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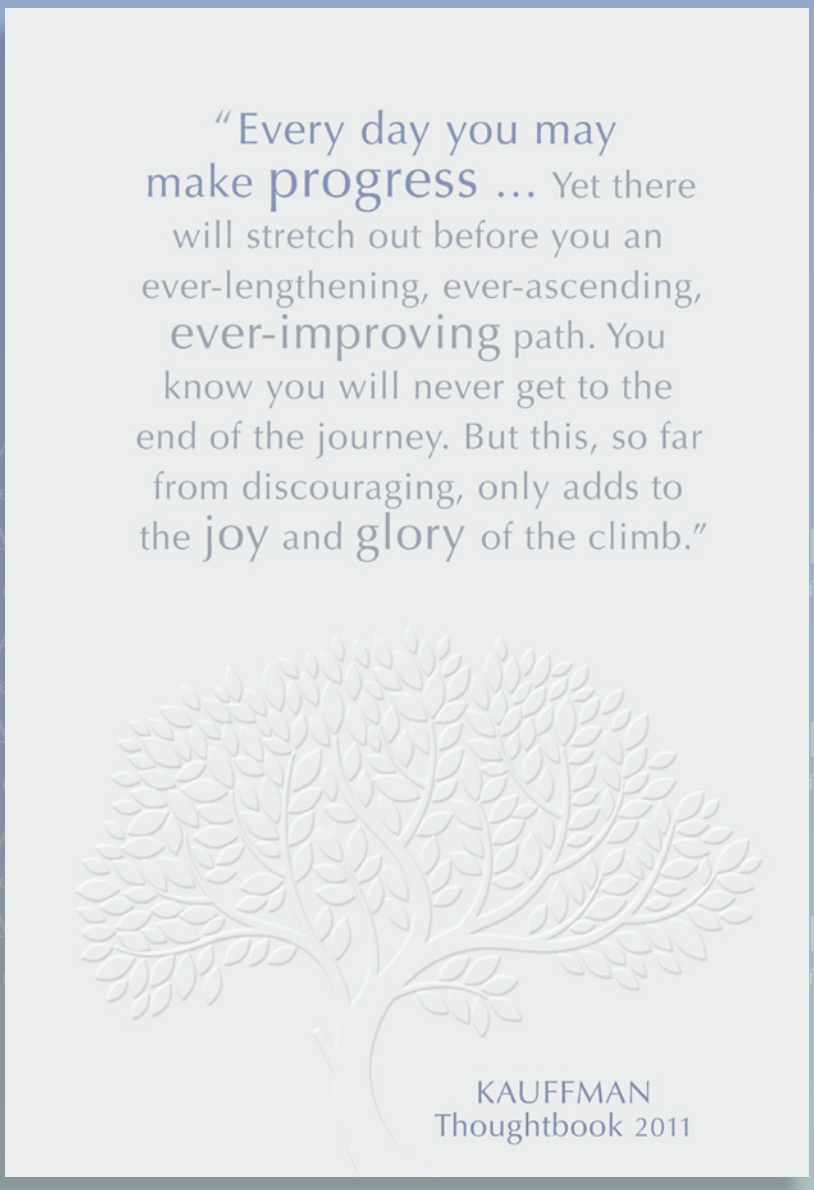

Fifth in an ongoing series, the **2011 Thoughtbook** captures what the Kauffman Foundation is thinking, learning, and discovering about how education, entrepreneurship, and innovation drive growth and progress in myriad ways. The essays are written by the talented Kauffman Foundation associates, partners, and experts who are pursuing the principles and vision set by our founder, Ewing Kauffman.

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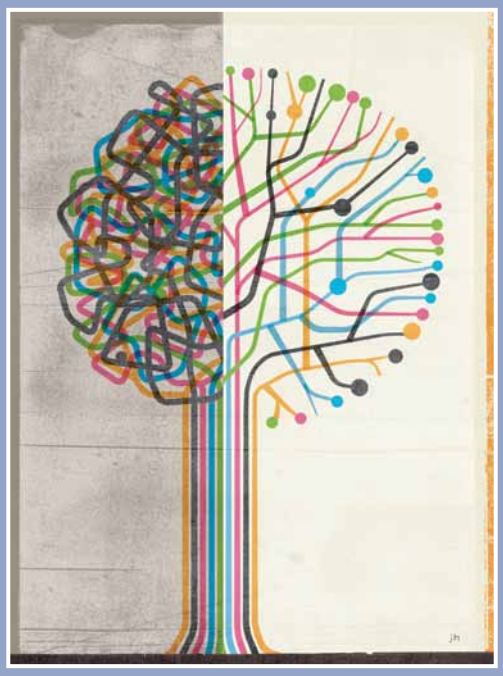
Cultivating Growth in Innovation



Many Paths, Many Levers

Innovating New Ways to Innovate

LESA MITCHELL
Vice President, Advancing Innovation, Ewing Marion Kauffman Foundation

In the United States, we spend billions every year funding scientific research in fields from medicine to energy. What we hope to get from that investment is not only discovery and invention, but innovation—a process that includes turning the products of our brainpower into actual new products on the market, to spur economic growth and improve our lives. However, in recent years, America's vaunted innovation pipeline has been showing signs of breakdown. There appear to be multiple disconnects between our capacity for generating new knowledge and our ability to put it to use.

