

INNOVATIVE ENTREPRENEURSHIP
AND PUBLIC POLICY

HERO WITH A THOUSAND FACES

A REPORT OF THE
2006 RUESCHLIKON CONFERENCE ON INFORMATION POLICY
BY KENNETH CUKIER

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ON INFORMATION POLICY IN THE NEW ECONOMY

IN COOPERATION WITH

 **Swiss Re**
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INNOVATIVE ENTREPRENEURSHIP AND PUBLIC POLICY

To order additional copies of this report please contact:

Fritz Gutbrodt, Head
Swiss Re Centre for Global Dialogue
Gheistrasse 37
CH-8803 Rueschlikon
Switzerland

For all other inquiries, please contact:

Viktor Mayer-Schönberger, Conference Co-Chair
The John F. Kennedy School of Government
Harvard University
79 JFK Street
Cambridge, MA 02138
Email: Viktor_Mayer-Schoenberger@harvard.edu
Web address: <http://www.rueschlikon-conference.net>

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Governments around the world see innovative entrepreneurship as the key component to robust economic growth and have pledged to shape their public policies accordingly. The European Union has embarked on an ambitious plan – the Lisbon Agenda – to redouble innovative entrepreneurship in Europe. In the United States, leading business executives have joined forces with politicians to emphasize the importance of innovative entrepreneurship in keeping America’s competitive edge. Similar policy initiatives are under way in Asia – from Japan to Singapore. Yet, even though we value innovative entrepreneurship and as a society want to encourage it, we need to know how.

To shed light on what public policy can and should do to facilitate innovative entrepreneurship in general and in the information and communication sector in particular was the task tackled by thirty select experts from around the globe, who participated in the 2006 Rueschlikon Conference on Information Law and Policy.

The annual conference’s aim is to stimulate dialogue between business strategists, regulators and academics. The 2006 conference took place at the Swiss Re Center for Global Dialogue from June 15 to 17, 2006. Its thirty participants debated for three days the salient issues of innovative entrepreneurship and public policy. The following report provides not only an analytical summary of the discussion, but also suggests a framework for action.

Once again, Kenn Cukier, the author of this report, has combined the many threads of three days of intense discussions into one beautiful, eloquent narrative. We thank him for his superb work. We especially thank our partner Swiss Re for invaluable substantive, organizational and financial contributions to make this conference happen.

Lewis M. Branscomb, *Aetna Professor of Public Policy and Corporate Management, Emeritus*
Viktor Mayer-Schönberger, *Associate Professor of Public Policy*
Kennedy School of Government, Harvard University

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INNOVATIVE ENTREPRENEURSHIP AND PUBLIC POLICY EXECUTIVE SUMMARY

The creation of technology-based start-ups is emerging as the bedrock of economic growth and better living standards around the world, as countries shift from an industrial to an information age. Promoting innovative entrepreneurship is thus a central concern for policy makers. The question is, how?

In the past, governments built infrastructure such as roads and power grids to further economic development. But the infrastructure and institutions needed today are different. Instead of ensuing stability, governments must be open to accommodating technologies that disrupt industries and markets; instead of investing directly in promising technical innovations, they need to resist the temptation to prejudge the future or assert control, and instead ensure that platforms exist for creativity to emerge. Moreover, rather than appeal to a parochial sense of protectionism, governments should consider promoting the free-flow of information, goods and people within and across their borders.

In this context, Viktor Mayer-Schönberger and Lewis M. Branscomb of Harvard University's John F. Kennedy School of Government convened 30 experts from industry, government and academia to consider the forces that promote and impede innovative entrepreneurship at the sixth annual Rueschlikon Conference on Information Policy on June 15-17, 2006. The event was held at the Swiss Re Center for Global Dialogue in Rueschlikon, Switzerland.

The report that follows, written by Kenneth Neil Cukier of *The Economist* who served as the conference rapporteur, is a critical synthesis of the discussions. Five key themes emerged (broken down into the "food chain" of innovative entrepreneurship):

- **Entrepreneur: The Individual** – *Innovation starts with a "random walk" in "design space," where ideas can be incubated and challenged. Investing in education is crucial, as is softening the consequences of failure.*
- **Social Networks: The Group** – *The relationships among people, firms, and nations help determine the degree of diversity they are exposed to, which influences inventiveness. Supporting the interactions across groups is essential.*

- **Organizing R&D: Universities and Firms** – *A networked-model based on connections, collaboration, flat hierarchies, modularity and constant “re-wiring” is required. This enables groups to respond successfully to discontinuities.*
- **Creating Clusters: Geographic Areas** – *Places where finance, technical talent, legal, accounting and marketing support intermingle aids the innovation process. Yet it should ideally be technology-neutral, and not reliant on one technical domain.*
- **Public Policy: The Role of Government (Municipal, Regional, National)** – *Reengineering society for a networked economy requires resources, patience and ceding control. International cooperation with new stakeholders is imperative.*

The report is divided into six sections: the first looks at the mystery of entrepreneurship; the second at the management of R&D and the emergence of technology clusters; the third at the importance of social networks and information flows (noting the role of diversity, trust and reputation). The middle two sections consider obstacles that hinder innovative entrepreneurship and possible steps for policy makers. The final section identifies some of the factors that go into a new model for innovative entrepreneurship.

There is no single approach that is best; indeed there are thousands of factors that account for our entrepreneurial hero’s success (which helps explains the cryptic title of the report, as well as hints at the conclusion). If supported well, entrepreneurship need not be the exclusive purview of just a handful of exceedingly smart or lucky individuals, but fostered in many people in multiple ways. Our hero has a thousand faces in that respect, too.

The participants concluded that promoting innovative entrepreneurship is essential for modern governments. Yet this requires that government officials themselves act entrepreneurial in moving forward with bold (and at times risky) policies, which include new forms of partnerships with industry, academia and civil society. Whether today’s leaders are prepared to accept this challenge will effect the success of tomorrow’s innovators.

HERO WITH A THOUSAND FACES – INNOVATIVE ENTREPRENEURSHIP AND PUBLIC POLICY

“Where you stumble, there your treasure lies.”

– Joseph Campbell, “The Hero’s Journey”

INTRODUCTION: “INNOVATION? I’M ALL FOR IT! ... NOW WHAT?!”

Innovative entrepreneurship is becoming the cornerstone of economic growth in the developed world. It is the source of jobs and high living standards for individuals, as well as great benefits for society in the form of technical progress and economic development. Of Fortune magazine’s Global 500 companies, one-third did not exist 40 years ago, and a quarter were only created over the last two decades. Today’s multinationals are yesterday’s start-ups.

Promoting innovative entrepreneurship is therefore a central concern for government and industry. To achieve this, a myriad solutions are proffered – which is itself a reliable indication that no one really knows how to do it for sure. Yet our ignorance does not restrain our ambition. Rather, huge amounts of financial and human resources are poured into fostering an environment for innovative entrepreneurship to thrive, with mixed results.

At the same time, however, some question whether it is even the role of public policy to support such endeavors. After all, Thomas Edison didn’t need state aid to create the incandescent lamp – a lot of pluck and a little luck was all it took, the argument goes. Moreover, the 20th century’s infatuation with planned economies and their horrendous results should have laid to rest the idea of government pulling the levers of the economy and society. Perhaps it is more sensible to leave it to the market to figure out, and civil servants steer clear.

But this view is deeply shortsighted. Edison and others, for example, did get state aid – a lot of it – only it was not in the form that we are used to thinking about government assistance. Edison benefited from a postal service that linked him with the outside world; with roads, potable water, libraries and public schools (though he was home-schooled), with a stable banking system and a judicial system that upheld contracts and patents. All these were the public goods that served as the substructure for the 19th century’s inventions and wealth creation. Countries that provided this flourished, those that did not had

a harder time. Private institutions also played a role, such as charities to smooth out capitalism's rougher edges, or the insurance industry to mitigate risk.

As the industrial age gathered steam, government supported business and broader society through new infrastructure: railroads, electrification, telephony, media, aviation, etc. Sometimes, it was done through public utilities or regulation; other times through favorable laws or financial subsidies. The result was economic growth. And the commercial firms that cropped up at this time embodied the same sort of big-is-beautiful ethos: vertically-integrated structures that vied for market dominance; hierarchical management to oversee the human capital.

Today, in the midst of the information age, we are faced with a similar challenge of adapting our economic organization for modern times. Clearly, new sorts of policies, infrastructures and institutions must be established to stimulate and sustain a new era of business. It is one where nimble, globally-minded start-ups rather than bloated bureaucracies are the motor of economic development. But we must discover anew what these policies, infrastructures and institutions are, and find the best way to provide them. We know it probably won't be delivered in the same way as in the past, or with the same set of stakeholders.

In this context, Viktor Mayer-Schönberger and Lewis M. Branscomb of Harvard University's John F. Kennedy School of Government convened 30 experts from industry, government and academia to consider the theme of innovative entrepreneurship and public policy for the sixth annual Rueschlikon Conference on Information Policy, held at the Swiss Re Center for Global Dialogue in Rueschlikon, Switzerland on June 15-17, 2006. To encourage frank discussion, the proceedings were not for attribution unless speakers gave their consent. This report is meant to document the dialogue, and is offered to the technology-policy community as a way to contribute to an understanding of the issues.

The report is divided into six sections: the first looks at the mystery of entrepreneurship; the second at the organization of R&D and the creation of clusters; the third at the importance of social networks and information flows (noting the role of diversity, trust and reputation). Section four and five consider obstacles that hinder innovative entrepreneurship and policies that government should and should not enact. The final section identifies some of the factors that may go into a new model for innovative entrepreneurship.

Too often, discussion about the topic suffers from banalities, akin to the caricature of a government minister who is quick to assert: “Innovation? I’m all for it!” but then has precious little left to say on the topic, just when it begs specifics. What is certain, however, is that every country – indeed, every country – aspires to become the next Silicon Valley, at a time when the barriers to entry for businesses have never been lower due to new technologies. The year 2006 will see the number of Internet users reach one billion, and one billion mobile phones shipped. The race to foster growth through innovation is increasingly a global one. And the stakes are huge: 75% of the increase in US economic productivity from 1973 to 2002 can be attributed to information and communication technologies.

Ultimately, Rueschlikon participants believed new approaches for promoting innovative entrepreneurship are required. Government can act as a catalyst to greater private action without serving as the agent of action itself. It should invest in upstream areas, such as education, as well as remove obstacles and encourage new forms of investment. It should not reward failure, but simply minimize the consequences when it inevitably occurs.

Just as nations established the infrastructure for the physical flow of goods in the past, today it must support platforms that facilitate the flow of information. Government and industry can create the platforms to tap into people’s creativity in whatever way it is expressed, rather than regard innovation as the domain of a small handful of people. In this respect, entrepreneurship should be treated like universal literacy in the 19th century, not the clergy in the 16th century.

Enlightened policy should promote entrepreneurship without pre-guessing the specific technological form that it takes. Intellectual property must be protected, but at the same time must not be so strict that it restrains innovation, which many attendees feared is currently the case in the “information sector.” Importantly, public policy should take after the very thing it hopes to promote – and embrace risk, experimentation and diversity. Provided the right balance is established, participants were optimistic that innovative entrepreneurship can flourish to the benefit of society.

I. BLACK MAGIC: UNDERSTANDING THE MYTHS OF INNOVATIVE ENTREPRENEURSHIP

To understand how entrepreneurship works, who knows better than entrepreneurs themselves, right? Consider the story of Sachio Semmoto. He founded DDI, now known as KDDI, Japan's second-largest telecoms operator, which challenged the incumbent NTT in 1984. Then in 1991, he started one of the country's leading mobile phone operators. In 2000 he raised over \$100 million in private equity to start a broadband access network provider, called eAccess, which went to public in 2003. More recently he founded a mobile broadband operator, called eMobile, raising \$1.1 billion for equity and \$2.2 billion for debt financing to compete with incumbents.

How did he do it? "If there is some 'contradiction,' but a growing market – that is what interests me," he says. The inconsistency might be high prices but no competition, or consumer demand but poor quality. He made his first foray in the 1980s, when the Japanese market was opening to rivals but few dared challenge the existing order. "No one stood up to compete. But I perceived that if no one stood up, that Japan would not change. So I stood up," he says. "As a graduate student in the US, I learned the value of taking risks and starting a company – a different sense of values than in Japan," Dr. Semmoto adds.

Or, to understand the formula for success, consider the story of Steve Abernethy, the CEO of SquareTrade, an e-commerce facilitator and dispute-resolution firm. He and friends left their comfortable jobs at a fancy consultancy and moved to Silicon Valley to capitalize on the easy venture-capital money going into dot-com start-ups. "The fundamental idea that we got funded for was not in my head when I decided to start the company," he admits. Basically, they had agreed to create a company before they knew what the company would actually do. (If that seems ludicrous, the approach at least has a good pedigree. "The question of what to manufacture was postponed to a later date," read the minutes of the first company meeting in 1938 of Bill Hewlett and Dave Packard in a Palo Alto garage.)

