Support Medical Decisions with Big Clinical Data

“Imagine you walk into a physician’s office with some strange things happening to you,” says Ricardo Pietrobon, M.D. “Unknown to you and your doctor at that point you have a rare disease that will kill you if it goes without a diagnosis and appropriate treatment. At that moment,” he continues, “your life and wellbeing rely almost entirely on the information the physician might have inside her brain: her previous experience with similar patients and what she might have read in the scientific literature. If any of those fail her and she makes a bad decision, you are now either dead or facing a miserable life until your last day.”

But it doesn’t have to be that way, Dr. Pietrobon told the CIMS Fall 2012 Conference. As Associate Professor of Surgery and Associate Vice Chair for Research Processes and Innovation at Duke University Medical Center, he and colleagues have been running experiments in applying “Big Clinical Data” to support medical decisions. Here he summarizes his presentation to the CIMS Conference (http://goo.gl/8n3Az).

Welcome to the age of decision support systems aided by big clinical data. By combining 1) the huge amount of data collected by hospitals in electronic health records, 2) massive numbers of scientific articles available from the international research community, 3) the personal experience from your doctor, and 4) your own choices, it is now becoming possible to have the best of each of these worlds in a system that will assist you and your doctor reach the best possible course of action.

Our group at Duke, in conjunction with CIMS, is attempting to tackle small parts of this massive problem using methods borrowed from what is now known as Big Clinical Data (1). Although there are probably as many definitions of what Big Clinical Data means as there are people attempting to define it, my current definition is that it represents a set of activities related to 1) data storage, linkage and organization, 2) modeling analysis or trying to extract useful information.
information out of a vast amount of numbers and text, and 3) making the information ready to be used in a valuable manner.

Here are three samples of the work we are doing in each of these areas, with a preview of peer-reviewed publication that will be coming out later in 2013.

**Data Enrichment**

The first example relates to what our academic group calls “data enrichment.” Traditionally, different patient databases could not be aggregated unless both of them were talking about the same individual. For example, if Joe’s information about his surgery was in a given data set and his cost data in another, I would be able to bring the two together. But if information about Joe’s high blood pressure had not been collected, researchers would be out of luck in knowing whether he had high blood pressure or not. With data enrichment techniques, our group is now creating a very large cloud of immediately accessible clinical data sets that allows biomedical researchers to find the best guesses to know, for example, whether Joe had high blood pressure or not.

The way this works is fairly intuitive: We first look up databases containing information on patients who are identical to Joe in relation to a number of conditions, say his other diseases, age, gender, geographic location, and race/ethnicity. Based on these common, matching characteristics, we define what we call “Joe’s twins,” or people who are identical to Joe. The premise is that if these people are similar to Joe in all of these characteristics, they are also going to be similar in relation to having or not having high blood pressure, ultimately allowing us to determine our best guess on Joe’s high blood pressure.

While the method itself is no rocket science, what is new is the method that allows researchers to have a multitude of databases at their fingertips allowing them to make those guesses, something that was not possible before.

**Collecting Care Quality Data**

The second example relates to monitoring healthcare quality using cost measures. The concept is simple: Most hospitals and clinics are simply not equipped to collect data on the quality of care provided to patients. They will usually require dedicated personnel, databases, and a significant amount of the time healthcare professionals could otherwise be spending with patients. In contrast, every single hospital or clinic collects cost data.

The novel concept is that cost data can be used as a thermometer for quality of care. For example, when a group of patients in a given hospital start having a higher post-operative complication rate or requiring unexpected readmissions to the hospital, the costs for these patients will increase significantly.

Looking now from a detection perspective, every time an administrator sees a
greater degree of variability, a red flag should go up indicating the need for a deeper investigation into its causes. If the reason for variability is related to healthcare quality, then an opportunity is created to address them. In our group, this type of analysis is conducted with a host of open source tools, the central one being the statistical language R (2).

