GLOBAL INNOVATION OUTLOOK

2004

IBM

INNOVATION IN A NEW CENTURY

The greatest innovation in human history had little to do with tools or technology.

MORE THAN THE FIRST WHEEL — MORE THAN EVEN THE HARNESSING OF FIRE — LANGUAGE PROVIDED THE FOUNDATION ON WHICH ALL FUTURE PROGRESS OF HUMAN CIVILIZATION WOULD BE BUILT.

As simple a notion as that may be, it holds lessons about innovation that we at the beginning of the 21st century would do well to consider: innovation requires human interaction and broad-scale adoption, and is almost always more about what we do with an idea than the idea itself.

We at IBM have tried to consider this as we launch our first ever Global Innovation Outlook, a worldwide conversation to examine the changing nature of innovation and the areas in which it might generate the greatest benefit for business and society.

It's easy to understand why we may have mistaken invention for innovation after two centuries of amazing accomplishment.

The 19th century firmly established science as the primary arbiter of progress. A century that began with an understanding of our universe still hampered by incomplete observation and lingering myth ended with a remarkable grasp of thermodynamics, electricity, magnetism and the key lines of inquiry that would uncover the worlds of relativity and quantum mechanics. Little wonder, then, that one century of such great scientific progress led to another preoccupied with the technology great science produced.

But who could have known how quickly that technology would transform the world? A century that began with horses as the primary mode of human transport culminated with astronauts in space stations, a race to unravel the great puzzle of the human genome, and calculating machines so powerful that they could best people at intellectual challenges long thought to be the domain of human reasoning.

We begin the 21st century with a general expectation that the one-two punch of science and technology will, by itself, generate an unending flow of discoveries, tools and gadgets to bring us closer to a utopian future. This premise has also shaped a general understanding of innovation as equivalent to discovery, invention and the flow of new technotoys. In reality, invention has always been as distinct from innovation as rivers are from oceans: one clearly feeds into the other.

A great idea or brilliant new technology that never influences or effects change simply doesn't matter. For speech, shaping sounds to words was not enough: the innovative power of language grew out of its collaborative nature, the accepted standards it generated and depended upon, and its ability to bridge the worlds of thought and action.

This is why we must define 21st century innovation as beginning at the intersection of invention and insight: we innovate when a new thought, technology, business model or service actually changes society.

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**SONY CORPORATION
JAPAN**

**John Furth
Chief Strategist,
Global Hub**

"I think most people when they think innovation immediately think technology, when indeed innovation can be anything. It can be a marketing innovation, a financing model, it could be the way you run your life…"

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**RENSSELAER
POLYTECHNIC INSTITUTE
USA**

**James Tien, Ph.D.
Professor,
Decision Sciences and
Engineering Systems**

"Innovation in this century, as compared to the last century or previous centuries, has obviously changed. One of the most obvious things that has changed is that the time between innovations is shorter."

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But it's not just our understanding of innovation that needs adjusting— innovation itself is changing in at least three major ways.

one:

It is occurring more rapidly — barriers of geography and access have come down, enabling shorter cycles from invention to market saturation.

two:

It requires wider collaboration across disciplines and specialties — where until recently, people hunkering down in a garage could create a new technology that would sweep the world, many challenges are now too complex to be solved by individual pockets of brilliance, let alone brilliant individuals. Combinations of technologies, expertise, business models and policies will now drive innovation.
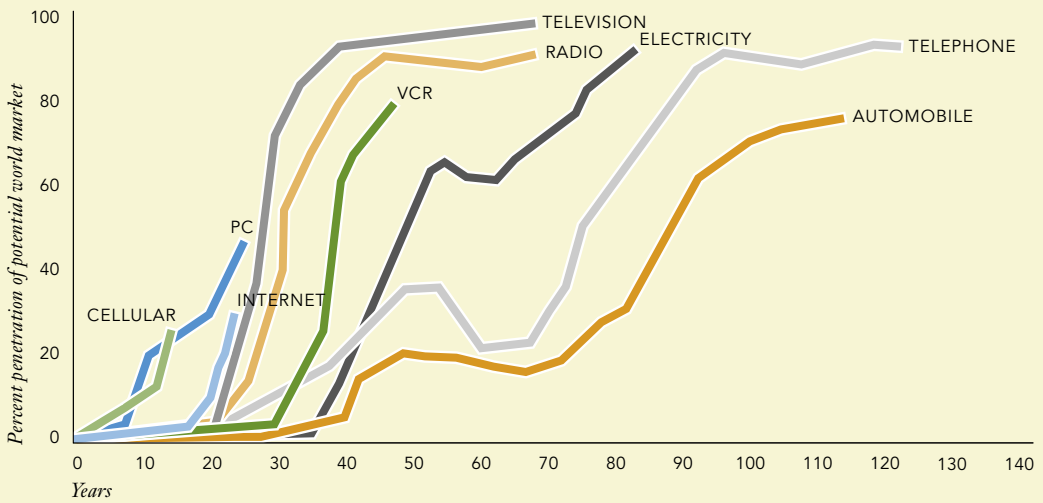
three:

The concept of intellectual property is being reexamined in the light of these collaborative demands. Increasingly, entities that treat intellectual assets more like capital — something to be invested, spread, even shared to reap a return, not tightly controlled and hoarded — will find the clearest paths to success.

This is fine in theory, but what does it imply for the practice of innovation? This question led directly to the creation of the Global Innovation Outlook (GIO).
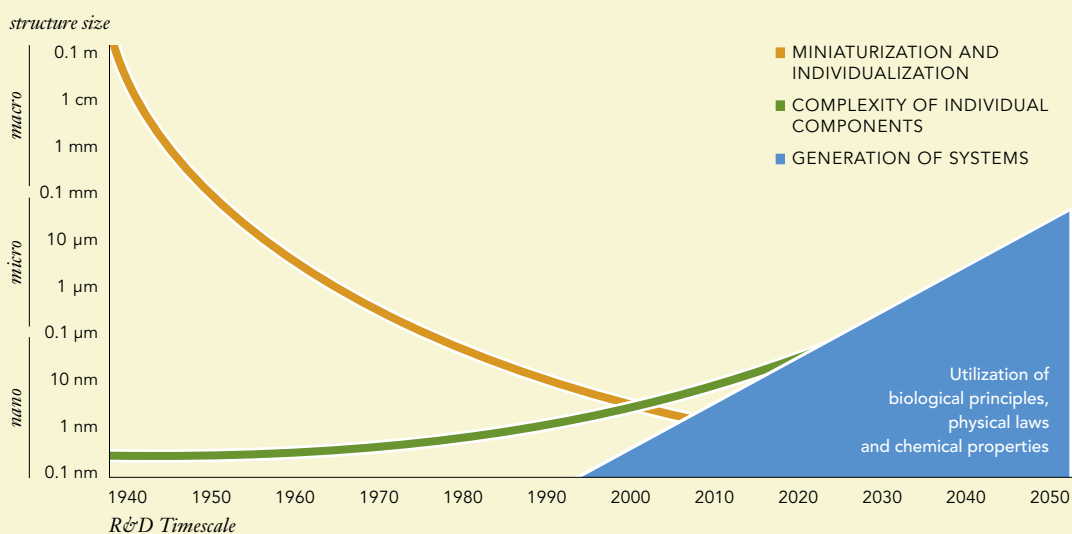
PACE OF INNOVATION ACCELERATING

Newer technologies taking hold at double or triple previous rates

INNOVATION WILL REQUIRE MULTIDISCIPLINARY APPROACHES

Example: Nanotechnology

structure size

■	MINIATURIZATION AND INDIVIDUALIZATION
■	COMPLEXITY OF INDIVIDUAL COMPONENTS
■	GENERATION OF SYSTEMS

macro
- 0.1 m
- 1 cm
- 1 mm

micro
- 0.1 mm
- 10 µm
- 1 µm

nano
- 0.1 µm
- 10 nm
- 1 nm
- 0.1 nm

1940 1950 1960 1970 1980 1990 2000 2010 2020 2030 2040 2050

R&D Timescale

Utilization of biological principles, physical laws and chemical properties

Wider collaboration is essential to innovation in many fields. In nanotechnology, for instance, insights from many scientific disciplines—including biology, which is ruled by molecular self-assembly—will soon help produce new families of productive systems that combine the best attributes of the "top-down" and "bottom-up" worlds.

Source: Dr. H. Fuchs, Wilhelm University of Munster in Westphalia. Courtesy: Lux Research.

Why the GIO?

After reviewing our internal forecasting processes, we realized IBM had excellent methods of examining technology and business trends, but no single integrated view of innovation.

For example, our forecasting process for technology—the Global Technology Outlook—examines in great depth the current trajectories of new technologies in the lab and marketplace, concentrating on trends that could be disruptive or the harbingers of change. It's proved remarkably prescient and has allowed us to make sound decisions and investments in future technology directions. It has also sought to anticipate some effects those technology trends might have on specific industries (such as banking, automotive, etc.). Separately from the Global Technology Outlook, we examine individual industries in great detail, including trajectories, market trends and economic analysis, to produce various industry outlooks and points of view.