As both entrepreneurs told their tales, and others added their own experiences, it became clear that a huge number of factors are at play. Two elements that consistently cropped up were crises or discontinuities on one hand (so that necessity can become the mother of invention), and exposure to diversity on the other (so new ideas can emerge from novel ways of looking at a problem).

However, the overriding message is that while numerous factors are important, no one really knows the complete recipe for success – it is largely a matter of trial and error, and being open to switching strategies on a moment’s notice. “This is an unbalanced panel: for every two successful entrepreneurs, there should be ten failed ones,” noted Augustin Landier of New York University’s Stern School of Business. And the importance of intangible factors outside an entrepreneurs’ vision make it necessary to look beyond their analysis, just as artists may not be the most appropriate people to decipher their oeuvre – and the attempt to do so evokes more myth than method.

That innovators act without fully understanding what they are doing, why they do it, or their ultimate impact is almost axiomatic of the inventive spirit. Edison expected the phonograph to be used as a dictation machine in business; Marconi regarded radio as a point-to-point technology; the computer’s inventors viewed their creation as just that – a device for computations. Tim Berners-Lee’s modest goal was to embed the location of physics papers into documents that cited them – and as a result, the World Wide Web was born.

Understanding how innovative entrepreneurship works is like opening one’s eyes underwater – the images are blurry, and what’s really happening on the seabed is far too deep to see as we skim the surface. “As a CEO, you would tell your staff: ‘We need to become more innovative.’ But it does not work like that,” explains Olof Lundberg, who formerly led the satellite group Inmarsat, and later ICO Global Communications. “Innovation goes much deeper – it is first of all a personality issue and then also a cultural issue: the environment has to support and nurture those who dare think about change and think in new orbits.” The challenge today, many participants noted, is to increase the potential pool of innovators by creating the platforms on which they can express their creativity, similar to how the electrical power grid enables any appliance to plug in.

Just as the nature of innovation is sometimes misunderstood, so too the term “entrepreneur” is often misused. It does not refer to someone who starts a business. A sole proprietorship may entail risk, but the world does not progress because of a new restaurant or another laundromat. Rather, for the Rueschlikon participants, entrepreneurship meant something different, closer to how the economist Joseph Schumpeter described it: an attempt to fundamentally change how the world works through the commercialization of a new idea that disrupts existing markets or creates entirely new ones.

One of the biggest factors that seem to contribute to entrepreneurship is previous entrepreneurship – creating a culture that respects and encourages it. These cultural signals can be very powerful. Certainly the success of start-ups in America appears to partly spring from the country’s tolerance of risk, individuality and reward. It is expressed in so small a dimension as its children’s stories (recall *The Little Red Engine That Could*, panting “I think I can, I think I can...” as it chugs up the hill with his friends in tow). But it is also embodied in its laws such as bankruptcy protection and even ersatz “support groups” for entrepreneurs, like Silicon Valley’s celebrated Churchill Club. The role of “angel investors” for providing mentoring rather than simply giving money is critical, too. “In the US, everyone is potty-trained to be an entrepreneur,” quipped one participant.

Jonathan Kestenbaum, the CEO of NESTA, the UK’s National Endowment for Science, Technology and the Arts, identifies a link with role models and traditions of entrepreneurial activity. “One generation creates the other,” he notes. “Innovative entrepreneurship is not about money alone – there is a cultural dimension about it, an ecology,” he says. Previously as a venture capitalist, and now as someone tasked with promoting innovation in different regions across Britain, he has noticed a strange phenomenon: although NESTA is open to receiving business plans from anywhere in the country, it turns out that the locations that in the past lacked entrepreneurship today have almost no entrepreneurs. For example, the cities where people were largely employed in ship-building – and thus worked for big companies rather than started their own – are places where few ideas for start-ups emerge. “They have no role models to build on – no experience in it,” he concludes.

One shortcoming of the cultural dimension is that families and societies have a tendency to write their history after the fact, not during the process – so they characterize as entrepreneurship something that may have started out very differently, such as losing a job or emigrating in exile.

“What of the other side – the people that do not fit in? Any corporate effort to grow these people will not work,” noted Ronald Burt of the University of Chicago Graduate School of Business. “This is part of the puzzle: is it the case that successful entrepreneurs are temporary grit in the oyster?” If so, it raises the question whether companies are a suitable place for innovative entrepreneurship to emerge. Companies spend huge sums annually on research and development, with an eye to fostering innovation and a culture of risk

and reward. Yet often the results are disappointing, as if there is something in the enterprise that is anathema to innovation, and corporate antibodies race to eradicate the foreign intruder as a hostile enemy.

In some ways the problem is understandable. Big companies have more to lose, particularly in terms of damage to their brand, so they are naturally risk averse. Moreover, the role of incentives plays a big part: a large company may find that a \$200 million opportunity is simply too small to pursue, considering the revenue will merely be a rounding error in the annual report. This helps explain why AT&T declined an offer from the US government to run the Internet backbone: it felt the Net was too small a market to be worthwhile.

It is a traditional problem for big companies, described as “Raising Mice in the Elephant’s Cage,” in the title of an essay by Jim McGroddy, a former president of IBM’s research labs. Indeed, how IBM introduced the personal computer in 1981 is instructive, precisely because the firm had to adopt extremely “un-IBM-like” ways, explained Prof. Branscomb of Harvard’s Kennedy School, who served as IBM’s chief scientist from 1972 to 1986.

The company created a “skunk works” team of a dozen people, set them up in Boca Raton far from the company’s headquarters in Armonk, New York, and freed them from the firm’s stifling bureaucracy of marketing plans and budgets. The group was given 12 months to produce the PC, and could look outside of IBM for its parts (a radical proposition at the time, particularly for IBM, the paragon of the vertically-integrated company). Moreover, IBM understood that it should not supply the software but merely provide the platform. This is because users would figure out what they wanted, which nimble software firms could fulfill better than a big company. The results were extraordinary – it ushered in the PC age, of course – and surprised many, IBM most of all.

Among the morals of the story of the PC is that there is a role for both large companies and small ones in the innovation food-chain. A big company can introduce an environment for innovation that smaller firms can also capitalize on. (It may be to the big company’s advantage: Microsoft Windows has greater value the more that independent software firms develop applications atop it. Yet it may also be to the big company’s detriment: in the case of the PC, IBM chose a processor from Intel and the Microsoft operating system – only to watch as both companies captured the majority of the revenue around the PC, eventually resulting in IBM selling its low-margin PC division to the Chinese

firm Lenovo in 2005.) Both the large and small firms play a role, just as navies are comprised of lumbering battleships and nimble attack-boats.

Between the perspectives “bigger is better” and “small is beautiful,” there is space for both approaches to work in tandem, such as a large company and many small suppliers. How they interact sheds light on the positive and negative aspects of centralized versus distributed innovation. It is a tradeoff. From the standpoint of efficiency, centralized systems can change quickly by mobilizing resources all at once because coordination problems are minimal. Distributed systems, on the other hand, are slower to change immediately but more flexible and innovative when they do, because they collectively entail differentiation, experimentation and redundancy. But the advantages and disadvantages cut both ways. “The irony is that in this networked environment, we may be more locked-in to the platforms,” noted Philip Evans of the Boston Consulting Group.

In many ways, innovative entrepreneurship seems to be the defining characteristic of our time, as the world molts from an industrial to information economy. But it actually has a long lineage. Adam Smith’s pin factory was innovative: specialization of labor was a manufacturing rather than technical advancement, as was the notion of interchangeable parts a half century later.

Such inventiveness is well understood by today’s entrepreneurs, who seek out innovation in operating processes and business models, not just from raw science. The dot-com delirium of the late 1990s, commonly derided today, actually represented a magnificent outpouring of creativity that should be celebrated rather than denigrated. Because the Web dramatically lowered the barrier to reach customers, companies cropped up to test new business ideas at low marginal cost, and put products out for free to see if there was a response before figuring out later how to earn revenue. While the excesses and greed that also typified the period may be laughable or pathetic, the ethos of mass ingenuity that greeted the first phase of the web’s commercialization is to be respected and encouraged.

“The entrepreneur is the innovator who implements change within markets through the carrying out of new combinations,” noted Joseph Schumpeter in 1934. “Innovation is the specific tool of the entrepreneur, the means by which they exploit change as an opportunity for a different business or a different service,” wrote Peter Drucker in his 1985 book “Innovation & Entrepreneurship.”

In the past, the philosophers of innovation sought to describe the phenomenon; today's cyber-pundits vie to unlock the mysteries of how it happens. As always, the point is not to interpret the world but to change it.

The elixir of success is elusive. "Idea + ????? = Profit!" is the calculus presented by Cory Ondrejka, one of the founders of Linden Lab, which operates the online world Second Life. Throughout the Rueschlikon conference, participants referred to the idea of a "random walk" – the vital period of time when ideas are incubating, and entrepreneurs meander intellectually to gain exposure to new approaches and shift strategy.

At this point, financing is important. The link between the inventor and the investor is traditionally called "death valley," because ideas either prove themselves or die. It is a time when all participants face risks from lack of information as well as mistrust from lack of experience with partners. And yet all dream of great achievements if they cross the valley with their dreams intact. But Prof. Branscomb of Harvard's Kennedy School believes the death valley metaphor fails to convey the reality that, in this period of ferment and excitement, there is new life being created, as well as death. He proposed a different metaphor: the "Darwinian Sea."

"The narrative of success for innovative entrepreneurship is written by the victors," explained Ed Felten of Princeton University. "It goes like this: The entrepreneur gets a good idea; the funders saw that it was a good idea; and the market saw that it was a good idea; and it was successful," he said. "But here is how it really works: the entrepreneur gets a good idea but does not know yet that it is wrong; then, he figures out what to do to fix it, and does it. Then it succeeds. And then he writes a book about how what he did was right."

In other words, the problem of trying to institutionalize innovative entrepreneurship is made particularly tricky because no one really knows what works and what doesn't, until it works, and then we construct a narrative about why it worked all along. In this context, it shouldn't be a surprise that successful firms like eBay and others are often accused of conservatism in the way they operate – they know that their success is fragile, and not even they are really sure what accounts for their good fortune. Taken together, the best we can say for sure is that we know a lot less about innovative entrepreneurship than we thought we did before.

II. NETWORK OF NETWORKS: THE ORGANIZATION OF R&D AND THE CREATION OF CLUSTERS

A quick look at how industry was organized and innovation happened in the past sheds important light on how it might evolve in the future. In the Middle Ages, guilds were the locus of technical progress. Secrets of the trade were guarded among members, sometimes on penalty of death. Later, the “gentleman scientist” emerged as an icon of engineering; knowledge was transferred through meetings at the Royal Society and the journals that let amateur scholars keep in touch. (Universities didn’t dirty their hands with such practical technical matters, preferring to concentrate on “Science” or “Natural Philosophy” – and rarely things that had industrial application, until Francis Bacon’s utilitarian methods became established.) As for business, labor was eventually organized into factories, structured like the gears of the clock that kept the workers’ motion as syncopated as the machines they mimicked.

The 20th century begot a lot of changes. For industry, time-motion studies evolved into empowering workers. Ford’s assembly lines were replaced by Toyota’s lean manufacturing, and all American industry worried that its hierarchical tree-and-branch approach would be crushed by Japan’s layered model. In the case of technology, the US pioneered government-supported science, first during World War II by spending on everything from radar to the computer to the atomic bomb. After the war, the country took on board Vannevar Bush’s “disconnected” model of research and development, in which universities did the R (largely under government grants) and industry picked up the D.

Curiously, this model of R&D left out the “&” – that is, it presumed it was a smooth glide from the Petri dish to the factory floor, which turns out to be anything but the case. “The hand-off process was not even contemplated – it was assumed,” noted William Bonvillian of MIT. A number of institutions would need to be created to help that transfer take place, from venture capitalists to identify promising ideas, to America’s controversial Bayh-Dole Act of 1980 that encouraged the patenting of federally-funded university research (thereby adding the fuel of self-interest to the fire of invention), so technologies might go beyond the campus gates.

One of the most successful models for innovation has been DARPA, the US Department of Defense’s Advanced Research Projects Agency. The reason is the way it is organized. It connects R with D by forging a “hybrid” model that

joins university researchers with small companies, and then spins-off the innovation to the civilian sector. The economy (and military) recaptures the benefit, after the private sector bears the development costs. In essence, DARPA's approach was to work from right to left: to define the D first in order to spark the R, rather than the other way around, which is the traditional way science is commercialized.

In the DARPA model, innovation happens on both the personal and organizational levels. First, individuals and small "great groups" are formed around an inspiring mission. Second, the people are organized in a unique "networked model" of flat, collaborative, interconnected teams. This is more flexible and faster than other ways of organizing talent, be it the hierarchical firm (efficient but inflexible) or the 1970s layered model of teams (in which groups have ties to each other, but are structurally separated). "Entrepreneurship may be individual, but innovation has got to be a team activity," Mr Bonvillian emphatically stated. Ultimately, the organization of R&D marks a crucial third pillar for innovation, which previously only stressed investment and talent.