**Data-Driven Decision Support**

The third example is related to data-driven decision support at the point of care. Duke currently hosts anonymized data from close to 40 electronic health records around the country. In a project led by Dr. Kenneth Gersing at Duke and Dr. Ketan Mane at **Renaissance Computing Institute (RENCI)**, we now use this massive data set to predict which medications will lead to the best results for individual patients. For example, imagine a patient with depression who might not be doing well. She comes to the office and this predictive system analyzes her past, compares her to a massive data set, and then identifies a medication that will be the best choice for her.

To help doctors and nurses make better patient decisions, researchers at Duke and **Renaissance Computing Institute (RENCI)** build user interfaces that integrate Big Clinical Data onto a single screen that matches the clinician’s thought process and at the same time facilitates his/her decision-making process. Its uses the Medical Record Number (MRN) to identify patients and display demographic information.

*See Big Clinical Data, pg 4*
Emphasis on Support

There is really no going back when embarking upon the Big Clinical Data path to decision support. That being said, it is important to emphasize the support concept. In other words, data does not drive decisions and is no replacement for common sense and experience.

While the pharma industry is already actively engaging with Big Clinical Data, healthcare is just beginning to contemplate its use. In order to get there, two steps are essential. First, data should be made interoperable, ultimately ensuring that different data sets use similar standards so that they can be combined. It is only when massive data sets are assembled that the full power of data discovery is realized.

Finally, it is important to recognize that simply analyzing data is not enough. One has to be willing to listen to what the data says and then — the most important point — act upon it.

References

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Corporate Experience

Stopping Knowledge Loss in R&D

Knowledge management is not simple. Although much knowledge is often created in the development process, much is also lost as projects traverse the numerous, distinct phases of the gated control process so many companies have come to use.

Northeastern University Professors Marc H. Meyer and Tucker J. Marion investigated this phenomenon at 146 large multinationals in such complex industries as aerospace, automotive, electronics, and consumer products.

They observed that while many managers believe that information technology (IT) systems help lessen knowledge loss, current solutions fall short by leaving gaps or chasms in which knowledge is lost or translated in a way that defeats the original intent.

In this article they identify the primary areas of knowledge loss and
**Knowledge Loss from pg 4**

**highlight remedies management can apply.**

Three problem areas jumped out from our research:

1. **Customer, product and competitor information is often not shared well across corporate IT systems:** Also, the communication and integration of tacit knowledge within teams is by no means easy, especially because there is often no universal customer for a given innovation. One set of users will be tepid to a new idea while others appear wildly enthusiastic. This is classic customer segmentation within a given target market and it can make achieving clarity for the fuzzy front-end tricky.

2. **Lack of adherence to a unifying systems architecture within and across product lines:** Research that I (Meyer) carried out in 1976 with Al Lehnerd showed that adherence facilitates the use of shared parts and pieces, e.g., technology and product platforms.

3. **Ineffective commercialization of newly designed products:** This was particularly true for new products opening new channels to market, be it a new channel partner in a current market or a new geographic territory. Our interviews revealed that although most companies hired individuals knowledgeable about these new channels or geographies, their nuanced knowledge of the needs and requirements of new distribution partners and customers was not often used well. This knowledge was either brought into the innovation design effort too late to have the desired pre-launch beneficial impact, or if brought in earlier, was de-prioritized in terms of product, package, communication, and service design.

**Root Causes**

We detected three root causes for these kinds of information loss:

1. **Process-Induced Loss:** Processes for controlling R&D are often implemented as a sequential form of gated management. This system has the unintended consequence of creating gaps between stages in which knowledge—particularly tacit, hard-to-codify knowledge—can become lost, confused or misinterpreted.

2. **Domain Understanding-Induced Loss:** This so-called “Tower of Babel” phenomenon arises because specific corporate functions or groups are typically designated as primary owners of activities within certain phases of the overall process. Organizing work by assigning staff members from these various groups to project teams while still requiring them to report back to their functional managers can make them less receptive to knowledge developed by other groups.