But these processes are distinct and developed primarily within our company. An expanded view of innovation, therefore, called for specific adjustments to our practice.

First, to collaborate more widely across disciplines, we had to include other important viewpoints from beyond our company's borders—in particular, the essential perspective of those who actually use technology: clients, partners (both academic and business), thought leaders and proponents of change.

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**INNOVATIONXCHANGE
NETWORK
AUSTRALIA**

**Grant Kearney
Chief Executive Officer**

"Innovation must have some social value, to my mind. The development of new ideas and new technologies, if they don't have some social value or contribute to the human condition, then they're simply not innovative outcomes."

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Second, we felt a need to correct an "invent first, apply second" bias that has crept into modern thinking. We believe the center of gravity for innovation is shifting from solving narrow problems focused primarily on a technology or single business to issues and opportunities confronting us at the societal level. Instead of creating technologies that we assume will somehow improve our quality of life, we should examine aspects of our lives that most require improvement, then work across disciplines and specialties to bring innovation to bear on them.

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SO IN DEVELOPING THE GIO, WE SET

TWO MAJOR GOALS:

FIRST, extend the integration of our business insight and technology expertise beyond our company's borders to include the best thinkers from academia, our clients and partners, and other leaders in areas critical to innovation.

SECOND, follow a different path to discovery: begin with several areas critical to society over the next five to ten years, then consider implications for businesses and other integral components of society, finally considering what technologies or solutions might need to be developed.

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WE MADE ONE OTHER DECISION ABOUT OUR APPROACH TO THE GIO: the process to produce it would be quick and spontaneous and would maneuver around the boundaries of normal business practice — exactly the conditions under which innovation thrives.

We began in June 2004 with a series of internal brainstorms with leaders of our technical and business disciplines. We explored current trends (societal, industry and technical) and developed an initial set of questions to stimulate further discussion and assumptions related to innovation. We had no shortage of topics — they ranged from healthcare, education, and the environment to new branches of science and the evolving nature of government. It quickly became apparent that approaching innovation from a societal perspective could become paralyzingly complex and broad.

So after careful consideration, we selected three topics that seemed to hold the most potential to improve the quality of lives across the world as well as stimulate significant economic opportunity:

Healthcare
page 20

Government and Its Citizens
page 38

The Business of Work and Life
page 54

For each, we wanted to convene a varied set of contributors and tap what we think of as an "ecosystem" — the many entities that interact within a common area but whose disparate disciplines would offer viewpoints both complementary and conflicting, because areas of friction are often fertile ground for innovation.

We then extended the discussion to members of these ecosystems. By design, the more than 100 participants ran the gamut from some of the world's largest and most respected companies, universities, hospitals and governments to emerging organizations and one-person think tanks from around the world.

We didn't expect answers, nor were we attempting to predict the future. Such exercises usually miss the mark, as the world changes too quickly to be pinned down, and the assumptions on which the predictions are based shift faster than fashions. Instead, we searched for sparks that could ignite change.

GIO AT A GLANCE

- Global dialogue around the changing nature of innovation in the early 21st century, with sessions in New York, Shanghai, Washington, D.C. and Zurich

- 3 broad societal themes: healthcare, government and its citizens, and the business of work and life

- 10 ecosystem "deep dive" sessions over 24 days

- 109 ecosystem members* from 96 organizations

- 100 IBM researchers, consultants and subject matter experts

- 25 additional interviews with global thought leaders

- Participants representing 24 countries and regions

* Ecosystem participants included representatives from academia, governments, nongovernmental organizations (NGOs), major multinational corporations, venture capital firms, think tanks and other leading organizations.

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CONSISTENT THEMES EMERGE FROM DIVERSE PERSPECTIVES

WHILE THE CONVERSATIONS COVERED A WIDE RANGE OF IDEAS, THREE THEMES RAN THROUGH THEM ALL:

- The need for standard ways of exchanging information between members of each ecosystem (and across ecosystems)

- The need for more open collaboration between ecosystem members (even, at times, among competitors)

- The primacy of the individual as a focal point for innovation

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Standards

As a foundation for innovation within any ecosystem, the need for standards is a fundamental on a par with speaking the same language. Repeatedly, participants identified standards as requisite to unlocking new capabilities. Just as often, they cited a lack of standards as a major reason for systemic inefficiencies, escalating costs and general industry incoherence and confusion.

Across the healthcare ecosystem, for instance, patient information resides in different forms. Unique pieces of the information puzzle are held by insurers, government agencies, doctors, hospitals, pharmaceutical companies, patients and their families.

Within any particular government, agencies rarely store information (economic, trade, security, educational or healthcare-related) in the same way. This situation only grows worse across various levels of government—national, regional and local—or between sovereign nations.

Workers and consumers alike face a morass of largely incompatible information types needed to work and live: calendars, medical records, work files, educational histories, professional and personal licenses, music, movies and book collections—and much more.

Arriving at accepted standards, then, is a fundamental prerequisite for innovation and, in many cases, a subject in need of innovative thinking itself. While all of our GIO groups acknowledged this need, most struggled to identify who might take the lead in establishing them or what would ultimately be the driving force for that work to begin, which implies opportunity for creative—and potentially disruptive—forces to emerge.

Sharing and collaboration

Collaboration among parties not used to working with each other (or to the extent necessary) was one of the most serious challenges to societal progress cited by GIO participants.

In healthcare, doctors, hospitals and research institutions generally maintain strict control over what many view as proprietary information. Yet that barrier needs to fall before the healthcare ecosystem can deliver care targeted specifically for each patient.

For governments, cross-departmental collaboration presents a daunting challenge, but one worth confronting. Expanded collaboration could reduce widespread inefficiencies, close security gaps and increase economic opportunity. Similarly, closer collaboration with industry could help governments keep abreast of the fast-paced changes in technology and process innovation and accelerate the pace of innovation for both government and industry.

And as all of us work and play, we find our world evolving to one in which we must interact with an increasingly diverse mix of people, whether we are part of a global team charged with completing a project or immersed in an online virtual game with international players.

Much of the GIO discussion cautioned against relying too much on technology to meet this challenge. While today's collaborative trajectory was launched by technology innovations (the Internet, e-mail, instant messaging, etc.), most participants felt one of the greatest challenges to collaboration lies in the differences arising from various cultural expectations and norms.

Wider collaboration implies far more, though, than increased efficiency, wider awareness or improved processes. Such close cooperation across an ecosystem will stimulate new business designs, as companies redefine what they do and what they rely on others to do. It will also likely lead to reconfigurations of entire industries with more permeable

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AVENTIS PHARMACEUTICALS
FRANCE

**Frank Douglas, M.D.
Former Executive
Vice President and
Board of Management
Member**

**"In order for innovation to
happen there has to be a good
discussion among the discovery
side, the development side
of any organization, and the
commercial side. Unfortunately,
we're not talking to one
another...one of the solutions
is intercommunications across
the whole value chain."**

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company borders that allow new ways of doing business, new partners and types of affiliations.

To make possible such a world of more fluid and inter-connected relationships, GIO participants agreed we would need to reconsider and adjust today's approach to protecting intellectual property. Ensuring that innovators maintain some control over their innovations and are able to extract some economic benefit from them remains important. But patent policy and intellectual property strategies conceived during the industrial age will likely inhibit, rather than enable, innova-tion in the 21st century.

Primacy of the individual

Where much innovation in the last century grew out of the adoption of mass production, innovation in the 21st century will primarily be built on the infrastructure of the individual.

In the medical arena, the potential for targeted medicine hinges on diagnosis and treatments better tailored to an individual. Many governments already offer services that allow citizens to interact with agencies at their own pace and time, no longer bound by office hours or location. Products and services for work or play are now customized according to unique preferences and made available on demand, as opposed to delivery models where choice is confined to a company's definition of a demographic.

But this implies more than just mass customization. The individual contributions of members of the open source community have brought radical change to the I/T industry. Major repositories of valuable information are being built on-line by self-organizing groups whose members act alone to contribute, edit and police the contributions, changing the way encyclopedias and other reference works are conceived. In new ways, people acting as individuals will drive innovation with a force that previously required people acting en masse.

Launching a global discussion.

Over the course of 24 days, with ten different groups of thought leaders in locations around the world, we had vigorous discussions full of divergent views. For each area, we saw an ecosystem in flux, a general movement (or a desire for movement) toward an improved future, and potential barriers to reaching it.

But what proved most noteworthy was a general validation of the GIO process. Applying an ecosystem-level approach to societal issues struck our participants as the right method at the right time. Most felt it imperative to continue—and broaden—the discussion.

We agree, and offer the results of our work as just that, an opening contribution to what must become a more pervasive conversation. We invite you to join us as we apply new and intriguing notions of innovation to the actual act of innovating in ways that reward innovators and society alike.

