their home longer.
- Universities provide the longer-term science and need to collaborate with industry to develop the innovations needed to address the health and social challenges of an aging population, and bring multiple disciplines—health, economics, and the social sciences—together to address the challenges of an aging population in communities.

Challenges of an Aging Society

There are more people above the age of 65 on the planet than there are under the age five. The usual pyramid of society's population—with many young people at the bottom and a smaller portion of people in higher age ranges at the top—has turned upside down. There are fewer young people to care for a growing population of older people, and greater

challenges for health and social services. If these challenges are not addressed, the financial burden of taking care of this aging society will not be manageable. Eighty percent of costs in Medicare today involve age-related diseases and, as the older population doubles and triples, these costs will also increase. Public health must increasingly focus on preventive care, rather than health intervention, and on the social aspects of an aging society. However, most research in medicine is on diseases, but very few researchers study healthy aging.

The U.S. National Academy of Medicine founded the Healthy Longevity Global Grand Challenge, a global initiative to improve physical, mental, and social well-being for people as they age. It seeks to catalyze groundbreaking ideas and research, drive scalable innovations, and build an ecosystem of researchers, engineers, innovators, entrepreneurs, health leaders, and policy makers to work toward achieving healthy longevity. The Academy has launched a three-phase Healthy Longevity Global Competition with awards and prizes open to innovators in 50 countries and territories. In the first phase of the 2021 competition, innovators from around the world submitted more than 1,000 concepts. In the final phase, one or more winners could win a grand prize of up to \$5 million.

Bridging the Healthspan Gap

There are variations in life expectancy across zip codes, and between racial and income groups. Differences in life expectancy and health in old age are tied to existing biases, structural racism, and inequities. The pandemic made health care disparities in some communities even more apparent. Scientific research cannot solve these issues alone, social science must be engaged.

Howard University has a strong interest in the African Diaspora, research on the aging of African Americans, and how aging changes the social structure. Howard focuses on integrating social science and medicine (such as in the study of Alzheimer's and Parkinson's disease, and diabetes, which affect African Americans at earlier ages) and in examining the impacts of an aging society.

For universities to have a positive long-term effect on healthspans and engender trust in their institutions, engagement with communities is crucial to demonstrate the research they perform is helping the greater good. They can bring multiple disciplines together—health, economic, and social sciences—to help their communities.

Technologies and Consumer Products Must Adapt to an Aging Population

The ways in which humans interface with technology will need to change to accommodate a growing population with sensory and visual impairment. Similarly, modes of transportation and vehicles will have to adjust to a growing population with mobility impairments. This creates opportunities for autonomous devices and vehicles.

Physical infrastructure—such as architecture and roads—are not now designed with an older population in mind. For example, communities need to be designed for the cognitively and physically impaired. Similarly, consumer industries are focused largely on a young and active population, but the growing older population will demand products that meet their specific needs, for example, food product labels and packaging for those with visual or physical impairments. Emerging digital technologies, such as artificial intelligence and assistive systems can also help older people navigate their daily lives, while smart homes and robotics may help them stay in their homes longer.

The distinction between wearables and medical devices is blurring. For example, the Apple Watch is a wearable IT device for some and a medical device tracking vital signs for others. Today, the distinction between consumer IT and medical devices is in the regulator's hands; regulatory frameworks need to adjust to the challenges presented by an aging society in terms of these devices, data usage, and privacy laws.

Role of University Research

The pandemic has demonstrated the benefits of America's investments in science and research. Long-term research led to the development of novel vaccines and oral therapeutics for treating COVID-19.

Molnupiravir, a medicine developed at Emory University, was for use on an experimental basis in the United Kingdom, and the FDA issued an emergency use authorization for its use in treating adults with mild to moderate coronavirus. The medicine came from decades of research in virology and anti-viral therapeutics, a success of science at Emory and its Drive LLC (Drug Innovations at Emory), an initiative to translate academic research into drugs to treat viral diseases. Drive partnered with Ridgeback Pharmaceuticals for early-stage clinical trials, and with Merck for later-stage trials and worldwide manufacturing and distribution. Drive, Ridgeback, and Merck agreed to join the patent pool to make Molnupiravir available to low-income countries during the pandemic.