3. **IT-Induced Loss:** Information technology ought to eliminate human error, or at least lessen its likelihood. It should also complement standard business processes by offering a seamless flow of data, information and knowledge.
across these processes. However, when it comes to R&D, this type of information pipeline is rare indeed.

For highly structured, explicit knowledge such as detailed engineering designs, the knowledge about subsystems and components can be more readily stated in documents or electronic files and then viewed in digital design diagrams or, better, prototyped models. However, such codification and transmittal for the tacit knowledge created in the process was so rare that only a few of our 146 firms reported any systematic method. A few maintained Microsoft SharePoint® folders, for example, to store user needs and concept diagrams. Others had developed specific home-grown systems to store and track user requests across the R&D roadmap. Nevertheless, most had nothing.

We did not find any company operating a single, pervasive content management system to house the innovation knowledge and information for the entire process. Typically, each stage was dominated by a different IT solution or a combination of solutions, none of which were integrated.

Moreover, we found no instance where the knowledge of channel strategies required for new products and services was codified and stored in such a way as to make it a portable and more generally useful knowledge asset. Go-to-market remains a failure point for many promising innovations.

What To Do

There are a number of obvious remedies for these knowledge management problems. For example:

• Placing up or downstream human resources together, face-to-face, fosters empathetic discovery and translation of tacit knowledge.

• Removing phase boundaries in gated development systems can be central to improving confluence.

• Adopting project wikis or groupware, which allow project visibility from team members throughout the innovation process. This includes extending the IT infrastructure to key suppliers.

• Centrally coordinated “architecture committees” — with architects from different product lines meeting regularly to identify specific opportunities and metrics for commonality and component reuse — bridged technology knowledge gaps for several leading companies.

Content Management System

A more fundamental solution path is to design and implement an information system that will enhance collaboration and information sharing in the new-product development process.
In the model illustrated here, each knowledge unit needs to be indexed or “tagged” in very specific ways to allow efficient query and retrieval. The typology used to index these knowledge units becomes the “schema” for the knowledge database.

One important tag is knowledge type. For example, “market information” would include size, growth and trend data for specific markets; “user information” on the expressed needs of target user groups, their use scenarios, personas, etc.; “engineering information” would include designs, component specifications, cost models, and suppliers. Meta-tags for manufacturing, sales, and financial information are equally useful.

See Knowledge Loss, pg 8
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A second important tag for each knowledge unit is an identifier for the specific product or service development in which the knowledge was created.

Third, R&D teams in many corporations are working on common engineered or manufacturing process components such as a common ingredient for a food manufacturer, a common engine/transaxle for an automobile company, or a common chemical for pharmaceutical firms. These are the product platforms.

A product tag versus a platform tag also becomes part of the recommended schema. A platform tag relates the R&D effort to core components used across multiple products, such as a software interface, a sensor or in the Mars’ chocolate world, for instance, a new low-fat chocolate recipe for different chocolate products.

Finally, it is important to identify the organizational affiliations behind the contributor of the knowledge unit, be it by function or division within the corporation, or a supplier external to it. Innovation teams in our field research told us that having visibility into the source of the customer insight is an important part of assessing credibility and value. It also becomes a convenient way of retrieving all content from particular departments, divisions or vendors if one wishes to gather a broad historical sweep of said contributions.

When formed and indexed in this way, the knowledge repository, or database, becomes one in which participants in the innovation process can search for information by a specific domain, product application, platform type, or company affiliation to quickly gather knowledge they require more efficiently and, of course, more effectively.

Most of the companies we surveyed had some type of digital design and PLM (product lifecycle management) IT-based system to leverage existing data from PLM suites like PTC Windchill®. Nevertheless, none viewed these systems as solving the types of knowledge management problems identified here, particularly for managing the identification and implementation of specific customer requirements or needs.