Since the late 1990s, for example, federal funding of research in the life sciences has more than doubled, yet the number of new drugs for medical treatment coming to market has shrunk by more than half. From 2006–'09, seventy-four new drugs won FDA approval, compared to 157 from 1996–'99. In the emerging cleantech industries, based on new technologies for generating and conserving energy, the United States has cutting-edge research, plus a venture capital industry eager to finance new firms in this space. Yet, other countries are far outpacing the United States in commercializing energy technologies.

Obviously, the recipe for better results is more complicated than "just add money." To help identify the issues and catalyze new thinking, the Kauffman

Foundation launched a major initiative, called Advancing Innovation, in 2004, at a time when many still thought there were only minor problems on the innovation front. Today, the initiative is expanding greatly, both in terms of partners working with us and in terms of scope.

Our initial focus was on technology licensing offices (TLOs) at universities. These offices, charged with transferring new technologies from university labs to the private sector, often were seen as bottlenecks instead. Many individual TLOs tend to be overburdened, and numerous programs now are under way to improve the tech-transfer function by combining efforts and streamlining the process: They range from Kauffman's iBridge Network, a web-based platform for disseminating research technologies, to shared TLOs among the public universities in some states.

But a broader, systemic approach was needed. Innovation is more than a matter of handing off technologies. It is an elaborate human process that can be sharpened only by optimizing the entire ecosystem in which innovators of all kinds have to operate.

Widening the Innovation Path

Current efforts are so wide-reaching that we can give you only a brief sample here. In one thrust, we and our partners are looking at new ways to support and incentivize the young researchers most likely to become tomorrow's innovators. Postdoctoral fellows and young tenure-track faculty represent much of our top up-and-coming research talent, but they seldom are encouraged to pursue commercialization of their research. They are channeled into a more strictly "academic" research path, rewarded for publishing their findings—and for then winning still more research grants. Our Kauffman Labs Entrepreneur Postdoctoral Fellowship Program, which we launched in 2009, was aimed at postdocs interested

in practical application of their work (read a profile about the work of one postdoc fellow on page 101), and others are prodding universities to give more credit to such activity in tenure decisions.

Innovation works best when it can travel by many paths from one sector to another, and when the exchange of information is constant.

We also are working to build more interfaces and collaborations between universities and private industry. The present system mainly allows for two formal modes of interface: industry sponsorship of research, and the licensing out of university technologies. That is a very limited view. Innovation works best when it can travel by many paths from one sector to another, and when the exchange of information is constant.

Last, but not least, we and our partners now are looking seriously at the public-policy aspects of innovation. Many policy barriers have arisen over the years, and many policy levers that might increase the flow of innovation haven't been tried.

For example: Huge amounts of biomedical research have been federally funded across hundreds of institutions, with no provision for building widely shared "open-source" tissue banks that other researchers could use and learn from. People talk about the tragedy of the commons; this is a failure to create a scientific commons that could greatly advance the search for treatments that have long eluded us.

Innovation in energy, meanwhile, could benefit from a "roadmap" approach like that taken years ago for semiconductors. The government and the semiconductor industry partnered to map out key new enabling technologies that would be needed by many firms in the years ahead, and formed consortia to support research in those areas. Applying this model to energy would be similar to

specifying open tissue- and data-sharing in the medical space, in that both would be cases of supporting much-needed precompetitive R&D.

When precompetitive work is done widely, the glass of innovation is half full. It's then easier for individual firms and institutions to pursue a variety of completion paths. We Americans have drifted away from this approach; we are more apt to fight for competitive advantage from the very bottom of the glass, by measures such as gene patenting. So, perhaps the virtues of "precompetitive advantage" need to be explored anew.

Another area of need is helping emergent innovations to cross the proverbial valley of death, between the point where research funding ends and the point where the innovation is well developed enough to attract private financing. Small Business Innovation Research grants are one good mechanism for crossing this valley, but we need more, such as the proof-of-concept centers now operating at some universities for development work that "bridges the innovation gap." Also, in medicine, every new drug has to cross the dire valley of clinical trials. The trials are necessary for testing the efficacy and safety of drugs, but they could probably be structured so they don't consume most of the cost of drug development, as at present.

Many levers, many paths. In an era when so much is changing in science and industry worldwide, it shouldn't be surprising that much of the American innovation system needs to be re-thought or rebuilt. This is, in fact, an exciting time. Growing numbers of us are engaged in meta-innovation: innovating new ways to innovate. The opportunities are tremendous.