The American university is still a major driver of the U.S. economy. However, the post-World War II partnership between American research universities and the Federal government has moved away from innovation, which needs support now. There needs to be a balance between deep basic discovery science and very innovative ideas. This includes engaging with the private sector and immersion of faculty in industry.

Economic and Competitive Benefits of Extending the Healthspan

Healthy aging could have great economic and societal return. For example, with longer healthspans, people can participate in the workforce for longer periods of their life—contributing to GDP and generating more economic activity. A recent study concluded that a slowdown in aging that increases life expectancy by one year is worth \$38 trillion.¹ More-

COVID-19 Vaccines: A Miracle in a Moment Was Years in the Making at U.S. Universities

A University of Pennsylvania researcher, Dr. Katalin Kariko, and her collaborator Dr. Drew Weissman had focused for years on how to use messenger RNA to get cells to make their own medicine. Her ideas were unorthodox, the research difficult, and she struggled to get grants to fund her work. Breakthroughs in her research failed to get attention, even though they showed the potential for mRNA to induce the body to make protein drugs, or even vaccines. This work formed the foundation for the COVID-19 mRNA vaccines. In January 2020, Chinese scientists published the genetic sequence of the virus and, drawing on years of his own work, Jason McClellan of the University of Texas at Austin quickly isolated the spike protein the virus uses to penetrate the host cell. BioNTech designed its mRNA vaccine in a few hours, and Moderna took two days. The first vaccine clinical trial began 66 days after publication of the genome.

over, new industries will develop to meet the needs of this growing part of the population. For example, Japan and Korea are world leaders in robotics, in no small measure due to their long-term efforts and investment to develop technologies to meet the needs of their aging populations.

¹ All's Well that Ages Well: The Economic Value of Targeting Aging; Martin Ellison, University of Oxford; Andrew J. Scott, London Business School; and David A Sinclair, Harvard Medical School; January 8, 2021.

The Future of Placed-Based Innovation— Expanding Access and Enhancing Diversity

Keynote



**The Honorable Gina
Raimondo**
Secretary of Commerce

Increasing U.S. competitiveness is the overarching goal of the U.S. Department of Commerce so our workers and companies can succeed in the global economy. But America's ability to compete globally depends on strengthening our domestic workforce, innovation, and supply chains, as well as rebuilding our manufacturing base.

The Department is responsible for investing \$3 billion from the American Rescue Plan for economic development to support communities affected by the pandemic. As part of that investment, Commerce is launching an initiative to develop industry-led workforce training and apprenticeships, with an emphasis on training women, people of color, and underserved communities. The Commerce Department will also oversee the administration of nearly \$50 billion to

deliver universal, high-speed broadband to every American. Secretary Raimondo is leading the Administration's efforts to dramatically increase domestic production of semiconductors. The Biden Administration is also urging Congress to pass the United States Innovation and Competition Act, which would invest \$10 billion in new high-tech hubs across the country, bringing new capabilities to new communities to help close the innovation ecosystem divide. The Act will also establish a new Supply Chain Resiliency Office at the Department of Commerce to develop new tools and process to address future supply chains disruptions.

Key Takeaways

- America's land-grant universities have tremendous potential to expand the innovation ecosystem in the United States, but there are challenges that must be met, such as establishing adequate broadband infrastructure to ensure greater regional inclusivity and enable online learning and remote work.
- Land-grant universities can capitalize on their region's assets, for example, national laboratories. But partnerships—with goals and plans for the future—will be needed.

Panel



General Richard B. Myers

President, Kansas State University

National Commissioner



Mr. Bill Bates

Senior Advisor, Council on Competitiveness (Moderator)

Unique resources and competencies in a region can be a source of place-based innovation, economic development, and competitiveness. Universities are big employers and civic stakeholders in many U.S. regions and are often well-placed to lead place-based innovation.

But many communities are not part of the U.S. innovation ecosystem, or part of a thriving high-tech, knowledge-intensive economy. Many potential innovators and entrepreneurs do not view themselves as part of this system either. Moreover, innovation activities and venture capital are highly concentrated in a handful of U.S. regions, especially on the U.S. coasts. We are leaving people behind. We must expand the geographic footprint of creativity, the innovation ecosystem, and the high-tech, knowledge economy, making it more inclusive.