As an executive of one of the leading PLM software global vendors told us, “We can’t find one company that does this well. Companies are still using the same old examples. We even joined a government project to see how the front-end information could be translated to engineering, but it was no help. This needs to be addressed. There is tendency for information [to be] lost and a lack of systematic thinking throughout the process. But it’s hard to get people to move beyond disparate systems. It’s easy to use a spreadsheet.”

Hopefully the ideas we’ve presented here will help you move beyond such disparate systems!
Further Reading


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Entrepreneurship

Prize-winning Startup Began with Request for Executive’s Business Card

The Samba Parades are over, the Carnival King has been crowned and the half-million foreign visitors have departed Rio de Janeiro’s famed Carnaval. Their place is being taken by a very different group of celebrants: an estimated 3,000 entrepreneurs, investors, researchers, and policymakers from 125 countries comprising the fifth annual Global Entrepreneurship Congress (GEC).

The GEC describes itself as a “gathering of startup champions from around the world...helping to bring ideas to life, drive economic growth and expand human welfare.” (www.gec2013.com). It opened on March 18 with Ewing Marion Kauffman Foundation and Dell sponsors.

The Best and Brightest Startup

David Osei is one of the self-styled “startup champions” attending the four-day Rio celebration. A prize-winning inventor-entrepreneur from Ghana, the 25-year-old Osei is a co-founder of Dropifi, which was judged “the best and brightest new startup” among nearly 400 applicants from 56 countries at the 2012 Startup Open in Accra. Osei told IMR he was anxious to network with the investors and business people in Rio and learn all he could about best practices and global entrepreneurship.
Startup Open is a featured initiative of Global Entrepreneurship Week (GEW), a collection of 35,000-plus competitions, seminars, training sessions, and other events that have brought thousands of innovators from 120 countries together each November since 2008 “to help them explore their potential as self-starters and innovators” (www.unleashingideas.org).

Supported by the Kauffman Foundation, Dell, Startup Digest, and Startup Weekend, GEW attracts any entrepreneur who has experienced a “startup moment” during the previous 12 months. The organizers define such a moment as “anything that can be interpreted as the company is ‘open for business’.”(www.startupopen.com).

Over the past three years, 1,227 startups from 59 countries have competed at Startup Open, says GEW executive VP Mark Marich.

**A Different Web Messaging Platform**

Osei’s startup moment came in 2011 when he started Dropifi with fellow post-graduate students Effah Philips Mensah and Kamil Nabong. Their product is a web messaging platform in which the conventional reply button is replaced by “a smart widget that allows companies to better analyze incoming messages, discover the real personalities and emotions behind messages and rechannel them to the right persons in their organizations based on business rules they set.”

Dropifi’s website, www.dropifi.com, invites prospects to “Turn Your Site Visitors into Loyal Customers” by connecting to them “emotionally” and utilizing real-time business analytics. The software “widget” enables an email recipient to learn more about the sender, including identity, interests and tone (e.g., positive or negative), and thereby reply more effectively, Osei said.

At the time of this writing, Dropifi was in beta trials with 300 clients around the world, some paying between $5 and $29 for full-feature access, according to Osei.

Ghanaian startup Dropifi won grand prize for “an intuitive contact widget that brings to businesses a new breath of air in lead generation, customer engagement and simplified customer support.” Its founders, from left to right, are Kamil Nabong, David Osei and Effah Philips Mensah.
Dropifi was awarded grand prize at the 2012 Startup Open on the basis of its growth potential, market knowledge, business concept, and ambition. Joey Pomerenke, one of the judges, observes that there are millions of contact forms on the Internet but most are old technology and give recipients little more than a name, address and the sender’s message. “The problem Dropifi was trying to solve was to make the contact form more intelligent,” he explains. “No one had really addressed that yet. A problem like that has huge market potential.”

The prize was Osei’s all-expenses-paid trip as an official delegate to the Rio GEW.