In the essays that follow, some of the country's leading meta-innovators share what they are thinking—and doing. U.S. Secretary of Commerce Gary Locke

highlights his recommendations for enhancing innovation in America. We preview the making of the "Personalized Health Manifesto," and we feature an essay that explains how U.S. innovation policy needs to recognize entrepreneurs' role in generating clean technology business models. You also will read about how the complexity of today's world presents limitless opportunities for innovators, and we present a new tool for expediting university innovations that we hope will inspire other universities to follow suit.

Fostering the Conditions to Reinvigorate Entrepreneurship and Innovation in the United States

GARY LOCKE
U.S. Secretary of Commerce

Successful relationships among entrepreneurs, innovators, universities, and government have never been more important to the economic success of America. By working together through public-private partnerships and other means of collaboration, we can help create the conditions necessary to promote the innovation and entrepreneurship needed for sustained economic growth and job creation.

What's certain is that, in these tough economic times, we can't simply continue to do what we've done in the past and cross our fingers that things will get better. Consider that, during the height of the recent crisis, the economy was losing an average of three-quarters of a million jobs a month.

That number speaks to the profound damage done to the economy and the American people during the recession. And, it's important to understand that, while the worst of the economic calamity may have been recent, it was years in the making.

From 2001–2007, America experienced the slowest job growth of any period of economic expansion since World War II. What growth we did see largely was

built on the shaky foundation of real estate speculation and consumer debt. Middle-class families saw their wages flatline for a decade while the cost of things like tuition and health care continued their rapid climb.

Fortunately, the worst-case scenarios many were predicting in early 2009 never came to pass, in large part because of the aggressive steps the president and leaders in Congress took to stabilize the financial system and create demand in our economy when local governments, consumers, and businesses couldn't or wouldn't spend.

With history as a guide, today's entrepreneurs will capitalize on innovation and create opportunities derived from technological change.

As America continues to work through these exceptionally trying times, we can reflect on our past and say with confidence that we will get through it—and when we do, entrepreneurs and innovators will be leading the charge.

A Kauffman Foundation study indicated that more than half of the companies on the 2009 Fortune 500 list were launched during a recession or bear market. With history as a guide, today's entrepreneurs will capitalize on innovation and create opportunities derived from technological change.

Entrepreneurs and the innovations they bring to market also produce high-paying jobs. Average compensation per employee in innovation-intensive sectors increased 50 percent between 1990 and 2007—nearly two-and-one-half times the national average.

But, to make the most of the emerging opportunities that change brings, we must acknowledge that America's innovation engine is not as efficient or as effective

as it needs to be. Neither is the national ecosystem for high-growth, innovation-based entrepreneurship as expansive as it should be.

The Commerce Department is in an ideal position to help. It touches entrepreneurs on all points in the continuum—from the development of innovative concepts through the global growth of entrepreneurial firms. We pursue all of these initiatives with partners who are passionate and committed to their success.

Like our partners, I am determined to help foster the right environment for private-sector investment and competitive markets. Improving commercialization, i.e., the process by which the fruits of research enter the marketplace, is one of my highest priorities at the Commerce Department. How well the United States moves ideas out of research labs and into the marketplace will determine whether we remain one of the most competitive and vibrant economies in the world. Here, too, entrepreneurs and innovators, including those at America's universities, will lead the way.

To that end, in September 2009, I created the Office of Innovation and Entrepreneurship at Commerce to drive policies that will help entrepreneurs translate new ideas, products, and services into economic growth.

My department also initiated the i6 Challenge. In partnership with the National Institutes of Health and the National Science Foundation, this multi-million-dollar competition funds teams of organizations across the nation that provide ground-breaking approaches and solutions for driving technology commercialization and entrepreneurship in their regions.

Although I believe this administration has a valuable role to play in promoting entrepreneurship and the commercialization of new technologies, we don't have all the answers. So, we rely on the best possible counsel. This is why I also have

convened the National Advisory Council on Innovation and Entrepreneurship. One of my goals with this group is to solicit its members' analyses and recommendations on where and how we can do better in areas surrounding innovation and entrepreneurship. These experts provide me with guidance on whether we are on the right track. We are working together to conceive, debate, and recommend the strategies our nation needs to support high-growth, innovation-based entrepreneurs, turn dreams into innovations, and create the jobs that will keep America great for decades to come.

The economic downturn has provided us with an opportunity for reflection. It has allowed us to clearly identify what is working and what we need to do better. And it has helped focus our energies on the priorities that should have received more attention before the financial crisis.

America is not lacking for groundbreaking ideas, and we're not short on entrepreneurs willing to take risks. Moreover, we know that, when you get businesses, government, academia, and nonprofits together, pulling toward similar goals, good things happen.