Place-based Innovation in Kansas

Kansas State University is a land-grant university, with a mission to expand opportunities for entrepreneurship, innovation, and discovery in all the areas of the state. The university is capitalizing on its current assets, for example, leveraging a new U.S. Department of Agriculture national laboratory, driving critical

research and innovation in bio-agrarian security and food security—issues that people care about and of high importance to the state. As interest in these issues grow and gain momentum, more capital will flow and more opportunities for partnerships will arise. Kansas just released its Economic Development Plan for the state, which will rely heavily on partnerships and collaboration.

Telework Could Inject New Economic Life into Regions But Broadband is Key

The recent scaling of telework, which de-coupled employees from employer premises, has the potential to inject new economic life and vitality into rural and other declining geographic regions. Telework has great potential for economic impact, especially in a rural state like Kansas. A key to making the most of increased remote work, however, is broadband; even in larger communities, connectivity is spotty and often not enough to fully participate remotely in a professional environment or to connect to classes at a university. A partnership between Kansas State University and broadband carriers is working to expand broadband connectivity across the state, using some Federal funding that was part of the COVID-19 support payments. While these efforts are important during a pandemic crisis, they are not enough for the future.

Best Practices in Partnerships

Having a strategic goal and plan for the future are critical for such partnerships. However, they remain a novelty, and do not translate into best practices yet. Looking to the future, as we rethink the role of land-grant universities and bring them into the innovation ecosystem, they will be able to support the mission with a model. Kansas State University's research and extension efforts touch many counties across the state. A model like this can be used to bring education closer to people across the state and, as a result, become more inclusive and regionally innovative.

Tech Talks

The Future of U.S. Leadership in Disruptive Technology

Key Takeaways

New technologies are disrupting the economy and industry, and hold promise for solving sustainability challenges.

Energy

- Hydraulic fracturing and horizontal drilling converged unleashing a shale oil and gas revolution that propelled the United States into the world's energy powerhouse, energy independence, and an energy exporter. In about a decade, U.S. household spending on energy fell 25 percent and U.S. energy costs are about half of the costs in Europe.
- The oil and gas industry must meet the growing demand for energy, while reducing its emissions footprint. The industry is looking to advanced technologies to meet this challenge, including sensors, robotics, advanced computing, methane detection, and carbon capture (including storing carbon in the root systems of plants).

Cybersecurity

- The Colonial pipeline and SolarWinds cyber attacks, and the massive shift to on-line learning during the pandemic illustrate the vital role information infrastructure plays in U.S. resilience and the importance of cybersecurity.

- The private sector plays a pivotal role in securing cyberspace, but the United States currently lacks a cybersecurity workforce of sufficient size to meet that challenge. New cybersecurity training initiatives are being established.

Semiconductors

- Materials engineering and improvements in materials have driven the advancements in semiconductors that enabled unprecedented gains in digital device performance and power, with falling costs. But this continued scaling of Moore's law has slowed down, but the need for computing power and performance continues to increase. At the same time, the growing use of digital devices is consuming more and more energy.
- Creating microchips at the nanoscale (to pack them closer together) and producing them at industrial scale offers a solution for increasing power and making them more energy efficient.
- The United States needs a coherent approach to semiconductor innovation to enable advancements needed to address some of the challenges the semiconductor industry faces and to continue the economic, productivity, national security, and societal gains enabled by semiconductor technology.

Sustainable Food

- One third of food consumers buy gets thrown away, accounting for 21 percent of U.S. municipal waste—more than 63 million tons of waste annually. Residents contribute the largest share of food waste in the landfill.
- Properly storing food—for example, with better refrigerators—not only extends the timeframe in which it can be eaten before it spoils and must be discarded, it can help food retain its good taste longer, and prevent loss of nutritional value.
- Improving the sustainability of food also requires a focus on water, energy, and labor across the food value chain.

The Digital Transformation of Manufacturing

Keynote



Ms. Brynn Watson
Vice President,
Digital Innovation and
Implementation, Lockheed
Martin



Mr. Chad Evans
Executive Vice President,
Council on Competitiveness
(Moderator)

A new wave of digital revolution is under way, whether it is called Industry 4.0, smart manufacturing, or digitally enabled manufacturing. Multiple technologies are converging in the manufacturing sector, optimizing processes, revolutionizing production, and radically transforming the way we conceive, design, and make things. Frontier technologies—such as quantum technology,

virtual and augmented reality, AI and machine learning—will drive even bigger changes. Already, these technologies are enabling a mosaic of powerful capabilities, from predictive maintenance and real-time visibility on supply chains to designing thousands of product features before a prototype is made.