**Getting Started**

Osei told a blogger for Venture Capital in Africa ([www.vc4africa.biz](http://www.vc4africa.biz)) in a December 2011 interview that he conceived the original concept for Dropifi after requesting a business executive’s card at a meeting and watching the man “wade through an enormous pile of cards” to retrieve his own. “I figured out then that collection, organization and storing of business cards must truly be a huge task,” Osei explained to Mac-Jordan Degadjor in the interview.

This encounter led Osei, in 2006, to envision a mobile app to help people handle their cards, but he received little encouragement from the entrepreneur he pitched the idea to. Following that, Osei, who had graduated from the Kwame Nkrumah University of Science and Technology with a B.S. in math, enrolled in the new Meltwater Entrepreneur School of Technology (MEST).

MEST is funded by the Meltwater Group to train and mentor “aspiring African software entrepreneurs with the goal of creating wealth and jobs locally in Africa.” As an aspiring entrepreneur, Osei continued talking with executives about mobile applications until by 2011 his original idea had evolved into an online platform that allowed businesses to respond easily to consumer queries. Joined by two other Meltwater students—Mensa and Nabong—he officially formed Dropifi in February 2012, with Mensa as chief technology officer and Nabong as business manager. Osei is CEO.

**Awesome Experience**

In November 2011, the trio participated in the GEW Startup Weekend at MEST. Startup Weekend, sponsored by the Kauffman Foundation together with the Gates Foundation, Google for Entrepreneurs, Microsoft, Amazon, and .CO Internet, calls itself “a global network of passionate leaders and entrepreneurs on a mission to inspire, educate and empower individuals, teams and communities” ([http://startupweekend.org](http://startupweekend.org)). Offered the opportunity “to launch a startup in 54 hours,” more than 45,000 people from 100 countries have come together in some 400 cites since 2009 for the weekend-long workshops at which they pitch ideas, form teams, receive feedback from peers, and hopefully start their own companies.

*See Prize-winning Startup, pg 12*
“Startup Weekend Accra was an awesome experience.”

“Startup Weekend Accra was an awesome experience,” Osei told blogger Degadjor. “Building a product from customer discovery to idea validation within three days or less proved more effective than the traditional months I used to prototype an idea.”

Osei says the experience gave his team a more viable product along with $50,000 seed funding from the Meltwater Group. Currently one of Meltwater’s incubator companies, Dropifi has brought on three interns and engaged a patent lawyer.

In his November 6, 2012 blog, “Entrepreneurs as Dissidents,” entrepreneurship expert Steve Blank wrote that “some small segment of founders are truly artists—they see something no one else does.” Asked whether he considered himself an artist or just a company founder, David Osei replied that he sees himself as an artist. Rio might help him complete the picture.

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Corporate Experience

How Kelly Services Creates Its Culture of Innovation

Creating a culture that fosters innovation goes beyond simply telling employees why innovation is necessary. Employees need to see firsthand that they have an important role in generating the creativity that enables innovation to flourish, and they need to learn how to think differently.

Rolf Kleiner, Kelly Services Chief Innovation Officer, is showing employees how idea generation and collaboration can power innovative solutions to real-world business-related challenges. Here’s how Kelly Services is fostering a culture of innovation among more than 8,000 employees around the world.

Helping employees at a large company see the connection between the nebulous concept of innovation and the everyday world of corporate reality isn’t an easy task. The keynote presentation by Heather Yurko at the 2012 CIMS Spring meeting sparked my interest (see “Building Your Innovation Culture,” CIMS IMR Jan./Feb. 2013). Her “idea jam” session provided a hands-on exercise in ideation.
I shared Yurko’s presentation with Kelly’s Global Learning department. With their insight and input from additional sources, we developed a model for our own idea jam session—an innovation road show—to help employees learn how to think differently.