Until ideas make their way into the products and services, they are as ephemeral and fleeting as whispers in the wind. Ideas are not scarce, many participants noted, but good ideas are, as are the means with which to cull mediocre ones. If true, then the good news is that this makes the problem one of managing processes, not minting prodigies. "Individual genius combines with discontinuity or crises to create entrepreneurial innovation. The question is how those characteristics are understood and transferred in an institutional environment, so one does not need to wait for the 'accidents of individuals' to come along," noted Rick Murray of Swiss Re.

The great trend in recent years has been to institutionalize the ingredients of innovative entrepreneurship through overt action, rather than wait for it to spring up organically, as largely happened in the past. The corporate strategist Michael Porter has long looked at regional "clusters" of expertise as a way to fuel economic development. But the idea is hardly new. Clusters have always been with us, from the Middle Ages with their Venetian trading states and guilds, to the 19th century, where relatively isolated regions were demarcated by the industries they bore, from steel in Sheffield to silk in Lyon. Today, there is Madison Avenue in New York, movies in Hollywood, international organizations in Geneva and financial services in Zurich.

These concentrations tend to emerge naturally, because of efficiency and network effects. In America, five states account for 85% of all patented innovations in telecoms, and 75% in computing – over half of them in California alone. “The monoculture creates vulnerabilities; there are problems when you become captive to it. The way up is great and the way down is depressing,” explains Eli Noam of Columbia Business School.

Moreover, the problem with trying to create a cluster where one doesn’t exist is the classic chicken-and-egg dilemma. Many policymakers, from Singapore to Scotland, have faced frustration, as they learned that it takes money to make money; it takes talent to attract talent; it takes entrepreneurship to generate entrepreneurship. And it takes tolerance of failure to learn to take risks. “Everyone wants to be Silicon Valley – but how did Silicon Valley come to be Silicon Valley? We should at least consider the simplest explanation: there had to be a Silicon Valley; someone had to come out on top!,” says Suzanne Scotchmer of the University of California in Berkeley. At the same time, she notes, “institutions matter.”

This is not to say that efforts to spark a fertile cluster are futile. If anything, new technologies may actually make it easier for new clusters to form, and certainly boost their stature. “Globalization increases the importance and weight of regional clusters,” noted Fritz Gutbrodt, who directs the Swiss Re Centre for Global Dialogue. A look at one successful cluster that emerged over the past three decades – the city of San Diego, California – reveals some of the factors that go into the formula of how technical hotbeds can emerge.

San Diego first flourished with the Gold Rush in the 1840s, but its stature was only cemented in 1907 when it became the site of a Navy coaling station. That its wealth was largely dependent on military spending continued after World War II. But by the 1970s, the city hit hard times. Local businesses were ailing, partly because Navy work dried up. Around 160,000 people were unemployed. The municipal government was unsure how to proceed; state officials looked the other way. Ultimately, the inertia was overcome by the university community teaming up with the business community, and acknowledging that there was a problem that needed to be addressed fast. It was a deliberate act of creation.

A local scientific and educational institution, the Scripps Institution of Oceanography, was led by a visionary director, Roger Revelle, who saw a great

opportunity not only for Scripps but for rejuvenating the economy of San Diego. He championed the dream of a new university campus in the California system. His novel approach was to build the university from the top down, with graduate programs first, thus assuring that the University of California San Diego (founded in 1960) would be a research power house from the start.

It created a snowball effect. The nearby Salk Institute for Biological Studies, also created in 1960 (named after Jonas Salk, the developer of the polio vaccine), quickly established itself as one of the premier independent biomedical research organizations. And new technology firms decided to take root, lured in part by government incentives from real-estate to tax benefits. One was Qualcomm in 1985, which today is one of the world's most important wireless technology companies.

Together, these activities helped fuel the region's emergence as a thriving wireless and biotech hub. Scores of start-ups have cropped up, in the penumbra of the large companies and educational institutions, begun and/or funded by alumni of those organizations. Around \$1 billion in venture capital is invested in San Diego companies annually. And as a pump-primer for industry, local firms garner around \$950 million in federal contracts, around half in life sciences and a quarter in defense-related technology.

Importantly, the efforts are either initiated or amplified by CONNECT, a citywide group of leaders from universities, VCs, the businesses and policy-makers. Being in a position to offer an ecosystem of business services to aid this community is essential, from patent attorneys to public relations agencies. Additionally, the importance of already successful entrepreneurs to act as role models as well as angel investors to weed out ideas and seed the good ones is vital. Moreover, putting people together from different backgrounds is imperative, since diversity is the source of new ideas.

Often, this exposure to diversity is seen in quotidian things: the physicist in one swimming lane and the telecoms engineer in another strike up a conversation in the pool's changing room, and a new business is born. But there is an institutional dimension to it too. To cite just one example: The University of California San Diego's Bioinformatics Department boasts a budget of over \$35 million – funded from more than ten different university departments, from biochemistry to supercomputing. Researchers from different disciplines have no choice but to intermingle.

“Innovation is a contact sport, not a distance learning enterprise. It needs contacts that spill over and across domains, not within domains. It is a relational, not transactional process,” explains Mary Lindenstein Walshok of the University of California San Diego. And to critics who believe that such success emerges regardless of premeditated design, they may be surprised to see to what degree the city has long taken an activist role in polishing itself for investment: San Diego only became a Navy coaling station in 1907 after it invested in dredging the harbor.

Clusters are ferociously recursive: the best indicator that a region will be successful is that it already is. For instance, the most innovative 30 areas in America don’t change over time, they simply move around the rankings. Clusters embody network effects; like a popular night club, the more people it has, the more people it attracts. Strikingly, this is entirely rational behavior, noted Philip Auerswald of George Mason University. “The risk is lower in those regions – that’s why people go there,” he said. Because the cluster can tap into a wealth of talent, money, experience, ever-changing contacts, new people and support services, it is easier to start and maintain a business in a cluster than off the beaten path (even if the price of real-estate in remote places is dirt cheap).

This has global implications. “The perception that European entrepreneurs are not risk-taking enough is utterly wrong,” explained Viktor Mayer-Schönberger of Harvard’s Kennedy School of Government. The US mitigates risk through policies such as Chapter 11 bankruptcy protection, being able to swiftly hire and fire employees, easily-obtained intellectual property rights and a verdant venture capital market. The result is that society takes on some of the risk. “It is not very risky to become an innovative entrepreneur in the Bay Area, whereas it is more risky to be an innovative entrepreneur in Madrid. So what is needed is not more risk-takers per se, but a redistribution of societal risk,” Prof. Mayer-Schönberger said.

And so a global race is on, both to organize R&D institutionally, and to create clusters where these processes can commingle in order for the whole to become greater than the sum of its parts. It is a competition – since clusters exhibit winner-take-all, or at least “take-most,” characteristics. As a president of MIT is said to have remarked, explaining why over 150 biotech firms are a stone’s throw from campus: “We lost Silicon Valley to Stanford – that will never happen again!”

III. CORPORATION 2.0: REENGINEERING THE ORGANIZATION FOR INNOVATION

Take two different executives in a company, James and Robert. We know them both well, since they exist in every firm, every club meeting, every dinner party. The world wouldn't progress without them. But they bring very different things to the table – and the biggest reason why this is so can be understood by looking at their social circle. James is in a tight-knit group, Robert spans many different ones.

James's friends are a lot like him, hailing from the same background. At work, he specializes; he digs deep into what's happening and cleans up the sprawling mess that practical operations create. James drives variation out; he is a master at things like Six Sigma and "lean manufacturing" – basically, the process of doing better what we already know how to do. Robert, on the other hand, lives on the edge – literally. He lives on the fringes of numerous different groups rather than belonging to just one. Where James drives out variation, Robert brings it back in – in the form of new ways to tackle problems. He's considered inventive; resourceful; creative (some criticize him as a loose cannon...). He gets these ideas because of the diversity of perspectives and experiences that he is exposed to. James optimizes. Robert innovates.

The previous sections looked at how innovative entrepreneurship can be fostered in terms of how it is organized and how clusters can support it. But at its core, innovative entrepreneurship is about people. Fittingly, this section looks under the hood of the human machine; specifically, the role that social networks bring to bear on innovation. The conclusion is that it is not just the infrastructure or the ideas that matter – it is the individuals, the connections they form among each other, and the way information flows among them. The currency that enables these groups to form and to function is reputation, reciprocity and trust.

That is why James and Robert are so important. Although both bring value to their organization, they do so in opposite ways, according to the nature of their relationships. James is tied to a specific group, while Robert has links to many.

The Jameses and Roberts of the world frustrate each other. The Roberts are a pain in the neck to the Jameses – they're always talking about what can be

done differently. Meanwhile, the Jameses always seem to be impeding progress, in the eyes of the Roberts. But seen from the outside, a different phenomenon is taking place: the Roberts earn more money, do better on teams, and score higher on performance reviews than the Jameses. Why do Jameses not do better?

Insularity. “They’re drinking their own bathwater,” explains Prof. Burt at the University of Chicago. “The more you live with people like you, the more your performance is substandard. The more you are exposed to people who are different than you, the more you do better, have higher pay, faster promotions, et cetera. By being exposed to variation, you see things others don’t see, like an MRI scan or a radar signal seeing what’s over the horizon.”

In the past, social capital was measured by the strength of the ties; today, we realize that what is more important is the size of the holes. “It is at the intersection of social worlds that the accident of production takes place,” noted Prof. Burt. Moreover, this pattern is apparent not only in individuals, but also across groups, firms, clusters and countries. The implication is that it is vital to increase the amount of “white spaces” in the network – creating a way for variation to come in. It is what Jean-René Fourtou, as CEO of Rhône-Poulenc, referred to as “la vide” (emptiness); the spaces between groups. Likewise, it is what Jack Welch, the legendary CEO of General Electric, called “integrated diversity” – maximizing the links across different groups, not simply the cohesiveness within one.

To see how important the role of social networks are in technology businesses, compare the evolution of Silicon Valley and Boston’s Route 128 corridor. In 1960, the two regions couldn’t be farther apart in success. Boston boasted around four times the number of high-tech jobs than Silicon Valley. Yet by the early 1990s, the West Coast had not only surpassed its rival, but it employed twice the number than back East. In 1994, over 20 Silicon Valley firms boasted market capitalizations greater than \$1 billion, compared with only five in the vicinity of Boston. Today, the imbalance would be so much larger that no one even bothers to compare the two anymore, the most telling symbol of defeat – though Boston is resurrecting itself as a biotechnology hub and is the second most productive high tech cluster, after the San Francisco Bay area.

What accounts for this reversal in fortunes? The nature of the networks among people, according to AnnaLee Saxenian in the classic work on the

subject, “Regional Advantage: Culture and Competition in Silicon Valley and Route 128” (Harvard University Press, 1994). Route 128 was dominated by a small number of large, integrated computer companies that had no relationship with each other, or with local and regional institutions. Meanwhile, Silicon Valley is organized around networks of start-ups that compliment as much as compete with each other.

To simply churn out millions of minicomputers each year, an independent structure works fine. But to constantly incorporate new technologies is extremely hard to do within a single entity – it requires a porous conception of the firm’s activities, which a networked approach encourages. On Route 128, the model career was to stay within one company and work one’s way up the corporate ladder. In Silicon Valley, techies share knowledge and place a premium on relationships. Essentially, the structure of the relationships among people determined the degree to which each region successfully innovated. James lives in Wellesley, Robert in Palo Alto. (And because this pattern appears at the level of countries, too, it may explain why some places do better than others at fostering innovative entrepreneurship, i.e., James lives in Frankfurt; Robert in Tel Aviv.)

These networks among people are enriched not only by the innovative entrepreneurs, but by a massive human infrastructure of business support-services, everything from VCs and PR firms, to headhunters, accountants, lawyers, intellectual property specialists and business consultants, noted Gertraud Leimueller, the founder of winnovation in Vienna, Austria. Moreover, they provide more than just services – they share information within and across domains. “There is a huge backchannel of information,” explained Mr. Ondrejka of Linden Lab. “Every developer knows every other. VCs tell other developers what their competitor is doing. The best part of accepting venture capital is the access it gives you to that channel.”

At the same time, a natural economic specialization takes place. “Why should we think that the person who develops an idea is also the one to evaluate it or to fund it?,” noted Prof. Scotchmer at Berkeley. “We need an incentive structure that separates ideas from innovations and establishes a market for both,” she said. “Ideas are ‘options’ – one idea may not be good, but you get the chance to hear my next one! The venture capitalists are a class of actors whose job it is to intercede and evaluate the ideas and determine which ones get funded.” Indeed, the consensus among Rueschlikon participants was that

neither ideas nor capital are scarce in the networked economy, but institutions to evaluate them are, as are mechanisms to ease the handoff of ideas to organizations that can commercialize them.

