



Ambassadors of Progress: Enabling Innovation Through Education

by

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Good morning. Thank you, John, for your kind words of introduction.

On behalf of myself, and of the administration, faculty, staff, and students of Rensselaer Polytechnic Institute, I thank you for the opportunity to speak here today.

Rensselaer has been an active member of CASE for many years. The organization provides a forum in which to work together with our peers toward the shared goals of becoming better at what we do; of making hard-won dollars stretch further; of continual self-reflection on, and improvement of, the state of higher education; and encouraging more champions to help support the young men and women who wisely choose to invest in a college or postgraduate education.

I applaud CASE and its many accomplishments, and would like to commend Mr. Lippincott, who has been a model of leadership since his appointment as CASE president in 2004, for growing the scope and global reach of this organization. And you know, John, education is, indeed, a close-knit community. It is interesting that William Walker, my vice president for strategic communications and external relations, served on the CASE International Board of Trustees from 1998 to 2004, chairing its Commission on Communications and Marketing, and was on the board that appointed you as president. I believe that Mr. Walker and the board were very wise in their decision to do so.

I also would like to recognize CASE District II Chair Anne Berry, as well as Conference Chairs Karen Faryniak and Tilghman Moyer. I am impressed by the way CASE leadership harnesses the enthusiasm of a diverse pool of educational institutions, and weaves them together into an international narrative that is more telling than any single chapter read alone.

Nonetheless, many of these individual chapters are quite fascinating, and tell encouraging tales of success. In fact, many of the advancement and communications professionals in this room are the central characters, even heroes, of these profound stories.

At Rensselaer, we recently completed an ambitious \$1.4 billion capital campaign: The Renaissance at Rensselaer. We reached our goal nine months ahead of schedule. The campaign was undergirded by a \$360 million gift I

solicited from a donor who wishes to remain anonymous, and a \$514 million gift-in-kind from PACE, or Partners for the Advancement of Collaborative Engineering Education, a joint philanthropic initiative of General Motors, EDS, Sun Microsystems, and UGS Corp.

The Campaign and *The Rensselaer Plan* has brought us success on the alumni, current faculty and student front. We have increased the number of alumni and alumnae participating in our programs by over 200 percent. Our freshman applications have escalated, with 2010 numbers reflecting a 140-percent increase from 2004, and our student body has grown both in calibre and diversity. We have invested more than \$700 million in campus infrastructure over the past decade, and faculty research funding is at an all-time high. Over the past ten years, we have hired more than 270 faculty members, including 40 in 2009.

I am very proud of what we have accomplished. Rensselaer is on a trajectory that, not long ago, many thought impossible. While we did take time to celebrate and reflect upon these achievements — with a series of 10-year anniversary events for the Rensselaer community that culminated in private concerts by violinist Joshua Bell and the legendary Aretha Franklin — the revelry was brief, and bright, and before we knew it, we were back in the conference room mapping out the next decade for continued success.

That, of course, is the curse of competence that everyone in this room, I imagine, knows all too well. The reward for hard work and success is, inevitably... more hard work.

That is what I want to talk with you about today. All of us here certainly have our work cut out for us. Despite our triumphs; despite our ingenuity with belt-tightening and coaxing new efficiencies out of slimmer budgets in the midst of this Great Recession; despite meeting and exceeding targets; despite upward trends of key enrollment and advancements metrics; there is no respite in sight. Our diligence only begets the need for further and continued diligence.

What I submit to you is that our efforts, our labors, our results, and our victories are more critical than ever. It is imperative that we continue to strive for, and exhibit, excellence. This is because new paths for the academic enterprise, new models of knowledge generation and value creation, are imminent.

As President of a technological university, I am especially focused on the promise of science, technology, engineering, and related fields. We are laying the foundation for a stronger economic future based on scientific discovery and technological innovation. This is important for maintaining US global economic competitiveness and leadership. We must assemble a self-sustaining innovation ecosystem, much like that of a coral reef, in which each element thrives by playing a vital, social role that builds upon, and contributes to, the efforts of the others.

This is why our joint success is so critical. As leaders and administrators of schools, colleges, and universities, we are more than the stewards of endowments, more than the shepherds of young minds. We are enablers of our institutions, and of each other. The work we do has subtle yet profoundly important, implications for the rest of the ecosystem.

There are four key facets of an innovation ecosystem: strategic focus; idea generation; translational pathways, and capital, of which there are three types — financial, infrastructural, and human.

It is at the points of intersection between these elements where promising ideas may slip through the cracks and go unrealized, if the interplay between these elements is insufficient or counterproductive. To ensure that this does not happen, it may require new policies, new approaches, and — particularly from those of us in education and academia — more hard work.