Five trained facilitators travel throughout North America, Europe and the Asia-Pacific region, conducting live sessions according to a rollout schedule based on geography and instructor and audience availability. They also conduct virtual road shows as needed. Our intent is to reach all operating units in field and headquarters locations. Each event lasts two to three hours, and has two purposes:

• To outline Kelly’s approach to innovation and the role of every employee in the process.
• To provide participants with the tools and knowledge necessary to conduct the road show for their own teams in the future.

Making It Real

The first part of the road show is strictly to educate. We discuss why the Office of Innovation exists and provide clarity and urgency around the need to innovate. A video we created sets the tone and makes participants feel compelled to act based on strong data about trends around us. This usually fuels a lively discussion among participants as to why innovation is necessary for the survival of Kelly Services.

The second part of the road show is a four-step idea jam session—our hands-on ideation exercise. First, we present the group with three relevant business-related challenges (predetermined by the group’s leaders). Examples of challenges include “how to build a credible image of competence for engineering and IT recruitment services in our market” and “how to gain the competitive edge in solution delivery to clients.”

The group selects one challenge to focus on for the remainder of the exercise, and then the jamming begins. Notes are written on easels throughout the session for everyone to see.

Step 1. We set the stage by discussing “assumptions.” We talk about their definition, the dangers of relying upon them, whether they are accurate, and the implications of challenging the status quo. Then we brainstorm and talk openly about the existing assumptions related to their selected business challenge. This discussion usually creates considerable distress as participants explore the constraints they operate under, but that’s expected.

Step 2. We separate participants into groups of 5 to 10 to flip the assumptions and generate provocative “what if” questions. We ask, “What if the assumptions and restrictions we operate under didn’t exist?” The goal is to help the group let go of existing assumptions and boundaries. Once the creativity...
starts flowing, you can feel the energy in the room. The volume rises and the mood swings up higher as each group reports their favorite “what if” questions to all participants.

**Step 3.** Each group creates an opportunity statement that can be further developed into a solution. The statement is created from a formula that clearly identifies who benefits, the advantage that is delivered, and the objection the solution will address. This step forces participants to anticipate how the target audience will react to innovation. Each group shares their opportunity statement with all participants.

**Step 4.** With the opportunity statement in hand, each group shapes an innovation by applying the “what if” questions generated earlier. This is when the mood in the room is at its best. Participants realize they can challenge what has always been and make improvements. They begin to craft the solution based on their opportunity statement, and they see that we don’t have to impose limitations on ourselves. Again, each group reports their solution to all participants.

This “pull” approach to ideation enables participants to think freely about our business, as opposed to feeling enslaved to it. They’re engaged, and they’re having fun. We often hear comments like, “I didn’t know we were allowed to do this,” or, “Now I get it.”

**Keeping It Alive**

To sustain the momentum following the session, we immediately invite each participant to join Inno-voice, our online virtual innovation community that serves as a pathway for ideas to continuously bubble up throughout the company. Leaders are also given materials to conduct additional idea jam sessions on their own. (We suggest one session per quarter.)

We are also forming a network of Innovation Champions throughout the company. Employees are appointed to the role based on their demonstrated passion for innovation, and anyone working anywhere in the company is eligible. These individuals dedicate 10 percent of their annual work time to serving as a focal point for innovation and related change activities within their geography and organization.

**Innovation In Action**

We currently have a variety of ideas progressing through our innovation process, and many of them are a result of our road shows. The most promising ideas likely to be implemented relate to leveraging technology to enhance our service delivery model.

With our global rollout well under way, we’re making great strides toward helping our employees condition their minds to generate ideas and experience
the power of collaboration. With more practice, they will all become more comfortable with sharing, combining, and refining ideas. And we expect to make even greater strides toward realizing the true benefits of a culture of innovation.

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Tips for Success

Gain executive sponsorship. Early on, our CEO and COO reinforced the importance of creating a culture of innovation in messages to all employees, and they continue to do so. Their support is critical to sustaining the organization’s innovation strategy.