As a metaphor, one can think of the social networks in the same way as one regards the technical networks themselves. The telephone system is centralized; efficient for one application but inflexible for adding new innovations. The Internet is a decentralized system comprised of interconnections among end-points, and is inherently open to innovation. The 20th century firm looked like the telephone company: it was vertically-integrated, embodied centralized control and had a strict hierarchy. (James, for example, would have been in middle management, and received a gold watch after 40 years' service.) The 21st century start-up does best when it resembles the Internet: it participates in an ecosystem with other firms which are simultaneously partners and rivals. It has a relatively flat hierarchy and is comprised of self-organizing teams that emerge and disband to address specific business needs as they arise. (Here, Robert might be an outside consultant, as just one of his many different professional activities.)

Just as the structure of social networks affects the degree to which individuals can innovate, the organization of the relationships within a firm and between its partners influences its productivity. Over the past three decades, companies have thrown IT into their processes, which empowered workers and eased the sharing of information. But unless the introduction of technology comes alongside substantial changes in corporate processes, the investment does not capture all the benefits that it might otherwise have been able to obtain. And it requires new styles of management adapted for the networked economy, with a premium placed on reputation, reciprocity and trust.

For example, consider the productivity of US and Japanese carmakers. From 1968 to 2001 the growth in the "value-added per employee" between the two countries was radically different, because of the way their operations were organized. Toyota was able to increase its productivity more than six-fold during that 33 year period. Moreover, its suppliers matched that growth almost in lockstep. Meanwhile, American carmakers saw only a three-fold increase in productivity over the same period, and their suppliers' efficiency barely budged at all.

The difference is due to how their relationships are structured, explained Mr. Evans of BCG. Toyota's operations use technologies that are pervasive

rather than cutting-edge; it relies on technology for operations, but taps into employees' intelligence and creativity for managing processes. And it shares the intellectual property related to processes so that all firms can benefit (without sharing the intellectual property related to product designs, which remain a source of proprietary advantage). Also, labor assignments are fluid within and across companies, and the results of small-scale experiments are shared across groups. Lastly, the system is held together by long-term but open-ended contractual relations among firms, based on a high level of trust founded on reputations. Together, this creates low transaction costs and rapid diffusion of knowledge.

Importantly, the use of technologies and communications alone does not account for productivity. Two firms that are as wired as the next will perform vastly differently depending on how they manage their relationships. "If GM's suppliers can show that they can boost productivity, GM will say 'give us price cuts!' Thus there is a disincentive to do this, and so the information is not diffused," said Mr. Evans. On the other hand, Toyota's operations constitute a fluid network that can be "rewired" at low cost.

Companies can reengineer their practices to harness the advantages of a networked environment. One of the critical components is making processes as "modular" as possible, so small discreet improvements can be incorporated at any time. Consider the case of the Mozilla source code, upon which the popular Firefox browser is based. After the code was released to the developer community, it didn't generate an outpouring of activity; rather it sat idle for months. The reason was that the code base was tightly integrated: a change in one file would require that some modification be made to 17% of other files. Because the "cost" of making changes was high, there was less incentive to add new contributions.

Recognizing this problem, a team of developers reorganized the Mozilla code base so that it was more modular and less integrated. By doing so, changes to any one file meant that only around 3% of other files would need to be modified – a far more acceptable price to pay for incorporating improvements. This sort of modularity changes the economics of innovation, noted Mr. Evans. For example, the average contribution for the Linux operating system is around 20 lines of code – "too small as an economic transactions, but quite possible as a gift," he explained.

This places a premium on process. In the past, the approach to working with business partners was like a concert of successive ensembles, in which after one group played, the musicians left the stage for another group to take over. Each firm performed its proscribed role. However, the networked corporation is like one great orchestra, in which the firm acts as the conductor in making sure all the sections play harmoniously together.

So far, technology has been used by business to reduce their internal costs and later, to operate from afar and outsource work to others. The former made for more efficient silos, the latter created sprawling hub-and-spoke networks with a strong center. But now the networked model is taking over. Technology is increasingly allowing companies to meld their operations with other firms as part of a massive, seamless business. Sam Palmisano, the chief executive of IBM, calls this the “globally-integrated enterprise” in an article in the journal *Foreign Affairs* (May/June 2006) that was much discussed by Rueschlikon attendees. In his view, firms will specialize and integrate tightly with others, because their processes are modular and their technology based on open standards. Such tight collaborations previously couldn’t take place because the technology wasn’t capable, and more importantly, the corporate ethos forbade it. But in the future, such interactions among firms will be commonplace.

“This is a welcome shift in the acknowledgement by big companies of where their truly competitive aspects are,” explained Prof. Branscomb. “Big companies appreciate the importance of their deep pockets, worldwide market access and large-scale manufacturing capability. But in a fast moving world, they are increasingly outsourcing their innovations to small- and medium-sized enterprises – the global economy means that SMEs can be anywhere in the world. If IBM is taking the view that there is an area of innovation that is different from the producer-oriented innovation,” he said, developing these links “may well be the area of innovation that big companies will actively take a lead on.”

The structure of the individual and corporate networks is a critical determinant of success. And it is at the intersections of people and groups where the friction creates sparks of innovation. The open, networked company is also welcoming of ideas that come from customers – so-called “user-driven innovation.” The importance of the modular approach is that it allows for rapid re-combinations. This is one of the biggest assets of clusters, and why a

technology neutral approach is vital. “Whatever is the next new thing, you can mobilize the teams,” says Dr. Walshok.

But one factor that fuels this fluidity is the acceptance of occasional failure. Although it shouldn’t be celebrated, it ought not be too harshly penalized, either. Companies are learning to find the right balance. For example, when “New Coke” was introduced and flopped in 1985, no executives were fired or demoted. The company knew that if it took those steps, it would send such a chill through the ranks that no one would dare take risks again, according to a 1986 memoir by Roger Enrico, the CEO of rival PepsiCo. Likewise, Raytheon has an annual award for “the most interesting failures.” One of the distinguishing traits of innovative entrepreneurship is that along with high rewards comes high risk – and high rates of failure are unavoidable.

Ultimately, this underscores the importance of diversity. Not only does variety help the innovation process by bringing in new ideas, but it also prevents people and organizations from being so insular that they fail to see problems – the idea of “drinking one’s own bathwater.” In politics this vulnerability is called “groupthink.” In regards to innovative entrepreneurship (to extend Prof. Burt’s unappetizing metaphor, from earlier in this section), it might be described as “groupdrink.”

IV. INNOVATION AND ITS ENEMIES: OBSTACLES FOR INNOVATIVE ENTREPRENEURSHIP

“The biggest problem of doing business in eastern Europe is that you can’t enforce a contract like you can in the West, and the justice system is completely corrupt,” explained one participant. He told the story of a technology-related company he ran in eastern Europe, that when a service contract was expiring and he prepared to select a different provider, he was told to renew the agreement or harm would come his way. He renewed the contract, as a cost of doing business.

The example is extreme and the problem could have as easily occurred elsewhere (and does, such as with Japan’s notorious industrial gangs, and organized crime in American and Europe). Still, perceptions matter, and the anecdote underscores an important issue. When we consider the obstacles to innovative entrepreneurship and how public policy can overcome them, we sometimes forget that what most companies want from government are less acronym-laden programs and more the basic functions of government, such as the rule of law.

On the other end of the scale is too much government attention, in the form of over-regulation. The Sarbanes-Oxley Act, for example, has increased the costs for publicly-traded companies in America to such a degree – estimated at as much as 1% of operating costs, which is huge in a climate of razor-thin margins – that many big firms are taking themselves private. Start-ups resist the IPO route and seek to be acquired instead. As a result, the US is losing its place as the world’s preeminent location for equities. In 2001 America accounted for 36% of IPOs worldwide by value; in 2005 the figure tumbled one-third to 24%. More damning, of the 25 biggest IPOs in 2005, only one took place in the US, with most going to London and Hong Kong.

If because of Sarbanes-Oxley there is a shift in the geographic origin of equity assets to other jurisdictions, or from the public market to private firms and private transactions, this can have serious consequences for individuals and economies globally. It would remove the chance for middle-class people to participate in the wealth creation of large companies (only wealthy individuals are allowed to invest in private equity funds), and relegate them to a class of investments that often entail less attractive returns. Moreover, it would move a large portion of the corporate economy outside of public scrutiny (which the

public market provides, though corporate governance). A large swathe of the economy would slip under the radar of regulators and the scrutiny of public shareholders. And ultimately, it would throw into question the funding and organizational model for the next generation of innovative entrepreneurship, which taps into the resources of large public companies (as well as offers the reward of a possible IPO to small start-ups).

Government can create problems when it acts as much as when it doesn't: finding the right balance is crucial. For example, among the biggest obstacles to innovative entrepreneurship identified by Rueschlikon participants was intellectual property. This might seem strange, since an information economy fundamentally relies on the protection of ideas. Ensuring copyrights, patents and the integrity of trade secrets should be vital to spark companies to invest in subsequent R&D. By granting the property rights and adjudicating conflicts, government policy is at the center of innovation and business.

Although intellectual property rights are critical, the issue was raised in many different contexts by participants of many different backgrounds that their enforcement is sometimes so stringent that it inhibits innovation rather than acts as an incentive for it. For instance, patents are intended to be a trade-off between the inventor and society: government grants a monopoly on the technology for a limited term (usually around 20 years) in return for the public disclosure of the innovation, so that society can learn how it works, and implement it freely once the term expires. In other words, the presumption is that the greatest value of the invention is not captured by the innovator, but by society at large.

But if patents are awarded spuriously, or enforced too strictly, this tradeoff breaks down. For example, a technology that is too heavily encumbered with patents will deter subsequent investment. A study by the American Association for the Advancement of Science in 2005 noted that this is happening in certain areas of university biotechnology research. Additionally, awarding a plethora of patents on extremely minor and narrow innovations may lead to a "patent thicket," in which the cost of acquiring all the rights to implement a single technology is so costly and cumbersome that it may prevent the technique from being commercialized. The situation is also referred to as an "anti-commons," and the evidence is divided whether it truly happens in practice. If the patents themselves are overbroad, it becomes a tax on the sector to stay in business.

Should the patents be of dubious merit to begin with, it increases the cost to companies as they turn to the courts to litigate the matter.

Furthermore, some technologies are best promulgated when there are no property rights associated with them. This is the case with human genetic information, which was uncovered by the Human Genome Project in 2001, an international, public-private sector activity. The Internet is also an example of how the lack of property rights can fuel innovation. It couldn't have emerged from the confines of any single company, because it entailed giving up control (for a firm's sole benefit) in order to create an entire industry (for the benefit of many firms). Partly for this reason, it took government funding to get started. And the role of academia – with its long time-horizons and non-commercial ethos – was critical, explained David Clark of MIT, who helped pioneer the Internet's earliest protocols.

Enlightened government action, then, would ensure that intellectual property rights draw a balance between the interests of inventors and those of society, explained Connie Chang of the US Department of Commerce. Yet many participants at Rueschlikon noted the extent to which this is hard to achieve, and is wrapped up in enormous political lobbying by the very firms that have the most at stake (and by public interest groups on the other side, who do not always have the best political acumen in making the case for reform).

As such, government tends to believe it is best to leave it to the market and courts to sort out. But in the case of an inefficient property-rights regime, this is the least appropriate approach because it almost guarantees that the problems will become enshrined in legal precedents and financial rewards. And this, in turn, makes the problem that much harder to fix.

Other governmental obstacles to innovative entrepreneurship include restrictive immigration policies. It is a politically controversial issue in most developed countries today; right-wing parties in many European countries are gaining ground arguing for less foreigners, and America is building walls (literally, in the case of the Mexican border; figuratively, in the case of its regulations) vis-à-vis the rest of the world. After 9/11, it has become so difficult for foreigners to visit the US – to say nothing of studying or living there – that the best and the brightest from abroad are deciding that it is not worth the hassle.

In the case of education, universities from Britain, Canada and elsewhere have seen an increase in applications from foreigners since 9/11, attributed in part to students choosing places other than the US because of the difficulty. For innovative entrepreneurship, this trend is particularly important because studies show that most people tend to stay within 50 miles of where they earned their last degree. At the same time, where in the past foreigners studying in the US sought to remain there after completing their education (thereby contributing to the economy), today many are choosing to return home to work or start a business. Part of the reason is due to things like the Internet, that make it viable to remain a part of one's social network despite the distance, which would have been previously impossible.

There are common motives for restricting immigration in the interest of preserving a technology lead in the economy. First is an industrial-age presumption that a job given to a foreigner within the country is one stolen from a national. Obviously this reasoning is preposterous: the Taiwanese physicist doesn't take the Detroit autoworker's job – rather, he pays high taxes, buys cars, contracts home improvements, and someday may start a company that employs scores of staff. The reasoning is especially ridiculous at a time when employment is mobile while labor is stationary – the jobs can simply be outsourced to people offshore rather than in the country. Yet so long as domestic workers vote and temporary foreign ones do not, the political process will be more sensitive to one set of stakeholders than another.