ECOSYSTEM PARTICIPANTS

24 countries and regions

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ARGENTINA
AUSTRALIA
AUSTRIA
BELGIUM
BRAZIL
CANADA
CHINA
FRANCE
GERMANY
INDIA
ITALY
JAPAN
NETHERLANDS
NEW ZEALAND
NIGERIA
NORWAY
POLAND
SINGAPORE
SWEDEN
SWITZERLAND
TAIWAN
TURKEY
UNITED
KINGDOM
UNITED STATES

HEALTHCARE

In some ways, the healthcare ecosystem is a victim of its own success. Innovations in disease diagnosis, treatment and early intervention have helped lengthen life spans, fend off dire threats and produce an overall expectation of steady progress to the eradication of disease. Due to its very nature, there is also a societal expectation that healthcare be universally accessible. So participants in the global healthcare ecosystem face a herculean task: provide better quality service to more people more efficiently and at lower cost.

Participants in the GIO discussions agreed the evolution of healthcare must proceed along a logical trajectory from today's focus on acute care (dealing with immediate and severe episodic outbreaks of an illness) to chronic care (ongoing care for long-term illnesses that in many cases may reduce the number of acute cases) to preventive care (care focused on early detection and treatment of illnesses, including immunization and well person care).

Further, many saw the greatest opportunity for innovation in healthcare as pushing beyond preventive to **predictive medicine:** not waiting for early signs of illness but predicting and thwarting it before it has a chance to take root.

Of course, there are many potential barriers to reaching this vision for the future. Most routinely cited: costs across the ecosystem continue to increase. Several participants, though, noted an important difference between costs and spending—increased global spending on healthcare could be money wisely spent if the results were commensurate with the investment.

Others underscored a difference between spiraling costs for new treatments and technologies (to be expected and not necessarily a barrier) and high cost due to administrative inefficiencies and antiquated business models (a barrier to be removed).

Providing access to basic care seemed to many participants a practical stepping stone to global improvement. Yet even this level of care presents serious challenges, as developed nations deal with problems of caring for the uninsured or those in remote areas. Many nations must deal with rural to urban migration patterns that complicate delivery. Are the newly arrived people registered? Do they have medical insurance? Are they aware of what basic levels of care to request?

Thorny ethical issues can also act as barriers to innovation: What is the correct balance between individual privacy and protection on the one hand, and potential systemic improvements to healthcare and public health on the other? While many industries adopt risk management techniques to help control costs and pursue innovative strategies, what defines acceptable risk when human lives are involved? What about research in areas of great promise, but popular controversy? What other factors beside cold logic should rightfully be employed in making these decisions?

GIO participants also raised questions about current models for collaboration and the treatment of intellectual property (IP) within the healthcare ecosystem. Will developing nations continue to pressure large corporations to cede the advantages of patented drugs or procedures within their borders, as Brazil has done with AIDS drugs? Is there a need for revised intellectual property strategies where IP is viewed not as a cash cow, but as a foundation on which further innovation and profit can be built? Perhaps we also need agreement on global patent rights, including the notion that the scientific discovery of existing natural phenomena should not be patentable.

Over the course of the global discussions, three areas emerged that hold significant promise for innovation:

- ## Integrated healthcare records

- ## The implications of new delivery models designed to meet the needs of underserved populations

- ## Implications of a deeper understanding of ourselves

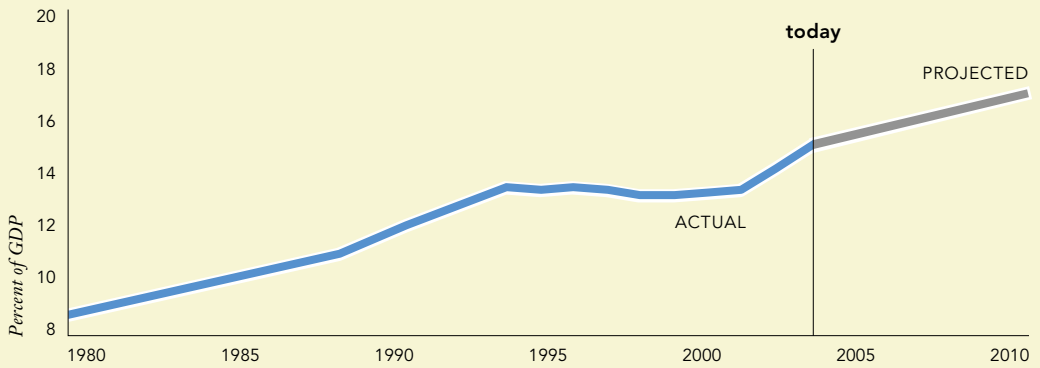## POPULATION AGE 60 & OVER

1950 – 2050

- WORLD
- DEVELOPING REGIONS
- DEVELOPED REGIONS

In millions
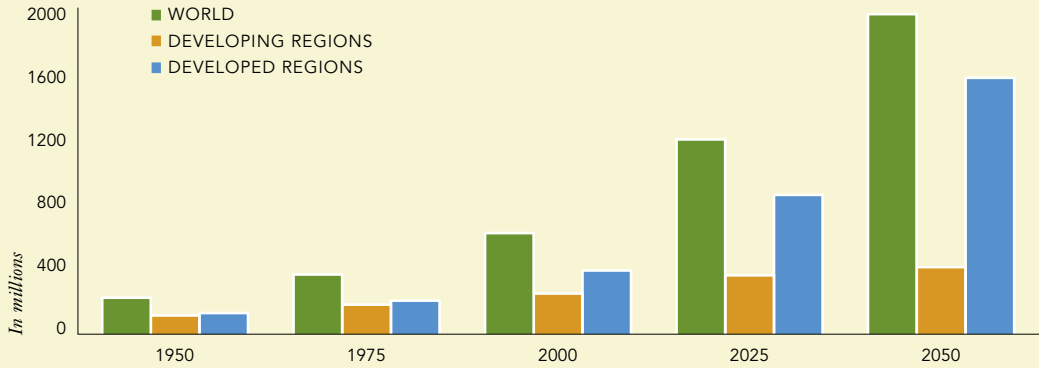
U.S. HEALTH EXPENDITURES

Increasing as a share of Gross Domestic Product (GDP)

Percent of GDP

today

PROJECTED

ACTUAL

Source (top): Population Division, Department of Economic and Social Affairs, United Nations
Source (bottom): CMS, Office of the Actuary, National Health Statistics Group

INTEGRATED HEALTHCARE RECORDS — THERE'S A WAY, BUT WHERE'S THE WILL?

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WHAT INITIALLY SEEMS JUST A NUISANCE — your x-rays reside with your orthopedist, your stress test results with your cardiologist, your childhood immunization records who knows where — can become a critical factor during an unexpected emergency. The lack of a single integrated view of all of a patient's medically relevant information also stymies advances in other critical areas: early detection of disease outbreak, epidemiological studies to correlate genomic data with disease history to provide more targeted care, even cost reductions enabled by better information flow and management.

GIO participants agreed that substantive improvements in healthcare depended on having such an integrated patient health record to provide relevant information to key ecosystem members when needed. But they also warned of a twofold challenge to realizing it.

First, healthcare may be delivered locally, but the ecosystem spans local, regional, national and possibly international levels, and includes a wide array of participants. Some are large corporations with sophisticated information technology; others are "mom and pop" size businesses unable to invest in large-scale I/T systems. In some countries insurers are part of the equation; in others, governments at various levels act as providers. Medical researchers, both academics and those working for pharmaceutical companies, also tap (and in some cases want to control) pieces of patient data.

Second, integrating a patient's record raises huge issues of privacy and ownership — who controls the records and, ultimately, to whom do they belong? Most participants agreed it is the patient. If so, it's unlikely patients will support a move that threatens either their privacy or control over their records unless they perceive a substantial benefit.

It may be, then, that smaller pilot programs to integrate patient records that also offer patients an immediate advantage — quicker service? lower costs? demonstrably better care? — will pave the way for larger scale acceptance. But this approach would only add another barrier to an ultimately integrated record if it did not follow some standard method of defining and recording patient information that would scale to include all potential participants.

That's why establishing standards across the healthcare ecosystem stands alongside integrating patient information as its most crucial near-term area for innovation.

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JOHNS HOPKINS MEDICINE USA

Edward Miller, M.D. Dean and Chief Executive Officer

"The problem that I see [in the healthcare sector]…is that we have so much information and we need to be able to translate that information into care."

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THE UNDERSERVED
WILL SHOW US THE WAY.

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WHEN WE SPEAK OF THE UNDERSERVED, it's easy for people in the developed world to view large masses of "others" in lands far away as a problem for foreign governments and charitable organizations to address. They agree something should be done, but it doesn't seem as urgent because it's not close to home. Nothing, of course, could be more untrue.

The rapid spread to the developed world of recent regional outbreaks such as SARS has demonstrated that maintaining a basic level of health is crucial for everyone. And, as many participants remarked, the issue isn't just humanitarian. Health is a necessary precondition for a productive workforce, and as the world's economy depends more on developing and emerging growth economies, the health of citizens in those nations becomes a global issue.

Participants in the GIO saw an interesting possibility here. Because of the unique conditions in some large developing nations—India and China, for instance—radically different approaches to providing basic levels of healthcare at a modest cost are emerging. These include expanded telemedicine, new health providers and educators at more local levels, and studies into the efficacy of applying traditional (non-western) medicine to western medical practice. In fact, closer examination of traditional medicine, though not scientific in origin or method, could open new doors to innovative medical practice.