The first element of a successful innovation ecosystem, strategic focus, is the province of lawmakers and thought

leaders. Beyond investments already made, our strategic focus should include the urgent national challenges of energy and environmental sustainability, and health care.

Embedded within these areas is the potential for introducing radical new technologies, and the promise of unconstrained economic opportunities: renewable power sources and better energy storage technologies; transportation based on electricity rather than fossil fuels; new health information technology systems; the mitigation and cure of diseases; or genome sequencing and personalized medicine.

But, to move forward in these challenging arenas, we need an innovation ecosystem to fast-track solutions, to build new enterprises and enhance existing ones, and, of course, to create jobs.

The second and key element of our innovation ecosystem is idea generation. Universities and colleges, by their very nature, are important players here. Basic research aligns seamlessly with the mission of our institutions to educate. Every scientist, engineer, and researcher will admit that basic research leads to both intended and unintended results. Often these serendipitous results are more fruitful and valuable than what was originally expected.

A pair of examples from Rensselaer are Professor Shawn-Yu Lin, who developed the darkest material known to man, which holds the potential to revolutionize solar panel technology; and Professor Nikhil Koratkar, who discovered quite accidentally that a certain polymer infused with carbon nanotubes holds the potential for creating self-healing wings for jets and other aircraft, which would be a game-changer in aviation and transportation. So, even in the wake of a global financial crisis, in a situation with a low global tolerance for risk, we must invest in serendipity.

The primary contribution of universities to the ecosystem is the education of bright, motivated young people — people who ask shrewd, difficult questions, which may take decades to answer. For research universities like Rensselaer, the education of young people is inextricably linked with inquiry-based learning. Out of such unbridled exploration, and the patient support of it by colleges and universities, blue oceans of opportunities are created, societal important discoveries are made, and thriving industries are born.

After more than 80 people died from contaminated, animal-derived heparin in 2007, Rensselaer professor Robert Linhardt and his group helped to uncover the source of the contamination. Shortly thereafter, Dr. Linhardt announced the successful creation of bioengineered synthetic heparin. This result came after decades of work on polysaccharides by Dr. Linhardt and his colleagues.

There are other examples. Rensselaer researchers have created a paper battery, discovered clues about climate change in 250-million-year-old fossils, and attacked the flu virus, for the first time, on two flanks — at both its H and N proteins. The endpoints of basic research in terms of commercial technologies and value to humankind often cannot be envisaged — even by the researchers themselves.

For example, it was basic research at the Defense Advanced Research Projects Agency (DARPA) that gave birth to the Internet, and microwave technologies developed for missile detection which, now, are used in cancer treatments.

As this audience well understands, we, therefore, need to support our universities, in order to enable the kind of life changing discoveries and innovations these examples illustrate.

This harkens back to our being enablers. It is important to keep the broader perspective, to remember that, while we are fundraisers who cultivate potential donors; while we are communicators who write and convey the achievements of faculty and students; while we are administrators who shape and draft school policies, and set strategic

direction — our efforts encompass and undergird an academic infrastructure, steeped in history and tradition, that changes the world through the vigor, passion, and ingenuity of our students.

The third element of the innovation ecosystem is establishment of translational pathways, bringing the second element — idea generation — to applied, commercial, and societal use. The protection, regulation, and efficient use of intellectual property are key examples of this in action.

Spurred by the Bayh-Dole Act, passed in 1980, the deliberate exploitation of intellectual property has linked research universities to the marketplace more strongly than ever. The Bayh-Dole Act gave universities ownership of the results of their federally funded research, the right to patent and license them, and to share royalties with researchers, which, in turn, has spun off thousands of new enterprises.

Obviously, innovation has much to gain if universities cast open their storehouses of knowledge. But, as such knowledge is exploited, we need to ensure an appropriate focus on the ethical and security issues embedded in technological innovation, and to create mechanisms for vigilance to balance these issues with free exchange.

The final element of a successful innovation ecosystem is capital — financial, infrastructural, and human. Financial capital, in the form of venture or seed capital, is critical. We need to attract, or create, more venture capital that is regionally focused — and patient. Industry generally reserves its investment dollars for “sure-risk” technologies and start-up companies that are relatively close to launch or commercialization. We need new financial models, possibly supported by government, and even our donors, to provide early-stage support for potentially transformative technologies.

Rensselaer professor Jonathan Dordick and his partners at start-up firm Solidus Biosciences have created biochips, cell cultures that allow a rapid screening of the toxicity of drug candidates without the need for animal testing. Solidus spent six years at the Rensselaer Incubator before recently moving its headquarters. This has the potential to be game-changing, yet the chemical and pharmaceutical businesses that have the most to gain are not investing in it, because its applicability is too broad. Instead, federal grants are supporting the start-up company, to scale up and commercialize the technology.