But, as a nation, we must continually reinvigorate our entrepreneurial ecosystems, adapt to ever-changing global challenges, and expand our innovative capacity. Recent initiatives within the Commerce Department and across the federal government show a commitment to doing just that. But it is only by working together and holding each other accountable that we can be truly successful.

The Making of the Personal Health Manifesto

A call for the medical community to support reforms for the rapid adoption of new scientific breakthroughs in personalized health

DAVID EWING DUNCAN

Director, Center for Life Science Policy, University of California at Berkeley; Author of *Experimental Man: What one man's body reveals about his future, your health, and our toxic world*

Modern society is on the cusp of a vital new era of health care, one in which medicine will shift from primarily addressing illness to a greater emphasis on prediction and prevention, improved diagnosis, and on individualized care. This historic transformation comes from a deepening understanding of biology and new technologies, and a rising demand for individuals to understand and take charge of their own health.

The promise of this new era of medicine is for healthy people to get a personal snapshot of their bodies—organs, cells, DNA, proteins, and a whole molecular universe of other tiny structures—cross-referenced with environmental input. Indeed, changes in diet and lifestyle, in medications, and in other treatments will be tailored to an individual's specific profile.

In fifteen to twenty years, a visit to the doctor will provide a profile of a person's entire body, which will reveal hundreds or thousands of bits of data—all of which can be seamlessly integrated by a computer into a health scorecard. Eventually,

this information may be downloaded onto handheld devices—perhaps a modified iPhone or Droid loaded with personalized health apps—that will contain detailed information about our physiology, genetic proclivities, and safe scans of our brain and body. The device will input real-time environmental data about what we are exposed to as we walk around, eat, and work: levels of mercury and benzene, say, and exposure to UV rays.

This personal stream of information will be referenced against massive global databases to come up with a constant and dynamic assessment of not only a person's health status, but also risk factors for health and disease based on choices in diet, medications, procedures, and lifestyle.

But turning this vision into an everyday reality depends on overcoming a number of obstacles.

First, the U.S. health care system is dominated by one-size-fits-all medicine, in which care is focused on diagnosing and treating disease, and drugs and protocols are focused more on averages and populations than on individuals. A small but illuminating example: Cholesterol scores are treated the same by physicians, even though the significance of the scores depends on an individual's genetics and physiology.

Second, despite almost $1 *trillion* of spending on life science research and development in the public and the private sectors this decade (twice the amount spent in the 1990s), there has been a sharp decline in the number of drugs approved by the U.S. Food and Drug Administration—from a peak of fifty-three in 1996 to an average of twenty-one a year between 2005 and 2009. One reason for this unexpected outcome is a failure of biomedicine to translate the

unprecedented discoveries in basic research into drugs and other products, and the resistance of new technologies such as genomics in the clinic.

Third, the medical system today invests considerable time and resources on basic research and on creating an ever-more-specialized phalanx of experts. While this research has produced critical insights into human health and disease that has made this burgeoning age of personalized health possible, there is also a downside. The research has encouraged a parsing of knowledge and a silo effect that has made it difficult to integrate discoveries into a systems and holistic approach that is necessary for translating findings into real-life applications.

To mobilize support for reforms and for the rapid adoption of new scientific breakthroughs in personalized health, luminaries in the life science field have signed a "Personalized Health Manifesto."

"Scientists are so caught up in doing the best science that they are failing to translate that science into anything useful," said Intel CEO and Parkinson's disease activist Andy Grove.

To mobilize support for reforms and for the rapid adoption of new scientific breakthroughs in personalized health, luminaries in the life science field have signed a "Personalized Health Manifesto." It calls on the biomedical community, policymakers, patients, and society to:

- Understand and acknowledge that this new era of prediction, prevention, and personalized health is upon us, and to promote philosophical and structural changes to optimize its timely adoption;

- Promote a new system of health care that emphasizes the whole human organism as much as its parts, and individual patients as much as populations;
- Restore a balance between reductionist and specialized science, and the need to integrate discoveries into systems and larger trends; and
- Create a comprehensive and dynamic plan to develop and implement a new life science paradigm focused on personalized health.

An important consideration for this new age of personalized health is to use new discoveries and protocols to not only improve health, but also to reduce medical costs. Eventually, the hope is that personalized health technologies will be available globally, in both the developing world and developed countries.

Shifting to a health care paradigm that embraces healthy wellness and personalized health is a formidable challenge, one that will take many years. In the meantime, the goal is to use all the available tools to promote predictive and preventive health for people before they get sick, and then to use science to target disease when it comes. The end result will be people living longer and healthier lives around the world.

To read the entire "Personalized Health Manifesto," go to www.kauffman.org/manifesto.

Policy Levers for Fostering Innovation and Entrepreneurship in Clean Technology

ANDREW HARGADON, Ph.D.