Taken together, this implies ample room for many forms of innovation. Technologies, to be sure, will be created that embed sufficient processing power in medical devices to make them easy to use, even for people with little knowledge of technology. And sheer scale will help drive affordable implementations.

But innovative business models and collaborative partnerships will be an equally, if not more important, part of the solution because current delivery systems have flaws. For instance, in India, estimates put 80 percent of all healthcare spending as private "out of pocket," which does not bode well for impoverished people in rural areas. And almost 90 percent of what the government spends gets spent at the state level, where most of it goes to administrative salaries.
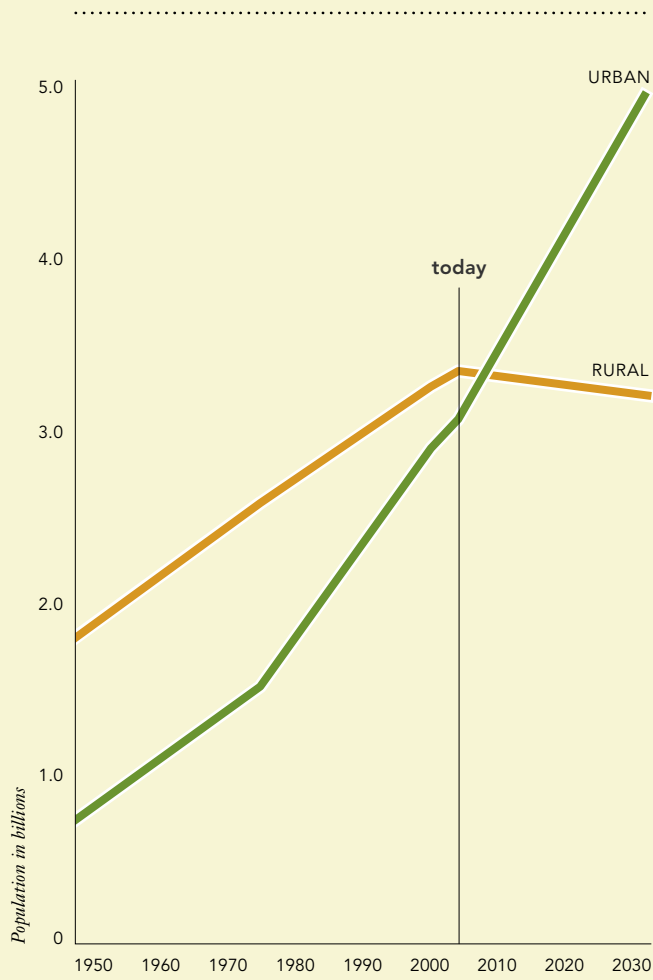
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ACROSSWORLD COMMUNICATIONS USA

**Anil Srivastava
Executive Chairman and
Chief Strategy Officer**

"Innovation is very much possible in societies where there's an urgent need, provided we look at innovation not as a technology culture...but really supporting the economic purpose of the society."

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WORLD URBAN & RURAL POPULATIONS

1950 – 2030

Clearly systems such as these will be unable to scale in their current form to meet the needs of large underserved populations unless radical innovation occurs, including new models for public healthcare spending, more affordable care and institutions that will work together to supply it. The good news is there are innovative companies trying new ways to bypass current gaps and meet these needs.

If their methods prove successful, there is reason to believe they could be applied in developed lands to provide basic service at a very low cost. Several GIO participants pointed to pilots set up in some department stores in the United States that tap nurses trained to use decision-tree diagnostic software to screen patients and recommend simple treatments for common ailments (under the supervision of a licensed physician). The cost for the service is minimal, and access within easy reach (no appointment needed).

These trends raise the possibility that important innovation may emerge from outside the current ecosystem, a notion supported by another GIO point of discussion: an eventual move to predictive care.

X, Y AND GENERATION YOU.

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THE HUMAN GENOME PROJECT REPRESENTED a remarkable achievement for humanity. Its recently published finished report tells us we have approximately 25,000 genes and provides us the sequence of the genome's nucleotide bases, 99.9% of which is exactly the same for all of us. This has opened the door for us to discover and study the functions of each of those genes and their implications for how our bodies work, though the road ahead is daunting: while the genome map is roughly the equivalent of 10 million pages of information, it's been estimated that understanding it will require analysis of data sets at least 1,000 times larger.

But this general knowledge pales when compared with what we can learn from the 0.1% of the nucleotide sequence that differs from person to person—the tiny variance that makes you *you*.

When we unravel the mystery in this seemingly trivial difference, we will have made a leap in understanding ourselves greater than any generation in history, down to minute details of why we grow, develop and look as we do, aspects of why we like the things we do — maybe even why we think the way we do. We will be able to investigate not just the human condition, but our individual condition with an unprecedented precision.

What will we do with our newfound knowledge?

GIO participants agreed that such a level of personal information could help make predictive medicine a reality. Today's healthcare delivery systems concentrate on acute care, an approach that is expensive because it deals with the consequences of an illness rather than its causes.

What we learn about a person's genetic makeup may allow us to predict accurately what illnesses he or she will most likely face. Armed with that information, a person could alter diet, activity levels, medication and a host of other possibilities to eliminate or lessen the risk of contracting that illness.

But the path to predictive medicine is not only a matter of decoding a genome or deciphering the functions of individual genes.

It's been said that "genetics loads the gun, but lifestyle and environment pull the trigger," implying genomic data holds only part of the answer. We'll need to understand better the ongoing interactions between genes, proteins, cell and systemic activity, as well as the physics supporting the molecular behavior (such as protein folding, active site interactions, etc.) that governs the body's workings. Instead of studies that identify associations — eating tomatoes slightly reduces the risk of getting cancer, for instance — we'll need studies that help us better understand why those associations exist, and what relevance they have to a particular person.

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SAN RAFFAELE UNIVERSITY
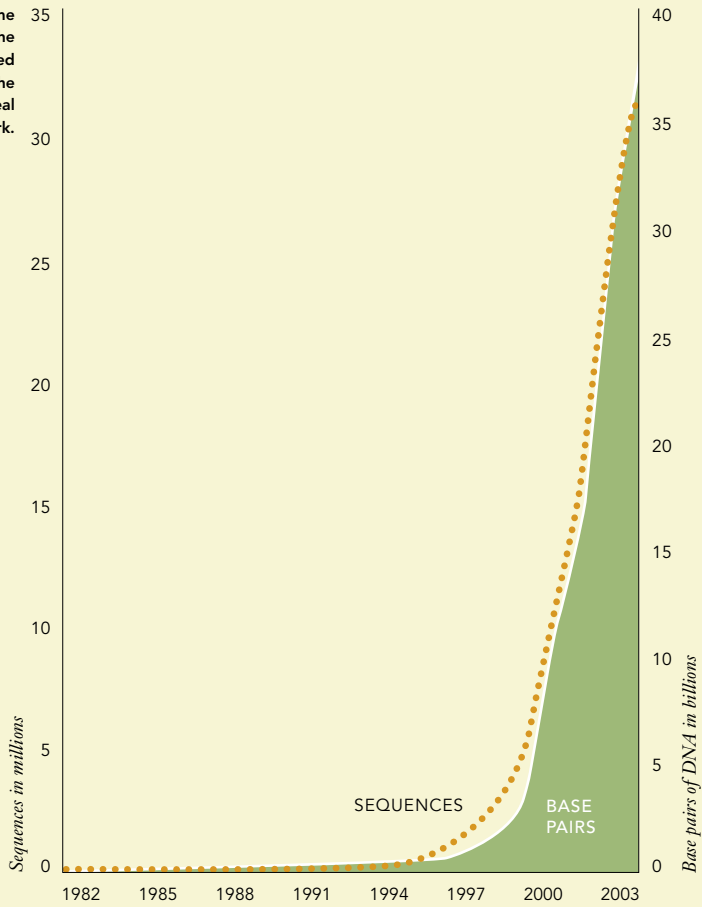ITALY

Claudio Bordignon, M.D.
Scientific Director

"We do not talk anymore about 'preventive' medicine, but about 'predictive' medicine. In other words: a disease is no longer identified in its beginning stage…but even before that, through genome and proteome analysis, even when no sign of the disease has appeared yet… Obviously, this requires very complex demographic and informatics analysis, the gathering of all the data, the correlation between the patients and the response to the drug treatments. All this is changing completely the concept of 'medicine'."

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UNDERSTANDING THE GENOME

Growth of genetic information

Sequencing the human genome
was only the beginning. As the
amount of genomic data collected
rapidly increases, so does the
difficulty of analyzing it to reveal
just how our genes work.

Sequences in millions

Base pairs of DNA in billions

SEQUENCES

BASE
PAIRS

1982   1985   1988   1991   1994   1997   2000   2003

We'll also need better biological monitoring to help us gain such an understanding, and to detect problems earlier and more consistently. Checking blood pressure once a day may not prove to be as meaningful as continuous monitoring by an unintrusive sensor that shows the patterns of its rise and fall. But the more functions we monitor to improve diagnosis, the more important it will be to limit the monitoring to what really matters—over-monitoring risks inundating us with information and driving costs higher.