Lockheed Martin—the world's leader in the defense industry—has been at the forefront of this journey to digital transformation of manufacturing. This mosaic of technologies is creating a digital thread through the manufacturing process from intelligent design and operations to production and sustainment in the field. For example, Lockheed's Stardrive seeks to re-engineer the culture, processes, and tools needed to operate in a fully integrated digital work environment across the entire product life cycle. In a project focused on hypersonics, improvements achieved include a three percent reduction in the time to generate work instructions and a 35 percent reduction in touch labor. In the missiles and fire control business area, Lockheed is exploring model-based engineering, which has reduced touch labor by 25-75 percent. Lockheed is leveraging Digital Twin technology that creates a digitized twin of a product for life-like simulation that can be digitally "flying before flying."

The use of digital automation allows for greater opportunity to upskill employees. Lockheed created the Digital Academy, which focuses on learning tied to the new digital future, empowering employees to improve and build out their skills, and fostering a culture of continuous learning.

Energy Is Transforming



Mr. Greg Hill
President and Chief
Operating Officer, Hess
Corporation

[National Commissioner](#)



Mr. Chad Evans
Executive Vice President,
Council on Competitiveness
(Moderator)

Energy is the lifeblood of the economy, and its cost and use are inextricably linked to competitiveness. Hydrocarbons permeate all aspects of our lives—not just oil and gas, but in products such as pharmaceuticals and plastics. If current trends continue, we are set to use more energy in the next 50 years than in all of recorded history. U.S. competitiveness in energy technology could determine the position of the United States in global markets.

The oil and gas industry has a long history of using advanced technology. Hydraulic fracturing and horizontal drilling converged to unlock oil and gas resources previously thought to be inaccessible, unleashing a shale oil and gas revolution, propelling the United States into the world's energy powerhouse, energy independence, and a net energy exporter. Between 2008-2020, U.S. household energy spending fell 25 percent and, even today, U.S. energy costs are about half of the costs in Europe.

This shale revolution also has had tremendous environmental benefits. Since 2000, the United States has reduced its energy-related CO₂ emissions more than any other country in the world and, due to the growing use of natural gas, U.S. CO₂ emissions are at the lowest level in a generation.

Looking to the future, sensors, robotics, and advanced computing are going to impact the oil and gas industry. For example, Hess Corporation is pushing to develop autonomous fields to reduce their environmental footprint, health and safety risks, and the costs of production. Hess is making significant progress in methane detection and carbon capture. Scientists are working to modify plants so they can store carbon in their root systems, which would enable gigatons of CO₂ to be stored.

They world is facing the challenge of meeting a potential 20 percent increase in energy demand by 2040. People need energy, but we must reduce our emissions footprint to net zero. This will require new partnerships, new technologies yet to be invented, and changing consumer behavior.

Cybersecurity Vital for Resilience



Mr. James B. Milliken
Chancellor, University
of Texas System

Digital information infrastructure underpins the U.S. economy and society and has been crucial in maintaining the function of both during the COVID-19 pandemic. For example, the University of Texas (UT) is the country's largest public university system. When the pandemic hit, a quarter million of its students transitioned to on-line learning. But fewer than 20 percent of faculty had taught on-line, and less than half of students had previously taken on-line courses. The vast majority of the university's workers transitioned to telework. The university was more resilient than its leaders had thought it could be, but this resilience would not have been possible without the university's digital information infrastructure.

U.S. resilience depends on cybersecurity against national and global threats. That criticality became apparent to many Americans a cyber attack that forced the shutdown of the Colonial pipeline, which provides 45 percent of fuel consumed on the East Coast of the United States, causing gas shortages. The SolarWinds cyber attack that made headlines went undetected for months and spread across thousands of users of SolarWinds software, including Federal government departments and agencies,

enabling the perpetrators to spy on companies and organizations. There is also the potential for cyber attack during military conflicts. Our resilience will depend on how we respond to such attacks and how quickly.