Also important is physical capital, or infrastructure. This may include research facilities as well as computational centers, instrumentation, robotics, clean rooms, and fabrication facilities — facilities that no single company can afford. While colleges and universities may provide such infrastructure, they cannot be the sole infrastructural piece of innovation.

Another approach is the development of infrastructure that can be shared by fledgling industries. This could be based at a university in stand-alone facilities — with appropriate safeguards. The Rensselaer Computational Center for Nanotechnology Innovations (CCNI) offers a potential model. Located off the main Rensselaer campus, it is a joint project of IBM, New York State, and Rensselaer, and it hosts one of the most powerful university-based supercomputers in the world. The CCNI allows companies large and small to perform research, to model devices or processes, and to tap the expertise of Rensselaer faculty. Thanks to a high capacity broadband connection with the Troy campus, the CCNI also provides immense computational power for our faculty to use in their research.

Finally, there is human capital. I would like to explore this element more in depth than the others. I mentioned previously the gravity of the work ahead of us, making sure that academic and educational institutions pull their weight so as not to offset the rhythm and cadence of the carefully-balanced innovation ecosystem. I want to reiterate that communicating our missions, our visions, our triumphs and successes is a part of our charge. We have, to be sure, a self-interest in growing our enrollment numbers, and keeping classrooms full. But those goals also put us on the front line of a larger, more pressing conflict.

Innovation requires investment in research and development, but innovation fundamentally requires people. The question is, are we, as a nation, and global community, equipped with the human capital for the robust innovation needed to support a successful innovation ecosystem?

As a university president, and as a theoretical physicist, I have deep concerns that our national innovation capacity is in jeopardy. Converging forces have created what I call the “Quiet Crisis,” which is eroding the production of scientists, mathematicians, engineers, and technologists we need. The scientists and engineers who came of age in the post-Sputnik era, are beginning to retire.

At the same time, we are no longer producing sufficient numbers of new graduates to replace them. This looming talent crisis already is evident in many key sectors, including energy and health care.

The Quiet Crisis can upset the delicate balance of our innovation ecosystem, unless it is addressed. We must improve teaching in Science, Technology, Engineering, and Mathematics — the STEM fields — from the earliest days of a child’s education. Every sector — universities, government, industry — must contribute to a comprehensive education effort for technology workforce development and deployment. Academic institutions can collaborate regionally to offer students a wider range of course options. Our institutions increasingly also must look to young women and underrepresented minorities as an additional source of future scientists and engineers.

This “Quiet Crisis” is “quiet” because the true impact unfolds gradually over time — it takes decades to educate a biomolecular researcher or a nuclear engineer.

It is a “crisis” because our national and global innovative capacity rests solely upon their talents, and upon our ability to interest and excite all of our youth to the marvels of science and engineering — to the wonders of discovery and innovation.

Thankfully, the federal government is encouraging educational reform and research excellence. Through the \$4.35 billion “Race to the Top” fund and the \$650 million “Investing in Innovation” program, the U.S. Department of Education awards competitive grants to states working toward educational innovation and reform. Some now are calling this the start of a “Quiet Revolution” in education. On the research front, Rensselaer already has secured significant American Recovery and Reinvestment Act funds (ARRA) from the National Science Foundation (NSF) and The National Institutes of Health (NIH), to support more than 30 basic and applied research projects. Additional initiatives related to STEM education continue at the national level. It was a great honor for me, in April 2009, to be appointed by President Obama to serve on the President’s Council of Advisors on Science and Technology (PCAST). This past October, I attended a PCAST meeting at the National Academy of Sciences in Washington, D.C., at which thought-provoking presentations were given on federal STEM education initiatives and innovative STEM education programs. This attention to STEM education at the highest levels of government is encouraging.

In fact, while honouring educators who have shown excellence in teaching and mentoring in mathematics and science, President Obama had this to say at an awards ceremony at the White House last month:

“Whether it’s improving our health or harnessing clean energy, protecting our security or succeeding in the global economy, our future depends on reaffirming America’s role as the world’s engine of scientific discovery and technological innovation. And that leadership tomorrow depends on how we educate our students today, especially in math, science, technology, and engineering. So make no mistake: Our future is on the line. The nation that out-educates us today is going to out-compete us tomorrow. To continue to cede our leadership in education is to cede our position in the world. That’s not acceptable to me and I know it’s not acceptable to any of you.”

So where does this leave us as education professionals? Where is our place on this teeming stage?