Predictive medicine will also create new medical specialties. Just as the invention of the x-ray led eventually to radiology, predictive medicine based on a personal reading of your genetic fingerprint will undoubtedly lead to specialization in interpreting genetic data and making predictions based on it in the context of your lifestyle and environment.

Not surprisingly, the predictive approach also raises important questions. For instance, how does mental health fit in this model of care, and what are the implications for predicting mental illness? Since predictive care by definition extends healthcare to anticipatory treatments not covered by current payment models, who has a vested interest in paying for them? Patients, obviously. But due to its natural long-term view, predictive care might also imply a payment model where health insurance becomes a component of life insurance, giving life insurers an active interest in promoting innovation in healthcare.

Many of the early steps taken to prevent a predicted illness may not necessarily include medication, but might emphasize lifestyle changes. Because this implies a shift away from a drug-oriented model, what might this mean for drug development and the business model for drug delivery? It might intensify the emergence of so-called orphan drugs—prescriptions specific

to one form of a disease that are highly effective for a narrowly targeted part of the population—because most general diseases would be avoided through prediction. But the small quantities of such drugs required for targeted patient sets implies an astronomical cost to produce them, challenging the health-care ecosystem to devise an efficient payment model for such treatments. Predictive care that de-emphasizes drug therapy might also edge drug companies closer to a services model, such as those provided today for dialysis and physiotherapy.

But there are other implications of this deeper self-awareness than just predictive care to ward off sickness.

Many of us will undoubtedly seek to improve our overall well-being. Athletes today train to improve their physical performance—increasing flexibility, muscle mass, endurance—but do so for a particular sporting event or window of opportunity. Healthcare in the 21st century, no longer limited to the symptom/diagnosis/treatment regimen, will emphasize maximizing our enjoyment of all aspects of our lives: how we look, think, feel, play, even how we interact with others, finding new treatments, therapies and prescriptions to help us achieve our personal goals.

This will undoubtedly attract new entrants to the healthcare ecosystem. To augment the work of specialists who interpret genetic data, we can expect a related throng of advisors, experts and coaches to help feed the human desire to know ourselves and improve who we are—and pump us full of advice on the quickest path to get there. In such a world, members of the food service, fitness and lifestyles industries will likely be major forces in the healthcare ecosystem.

This raises an important question: who owns such an intimate interpretation of you? We may not now think of "owning" the pattern of our fingerprints per se, but the implications of a genetic fingerprint, especially when interpreted in light of more complete personal medical information, are far more critical. In addition to technologies to help us control and use this information, deciding who has access to it, how they can use it, and what types of decisions based on it we as a society will accept will require much careful and innovative thinking.

Ultimately this deep self-awareness could also add new ways of forming social ties. Just as today people with similar life experiences or illnesses meet to find support and camaraderie, people may reach out to others who share similar genetic traits and lifestyles. Such new affinity groups could easily tap existing and emerging technologies to assemble across the world. We may begin to think of a new set of identifying traits in addition to today's distinctions — gender (undeniably genetic), race (superficial enough that some experts claim it has little genetic basis) or even belief — allowing us to redefine ourselves around a much richer set of options for human diversity.

GOVERNMENT AND ITS CITIZENS

While the relationship between government and its citizens has changed over the past two hundred years, the modes of interaction have altered very little—until recently. Most governments still exist to serve their citizenry in three basic ways. First, they act as providers and regulators of services for their citizens. Second, they act as facilitators of public relationships and discourse, arbiters of the varied and, at times, competing interests of their citizens. Finally, they locate their citizens in a world of other nations, providing protection from, access to and the basis for relationships with them.

But as economic globalization has been accelerated by information technology, governments trying to fulfill these missions face new opportunities with a challenge: how do they help their citizens thrive in a world of more porous borders?

Additionally, related issues of cultural identity, stateless terrorism, disease outbreaks, and the effects of natural disaster challenge national security, the rights of personal privacy, law enforcement, and global public policy. What is the path ahead for governments and their citizens? How can governments act as agents for innovation (stimulating it within their domain), but also embody it as a way to meet 21st century challenges?

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GIO participants discussed many possible ways the relationship of a government to its citizens might evolve in the future, but noted significant changes that were inevitable.

- **Governments will have to become more efficient and integrated across agencies and ministries.**

- **Governments will become subject to new kinds of influence and pressure due to novel uses of communications technology—"they will not be able to escape the bloggers," said one participant.**

- **Governments will compete and cooperate with each other more on the basis of virtual factors (skills, expertise, infrastructure and productivity) than on simple, traditional geographic advantages.**

- **In some ways, governments may behave more like businesses (tying plans to budgets and strictly measuring results and return on investment to society), but in others, they will need to remember what makes them fundamentally different: they cannot pick and choose "clients," since they should act on behalf of all their citizens.**

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Governments face no shortage of barriers along the way. To some, even the thought of innovation and the creativity it demands presents a challenge: some parts of government have rarely, if ever, changed their approaches. On the one hand, what are the incentives for such government agencies to drive innovative change? On the other, how can elected officials operating on

relatively short election cycles initiate innovative reforms that could take many years, if not decades, to fulfill? And there may be some parts of government—regulatory enforcement, for instance—that should pursue only minimal innovation.
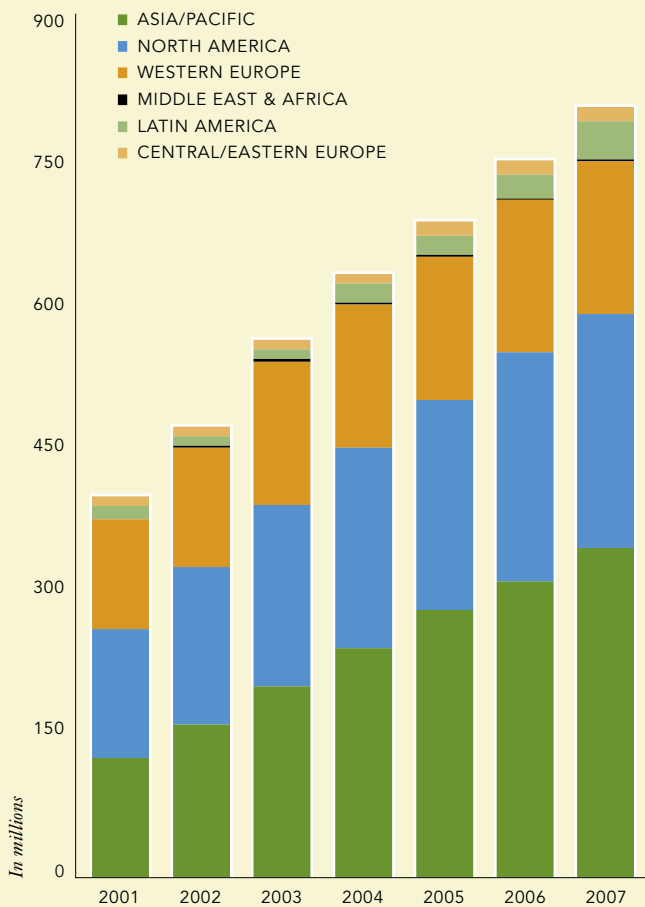
GIO participants commented on soaring budget deficits and stagnant economies, unequal distribution of the benefits of economic globalization among citizens, fractured administrative processes across government agencies, and the difficulties legislation and policy have keeping pace with technology as other barriers to government innovation. But perhaps no other impediment drew as lively a debate as the culture change that innovation requires.

A culture that deems a single failure an indelible mark on a person's career will likely have a difficult time innovating, because there is no innovation without risk, experimentation and occasional failure. A culture that embraces exploration and discovery, but eschews commercialization (the adoption of commercial tools and techniques) or applied science as a lesser pursuit will find itself with only half (or perhaps less) of the innovation equation. How does a government recognize and shift these deeply entrenched attitudes, ones that it itself may embody?

To some, the issue is not so much one of culture change, but of adjusting values to align with cultural expectations in the light of a changing world. It was clear in the GIO sessions that change, and at times wrenching change, was not only inevitable, but desirable.

Among the many seeds for change discussed, three generated intense interest: government transformation incited by growing access to information and communications technology, competition between nations on the basis of virtual resources, and trust as the key enabler of security in an increasingly borderless and digital world.

GLOBAL INTERNET SUBSCRIPTIONS

Legend:
- ASIA/PACIFIC
- NORTH AMERICA
- WESTERN EUROPE
- MIDDLE EAST & AFRICA
- LATIN AMERICA
- CENTRAL/EASTERN EUROPE

In millions

Years: 2001, 2002, 2003, 2004, 2005, 2006, 2007

Source: Gartner Dataquest, June 2003

TRANSPARENCY AND ACCESS, THE NEW BULLY PULPIT.