The second argument, equally fallacious, is that educating a physicist from China or an engineer from Egypt creates one more competitor when they return home. The reality is that many receive work-visas and stay in the industrialized country for extended periods. When they do return home, they create the capability in their nations to appreciate and profitably consume the West's technology exports. And that is quite apart from the value of having skilled partners in the West's own supply chains.

Yet anachronistic thinking persists as the substrata of the political dialogue. In only a few years, the idea of limiting the amount of smart people entering a country by visa restrictions will seem as bizarre and shortsighted as the Victorian era's bowdlerization of Shakespeare and the Bible to remove the naughty parts. On the contrary, we can imagine a day when countries try to lure in talented foreign people with tax breaks and other incentives, akin to the way governments try to woo foreign businesses today. It will be especially

likely, considering that the population in the West is growing older and requires migration for new jobs. This makes it more imperative to import knowledge workers.

Access to skilled people is the most important factor that makes a region attractive to firms, according to research by Randall Kempner, presented by Dr. Walshok of UCSD. Meanwhile, proximity to R&D centers was lower on the list of factors, cited by a quarter of survey respondents. Ironically it was tied in the rankings with “pure luck” (suggesting that development agencies ought to proceed with a bit of humility...). Interestingly, the degree to which the political environment is business-friendly was low on the list – cited by less than 15% of respondents. This probably suggests that so long as a suitable base-line of good governance exists, other factors take precedence. This explains why Bill Gates in 1975 had no qualms placing Microsoft’s headquarters in Redmond, Washington, just outside his hometown, rather than follow his peers to sunnier Silicon Valley.

This also helps make sense of myths about barriers to innovative entrepreneurship that really aren’t much of an obstacle. For instance, the persistent idea that what holds back innovative entrepreneurship in Europe is that it costs too much to create a company is “idiotic,” explains Prof. Landier of NYU. Policies to allow entrepreneurs to start a company in one day for one Franc are useless, he said, because it isn’t a real barrier for real entrepreneurs.

Institutional problems exist in the way that all governments try to promote innovative entrepreneurship. Consider science and engineering policy. Although America has had an enviable record in promoting technologies, from the computer to the Internet, it faces criticism. For instance, DARPA, celebrated for its successful model of R&D (as noted in the second section of this report) has been hit by complaints since 9/11 for shifting its emphasis from long-term research across wide domains to short-term efforts focused only on security matters – the types of things that industry is already doing, and probably can do better.

The general academic model for innovation is also fraying. There are cut-backs in funding, a lack of leadership and a lack of diversity in funding institutions. This, combined with the intrinsically conservative nature of peer review and low grant-award rates, creates a situation whereby academic research has become very risk averse. Professors just starting out prefer to concentrate on

attaining tenure than risk their careers by developing a world-changing technology, since the probability of failure is high and the consequences are personally catastrophic.

It leads to an environment of “Old Turks and Young Conservatives,” explained Dr. Clark of MIT. The very process of government grant-making is open to vast improvement. “If VCs were structured like federal research funding, you could only show one VC your proposal once a year, there would be no negotiation and it would take six months to evaluate it. And if it wasn’t accepted, you could never show it to them again,” Dr. Clark quipped.

The interplay between politics and technology has always been shaky. For example, as chairman of National Science Board from 1980 to 1984, Congress always used to ask Prof. Branscomb the question: “What percent of projects do not pan out?” The NSB knew its best posture. “We always refused to answer the question – we knew if we answered: ‘An amazing 87% were successful!’ we’d get 13% less money the following year,” he said.

“There is the belief that innovation falls like rain from the sky, but it needs resources. And it’s tough to tell politicians that you should put resources there,” said Prof. Felten of Princeton. “So DARPA is off the rails. But DARPA was successful before, when IT had less political power. And it has been successful for decades, so it’s not just luck. So the question is why?” he asked.

One possible answer is that DARPA was an institution perfectly in tune with its times – a technology-related organization housed within the Department of Defense precisely at a time when military matters were a national priority for nothing less than human survival. The solution was to outsmart the Russian Communists. Today, the argument could follow a similar logic, dusted off for modern times. Investing in education and innovation is a matter of national interest regarding the prevention of terrorism, as well as economic security. So one might imagine that the funding agencies ought to be housed within the Department of Homeland Security and the Department of Commerce, to fend off terrorist with one, and the Chinese Communists with the other.

The idea behind government funding of technology is that there are market failures if solely left to the private sector (i.e., industry and increasingly, philanthropic organizations like the Gates Foundation) that the public sector’s activities can remedy. For example, industry tends to have time-horizons only a few years out, and the emphasis is on commercial products rather than basic

science. Moreover, venture capitalists and corporate R&D is focused on developing technologies that are profit-maximizing at the firm level, but not at the industry-wide level. Big companies want to optimize existing products, not create technical disruptions that make those products obsolete. Start-ups fill niches. And critical mass matters: the small slithers of money invested by VCs are useless for technologies that rely on a certain scale to develop, like a particle accelerator. There are things that one can do with 100 shillings that can't be done by ten people with ten shillings apiece.

At the same time however, there is a fundamental inconsistency in turning to government for assistance in fostering innovative entrepreneurship. As Nathan Rosenberg and L.E. Birdzell put it in the book "How the West Grew Rich" (Basic Books, 1985), which was quoted during a session at the Rueschlikon conference: "In all well-ordered societies, political authority is dedicated to stability, security and the status quo. It is thus singularly ill-qualified to direct or channel activity intended to produce instability, insecurity and change. ... Innovation and change imply also insecurity and risk, for few changes fail to affect some people adversely." (pp 265-266)

Innovative entrepreneurship depends on disruptions and winners and losers. Technical disruptions often generate unemployment in the short term (such as automating factories, or inexpensive fiber optics in telecommunications). Could politicians really be seen as encouraging the layoff of their electorate? "Government is ill-suited to taking the sort of decisions that innovators need to take. But governments can foster the conditions in which constructive instability and change can take place," noted David White, the Director for Innovation Policy at the European Commission. Yet in asking of public policy to spur technology-related industries, are we demanding government do something it is simply not well-equipped to do?

V. ATLAS HUGGED: PRACTICAL ACTIVITIES AND POLICY REFORMS

“Should nations have a natural half-life? Should young countries be more innovative than old countries, and can old countries learn to be innovative?” asked Chris Marsden of RAND Europe. “And why would any innovation policy succeed, given what we know about political processes and nation-states?”

For years, a notable obstacle to innovative entrepreneurship was the reluctance of governments to assist it; now the problem may be that they want to do too much, or do the wrong things. Public funds often support projects based on political considerations rather than economic or technology imperatives. For instance, many European countries threw large amounts of money at national computer companies such as France’s Bull and Italy’s Olivetti (following their legacy of national telecom operators), without realizing that the computer industry was changing in a way that made this ludicrous.

But the same trend is apparent in our own day, as sound policy takes second place to populism. “Governments see cluster strategies as a tool to solve the problem of offshoring,” noted Chad Evans of the Council on Competitiveness in Washington, DC. The result is that government efforts may not prove successful, because they are misdirected.

To be sure, the need for government is acute. On one level there are failures in the private sector for promoting innovative entrepreneurship that the public sector can correct. At the same time, there are obstacles to innovative entrepreneurship in public policy that government can fix. Furthermore, government can go beyond removing barriers and actually take steps to promote it. The areas where innovative entrepreneurship intersect with government policy are large, from education, research and taxation, to laws covering immigration, accounting and securities regulations.

Both the public and private sectors have different roles to play. Industry is good at solving problems that respond to incentives at the level of individual firms. The downside is that this places pressure on the backers of innovative ideas to show results fast, or get out of the way for others. Universities have the fortune to operate with longer time horizons, noted Michael Kleeman of the University of California San Diego and a former telecoms entrepreneur.

“What we need is ‘patient capital’ in contrast with the short-term perspective of the political system that goes from election to election,” he said.

There are four main areas in which policies and reforms are needed, divided into education, investment, openness and political action.

1. Education, concentration of resources and research

A skilled workforce is obviously essential for innovative entrepreneurship. Indeed, this is so obvious that it is a mystery that it should remain a perennial complaint that not enough is done. The evidence helps make the case for an activist policy. According to a 2002 study by the Milken Institute, the factor that most explains the difference in income per capita among states is the percentage of college graduates. A one year increase in an area’s education level raises wages by 3% to 5%. A look at how education is organized and the rationale behind policies suggest areas for possible reforms.

At the primary and secondary level, education needs to be evenly distributed so that everyone in society receives basic skills. However, at advanced levels, policies with the well-meaning intention to evenly share educational resources actually have the negative effect of holding back educational opportunities. This is because at the level of university and doctoral research, scale matters. Just as clusters are important because human and financial resources are concentrated (so tapping into it entails lower transaction costs and is more efficient), the same holds true for education. Yet funding policies aimed at sharing the wealth across a region or entire country, albeit laudable, risks undermining the very education and research it hopes to foster.

This can be seen by comparing universities in the US and Europe. American universities have far greater resources, from faculty to students to equipment. Money has a lot to do with this, which attracts the best minds. America spends 2.6% of GDP on education compared with 1.2% in Europe. Shouldn’t more money by European governments fix the problem? Ironically, no. It depends on how it is spent. And the ethos of European governments to spread largesse even-handedly may end up handicapping it.

For example, where Europe’s 4,000 universities receive roughly the same amount of research funding, in America the funding is highly concentrated – around 95% of federal funds go to the top 200 schools, out of around 3,300. That stark inequality lets American schools do big things that their European

peers cannot match (similar to the comparison of large firms and start-ups in section four, where 100 shillings to one gent may beget more than ten coins to ten fellows).

At earlier stages of education, however, broadly diffusing improvements is vital. It constitutes the building blocks of a society's financial, social and political wellbeing. But the experiences of the past may lead to a false sense of comfort about the future. In the United States, for example, complaints have rumbled on for years about the deteriorating state of kindergarten to high-school education. Students from Europe can identify Niger on a map; Japanese schoolchildren excel in arithmetic and Indians win spelling-bees – leaving American kids in the dust.

Yet America has been able to avert the consequences of this. It has long been able to import fine minds from abroad. Also, its pedagogical emphasis on creativity rather than learning from rote may have led to a more flexible workforce. It is a skill that is well-suited for services, technology and media, which have emerged as the most important sectors of the economy in the past quarter-century.

In the past, the problems of poor primary education was compensated for because innovative entrepreneurship relied on the outliers anyway, the people who usually end up excelling despite an imperfect environment. But it is no longer sufficient to rely on this, because – so long as the platform exists and the reward mechanism is right – innovation can emerge from anyone rather than an anointed few. Those societies that lack the political will to seriously improve education will find they are out-innovated not by a few geniuses as in the past, but by the everyman of the future.

There is another dimension to the importance of education for innovative entrepreneurship: the role of academic research in devising breakthrough technologies. Industry often cannot do this, since it is preoccupied (rightly) with products that have existing markets rather than investing in things that may not pay off. For example, commercial R&D usually just “fills in niches, and tends to freeze the structure” of a technology or an industry, noted Dr. Clark of MIT. “If we find we have shifted the communications industry materially in ten years, it will not be because of small-business venturing, even in the aggregate, but a shift in the industry landscape that allows the pie to get bigger.

A big, hairy audacious shift – built out of big ideas, and big frameworks for modularity and interconnections.”

Unsurprisingly, one of the biggest trends in corporate R&D in recent years has been firms partnering with universities. It is sometimes criticized as changing the priorities of academe from blue-sky, upstream, basic science to more commercially-focused work. Yet a more optimistic justification is that companies finally recognize that gaining market-share from what already exists is not enough, and have to increase the size of the market itself. They prosper when everyone benefits. One important way this can happen is via academia. Yet universities need champions from industry: the academic community cannot advocate for itself, since it will be dismissed as self-serving.

2. Different types of capital and investors

Money is fungible. It is the most amorphous of substances, able to take the form of whatever it is put towards, be it a pharmaceutical factory in the developing world or an amusement park in the West. It can be transferred at the speed of light, literally, over fiber-optic cables. It is useful. Yet this leads to the incorrect perception that money is the same, when it is not. Some money might be “dumb money,” by foolish investors that signal alarms rather than good news; other times it may be too much money, which has a way of drowning its recipients who previously feared the inverse, death from thirst.

Understanding the different types of capital and categories of investors is therefore useful to appreciating how the public and private sectors can play a role in the pipeline of innovation. Different stages of entrepreneurship require different things from different investors. And different technologies themselves have different needs. Moreover, it is crucial to appreciate the motivation of investors. While entrepreneurs may be driven by lofty goals, financiers have a more practical focus. „I am doing this for the money,“ stated Mr. Cordt, the head of the private equity fund that bears his name. Innovation is a good thing for society, he explained, but that is not his objective; the financial return is.

In the food-chain of technology, initial ideas usually meet with “angel” investors. Early-stage companies sometimes appeal to government for funds to keep them afloat until they can prove their ideas to venture capitalists. After numerous VC rounds (with VC firms that have expertise at specific stages: early, medium or late), the companies may get their final push from corporate

venture arms, investment banks, before “exiting” into either the stock market or being acquired.