Private sector investment and action will be a key determinant of U.S. cybersecurity and resilience, as will the workforce needed to ensure that security. In August of 2021, President Biden met with private sector and education leaders to discuss the whole-of-nation effort needed to address cybersecurity threats and pointed to the challenge of nearly half a million unfilled public and private sector cybersecurity jobs. During the event, the University of Texas System announced it will expand existing and develop new short-term credential programs in cyber-related fields to strengthen the U.S. cybersecurity workforce. A major part of this effort will be to upskill and re-skill more than one million workers across the nation by making entry-level cyber education programs available through UT San Antonio's Cybersecurity Manufacturing Innovation Institute. Credentials do not depend on traditional degree pathways and should also contribute significantly to diversifying the pipeline.

At UT Austin, the Straus Center's Integrated Cybersecurity Studies program pioneers interdisciplinary study of cybersecurity at the graduate level, featuring the integration of perspectives from law, public policy, business administration, computer science, and engineering. Within the School of Law, Strauss sponsors a cybersecurity concentration for the Master of Laws degree. The UT program also provides a unique 2-3 day "technical bootcamp" intended for professionals who currently work in policy or legal positions that relate to cybersecurity or other cyber-domain activities, but who do not have relevant technical backgrounds and would benefit from presentations of cybersecurity-relevant technical concepts.

Economic Leadership Linked to Semiconductors



**Dr. Omkaram "Om"
Nalamasu**

President, Applied Ventures,
LLC

Senior Vice President and
Chief Technology Officer,
Applied Materials, Inc.;

[National Commissioner](#)

Materials engineering and improvements in materials have been the root of advancements in semiconductors that have enabled unprecedented gains in digital device performance and power, with falling costs. That's why you can carry a supercomputer in your pocket with a battery that powers it all day on a single charge. Semiconductors play a critical role in the global economy, touching every sector from automotive to agriculture to security and global climate change.

The United States needs a coherent approach to its semiconductor innovation infrastructure to enable advancements needed to address some of the challenges the semiconductor industry faces and to continue the economic, productivity, national security, and societal gains enabled by semiconductor technology:

- Two-dimensional scaling of Moore's law has slowed down. The need for improved power, performance, and time-to-market, however, has continued. The solution is to create tiny nanometer

structures in three dimensions to pack both memory and processor chips together more closely, which will reduce their consumption of energy, and make them faster and more powerful. What is needed is controlling materials at an atomic scale while producing at an industrial scale.

- With the insatiable demand for digital devices penetrating larger and larger parts of our everyday lives, more and more energy is consumed to power them with implications for climate change. Energy consumption for general purpose computing is growing exponentially, doubling every three years. But energy production is growing linearly at only two percent per year. Materials engineering can help with more energy efficient devices.
- There are other global challenges for which materials engineering may offer solutions, for example, in energy storage. By improving the energy density of electric vehicle batteries while reducing the cost per kWh, dramatic improvements in electric vehicles can be attained, especially as they reach price parity with traditional combustion engine vehicles. These energy density improvements in batteries are enabled through materials science and engineering.

These challenges cannot be solved by one company or one country alone. It requires collaborations across borders based on the rule of law and respect for intellectual property. The CHIPS Act is a monumental step in the right direction.

Shaping Living for Sustainability



Mr. Nolan Pike
President & CEO, North
America, Electrolux
[National Commissioner](#)

Electrolux is a century old global appliance company, with a strong commitment to sustainability and achieving climate neutrality. Since 2015, the company has reduced its absolute CO₂ emissions from operations by 70 percent. It has set goals of reducing its footprint by 85 percent by 2025 and achieving climate neutral operations by 2030. However, 85 percent of the company's climate impact is accounted for by customers using its products. It can make a larger impact on the environment by making its appliances more energy efficient, using less harmful materials that can be recycled, and by impacting the way consumers use its products. It has targeted a 25 percent reduction in absolute emissions from the use of its sold products by 2025 and to achieve climate neutrality in product use by 2050.

Electrolux efforts in sustainability involve three priorities linked to its products: taste, care (such as dish and clothes washing), and wellbeing (such as the quality of air and air filtration). For example, the garment industry is largely unsustainable; textiles account for nearly six percent of municipal solid waste in the United States, more than 17 million tons of waste annually. Developing appliances that reduce by half the detergent needed to clean clothes and that help extend the life of clothes can help reduce apparel consumption and waste.