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Policies aimed at spurring a clean technology revolution show little understanding of the innovation process, how it drives technological change, and how it builds on, as much as builds, new markets.

"Clean technology" describes renewable energies like wind, solar, and nuclear; energy efficiency; environmentally sustainable materials and manufacturing processes; carbon capture and sequestration; and water and waste treatment. Clean technology innovation aspires to provide solutions for climate change, global energy security, environmental health, and economic growth.

The Need for Process-Focused Innovation Policies

Current approaches to fostering clean technology innovation focus on the supply side, generating new technologies, or on the demand side, attempting to put a market price on clean technologies (e.g., carbon). Done well, these policies have clear benefits. But they are not always effective in practice and, worse, their implementation often is financially and politically costly—preventing more effective policies from being considered or attempted.

Federal R&D spending has produced alternative technologies (inventions), but none has enjoyed broad market adoption (innovations). So, while policies focus on manipulating either the supply or demand side of clean technology innovation, they neglect the innovation process, where supply and demand come together. To describe this neglect, I posit several basic truths about innovation, and explore their implications for a clean technology revolution.

First, innovation includes both the development *and* widespread adoption of new technologies and practices. R&D investment does not guarantee success. Most promising technologies never make it out of the lab. Those that do typically take decades to become broadly adopted—the light bulb, the automobile, and the Internet all took roughly thirty years before being embraced by the market. Intermediate goals, especially those that benefit specific interest groups, distort policy by neglecting both the long path to market and the value of each step.

While policies focus on manipulating either the supply or demand side of clean technology innovation, they neglect the innovation process, where supply and demand come together.

Teddy Roosevelt warned that the impossible better is forever the enemy of the possible good. Pursuing the next generation of laboratory breakthroughs—the impossible better—undermines commitments to putting current alternatives into practice. The United States spent the 1970s fruitlessly looking for breakthroughs in wind technology; meanwhile, Danish companies put current technologies into practice and created the modern wind power industry. Today's solar and wind markets remain marginal—less than 0.1 percent and 1 percent, respectively, of the total U.S. energy market—and wholly dependent on inconsistent incentives for their growth.

Second, innovation depends as much on new business models as on new technologies. As innovation scholar Clayton Christenson notes, disruptive innovations typically underperform existing technologies on *traditional* terms and only gain market acceptance by defining new performance terms. New business models break the traditional relationships between offerings, customers, and market structures, enabling emerging technologies to compete on their strengths. The incandescent light was around for forty years, claiming a small market for independent and isolated systems, until Thomas Edison introduced the now-dominant utility model. In the early days, electric lighting could not compete on cost with gas; Edison's model enabled it to compete instead on safety, convenience, and (ultimately) a broader platform of other applications and appliances.

The automobile remained a hobbyist's market until Ford Motor Company changed its business model to build a car for the masses. Over the next seven years, from 1907–1914, this new business model drove technological innovations that, together, culminated in Ford's system of mass production.

Today's extensive local, state, and federal energy market regulations inhibit, if not outright prevent, new business models from emerging. Solar power, for example, today competes as small-scale rooftop systems or as utility-scale plants, but is effectively prevented from exploring new business models in the vast middle ground between 100 kW and 20 MW. Similar barriers prevent development of micro-grid power systems. Unless new energy technologies can define new performance terms, they cannot compete with existing technologies' commodity pricing, production, and distribution.

Third, new business models tend to come from startups and the entrepreneurs who lead them. Incumbent firms drive incremental innovations that fit within their existing business models. By definition, incremental innovations are less risky, make better use of an incumbent's sunk costs in manufacturing, displace older

technologies at a comparable scale, and work within the existing organization and industrial structures. Radical innovations, also by definition, do not.

In many ways, we depend on small firms to identify and initially develop wholly new technological pathways. Entrepreneurs can organize *de novo* around an emerging technology's unique strengths. Indeed, because most startups' primary goal is finding and proving a new business model *before* scaling, startups are perhaps the most cost-effective way to explore new clean technology innovation business models.

Startups are perhaps the most cost-effective way to explore new clean technology innovation business models.

Fourth, innovations' biggest productivity growth and impact come after new technologies are put into practice. The market validation of new business models, technology platforms, and market needs spur investment in complementary innovations up and down the new supply chain. Until this happens, the next wave of researchers, investors, and other entrepreneurs waits on the sidelines.

In the two decades following the establishment of the electric industry, for example, entrepreneurs drove exponential productivity growth and cost reductions across energy generation (advanced steam turbines), distribution (alternating current), and use (electric motors in manufacturing). Moore's law, which projects the doubling of transistors every couple of years, reflects the combined effect of these efforts.

Commitment-driven Innovation

In short, U.S. innovation policy needs to recognize and support entrepreneurs' critical role in generating (and validating) the new business models that will ensure

emerging clean technologies gain a market foothold, and in the next wave of entrepreneurs who will innovate, in both production and use, the new technologies.