At the angel stage, individuals that have previously been successful entrepreneurs allocate some of their money – along with their advice and connections – to young entrepreneurs. Jonathan Kestenbaum of NESTA notes that personal wealth can be “smarter” than institutional money. Individual investors can screen ideas and people on a closer, less numbers-oriented level. Angel investors have more time and more at stake personally, and so can put more of themselves into the start-ups. They are investing small amounts that a large VC fund simply does not have the time to invest (for example, \$250,000, which is substantial for an individual but impossible for a venture fund to devote its resources to spend). Additionally, angels have the ability to shape business plans when they are fresher and more easily changeable.

Ironically, although the angel investor has relatively more at stake with its investments than big funds, those vastly larger entities tend to actually have less appetite for risk, since their investments need to pass through more bureaucratic hoops before the money can be spent. At the same time, VCs are able to tolerate failure better, since they spread their risk over a far larger pool of investments. The lesson for public policy thus might be to provide incentives to encourage angel investments – not by taking away the downside (which would minimize the consequences of failure, and thus dilute the very motivations that make angels so effective) but offer angels greater rewards by providing tax-breaks on the upside (so that more capital is freed up for this class of investment).

At the next stage, prior to institutional investments, companies need a helping hand to become slightly more established in order to attract venture capital. Here, government can play a role. In America, the US Small Business Innovation Research (SBIR) grant program was created in 1982, and requires certain federal agencies, including health, agriculture, energy and defense, to reserve a portion of their annual budgets for research contracts to small businesses (defined as American-owned and fewer than 500 employees).

At a slightly later stage for a young company, a second US initiative is available for support. The Advanced Technology Program (ATP) was begun in 1990 as a way for the federal government to provide matching funds to young companies with technologies still very much at the early development stage.

The vast majority of R&D comes from large firms, which face fewer external barriers to bring innovations to market. But smaller companies need assistance, especially since they may be developing the very technologies that make business life difficult for established firms. The outcome is positive: companies that receive ATP assistance are not more likely to receive VC funding, but they raise a larger amount when they do.

The SBIR initiative is important because it creates a possible anchor customer for a new technology. Many Rueschlikon participants from Europe noted that one major problem in the EU is the reluctance of large companies to buy from small firms. A policy to promote this, perhaps modeled in part on the SBIR, would help European start-ups, they said, and even help big companies that need to stay competitive by incorporating new technologies.

To be sure, the US programs are not free of criticism. ATP was said to lack substantial industry support and the initiative was ended in 2006 by the administration and its majority in Congress, although it was generally considered a success. Meanwhile, SBIR is teased for an alleged inverse relationship between its political support and its program quality (the former strong; the latter weak). Still, the idea of the federal government providing a temporary safe-haven for innovative companies to mature while they swim in the Darwinian sea – where they risk being devoured by bigger fish or suffering malnutrition – is at least established as policy.

Following this stage come venture capital funds. They aggregate risk over both projects and time, by investing in multiple businesses over many years. They willingly dilute their rewards by co-investing with other VCs to tap into their colleagues' experience and knowledge, as well as to re-affirm their valuations of the portfolio companies. At this stage, investors examine management team, market need, market size, customer base, the uniqueness of the product and the business model. Where angel investors are more intuitive than reliant on formal metrics, VCs perform due diligence that may place too much emphasis on numbers and too little on instinct. The best VCs, of course, do both.

It used to be that a typical VC fund comprised a couple hundred million dollars invested over seven years or so. One third of the capital would be used for initial investments in firms, and the remaining two-thirds would be used for follow-on rounds so the fund could maintain its stake as the company's valuation

grew and additional investments – with additional investors – were needed. But today this conception is meaningless: since 2002, after the stupendous dotcom returns (for some) and the paltry returns available from the stock market, the area of private equity and venture investing has ballooned into a massive investment class to the degree that it is unrecognizable compared to just a few years ago. The fear today is that funds are too large and cannot possibly invest all their capital, or invest it wisely. If the timeframes and expectations of returns have become unreasonable, the market should correct this (usually at the cost of tears).

According to data from a report last year for the US National Institute for Standards and Technology by Prof. Auerswald and Prof. Branscomb, corporate venturing accounts for 34% of funds for start-ups, federal money comprise 29%, angel investors 25% and VCs 4%. Even if the data, from 2003, is slightly dated, it suggests that there is a rich diversity of funds going into high-growth firms.

On the surface, it appears that the venture market is humming smoothly, but at all stages policies can play a role. To take just one example, Sarbanes-Oxley rules are seen as pushing firms to avoid the public markets; thus perhaps a new class of public company or new exchange for high-risk companies ought be established, that strikes a better balance between reasonable corporate governance and accounting on one side, and freeing up resources to invest in innovation on the other.

3. Openness: building ties, diversity and flexibility

Openness is in vogue, from open networks to open-source software. It is fashionable in public policy, too. Promoting open global markets, including the free flow of people and capital, are among the most important things that governments can do to foster innovative entrepreneurship, according to the 2005 Global Entrepreneurship Monitor by Babson College and London Business School, which annually measures entrepreneurial activity in over 35 countries.

This would suggest that governments adopt policies that attract businesses, foreign investment and skilled foreign workers to their shores, and resist policies that reject these things. It would also suggest that things which encumber open access to innovation be removed, such as deficiencies in the intellectual property system. These matters have been long-standing concerns, and sadly

remain unaddressed. Yet even more revealing is a novel form of openness – for social networks – that effect the success of innovative entrepreneurship.

There is no single way for this openness to be expressed. For example, the old Asian Trading House model of solid, long-term relationships is efficient but less resilient or innovative. Meanwhile, the modern Hollywood model of movie production – in which teams gel and disband regularly – is efficient and flexible, but prone to problems from less loyalty, a lack of trust or the possibility that different interests are at stake. “In Asia and Europe there are ten-year ties, not one- or two-year ties like in America,” noted Prof. Burt of the University of Chicago.

Silicon Valley and Japanese auto makers find a good balance between both extremes, because they are based on reputations (which are relatively constant) that are applied to work teams (which are continually changing). The days when Jack Welch of GE would chirp that a company’s loyalty to employees lasts only two weeks (that is, the traditional period of notice and severance pay in the US) seems as archaic today as the steam engine. Now, companies are competing for the best talent and pouring considerable management resources into making sure workers are happy and stay.

How firms are organized is critical, explains Mr. Evans of BCG. “It’s not one kind of ties, but different ties for specific purposes. It’s not just trust-networks, but adaptability; not just the ability to wire but re-wire,” he said. “It is about reputation – you can re-wire networks, so each party can then transact with other parties, and can port their reputations with them.”

Accepting diversity is vital. In the book “The Rise of the Creative Class,” Richard Florida notes that the factor most correlated with innovation in American cities is the number of gays and lesbians that live there. This is not to conclude that sexual orientation influences innovation; only that a society that accepts homosexuals can probably tolerate entrepreneurs too, in the words of one participant. Policies to mix people and places usually bear fruit. It explains why universities encourage students to study abroad and send scholars on sabbaticals. The corporate retreat may be mocked as a boondoggle, but executives usually admit productive ideas emerged that probably couldn’t have back at headquarters. Indeed, a five minute walk from Swiss Re’s Center for Global Dialogue in Rueschlikon, at IBM’s famous Zurich Research Lab, scientists and

staff all take a coffee break around ten o'clock in the morning. It provides a way for people to meet, mix and discuss ideas – which the lab's managers cite as a factor for their teams' productivity.

Forcing these combinations of people and backgrounds is essential. “The striking difference between business schools in Europe and the US is that in Europe they are not on campus; they do not have ties to the engineering community. US business schools market business skills to other academic communities,” noted Prof. Landier of NYU. These sorts of ties are especially important going forward, considering that American graduate students often regard their programs as places for assembling management teams and technical development groups, not just venues to attend classes.

The degree to which effective teams rely on long-standing reputations is substantial. At the 2005 Rueschlikon conference on critical information infrastructure protection, many attendees noted the need for pre-established links among officials and emergency responders as an essential way to ensure smooth operations during crises. At this year's event Dr. Walshok of UCSD unwittingly echoed precisely the same factor in respect to entrepreneurship. “It's important to build teams with lots of trust and complementarities – you have to have the relationship in advance,” she said. “Whatever the technology, you are ready to go.”

But the structure of these relationships must be extremely open for these teams to form. The policy implication is as profound as it is uplifting: countries that are typified by snobbishness are at a disadvantage, whereas places that are characterized by giving people a chance are better-placed to succeed.

4. The politics of public policy

Michael Nelson of IBM, recalling his days in the Clinton White House and the Federal Communications Commission, suggested reducing innovative entrepreneurship issues to “bumper stickers,” as a way to help the ideas pass into policy. Though this is not meant to imply that politicians lack the ability to comprehend more than a simple sentence, the practice is useful to distil an issue to its core, and express it in sellable terms.

Participants composed a number of pithy one-line phrases with which to identify key issues and raise their profile on the policy radar. Dr. Nelson started the group off with one in favor of clarifying software patent policy: “Free the

building-blocks of innovation.” David Clark of MIT suggested: “Learn to run faster, not trip your opponent.” Another participant offered: “Clusters for innovation, not real-estate development.” Others included “Mentors matter” and “IPR should benefit society, not lawyers.” As Ms. Leimueller of winnovation concluded from the exercise: “The high-tech lobby needs to use similar tactics as the sugar lobby.”

One approach to getting policy-makers on board is the use of metrics for rankings and project outcomes. The OECD, for example, compiles tables that compare the R&D of all its member economies for different industries as a percentage of GDP and per capita – it gives some nations a chance to crow, and hands policymakers from floundering countries the firepower to press for reforms.

Mr. White of the European Commission noted that since 2000 the EU has released an annual “innovation scoreboard” that serves the same function. Last year Switzerland, Finland, Sweden, Denmark and Germany comprised the “leading countries”; France, Britain and Italy posted average performance. Although countries in eastern Europe were generally below average, some of them were gaining ground. Countries deemed “losing ground” include Estonia, Spain and Turkey. Compared to Japan and the US, Europe as a whole is significantly less innovative, according to the EU, based on a formula that tracks 26 indicators (including patents, graduate education and IT expenditures). Yet the leading European performers are just as good as, or better than, both the US and Japan.

Information about the information economy, so to speak, is critical as nations re-tool for innovative enterprises. As a result, benchmarking entrepreneurship and innovation was considered by Rueschlikon participants as an important policy reform that countries should undertake. For example, America’s ATP program evaluates the impact of projects and tracks their results through the life of the project, and every other year for six years. “Only with better data and information can we make more informed policy and program decisions,” explained Ms. Chang of the US Commerce Department’s Technology Administration.

Sometimes, what is considered a hindrance to entrepreneurship can be turned into advantages, just as lemons make lemonade. For example, people grouse that government funding is unreliable. Good. Prof. Auerswald of

GMU sardonically posits a number of ways to promote innovation regardless of the obstacles. “Spend large sums of government money on defense related R&D. Stop spending. Wait,” he suggests. This was the experience of places like Silicon Valley, San Diego, Northern Virginia and Israel. The sudden disruptions forced firms to act cleverly and quickly – and it paid off, through their success.

Furthermore, if immigration is a big political issue – good. “Let foreign governments pay to train your workers,” Prof. Auerswald declared. That is, accept immigration from the brightest people abroad. But don’t stop there: “Permit theft of trade secrets and risky management of pension funds,” he says, with intentional mischievousness in the spirit of debate. In other words, California’s loose trade-secrets law invites a little cross-pollination that although disagreeable to the pilfered firm, leads to industry-wide gains. And the Employee Retirement Income Security Act (ERISA) pension-fund regulations in effect act as a national investment tool, by allowing capital to pour into start-ups, in search of good returns.

The role of national policies can correct market problems. For example, the pressure for corporate cost-cutting in Europe is far less than in the US because shareholder pressure is weaker. Possible remedies are to get big companies to focus on new markets and devise incentives so they accept small suppliers. There is also career risk. For example, 33% of Britons say fear of failure would stop them from starting a business, compared with 21% in the US, according to Enterprise Insight. Only 41% of British would prefer to be self-employed, compared with 61% of Americans. In such an environment, finding ways to reintegrate a failed entrepreneur would seem to be a policy priority.

Of course, embracing failure can sometimes be taken too far, particularly if it is enshrined in public policy. For example, the European Union provides a tax break for corporate R&D, which led one attendee to complain that “the EU celebrates mediocrity.” A defense of the policy (which exists also in the United States), is that what may be counted as a failure one year may actually nurture success another, just as dead leaves of the fall fertilize the Spring’s verdure. Besides, a variety of funding mechanisms is probably more socially optimal than a paucity of them.

Furthermore there are problems with turning to public policy to aid the innovation process: it depends on where policy plays a role. “Governments are

stuck in a 'heavy metal' society, while we live in the information age," notes Mr. Marsden of RAND Europe. "They support car-manufacturing, not software."