It is often said that education attracts individuals and professionals who yearn to make a difference, those eager to support the ageless traditions of knowledge transfer and curiosity driven inquiry. This likely will always be the case. Indeed, I hope it is. But we must refocus our efforts and restructure our priorities to account for the reality of The Quiet Crisis, in order to build and strengthen our innovation ecosystem.

In what we do to serve our students, our faculty, and our boards of trustees, we also serve the greater good. We are agents of innovation, ambassadors of progress who help to position our institutions to address larger, national, and global issues.

Still, this begs the question of how we really go about addressing the Quiet Crisis, and fostering a successful innovation ecosystem? This is the context in which I assumed the presidency of Rensselaer in 1999. Change was needed, and change we did. Rensselaer has spent the past decade positioning itself to answer these questions, to tackle these and other challenges.

In 1999, shortly after my arrival, we drafted and implemented *The Rensselaer Plan*, a comprehensive strategic plan whose essence and strength are drawn from two essential roots that date back to the founding of Rensselaer in 1824: "...the application of science to the common purposes of life," and the employment of unique educational strategies for engaged, interactive, self-directed learning.

Much like the CASE founding document that Alice Beeman, Edwin Crawford, and others drafted in 1974, *The Rensselaer Plan* is a series of "we will" statements that crystallized our intention to rechristen the Institute as a fully-realized technological university. Our intent with *The Rensselaer Plan* was to leave no aspect of the Institute untouched — to imagine a bolder, different future, built on the legacy and strengths of our university.

We set in place four transformative platforms to anchor and to animate Rensselaer education, research, and the student living/learning environment. One is the CCNI supercomputing center, which I previously mentioned. This and two other platforms specifically invigorate research and scholarship — the Center for Biotechnology and Interdisciplinary Studies (CBIS), and the Curtis R. Priem Experimental Media and Performing Arts Center (EMPAC). The fourth is the East Campus Athletic Village (ECAV), a LEED-certified complex that expands and enhances the Rensselaer experience for our scholar athletes, for all of our students, and for the greater Rensselaer community. In total, we have so far invested nearly \$700 million to provide, enhance, enable, animate, and secure the platforms, facilities, and physical infrastructure for the benefit of students, faculty, and staff.

We have revamped our curricula, sharpened the focus of our undergraduate and graduate programs, and introduced new programs at all academic levels. We have established greater opportunities for undergraduate research, and partnered with regional institutes to offer new hybrid degrees. We make our coursework and experiences deliberately global in outlook, intellectually rigorous and sophisticated, and socially nuanced, creating an environment that promotes powerful, mind-opening new experiences, which foster intellectual agility.

To further this aim we launched REACH, Rensselaer Education Across Cultural Horizons, which sends undergraduate engineering students abroad, and builds on several long-standing School of Architecture programs in Italy, China, and India.

Using advanced information technologies, we are on the cusp of implementing a "virtual bridge to Africa," in a collaborative partnership for innovation, with universities and other institutions in Africa. We, now, have exchange agreements in 12 countries with 22 institutions.

Our success under *The Rensselaer Plan* has impacted every aspect of life, learning, and research at Rensselaer--from the classroom to athletics; from a significant improvement in our student-to-faculty ratio, to the new Clustered Learning, Advocacy, and Support for Students (CLASS) initiative, which is built upon a residential commons and Class dean model and provides undergraduates with leadership and guidance from faculty, live-in student life professionals, and more senior undergraduate and graduate students who live with them.

So, in the first 10 years under *The Rensselaer Plan*, we have built a foundation for future success. We have amassed the necessary resources to attract the right people, and develop the necessary programs and platforms, to both grow as a university, and to position Rensselaer as a leader in nurturing a global innovation ecosystem. In the coming decade, we intend to continue along our path. We hope this new way of thinking, crystallized in *The Rensselaer Plan*, will serve as a model for other institutions.

I hope that my description of Rensselaer progress under our Plan reinforces that we are the enablers of young minds. We play an irreplaceable role in developing the human capital necessary for maximizing the global capacity for innovation. Our efforts nurture the future generations of thought leaders, scientists, and engineers who will carry through to fruition the technologies that will sustain the world and humankind through this century and into the next. We make this happen.

And for that, I thank you.

I am thankful for the Chief Executive Leadership Award. Thank you in particular to Lori Eastman for your work in orchestrating the Award programs for CASE.

As I accept this award, I would like to thank so many of my colleagues and friends from Rensselaer for being here this morning, for doing what they do for our University every day. I also acknowledge and congratulate those who are receiving awards for programs and service at this Conference, including Liz Discanio who will receive the Quarter Century Award tomorrow afternoon. Rensselaer has been recognized a number of times for best practices in alumni relations, advancement and communications and I wish to thank them as well for their hard work.

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