Policies that enable the small-scale demonstration of viable new business models would be more effective than large-scale demonstrations of unprofitable technologies. Policies that remove regulatory barriers, if only as experiments, would open the exploration of such business models. And policies that create certainty—within niche markets—will support the emergence of new companies committed to innovate along the emerging supply chain.

Innovation that Matters

NICHOLAS M. DONOFRIO

Senior Fellow, Ewing Marion Kauffman Foundation; Retired Executive Vice President of Innovation and Technology, IBM

The very nature of innovation is changing—I believe it already has changed, but most of us have not yet realized it or caught up.

The information technology sector—where I spent my whole career—offers a perfect case-in-point. For literally decades, innovation in IT meant mostly hardware improvements, which meant, above all, speed and power. How many calculations per second do you get for a fixed amount of money? Progress was prodigious for many years. Choose an arbitrary, round number—say, $1,000—and then look at what it could buy over time. Over one hundred years, the purchasing power of that $1,000 increased by sixteen orders of magnitude. That's ten to the sixteenth power more calculations per second for that thousand bucks over a hundred years. A thousand dollars today buys a whole lot of productivity.

Or does it? Certainly it buys sheer power. But how much sheer power do we need? How many calculations per second does the average user, or the average business, really need to do? How much memory do we need? How much storage? We've crossed the terabyte threshold. How many of us can fill a one-terabyte hard drive? How many of us really need ten? Some of us already have five million pixels of visible capability. Do we need ten? Maybe the clock speed of your processor already runs at five gigahertz. Does it have to go ten?

This is not to dismiss the importance of technological advance or to scold users who want or need more power. But it is to suggest that we begin to ask ourselves about the possibility of diminishing returns. “More” was a successful business strategy for a lot of IT companies for a long time. More speed, more power, more storage, more of everything. Developers didn’t ask what it was for. They didn’t need to. All their customers wanted “more” and that want translated into sales.

Some of that want was rational. Growing businesses needed more power. More speed meant more efficiency. More storage meant quicker access to a growing cache of records. But there was also an element of keeping up with the IT Joneses. The CEO had to have the smallest laptop with the fastest processor. Senior managers had to have better machines than middle managers. Company X had to have more advanced systems than Competitor Y.

That impetus for buying is mostly played out—which means it’s also finished as an impetus for innovation. Technology, by itself, is no longer the necessary and sufficient condition for success. Some companies had to learn this the hard way. IBM, where I worked for forty-four years, had to undergo a near-death experience to understand that times—and needs and wants—had changed.

Finding What Matters

Today, the innovation that matters is not the latest result of Moore’s Law, or doubling RAM, or tripling pixels. Those things still matter, but they matter much, much less. And, as innovations, they are old hat—merely the continued refinement and improvement of yesterday’s breakthroughs.

The innovation that matters now—the innovation that we’re all waiting for, even if we don’t know it—is the one that unlocks the hidden value that exists at

the intersection of deep knowledge of a problem and intimate knowledge of a market, combined with *your* knowledge, your technology, and your capability … whoever *you* are, whatever you can do, whatever you bring to the table.

This may seem mysterious. Let me explain it this way. The microchip was an innovation—a fundamental, technological innovation. Chips keep getting better by the year. Is every new one an innovation? Perhaps, of a limited sort, but not in a fundamental way like the first one.

Innovations can arise from fresh thinking in any number of areas: from product to service to process to business model.

The personal computer was an innovation, not in some technical league; rather, it was the transformational application of existing technology to a new market for new uses. Operating systems like the one that ran the early Macintoshes, and later Microsoft Windows, were innovations—ones that fundamentally changed not just existing technology but existing products and markets, by revolutionizing the user experience.

There already have been several decades of this type of innovation—and some very successful recent examples. Think of the iPhone. Steve Jobs didn't invent the phone or the cell phone or the handheld computer. But he put them all together into one attractive, easy-to-use, engaging package. Whether a die-hard techie admits it or not, that's innovation!

Yet, too many people still think of innovation solely in terms of a wholly new product or technological breakthrough. This is limiting, and it is false. Innovations can arise from fresh thinking in any number of areas: from product to service to process to business model. Michael Dell built a Fortune 500 company by changing the way computers are built and sold—but not changing anything about the device itself.

All of these things unlocked hidden value. It turned out that a more user-friendly interface than typing in the clumsy, unattractive DOS prompt drew people into computing and changed the way business is done and lives are lived. Thank Bill Gates. It turned out that people really wanted a multi-functional mobile phone with great design and were willing to pay for it. The design genius is what Steve Jobs brought to the table. It turned out that people wanted to buy computers directly, choosing for themselves the features they did, and did not, want. Michael Dell proved that.