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UNIVERSAL ACCESS TO CONNECTIVE TECHNOLOGY will transform two key aspects of government: the way it provides transactional services for its citizens, and its response to citizen groups advocating policy or governance changes. In both cases, the primacy of the individual drives change, not in the sense that the balance of power tips in favor of the individual, but in that what an individual knows and expects of the government, and what the government can know and expect of individuals, makes innovative improvements possible.

In the first case, citizens will bring expectations cultivated in their daily dealings with businesses to their dealings with government—if they can bank, buy and be entertained online, why not renew a license, pay local, state and federal taxes, or launch a new business by completing applications for necessary permits with a few easy clicks? To cater to these expectations, governments will need to integrate across agencies and regional layers to present to the citizen a single entity. They will do this because it will help them become more efficient.

For instance, cross-agency standardization and integration will eliminate redundancies, and self-service processes will lower operational costs. Easier said than done, of course, which will make this technology and government process area ripe for innovation.

But will such individual expectations lead to a greater voice for the citizen in setting policy and actual governance? Many GIO participants thought not, especially in the sense of "voting over everything." In fact, to them such a trend toward direct democracy would flout years of historical lessons: there is a reason representative democracies have been successful where mob rule has not. Still, they could not ignore the effects technology has had and will continue to have on elected officials seeking to represent the citizenry.

The advent of the Internet, e-mail, instant media and the increasing transparency it has forced make it easier for voices to be heard—more levers for influencers to pull, and more leverage per lever. The real question is, whose voices get heard?

In many democratic governments, elected officials don't necessarily need (or want) more individual opinions or input to the political process. But they are keenly interested in what groups of individuals—especially groups representing substantial voting blocs—have to say. So it's not difficult to imagine that the groups who most innovatively use these new technologies, both to attract supporters and to make their feelings known to elected officials, may have a greater voice in government.

But GIO participants saw potential for concern. Catering to the advocacy groups who could use technology to 'yell the loudest' might foment emotional governance, surely not the best way to make important decisions.

Finally, GIO participants identified another potential for change: the influence of newer generations (such as the so-called "Gen Y") raised on the latest information technologies and thoroughly comfortable with rapid cycles of innovation. Their expectations for change and the ease with which they absorb new technology could lead to an era of more frequent government innovation.

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THE WORLD BANK
USA

**Robert Valantin
Senior eGovernment
Advisor**

"Government is just one form of collectivity—a way people get together to express themselves and work together. And the question is, what other forms are emerging today? What different forms of groupings are we seeing in which people, citizens can get together and exercise their views?"

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NATIONS BECOME
MORE VIRTUAL.

....

WE BEGIN THE 21ST CENTURY with a variety of economic models around the world. In some countries, large pockets of the population are still agrarian; in others, the industrial age still dominates: economies based on manufacturing or the supply of raw materials. Others are shifting to a services-driven economy.

For many developed nations, though, future hope for growth depends on "knowledge work," where the chief good produced is intellectual capital.

In a world of "knowledge work" where competitors can arise anywhere and more porous borders exist, how do nations effectively compete? What is their distinct advantage? The answer, of course, is a nation's people and their expertise.

Competing on the basis of virtual resources encompasses most of the aforementioned models because it implies that what differentiates the producer is not as much the product as the expertise in producing it. The GIO participants saw two potential strategies for successfully competing in such a globalized economy:

- **Achieve the scale necessary to maintain a wide array of expertise, making the nation or group of nations globally competitive. In this approach, the government must stimulate innovation across a wide swath of potential growth areas.**

- **Create specialized "economies of expertise" to compete in the global market for specific opportunities. In this approach, the government must encourage a focused hotspot of niche innovation and keep abreast of rapid changes that may alter its competitive position.**

The United States and the European Union are two examples of the first strategy. India and China, by virtue of the size of their populations (and therefore, internal markets) will likely also be able to achieve this scale, though they have accelerated economic progress by specialization. Nations lacking the advantage of scale must decide first if they want to compete in the global economy and second, what area of expertise they will cultivate. The alternative — isolation and protectionism — is not promising.

BROADBAND CONNECTIONS
BY GEOGRAPHY

....

29%

39%

25%

7%
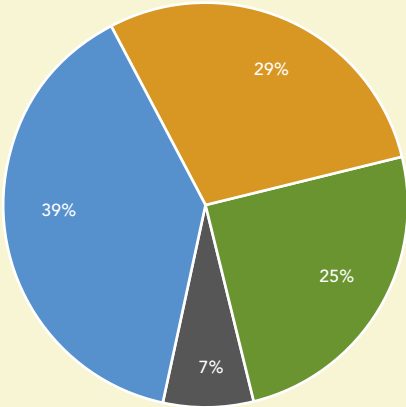
■ ASIA/PACIFIC
■ UNITED STATES
■ WESTERN EUROPE
■ REST OF WORLD

Governments building specialized economies must then find innovative ways to attract the best minds in the world in their particular area of specialization. As the world economy grows, these minds will have more choices of where to live and work and under what conditions, including the services and incentives a government should offer people with their expertise.

The challenge, then, for a country specializing in knowledge work will be to keep desirable job opportunities within its borders. For instance, will a country that needs to import expertise but does not extend full citizenship and all its privileges be able to compete successfully with countries that do? Will a country with a leading educational system in biotechnology be able to keep its graduates living and working in the country if its healthcare system is poor, its internal security suspect, or its market for cutting-edge jobs second rate?

Is there a viable model for governments that create a specialization to export the expertise? Perhaps not for many developed lands with declining and aging populations, but for some countries with young and growing populations, it may work. India, for instance, is exploring the idea of a "young India caring for an aging world" as a long-term strategy to provide opportunity for its citizens.

This raises an interesting possibility: will competition and cooperation between nations on the basis of virtual resources redefine the relationship between "nation" and "state"? Could the nation itself become virtual, while the state remains defined by geographic borders? Some countries already see a trend whereby their expatriates and "citizens on loan" to other countries form an extended portion of their nation.

While the existence of expatriates is certainly not new, as we move into the 21st century, its scale may be. This condition will be challenging for many governments, both for those with extended nations and those providing a new home to them. If the movement of expertise becomes common, how will these mobile experts primarily define themselves — as citizens of their new homes, or of their old? Could these trends move nations to define themselves on the basis of criteria other than traditional ideas such as geography or ethnicity?

This extended view could effect changes in governance for some countries. In Haiti, for instance, conditions imposed by the International Monetary Fund (IMF) require certain levels of expertise in the structure of the government before aid can be granted. To fulfill these requirements, a new government often taps expatriates from the United States, Canada and Europe to return. They bring with them an interest in Haiti, but also interests aligned with the thinking of their new homes.

All this implies a period of great potential for innovation: first, in the environments for innovation that governments seek to nurture as they compete with economies of expertise, and second as they themselves change in reaction to or anticipation of a more virtual, borderless world. Ultimately, this may imply that government is evolving to a form of collectivity, with its primary external function being an enabler of relationships, instead of a monopolistic, sovereign state.

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UNIVERSITY OF CALIFORNIA AT BERKELEY USA

Michel Laguerre, Ph.D. Professor

"We are moving from a sedentary type of government to a more mobile one — one that will take into consideration the needs of not only the local population, domestic population, but also a population that is abroad."

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GOVERNMENT IN A DIGITAL AGE — IT'S A MATTER OF TRUST.

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THE PRIMACY OF THE INDIVIDUAL IN INNOVATION presents an interesting situation for both governments and their citizens: in the knowledge age, governments can know more about each of their citizens, and citizens more about their governments. This situation raises serious issues about security, privacy and most important, trust.

In the past, when nations sought to ensure their security, they could concentrate primarily on the integrity of their borders. Internal policing was certainly important, but not as the primary key to national security. This has changed over the past few decades as terrorism has become an unwelcome part of the landscape of modern life. Also, other security threats, such as rapid disease outbreaks that ignore borders (SARS, avian influenza, AIDS) and social disruptions due to internal unrest (as globalization's benefits accrue unevenly), require governments to rethink how to ensure their nation's security.

Without making better use of individual information, it will be impossible to maintain national security. This raises the specter of governments misusing such information or in other ways threatening the privacy of the individual—violating one kind of security in exchange for another. Of course, the greater ease with which citizens can examine their governments could serve as a balance to this possibility. But this underscores why earning and maintaining the trust of citizens will be so important. In an age of open information, it will be challenging for a government that loses the trust of its citizens to continue to operate efficiently, especially with regard to security.

This presents the opportunity for many innovations. From a technical perspective, governments will need new techniques that allow them to tap individual information without unduly exposing an individual's identity and also to protect whatever sensitive information they have gathered. They will need new policies and procedures for acting on such information. There is the possibility that for certain types of information—medical records, for instance—trusted third parties may be used to store and protect it.

GIO participants in Europe felt that many of their governments are already achieving the necessary balance between an individual's need for privacy and the government's need for information. Participants in Asia and the Americas felt their governments may be newer to the challenge, either because their internal security has only more recently been threatened (as in the United States) or because a "conscience of privacy" is only now emerging (China, for instance).

Viewed from the reverse perspective of the individual citizen, this is a logical result of the emergence of a digital world. In a world where geographic borders mattered most, citizens wanted a government that could protect them within those

borders. In a digital world, citizens will expect governments to provide a secure digital environment, including protection of personal information.