Moreover, national ambitions can be misdirected in other ways. "Government acts too close to the end result," explained Prof. Felten of Princeton. It should concentrate on setting the framework and establishing the environment, he said, but then let the market take over. Other participants questioned whether government agencies were able to screen ideas well. And concerns were raised about both governments' and industry's ability to keep their hands off when need be. "It is not in the nature of the organization to foster and protect but not control," said Mr. Murray of Swiss Re.

For instance, the French government is spearheading a plan to inject as much as 2 billion euros over five years for projects such as a European search engine called Quaero ("I seek" in Latin). This is barely 2% of Google's \$120 billion market capitalization; Microsoft and Yahoo add another \$300 billion combined. It raises the question whether there is something that France's technocrats can do that the private-sector cannot? Ultimately, public policy can only go so far. After that, it is a matter of how businesses manage their operations. "The problem that has been identified is one of organizational innovation rather than technical innovation," concluded Prof. Noam of Columbia University.

VI. STUMBLING TO WALK – A NEW INNOVATION MODEL FOR THE NETWORKED AGE

“Innovative entrepreneurship starts as random walk around design space,” explains Mr. Ondrejka of Linden Lab. By this, he means that in its initial phase, people get ideas like honeybees collect pollen, going from flower to flower seemingly at random. Yet it is not just the activity that matters, but the area.

“If the same behavior in two different contexts have different outcomes, then it is the environment and not the behavior that is important,” says Prof. Burt of the University of Chicago. “So unless heterogeneity exists, it is a worthless walk. There is no evolution if all you bump into is the same thing you see elsewhere,” he says. Herbert Cordt, the president of Cordt & Partner, an investor and financial consultant to technology firms, describes the situation as “managed chaos.” Prof. Branscomb calls it the “lucky stumble.”

How can society increase the chances of such lucky stumbles? By establishing the climate for these things to happen. To understand how this may be done, consider a quick thought-experiment: if the exchange of knowledge is useful, then things that encouraged the transfer of information would be good and activities that restricted it would be bad. Thus, a policy that required that anyone who wanted to speak to pay \$1,000 for a license would obviously be bad. While it would be wrong on grounds of social justice, it would also be harmful on the basis of economic productivity, since communications would shrivel up by all but a handful of wealthy people. Lowering the cost of communicating therefore would be a good policy, because it decreases the transaction costs for the spread of information. This, in turn, may even let new creativity be expressed.

This mental exercise on the cost of communicating ideas offers a message about the need for a balanced intellectual property rights system. It also highlights a feature of the Internet compared to the earlier telephone system: how a decentralized “network” approach is more efficient than a centralized “hub-and-spoke” design. The Internet is an environment where users at the end-points can find other users at the edges without the encumbrance of a central organization that presumes to know what you want, make decisions, or charge you an introduction fee. It allows ad hoc groups to emerge and new forms of collaboration to take place. Individuals can contribute their knowledge (via a blog; a sentence in a Wikipedia entry; open-source software

code; etc), that are inconsequential on their own but when aggregated can create tremendous value.

These sort of things were not possible with the earlier public-switched telephone network for a variety of reasons. One implication is that this sheds light on the importance of the current dispute over “network neutrality,” that is, whether telecom operators should be allowed to charge senders and receivers depending on the type of traffic over the network, or based on who they are. To many, this would break the “end-to-end” principle of the Internet that has made it an open platform for innovation. Mr. Bonvillian of MIT regards the debate as the counter-attack of the hierarchical “tree-and-branch” model of the firm trying to restore its primacy against the networked-economy approach (where the telecom service is a commodity).

The larger point, however, is that the design of a communications system determines the degree to which it serves as a platform for innovation. And from this, of course, an even broader point can be made: one’s environment can either foster or squelch innovation – be it a homogenous village compared to Silicon Valley; overbearing patent protections relative to a vibrant public domain; or a company that rewards risk-taking by tolerating failure versus one that penalize any mistakes.

The virtual world Second Life is one such platform. The majority of content is created by the users themselves. People use it as a place to socialize. Users can make and sell virtual goods and services. The company charges a small monthly amount, and in return makes the technical system open for users to do what they will. What happens there is productivity, though not in the way that we are accustomed to thinking of it. It is not the drudgery of work, but innovation as something fun.

The virtual world receives around 120,000 hours of use per day, of which approximately 25% of this time is spent creating things (which represents 15 user-years per day). Since it was launched in 2002, over 300,000 objects and real-estate lots have been sold for many millions of dollars. In a typical seven day period, around 5,000 residents will have written original scripts totaling three million lines of code. Were a company to try to do this itself, it would require a 5,500 person content-development team, which would cost more than \$550 million annually, notes Mr. Ondrejka of Linden Lab, which created

and operates Second Life. Instead, users “work” with the same enthusiasm as children in sandboxes. The result is innovation and economic value.

The experience of Second Life holds lessons for the physical world. To maximize the probability that ones’ efforts will be innovative, it is important to have as many individuals participating as possible, as much communication as possible and as many different strategies as possible to create the richest “design space.” In short: to make everyone an innovator. The success of YouTube for posting videos and MySpace for social networking is similarly indicative of the power of platforms to spark creativity and harness production. But it should not be much of a surprise. The Web itself is the best example, with its more than 600 billion web pages, 1.4 billion auctions, 50 million blogs, and new sites and companies cropping up daily from anywhere in the world.

At the heart of these systems is the idea of organization: establishing a platform that makes innovation possible. “Does this coordination role belong to an organization?,” asked Dr. Clark of MIT. “The thing in common between what Cory is doing and the Internet is that both are platforms that comprise a very coherent, constrained and minimalist architecture on one level, that brings this flowering of innovation. But he’s nurturing it as a private company in the for-profit sector, in an enlightened way,” Dr. Clark noted. “We don’t know the single, new, best place to structure an organization like that – if the corporation is the best place for it,” he added. (And in a pleasant parallel to the theme of the conference, at one point during a session, Dr. Clark left his chair and wandered around the room deep in thought – taking his random walk.)

Essentially, the platform for achieving mass innovation needs to be established by an enlightened entity (be it government, industry, non-profit, academia, or a combination of them and others). But the organization that happens atop the platform is best enabled by the participants themselves. The reason is because it is more efficient, in the same way as capitalism proved more efficient than communism because relying on bottom-up coordination let information emerge and be exchanged more easily than when decisions were made top-down. This, in turn, leads to adaptability, which helps ideas be turned into innovations, and innovations to respond to the market in a timely and effective way.

“What makes it possible is that reconfigurations happen on the fly, that gives home to creativity. This squares the circle of what is the role of the organization.

The role is to manage information flows not on a hierarchical level, but on a reconfigurable level across time. This is a model for the corporate sector, as well as the academic and public sector, and for innovators,” explained Prof. Mayer-Schönberger of Harvard’s Kennedy School of Government.

To make this approach work, it will require a new model of innovation that touches on the interaction of knowledge, collaboration and the organization of firms and governments, as well as the activities of clusters and academe. How this may happen is explained below.

The value of tacit knowledge

When people communicate, they are more often passing along emotion than information. For basic problem-solving, explicit knowledge is required. But for more complex issues and innovation, transferring tacit knowledge is critical, explained Prof. Burt of the University of Chicago. For example, Prof. Felten of Princeton University explained that he tells his students that all he is teaching is tacit knowledge, because the rest can be just as easily obtained from text books.

The most common way tacit knowledge is transmitted is through conversation, where the content of the dialogue is only a small part of what is exchanged: it includes facial expressions and body language that show empathy, reassurance and the like. This helps explain why many executives will still jump on a plane to meet someone instead of relying on a video-conference link, where sound and video is communicated but not the more important human touches. Another way tacit knowledge is communicated is through narrative and myth: the timeless lessons of literature and art. (So too, when the Rueschlikon organizers wanted to document the discussions, they turned to a professional storyteller – a journalist – to write the report.) Indeed, the title of this year’s report and introductory aphorism tries to implicitly draw this connection by borrowing the title from a book by Joseph Campbell, a scholar of mythology.

In business, rivals sometimes complain that IBM’s more than \$1 billion in annual revenue from intellectual property licensing happens to include consulting contracts – the implication being that to consider it “intellectual property” is misleading. But the firms fail to realize that the value of intellectual property is less the right to practice the patent, and much more in the know-how to

implement the technology in the most cost-effective way with the least error-rate: the tacit information that the patent itself does not disclose.

Fostering the transmission of tacit knowledge requires a new way of thinking about education and information flows. It is important because it is starkly at odds with our classic thinking about how innovation happens, as a Great Game of Big Minds, often turned to science and engineering. This sort of rational decision-making assumes one can break the problem down to its discreet parts, identify the resources needed and organize the project to meet the goal. It is viable in engineering but not for innovation. “This assumes you can see the pieces of the puzzle at the outset – which you can’t,” said Mr. Bonvillian of MIT.

The importance of collaboration

In the past, labor was organized in a hierarchical fashion because it was more efficient as a way to manage human capital. Today, the networked economy relies on a decentralized form of collaboration because it is easier for this to happen than before, and because it is extremely productive. We see this taking place through things such as open source software, or on a technical-infrastructure level with things like “mash-ups,” (that is, sites that combine their content with other sites to create a new service).

Behind these activities are the technologies that make it possible. And behind the technologies is architecture – that is, a high-level set of relatively basic instructions about how the features of a system should be expressed and maintained. In the case of Wikipedia, the platform is not simply the Internet but wiki software, which makes it easy for many people to jointly author the same document online. In the case of mash-ups – like the combination of America’s Federal Election Database with an online map service, to show the amount of money given to Republican and Democratic candidates down to the level of individual street addresses – it relies on open application programming interfaces, known as APIs.

Strikingly, these sorts of things flourish when intellectual property rights are lenient. This is because requiring prior approval for something like a mash-up would add to the transaction costs, create delays and thwart experimentation. Trying to tally up all the rights of an encyclopedia entry written by ten thousand people would be impossible. The social contract of the Web is openness: creating a site presumes publishing to the world, and thus search-engines

are able to index sites by making and storing copies of the contents. (Sites are able to “opt-out” via simple HTML code that alerts search-engine “robots” not to index them, but very few sites do this). Were the classic approach to copyright enforced, the web, and certainly its search engines, could not exist.

At the Rueschlikon conference in 2003, the importance of balance with regards to intellectual property was discussed. One outcome of the 2004 Rueschlikon conference on Openness, Trust and Sovereignty was the idea of “jaywalking” – the minor acts of unlawfulness that enable society to function. This year, a similar theme emerged: how the slight skirting of the rules covering intellectual property allows society to progress. Whether it is hacking into children’s toys like Lego “Mindstorms” to give it more functionality (until Lego not only permitted it but made it a product feature), to the development of peer-to-peer file-sharing (which is now being embraced by the Hollywood studios), it is in the nature of innovation to occasionally press against the limits of the law. Ultimately, for collaboration to take place in a way that promotes innovation, it must be made as permissible as possible.

The essence of organization

For innovative entrepreneurship to develop, companies need to rethink the way they operate. Large companies tend to shy away from low-probability, high-payoff things: stability is rewarded by investors and is seen as the goal of managers, just as governments see stability, not disruption, as their highest purpose. “The reason why most organizations fail is due to their prior success,” notes Mr. Kleeman of UCSD.

This conservative approach is viable for certain industries but not ones where innovation is essential. For these firms, it will be important to restructure their practices, if not support risk-taking and failure, then at least tolerate it. Also essential is that companies capture their learning experiences, diffuse them throughout the organization and put them into practice. “The solution lies in the corporate community adopting small incremental changes on a systematic basis,” says Mr. Evans of BCG.

New approaches will be needed not just at the firm level, but in the way we think of innovation throughout society. For instance, we know of a “multiplier effect” for money in the economy, but we have little understanding of the amplification effects of ideas in a cluster. Might it be the case that ideas

beget ideas, just as laughter is contagious? Perhaps the ideas do not even have to be “good” or “successful” ideas; just by dint of their existence, other ideas are bound to emerge, increasingly the likelihood that some may bear fruit. Provided, that is, there are ways for ideas to be exposed, challenged and acted upon.

When ideas are put into practice through innovative entrepreneurship, there is an added role that government can play. In the industrial age, government established census bureaus and statistical offices to measure the economy and the flow of people in it. Some Rueschlikon participants floated the idea of similar agencies to measure the innovation in society and across regions and countries, as well as the influence of different policies. The European Union’s annual innovation scorecard is a good early example of what this might entail.

At the Organization for Economic Cooperation and Development, economists have devised new ways to measure the information society, such as one that looks at the number of web links from one country-code domain to other country-code domains, as a rough way to identify the “closeness” of countries in a world where physical borders are giving way to virtual ones. It is clear that if governments want to manage innovation, it will be important to measure it, and that new methodologies will themselves need to be invented.