These innovations not only created billions in wealth and probably millions of jobs—they increased our productivity, saved us time, connected us to new people and products, and enriched our lives. Before they existed, we didn't know we needed them and we certainly didn't want them. Now we can't live without them.

Limitless Opportunities for Innovation

The good news for innovators and potential innovators is that, given the incredible complexity and diversity of the world today, opportunities for innovation abound. As confused as you think the world is, it's great for innovators. There are so many problems—some known and some yet to come to light—that opportunities for innovation will never run out. But we have to take a new approach: Start from the problem, not the solution. That is, we no longer can say to ourselves, "The end product is 5 GHz" (or whatever). Rather, we must ask ourselves, "What needs to change?" and then—and only then—start thinking about how to change it. The question of what specific invention or product or innovation to pursue comes after that.

The kind of people who best will be able to seize these opportunities are those I call "T-shaped" as opposed to "I-shaped." I-shaped people have great credentials,

great educations, and deep knowledge—deep but narrow. The geniuses who win Nobel prizes are "I-shaped," as are most of the best engineers and scientists. But the revolutionaries who have driven most recent innovation and who will drive nearly all of it in the future are "T-shaped." That is, they have their specialties—areas of deep expertise—but on top of that they boast a solid breadth, an umbrella if you will, of wide-ranging knowledge and interests. It is the ability to work in an interdisciplinary fashion and to see how different ideas, sectors, people, and markets connect. But even the most brilliant "T" will find it difficult, and perhaps impossible, to innovate entirely on his or her own.

Inevitable Trends

I believe that two inexorable trends follow from this fact. First, nearly all future innovation will be collaborative. Whether it emerges from huge corporations or the smallest businesses, from century-old institutions or the latest startups, innovation will be the product of collaborative, global, and multi-disciplined processes. This trend is already under way, but it will intensify. The lone scientist or engineer in a lab will still play a role, but he will be an outlier. People you've never heard of and never will emerge with the keys to whatever puzzle you are trying to solve. You may know a great deal, but so do they—and they know many things that you don't know but need to. You need them.

We inevitably are going to move toward more open standards. There is no other way.

Which means you will have to include them, and which brings me to my second point, one that will be especially hard for IT people to accept, given their reverence for the sanctity of intellectual property. We inevitably are going to move toward more open standards. There is no other way. Tight-knit circles, secrecy, and firewalls keep out the knowledge that will be needed to devise

solutions and make them work. This is not to say that all innovation going forward is going to be freeware—far from it. But the old model of IP protection doesn't fit the future. And that in itself is a problem to be solved requiring—innovation.

To thrive in this new world, the "I's" are going to have to transform themselves into "T's." And we're all going to have to work together more so than we ever have done before.

Expediting University Startups

A Step Toward Advancing America's Prosperity

JOSEPH M. DESIMONE, Ph.D.
Chancellor's Eminent Professor of Chemistry, University of North Carolina at Chapel Hill;
William R. Kenan, Jr. Distinguished Professor of Chemical Engineering, North Carolina State University

Our nation's universities produce some of the most important basic and applied research in the world, contributing to America's competitiveness and prosperity in the global economy. University spinoff companies have the potential to become high-growth firms, in some cases creating entire new industries that not only change our lives but also generate hundreds of thousands of jobs—one need only think of game-changers like Netscape, Google, Cadence, and A123 Systems to understand the significance of these firms. Yet, there is evidence that restrictions at academic institutions themselves are slowing the diffusion of new technologies.

With approximately 60 percent of the nearly $150 billion federal R&D budget funneled directly to university labs, the Obama administration, too, recognizes that it is imperative that academic innovation finds a more streamlined path to the marketplace. Despite this support, however, successful commercialization of new knowledge remains inconsistent. In a recent speech to the National Academies of Science, Commerce Secretary Gary Locke acknowledged that "America's innovation ecosystem isn't as efficient or as effective as it needs to be," and he warned that "the United States cannot afford to merely fund research and say a prayer that some entrepreneur will commercialize it down the road."

To maximize the potential for economic growth, academic institutions must seek new opportunities to reduce lag time in harvesting discoveries and expedite their translation into the private sector. Fortunately, there are universities beginning to do just that. A few commercialization pioneers are on the forefront of creating new models for expediting university startups across the country.

The Carolina Express License Agreement: A Groundbreaking Model

The University of North Carolina at Chapel Hill has broken with traditional approaches to commercializing research by establishing a pre-negotiated set of terms that faculty may choose when launching companies. Acceptance of these terms promises a three-week approval process. Traditionally, universities channel commercialization of intellectual property through centralized technology licensing procedures established following the passage of the Bayh-Dole Act of 1980, which granted academic institutions the rights to IP stemming from federal support. Licensing arrangements for university research often can be complex, sometimes requiring elaborate negotiations between researchers, universities, and private-sector partners that can lead to bottlenecks that delay progress or deter entrepreneurs from even attempting the process. UNC has found a way to circumvent this costly and cumbersome impediment to progress with the Carolina Express License Agreement, which comprises a simplified set of terms that can facilitate widely divergent deals that bypass lengthy negotiations.