These possibilities raise interesting questions for how governments and citizens deal with the issue of trust. Will citizens allow a desire for privacy to be an impediment to the innovations they need to feel more secure? Or will privacy become an essential component of these innovations? If governments are successful in combating new security threats, will citizens feel the threats have been exaggerated, leading to a reneging on whatever privacy compromises they had supported? How can governments maintain the high level of trust needed in an era of information overload, especially when so much available information cannot be validated and might be inaccurate and misleading?

Greater transparency is a double-edged sword. It can build trust—there is nothing to hide—but if what becomes known is unexpected, it can also quickly undermine it. Governments that find ways to earn and keep trust will enjoy a distinct advantage over those that do not: a citizenry confident enough to allow information to flow unimpeded and thereby be put to use.

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NATIONAL GEOGRAPHIC
USA

**Terry Garcia
Executive Vice President,
Mission Programs**

"…there appears to be an inverse relationship between technological advances and public trust. And that issue is going to have to be grappled with by the public, government and industry because it's going to become more acute as we move forward in this century."

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THE BUSINESS OF WORK AND LIFE

Over two hundred years ago, the factory redefined work. For some, that definition no longer holds.

Across the world, work continues to get done in many ways, some ancient, some new. Farmers in one valley tap the latest in technology (mechanized harvesting, bioengineered crops) while those in another a country away still plow with oxen. Factory workers labor in manufacturing plants ranging from almost entirely manual to fully automated. But for a growing number of workers, work is radically changing. Knowledge is their chief product, and the means of production their brains, abetted by advanced information and communications technology.

GIO participants agreed innovation will bring improvements to all types of work. But for industrial and pre-industrial work, the primary challenge is to spread existing advances to populations so far untouched by it, rather than to innovate anew, whereas a majority of recent innovation has focused on supporting and harnessing the power of the knowledge economy.

Therefore, this year's GIO concentrated on knowledge workers. In particular, we examined the way they are reshaping traditional views established during the industrial era of life as being distinct from work, or as one GIO participant described it, "industrial indenture."

BENEFITS OF A KNOWLEDGE ECONOMY

**Strong correlation between GDP/Capita and
Knowledge Economy Index**

The Knowledge Economy Index,
calculated by the World Bank
Institute, is based on the average
of the performance scores of a
country or region in all four pillars
related to the knowledge economy:

Economic incentive regime

Education

Innovation

**Information and
communications technology**

GDP per capita

Knowledge Economy Index, 1999
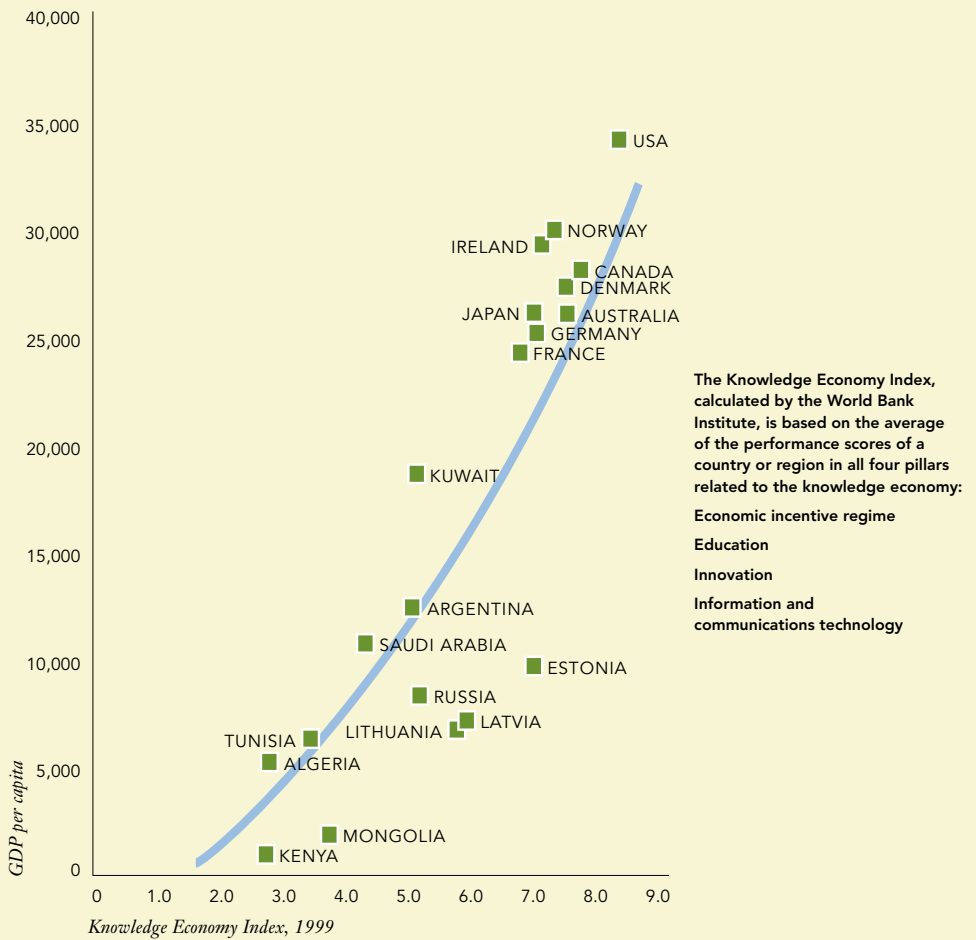
Knowledge workers complain of a blurring line between the personal and professional aspects of their lives brought on by the same tools and technologies that promised to boost productivity and create more leisure time. Since these workers *can* be online, the expectation is they *will be*.

As work becomes more virtualized—performed anywhere, at any time, over the network—so will the structures, relationships and institutions designed to facilitate it. Almost every aspect of work must be reconsidered: when it gets done, by and for whom, where and for how long.

In the near future, the concept of "worker" and "employer" may sufficiently change so as to render the terms antiquated. As innovation occurs rapidly, skills and expertise change just as rapidly, creating more fluid relationships and work styles. Looser aggregations of workers and those tapping their services may form and disband on an opportunity-by-opportunity basis.

Such a world comes with its share of challenges and uncertainties. The virtualization of work makes it easier to source work quickly anywhere, widening the field of competition. For many countries, new work styles could upend work policies and cultural expectations developed over many years. How will workers and employers transition to the new model? And what about workers whose jobs are still of the industrial age? Will a two-class system evolve, further exacerbating the digital divide?

GIO participants agreed that while the reality of virtual work might cause serious backlash in the short-term because of the intrusion of work into life, the inevitability of this direction will drive new accommodations by workers and employers.

This led to three areas of particular interest: the reintegration of work with life, the role of employers as educators in such a fast-changing world, and the emergence of corporate culture as a primary force for innovation and competitive advantage.

FINDING THE OFF SWITCH IN AN ALWAYS ON WORLD.

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IN MANY DEVELOPED LANDS (AND SOME DEVELOPING ONES), access to information and communications technology leads inexorably to an "always on" state: airplanes, cars, schools and most public spaces will soon provide wireless broadband access. This access saturation will result in a "back to the future" experience for many workers. Since the knowledge worker's means of production reside primarily in his or her head, work can be easily performed anywhere the worker chooses to be as an integrated part of the worker's life.

While this could sound like a nightmare — 24-hour workdays and no way to escape the demands — this really represents a return to earlier, pre-industrial models where work performed at home (in the fields, at the hearth) was not thought of as something entirely distinct from life.

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IBM CORPORATION
USA

Irving Wladawsky-Berger
Vice President,
Technology and Strategy

**"If an individual chooses a job
that he or she really enjoys
and that represents the values
they believe in, the boundary
between work and life may
become meaningless."**

....

What may make this palatable to knowledge workers is the flexibility and control it will return to them over their lives. Rather than either/or choices (I miss my daughter's daytime recital because I'm at work; I'll miss an important presentation because I am at the beach that week), the virtualizing of work and work relationships will offer a richer set of options. Rather than having their thinking confined to industrial age models, complete with preset limits for hourly work, knowledge workers will make a variety of choices as to how long they work, when, and for whom.

Closely associated with choice is motivation. For knowledge workers who align interests and passions with work, the work/life debate becomes moot—hours do not feel worked when you are doing what you enjoy and choose to do. To the extent that flexibility and motivation drive the knowledge workers of tomorrow, they will resemble today's entrepreneurs, except that they will make varying decisions as to what components of endeavor make up their lives, and need not allow work to become their life's defining feature.

Achieving such a radically different model will require much innovation, only some of it technological. Certainly we need better tools to interact with colleagues around the world in ways that engender the same level of trust and collaboration as does face-to-face interaction. Also, better ways to integrate the elements of our public and private lives—calendars, mixed-document storage—would make things easier. But by far the greatest challenges will be in creating the policies and practices that enable employers and workers to effectively virtualize their relationships.