The ever-reconfigurable cluster

The world of modern telecommunications has been characterized as “the death of distance.” It originally referred to the end of calling tariffs based on the where the call went, due to competition as well as a new surplus, rather than scarcity, of capacity. Yet the phenomenon ushered in something else: it ended the primacy of place. The Internet is diluting the central importance of location, as people find that they can be a part of social networks remotely. Paradoxically, the role of geographic areas have grown at the same time. But what has changed is that physical location is no longer sacrosanct.

This is new. In the past, a budding technology entrepreneur would need to turn up in Silicon Valley, similar to the archetype of attractive and ambitious young women abandoning Midwestern towns for Hollywood, hoping a star might be born. But today, this is no longer the case. The opportunities for development and success is still greater in clusters, but things are not so terrible away from them. As a result, for example, Indian and Chinese engineers and entrepreneurs who only a decade ago would have given anything for a visa

to remain in the United States after obtaining their degrees are now voluntarily returning home to start companies, partly due to the better social, financial and legal infrastructure, but also because it no longer means diminishing the ties in their all-important network.

This may have profound repercussions for the emerging “global innovation supply-chain,” for both “satellite start-ups” outside of traditional clusters and those firms that are located in more cosmopolitan climes. Indeed the lines between the two are blurring, as the idea of the “globally-integrated enterprise” as described by IBM’s chief executive takes shape. There is a symbiotic relationship forming between large firms at the center and smaller ones at the edges of the network. And this diversity may end up creating the very heterogeneity that is so desirable because it brings in variation – possibly more so than being part of a cluster itself.

A number of participants noted that an institution already exists which operates like a cluster, by establishing links across domains and providing the space for random walks for new ideas: the university. However, several participants were also quick to acknowledge that this describes the university in its idealized form and the reality is far different: inviolable fences across disciplines; elitism; pettiness; incentives that favor conservatism rather than fresh thinking; cryptic jargon to exclude non-specialists and hoarding knowledge rather than sharing it. Universities like to display the achievements of the Prof. Roberts, but their departments are often filled with Prof. Jameses. Verily, academe will have to change if it wants to be relevant in the world of innovative entrepreneurship.

Yet the role of the university to serve as a “safe haven” for ideas to form and for experimentation is imperative. A quick glance at the history of the World Wide Web reveals its importance. The first browser was created by graduate students at the University of Illinois at Champaign-Urbana, for which the university received royalties when it transformed into the company Netscape. And the US National Science Foundation funded Larry Page’s and Sergey Brin’s work at Stanford, that became the PageRank algorithm upon which Google is based.

Interestingly, the importance of innovative entrepreneurship changes the nature of the long-standing debate in American schools about the “canon” or “core curriculum” – that is, being exposed to a variety of fundamental subjects and texts that every citizen ought know. Some criticize this approach

as superficial: reinforcing the jack of all trades by making masters of none. Others say it imposes a Western ideological bias against a more global view. However, in the context of supporting random walks and diversity, the idea of cramming students with the humanities can be justified not only because it may create a citizenry capable of understanding references to T. S. Eliot at the cocktail party, but because it provides the breadth upon which ideas from one area can be cross-applied to other domains.

* * *

Ultimately, these dimensions of promoting innovative entrepreneurship – tacit knowledge, collaboration and the organization of companies, governments, clusters and academia – point to the degree to which managing information flows has become the essential feature of modern society. At its heart is individual empowerment – the idea that control is moving from an authority at the center to individuals at the edge.

One can see in it parallels to the reformation, when the church’s authority was bypassed by newly-literate people reading the Bible on their own, and establishing a direct relationship with God outside of the priest. Or, one can regard it in the same way as the rise of democracy against the monarchy. There is even a more direct comparison with the evolution of computing and data-networking: from a world of mainframes to minicomputers to PCs on people’s desktops, and now mobile phones in their pockets. At each increment, the center failed to hold – power was disaggregated. And in that time, IT went from making traditional hierarchies more efficient, to actually undoing them altogether in favor of a networked approach.

These analogies help reinforce the idea that something new is afoot. The British historian Arnold Toynbee used to speak of a “creative minority” that during times when society is challenged, come forth to save it (if it is to be saved at all, he adored adding). However, we are starting to see evidence that Toynbee’s view was a function of the environment, not of human nature. As platforms for self-expression, creativity and productivity are made more accessible to people around the world, the idea of a “creative minority” may be antiquated if not wholly wrong.

More and more people can be creative today. It was only a minority in the past because the ability to influence the world – through things like power, wealth and education – were in the hands of so few. Today, this artificial bottleneck on

creativity seems to be breaking down. As a result, innovation can be unleashed for economic gain, just as the drive by the public and private sectors in favor of universal literacy led to enormous gains for society in a myriad ways.

This makes the role of social networks essential. “We’re moving into a networked world where these links are more important, and the information that flows across them may be more important than the ‘random walk,’” noted Prof. Branscomb. Still, how such relationships are supported remains a critical question – and one that will continually challenge society going forward. “Government policies will have to help and not hinder bringing this about,” explained Prof. Mayer-Schönberger. “This may require that government itself changes its organizational structure towards an innovative organization,” he quipped.

CONCLUSION: FROM HUNTING AND GATHERING TO INFORMATION FLOWS

The importance of innovative entrepreneurship is finally understood by most countries, but how to support it is not. Part of the reason for this is because the process is inherently mysterious. The most interesting and deterministic events occur out of sight of economists and business school professors, in the turbulence of the Darwinian Sea.

We can identify the outward factors that influence it, such as education and capital, but less so the intangible aspects, such as the creation and cultivation of ideas. Like the reflections on Plato's cave, we only see the outward manifestations of innovative entrepreneurship – the smiling Google boys; the mythology of Bill Hewlett and David Packard's garage in Palo Alto – rather than the actual thing itself.

We need to reassess how we regard innovative entrepreneurship, because these very outward appearances actually send false messages about what it is, how to promote it, and why. It suggests that only a handful of exceptional people can be innovators, when we are learning that it can be the purview of anyone, given the right environment and tools. We believe innovators know what to do at the outset and succeed provided they never waiver, when the very opposite is true: the “random walk” is essential, as is adaptability. In this, crises and disruptions are not problems but essential features in the journey, since they force the process of change faster and more decisively than could happen otherwise. And innovative entrepreneurship need not rely on inspiration or luck, but can be fostered.

This requires that we adopt a new mindset about innovative entrepreneurship. And it also requires new policies, new institutions and new forms of infrastructure – not ones to oversee the movement of people, capital or equipment as in an industrial age, but to foster information flows, as befits a knowledge economy. On one level it is about physical networks: high-speed Internet connections. To this, the debate taking place in many countries around the world over municipal telecoms service or city-wide WiFi is an example of how the issue splits our customary conception of the roles of the private and public sectors. The argument about “network neutrality” does likewise, since it pits the “networked” approach of independent, self-forming links against the classic hierarchical model of the industrial economy. These physical networks also

include places for people to meet: the environment where one can encounter variation, as well as incubate and alter ideas.

But on another, even more important level, the policies, institutions and infrastructure are to support intangible networks – the structure of relationships among people and firms. Here, the most important features are the ease of establishing ties, reputation systems and diversity. Governments may see it fit to provide ways to ensure that these elements flourish. Just as the state previously created institutions such as an independent judiciary to enforce contracts upon which business relies, so too nations in the modern era may see that it is their responsibility to facilitate networks among people. In the past, the creation and flow of physical goods were supported by policemen, fire brigades, roadways, navies and diplomats; tomorrow, countries may decide it is worthwhile to establish ways to assist the creation and flow of information through new institutions.

Already, the ability of people to form ad hoc networks and collaborate is the defining trait of the times; things like Wikipedia, Second Life and open-source software are not just the best examples – they are only the tip of the iceberg. This suggests that innovation today is not simply about intelligence but management. For companies, the question is how to develop an ethos to capture ideas and bring them to market fast. For nations, the point is not so much to create clusters – the 20th century answer, that puts primacy on place – but to increase the speed and ease of information flowing across society.

This, at least, describes the situation today and the new world we are entering. How might it change over time? Little was spoken at the conference about the way the rise of China, India and elsewhere may affect the importance of innovative entrepreneurship and the approaches to promote it. In many respects it did not need to be verbalized, as it constituted the subtext for discussions.

In 2006, the combined value of developing economies exceeded the value of industrialized countries for the first time in history in terms of purchasing-power parity, evocative of the dramatic shift in the forces that shape our world. Where in the past the competition for growth took place among neighboring Western countries, today it is a global one. This offers profound opportunities for cooperation. At the same time, the developed world knows that unless it can reform its economies to retain and increase innovative industries, it will face uncomfortable challenges from new rivals.

The biggest advantages of the developed world ironically may come from its past, not its present: its institutional environment. Furthermore, it may come less from its scientific prowess but its organizational abilities. As developing countries start to lead in churning out scientists and engineers, what they still lack is the environment where talent can come together in the most efficient way. Meanwhile, the West's strength is its experience in maintaining precisely this environment: the union of physical and social networks. The private sector excels at vetting ideas, matching it with money and knowing when to cull floundering projects. It does this on the bedrock provided by government: security, a stable banking system, a robust legal regime and the like.

These sorts of things will not be enough for a society to lead, but challenges cannot advance easily without them. Were the Rueschlikon Conference on Information Policy to convene on the topic of innovative entrepreneurship in a decade's time, what might the conference report say about how the developed and developing countries cooperated and competed? Would it praise the rapport or regret the rivalry? How did the national policies to promote innovative entrepreneurship contribute to this outcome? Tensions are inevitable, but perhaps not in the way we expect. Over time, the starkest differences in living standards may not be among countries but within them.

The importance of innovative entrepreneurship represents an evolution in economic development, from the biggest farm to the biggest factory to the biggest ideas. All stakeholders have a role to promote this development. But if there is any single lesson, it is that there is no one way to do this, and that many can. Our entrepreneurial hero has a thousand faces; his mistakes are his most valuable learning experiences; he stumbles upon his success.

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ABOUT THE AUTHOR

Kenneth Cukier is a technology correspondent for The Economist in London, and serves as the rapporteur for the Rueschlikon Conference on Information Policy. He previously was the technology editor at The Asian Wall Street Journal in Hong Kong, European editor of Red Herring in London and from 1992 to 1996 worked at The International Herald Tribune in Paris. He was a research fellow at Harvard University's Kennedy School of Government between 2002 and 2004. Additionally, Mr. Cukier is a term-member at the Council on Foreign Relations and serves on the board of advisors to the Daniel Pearl Foundation. His writings can be found at: www.cukier.com

THE 2006 RUESCHLIKON CONFERENCE
PARTICIPANTS

Steve Abernethy *President & CEO, SquareTrade*

Philip E. Auerswald *Assistant Professor and Director of the Center for Science and Technology Policy, School of Public Policy, George Mason University*

William B. Bonvillian *Director, MIT Washington Office*

Lewis M. Branscomb *Professor emeritus, Public Policy and Corporate Management, Kennedy School of Government, Harvard University*

Ronald S. Burt *Professor of Sociology and Strategy, University of Chicago Graduate School of Business*

Christopher Chan *CEO, The Media Shoppe Bhd*

Connie Chang *Research Director for the Office of the Under Secretary, U.S. Department of Commerce's Technology Administration*

David Clark *Senior Research Scientist, MIT Laboratory for Computer Science*

Herbert Cordt *President, Cordt & Partner*

Kenneth Cukier *Technology Correspondent, The Economist*

Chad Evans *Vice President, National Innovation Initiative, Council on Competitiveness*

Philip Evans *Senior Vice President, Boston Consulting Group*

Edward W. Felten *Professor of Computer Science, Princeton University*

Fritz Gutbrodt *Head of the Swiss Re Centre for Global Dialogue, Swiss Re*

Jonathan Kestenbaum *CEO, NESTA, The National Endowment for Science, Technology and the Arts (UK)*

Michael Kleeman *Director, Cyber Infrastructure Policy Research, University of California San Diego*

Augustin Landier *Assistant Professor of Finance, New York University,
Stern School of Business*

Gertraud Leimueller *Founder and Managing Director, winnovation gmbh*

Olof Lundberg

Chris Marsden *Senior Policy Analyst, Rand Europe*

Viktor Mayer-Schönberger *Associate Professor of Public Policy,
Kennedy School of Government, Harvard University*

Richard H. Murray *Chief Claims Strategist, Swiss Re*

Michael R. Nelson *Director, Internet Technology & Strategy, IBM Corporation*

Eli Noam *Professor of Finance and Economics / Director, Columbia Business School /
Columbia Institute for Tele-Information (CITI)*

Cory Ondrejka *Chief Technology Officer, Linden Lab*

Suzanne Scotchmer *Professor of Economics and Public Policy,
University of California, Berkeley*

Sachio Semmoto *Founder, Chairman and CEO, eAccess Ltd.*

Mary Lindenstone Walshok *Associate Vice Chancellor for Public Programs,
University of California San Diego*

David White *Director for Innovation Policy, European Commission*

Floris Wijchman *Senior Vice President - Product Development, Swiss Re*

Note: Affiliations are listed for identification purposes only.