The Carolina Express License Agreement is transformative to those familiar with the intricacies and redundancies of the university licensing process. As an example, the agreement offers a 1 percent royalty on products requiring FDA approval based on human clinical trials, a 2 percent royalty on all other products, and cash payout equal to 0.75 percent of the company's fair market value in the event that the company is involved in a merger, stock sale, asset sale, or IPO.

Carolina Express Advances Startup's Development

Bacteria have responded to antibiotics—many of which kill the bugs by damaging their DNA—by evolving resistance to the drugs. The resulting decline in the power of antibiotics poses a worldwide threat.

A new company, however, hopes to reverse the challenge to antibiotics' effectiveness. Based on research by **Scott Singleton, Ph.D.,** associate professor at the University of North Carolina Eshelman School of Pharmacy, Synereca Pharmaceuticals was established with the goal of developing drugs that inhibit RecA, the enzyme that allows bacteria to repair injury to their DNA.

"The waning power of antibiotics is not only addressed by new antibiotics, but also by drugs that make existing antibiotics more powerful and refractory to the development of bacterial resistance," Singleton said.

Synereca, which Singleton created in fall 2009, wanted to license his research. The company contacted the University of North Carolina Office of Technology Development, prepared to begin the usually arduous negotiating process. That's when Singleton was introduced to UNC's Carolina Express License Agreement, a program that was being designed to speed the process of starting a company that would leverage technology developed at the university.

Carolina Express came about through UNC's existing intellectual climate, coupled with an entrepreneurial mindset that has infused the campus over the last few years. Ultimately, Synereca became the first company to sign a licensing agreement using the program.

"Typically, when an outside company is interested in developing a discovery from the lab, the academic researcher first must determine who to talk to at the university, then must undertake the process of educating himself, and then must complete a lengthy legal process that finally allows the company to use the technology," Singleton said. "I had been through that before. It took months and months. The process has been anathema to academics."

Carolina Express, however, promised to simplify and shorten the process. Its standard set of terms minimized the negotiating and legal processes, *allowing Synereca to receive its license in less than one business week.* The negotiating process, Singleton said, was "dead simple," and the terms are favorable for both the company and the University. As part of the process, UNC also filed a patent to protect Singleton's intellectual property.

Synereca's technology license allows the startup company to explore, at an early stage, whether the RecA research has potential to offer long-term value to the public. Working freely in the investigation space—knowing its intellectual property is protected by the patent application the University filed—establishes a favorable scenario for Synereca and Singleton to collaborate and facilitate the technology's development.

Carolina Express is the first program in the country that lowers the barrier for academics to commercialize their discoveries. Singleton hopes other universities will follow suit, encouraging university-based researchers to consider commercializing their technology, reducing licensing obstacles and, ultimately, empowering entrepreneurship.

"I look at Carolina Express as an important step in developing this sphere of entrepreneurship—taking academic ideas and devices, and making them publicly available to do good," Singleton said. "Carolina Express will help to change the academic mindset that it's possible to achieve this."

The license includes provisions that encourage broad commercialization of the licensed technology, including making products available for humanitarian purposes in developing countries.

Moreover, the new stance offered by UNC is designed to foster a collaborative spirit between the Office of Technology Development and the faculty involved in the process. This avoids pitting the university against the faculty member in a competitive negotiation. Such a program supports the faculty's entrepreneurial efforts, which will encourage serial entrepreneurs and likely result in an increase in entrepreneurial newcomers. This is a focus on deal flow for UNC that simultaneously establishes a fair deal for all parties involved.

Widespread adoption of the standard agreements promises to expedite the movement of ideas from the laboratory to the marketplace. It also is consistent with the Obama administration's "Strategy for American Innovation," which envisions enhanced investment in R&D, education, and our infrastructure in order to spur entrepreneurship and catalyze breakthrough technologies that address the "grand challenges" of the twenty-first century.

Sec. Locke has asked how the nation can find ways to make it easier to connect entrepreneurs and other business builders with ideas coming out of university research labs. The Carolina Express License Agreement is one answer. We challenge other universities to follow UNC's lead by developing new, innovative tools and pathways to accelerate the formation of university startups and maintain American competitiveness.

Spotlighting Creative University Approaches to Commercialization

UNC is just one example of how universities are finding new ways to advance innovations to the marketplace. The Kauffman Foundation created the "Kauffman Commercialization Leaders" award to spotlight universities that are accelerating the commercialization process for faculty and students. In addition to UNC, the inaugural award went to Carnegie Mellon University and the University of Missouri System. By recognizing these superstar role models, Kauffman hopes other universities will be inspired to innovate or imitate these examples.