What does this mean for management? Many companies are already struggling to help managers who may never see most of their employees. In IBM, on any given day, over 40 percent of the workforce does not report to a traditional office. Advance that scenario to a world of ad hoc work agreements. What does that imply for benefits and other services traditionally offered by employers? What would it imply for workplace cultures? How does a company balance the needs of individuals with those of the organization, given the dispersed and shifting nature of its workforce? How does it cultivate a sense of belonging and loyalty that is at the heart of any group accomplishment?

Assuming that employers still select workers on the basis of skills and expertise, on what basis will workers choose who they work for? Will a company need to use a core set of values—what it is; what it hopes to accomplish in the communities in which it operates; how it conducts itself in its dealings—to convince highly talented workers to affiliate themselves with it?

Perhaps most intriguingly, what will these changes portend for the societies in which they occur? Reforms in the way people work and live must eventually trickle up and transform the larger structures of society, making this an area that bears close watching.

FOR THE KNOWLEDGE WORKER, WORK BECOMES ACADEMIC.

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IF INNOVATION WILL CONTINUE TO OCCUR MORE RAPIDLY IN THE 21ST CENTURY, it follows that knowledge, expertise and skills will change just as rapidly. The majority of this new knowledge will likely be generated within innovative companies.

This strongly implies two things. First, workers will no longer be able to rely on expertise (including university degrees) earned early in life to keep them at the front of the skills queue. Second, it will be unlikely that universities and other educational institutions trying to keep abreast of the dynamic nature of work will be able to do so.

Furthermore, because innovation will require more collaboration, aspiring knowledge workers will need cross-disciplinary degrees and programs of study to compete. Historically, universities have found it difficult to provide such programs, in part because of the structure of schools around centers of competence aligned with established disciplines, and because of the way such institutions grant tenure.

One approach to overcoming this impediment would be tighter collaboration between academia and industry. Educational systems in some countries have good precedent for this. Others are now just beginning to explore such connections, since their educational culture has looked down on applied research or close commercial association. But even a close collaboration with academia cannot avoid the reality that the best way to gain knowledge and expertise will be on the front lines where it is being created.

GIO participants suggested a different approach. It might fall to companies to codify such new knowledge and validate what their workers know. This could easily lead to a time when leading companies join the ranks of universities in being accredited to offer advanced degrees. In fact, such degrees may become the most sought after.

What will this mean for academia? Will universities focus their efforts on the aspects of innovation at which ad hoc aggregations of workers and companies will be poorly equipped to excel? Different types of skills are needed along the continuum of innovation: idea generation demands great creativity, whereas generating profit from ideas generally requires the ability to imitate, iterate and apply to a perceived need. Too much focus on either can be counterproductive. In this sense, the medieval concept of an "academy" to nurture creativity and intellectual strength remains appealing, and the pursuit of ideas regardless of where they might lead invaluable.

This raises a related issue: will a world of virtual work, knowledge workers and rapid innovation primarily require generalists capable of applying a broad set of knowledge in novel ways, or specialists whose profound understanding leads to insights generalists would be unable to reach? Likely both will still be in demand.

What may shift is the balance between the two groups, and how they are educated. Will universities focus on providing a foundation for general and sound critical inquiry, while leading companies provide layers of specialization in current skills to continue the education process? Or will universities seek to educate both generalists and specialists who then develop applied skills in the work environment? Single companies may not be able to offer a rich enough educational experience to provide continuous skills-enhancement for top talent. Consortia across an ecosystem may provide better opportunities for a career path and refreshing of skills.

CORPORATE CULTURE CATCHES UP TO THE KNOWLEDGE AGE.

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JUST AS CONCEPTIONS OF WORK as distinct from life are shifting in the knowledge age, so too must corporate cultures. Technology innovation is altering work, but innovation in corporate cultures lags badly—most are still based on industrial age models.

Consider a corporate culture steeped in a traditional hierarchy of command, reinforced by everything from titles and reporting structures to office size and furniture. How is that culture promoted in a virtual setting? And will it effectively stimulate knowledge workers to be productive? How do individual knowledge workers who may be affiliated with the company on a project-by-project basis respond to command and control tactics? Will they choose to continue their relationship with this employer? Will the culture help them make better decisions, or make them feel they have the authority to do so?

Vestiges of this older cultural thinking still permeate many companies that think they've abandoned it primarily because cultures are notoriously difficult to change. They are even harder to change if companies have not defined where their culture is today, what it needs to become, and how their organizations can get there.

For instance, GIO participants highlighted changes brought on by aging populations in much of the developed world and the severe strain on social systems to care for them.

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Many workers who would have previously retired will seek to remain active and productive. Yet most corporate policies and cultures are still patterned after an industrial age reality where older workers could not continue to handle the same loads of physical labor, and so decreased in productivity. In the knowledge era, roughly the opposite may be true.

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If expertise is a key factor in the knowledge era, older workers who have kept pace with change may be the most sought after sources of expertise. Based on relationships established over many years, and an intimate knowledge of a company's inner workings, these workers could make significant contributions well past their retirement age, even if they chose to devote less time to work. But compensation systems for retirement still assume a peak of earning ability in the years before retirement, then a precipitous drop off in value, so that income from a retirement plan must fill the void. Corporate cultures that pressure knowledge workers to leave at a set age with no accommodation for an ongoing association may be wasting their best assets. This is just one example of the fundamental opportunities for cultural innovation that companies that hope to thrive must seize.

In addition to the aforementioned challenges caused by a virtual work environment, knowledge workers find themselves working with a more diverse set of colleagues than ever before. Whether the cultural differences are national, ethnic, linguistic, educational, expertise- or skill-related, they can create friction and the potential for misunderstanding if knowledge workers do not develop a cultural literacy. GIO participants saw at least two ways companies may meet this challenge.

Some may seek to ensure a significant part of their population has multicultural literacy through mobility programs in conjunction with universities, or require this of employment candidates. But an additional possibility discussed in several GIO sessions arose from a most unlikely source: the world of online immersive role-playing games.

People who play these games enter an environment with a set of clearly defined rules and a game culture that acts as a normalizing force for all participants. The game's structure and technical platform also make it possible for participants to join, accept responsibility, act and leave on their own schedule—a very close parallel to how we envision knowledge workers functioning in the near future. It could be that many of the technical and administrative techniques used in these games might inform the structure of future work and work management systems, albeit in a less playful way.

Perhaps the most compelling lesson to draw, though, is the value of a normalizing culture that allows interaction and collaboration. Companies that innovate in this area, developing cultures that encourage rich discussion and teamwork across a diverse set of talented people, will succeed in competing for business, as well as in the equally important competition for the best knowledge workers.

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**GOBI PARTNERS
CHINA**

**Thomas Tsao
Partner**

"As individuals have an increasing number of choices of where they want to work, what they want to do, it becomes even more important for companies to clearly define what they stand for, what their values are and to articulate that vision."

....

Epilogue as preface.

How do you conclude an exploration designed to uncover puzzles, contradictions, inquiries, implications and flashes of insight that pave the way for change? Quite simply, you don't.

That's why we're grateful to all who contributed to our inaugural GIO, not just for their many individual insights, but for underscoring the value of dialogue and debate in broadening our understanding.

Of course, while such a discussion needs to continue, it also needs to stimulate concrete action to prove innovative. And already it has—participants from GIO sessions are working on several projects sparked by the GIO.

We look forward to continuing both of these aspects of the GIO: the stimulating engagement with great thinkers, and the satisfying accomplishment that comes from working with great doers.

After all, that is
innovation at its best:
an idea, an insight,
an invention and all the
hard work needed to
make our world better.

**Representatives of the following organizations contributed to the
2004 Global Innovation Outlook**

....

3M

Academia Sinica

AcrossWorld
Communications

Alcan-Péchiney

American Association of
People with Disabilities

American College of
Physicians

American Express

Apollo Hospitals

Avenir Suisse

Aventis
Pharmaceuticals

Beijing TongRen
Hospital Management
Company, Ltd.

Berne University

Bocconi University

The Boeing Company

Bond University

BrainHeart Industries

Business Council
of Australia

Cambridge University

Center for Strategic &
International Studies

Centre National de la
Recherche Scientifique

Changi General Hospital

Chi-Mei Foundation
Hospital

China Merchants Bank

Chinese Academy of
Social Science

CIGNA Healthcare

Comcast Corporation

The Cooper Union

Culturecom

Department of
Environment, Food
and Rural Affairs, UK

Department of Industry,
Tourism and Resources,
Australian Government

Dom Cabral Foundation

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Engineering Management
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European Commission

Fudan University

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Partners

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Singapore

Global Medical Forum

Gobi Partners

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Institute for the
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International Finance
Corporation of the
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International Health
Consulting

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Poland

Japan Industrial Policy
Research Institute

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Lisbon Council

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Ministry of Economy, Trade and Industry, Japan

MM Consulting

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National Co-operative Business Association

National Geographic

New Media Consortium

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Siemens AG Medical Solutions

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Social Security Administration

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State Ministry of Finance, Austria

Swiss Federal Council for the World Summit on Information Technology

Swiss Federal Institute of Technology (ETH)

Syracuse University

Telecom Africa

United Hospital Fund

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