Food waste is an even bigger problem. One third of food consumers buy gets thrown away. It accounts for 21 percent of municipal waste in the United States, more than 63 million tons of waste annually. Residents contribute the largest share of food waste in the landfill. Properly storing food—for example with better refrigerators—not only extends the timeframe in which it can be eaten before it spoils and must be discarded, it can help food retain its good taste longer, and prevent loss of nutritional value. Limiting food waste also has positive impact on food affordability.

However, when people think of food waste, they often just think of the wasted item of food. But what goes into food before it reaches the table includes the resources such as water, energy, and labor used to grow and/or make the item of food. Electrolux only gets involved downstream in this farm-to-table value chain—in food storage—and, in this role, Electrolux is committed to developing the technology to ensure that your food keeps longer, but improvements are needed earlier in the food value chain.

Call to Action



The Honorable Deborah L. Wince-Smith

President and CEO, Council on Competitiveness

National Commission
Co-chair

The 2021 National Competitiveness Forum was a remarkable dialogue among America's leaders from industry, universities, and government. Across the Forum speakers and panelists, several key themes emerged which will shape the Council's agenda in 2022 and beyond.

The challenges and opportunities in achieving sustainability will be addressed by the Council's flagship National Commission on Innovation and Competitiveness Frontiers. This includes meeting challenges at the intersection of energy, food and water, which depends increasingly on the democratization of knowledge and innovation, and the proliferation of pioneering partnerships.

Similarly, U.S. research must embrace systemic democratization, driven by a national imperative for radical reform in the funding of our scientific enterprise, and the cultivation of America's next generation of researchers, innovators, and entrepreneurs. New challenges, new discoveries, new technologies, and new opportunities will come to the U.S. research, innovation, and industrial enterprise in areas such as energy, digital manufacturing, advanced materials and semiconductors, in cybersecurity and resiliency, and consumer-driven innovation in the circular economy.

In the end, people and place matter tremendously. Our companies, colleges, and unions are facing challenges as work transforms, and in providing the learning to meet the demand for specialized skills, for a more diverse and inclusive America—not centered around just a few cities and urban agglomerations—while preparing a workforce characterized by the opportunities that can come from adapting to continuous evolution and change.

We must expand our focus on the aging population to include not only disease intervention but the healthspan, lengthening the time in one's life that is healthy and active. This will require the redefinition and redesign of many aspects of living, supported by accelerating innovation.

New models for research and innovation are needed as plans are moving through Congress to make generational investments in long-term, basic research and development, the seed corn of innovation.

The Council and National Commission will build on the rich dialogue and expert insights from the National Competitiveness Forum with an ambitious agenda across many fronts.

The National Commission will host a major regional innovation summit in the first half of 2022, hosted by our National Commissioners along with Wyoming Governor Mark Gordon:

- Ed Seidel, President, University of Wyoming;
- Greg Hill, President and COO, Hess Corporation; and
- John Wagner, Director, Idaho National Laboratory.

The Council will continue its virtual engagement with our nation's Chief Technology Officers, and the Council's advanced computing roundtable and University Leadership Forum. The CTOs will keep up the pace of monthly virtual meetings and return to in-person dialogues in the Spring and Fall.

The Council will also continue its critical, strategic international engagements. We are a core partner in the 9th Brazil Industry Innovation Summit, which will convene in March 2022 in Sao Paulo. The Council's sister organization, the Global Federation of Competitiveness Councils, will host its 11th Global Innovation Summit in November 2022 in Athens, Greece. Our CTO community will re-energize efforts to partner with their peers in Australia.

The Council on Competitiveness stands ready to engage with our nation's policy leaders on the ever-more fundamental innovation agenda.

Acknowledgements

The Council on Competitiveness and National Commission Innovation and Competitiveness Frontiers recognizes and thanks the National Competitiveness Forum sponsors:



We thank Secretary Granholm, Secretary Raimondo, and Senator Klobuchar for their contributions and calls to action.

We thank the Council's Executive Committee, General Members and National Laboratory Partners, our National Affiliates, and our Distinguished and Senior Fellows for their continued support and engagement.

We thank and congratulate Janet Foutty, the Executive Chair of Deloitte U.S., on assuming the role as the Council's new Business Vice Chair. With this new leadership, the Council and Deloitte will build on our decade of work together on a range of critical competitiveness drivers, from pioneering research on the future of innovation, to mapping the world's manufacturing potential.

The Council's members also thank the other Board members for their leadership:

- Chairman Brian Moynihan, Chairman and CEO, Bank of America
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