Connect with your participants. Make the road show relevant to your business. Consider creating a video or presentation to demonstrate the sense of urgency for your industry, and carefully choose challenging topics that employees can relate to for the ideation exercise.

Gather a diverse audience. Every participant brings a unique perspective. The various tenures, levels of responsibility, and roles within the organization will all affect the spirit of the exercise. Greater diversity in the audience will yield greater ideas.

Prepare participants. Tell them in advance why they should attend. Let them know the event is informative and interactive, not a two-hour lecture.

End on a high. The positive energy created during the jam session can be infectious. At the end of the session, facilitate a discussion to bring it all together. Point out how brainstorming around the topic changed their perceptions and encourage participants to embed these exercises into their daily jobs.

— R.K.

INVENTOR’S VOICE: No Traditions or Hierarchies

“The loose organization and the lack of feeling of hierarchy made it possible that anybody could talk to anybody else in utter trust.”

Virginia Powell Strong was a 22-year-old chemist when she was hired at the Massachusetts Institute of Technology’s famed Radiation Laboratory in January 1943. The History Center of the Institute of Electrical and Electronics Engineers has called the “RadLab” operation “one of the most important episodes in the history of twentieth century science and technology” and “a prototype of an institution for achieving rapid technological advance.”

Strong was one of a small female technical staff and worked on the then-infant
INVENTOR’S VOICE from pg 15

Hastily set up in the fall of 1940, MIT’s Rad Lab made major contributions to the development of microwave radar technology in support of embattled Britain and the entire war effort. Here its technicians work in a rooftop tarpaper shack dubbed the “Roof Laboratory.” Photo courtesy of MIT Museum.

technology of crystals for rugged rectifier switches in radar sets. They handmade “everything from melting the silicon in a vacuum chamber to the final testing.”

Asked by William Aspray of IEEE History Center what it was about the RadLab management that made it so “very effective and very special,” she replied:

“It started small. You’re not coming into General Electric. You’re starting a General Electric, you see. So you don’t have any traditions or hierarchies to deal with. People were humble about what they didn’t know. Many of these people were not natural managers, but they learned to be or they found managers or good secretaries that could take care of that, while they were dealing with something else. There was no precedent. It was made up as it went along.

“Second, it had very bright people and very dedicated people. I think that was important. The loose organization and the lack of feeling of hierarchy made it possible that anybody could talk to anybody else in utter trust. I think those would be the managerial skills that I thought were evident. You couldn’t see territoriality.”

Virginia Strong was interviewed in 1991 by William Aspray for the IEEE History Center, Rutgers University, New Brunswick, NJ. It can be found at http://www.ieeeeghn.org/wiki/index.php/Oral-History:Virginia_Powell_Strong
Innovation Lit: Venture Capitalists, Inventors, U.S. Innovation, Startups, Global R&D Funding, Higher Ed, Internet of Things

“Something Ventured: Risk, Reward and the Original Venture Capitalists”; film by Dan Geller and Dayna Goldfine, executive-produced by Silicon Valley VC Paul Holland and Molly David of Rainwater Communications. Information and purchase at www.somethingventuredthemovie.com

“In the beginning they barely knew what they were doing…” introduces interviews with ten venture capitalists and eight entrepreneurs who created a brand new industry that will likely remain a model for innovation and economic growth for years to come. The series begins with pioneering VC Arthur Rock recalling what happened in 1957 when he received “an unusual letter” from eight engineers who had just left Shockley Semiconductor in California. He is followed by Tom Perkins, Don Valentine, Gordon Moore, Dr. Herbert Boyer, Mike Markkula, Sandy Lerner, and others who recall the opportunities they saw where others saw only risk.


Industrial designer and inventor Brett Stern interviewed 23 inventors not, he writes, to produce a recipe book for inventing and commercializing a product but rather to let readers hear “real inventors speaking candidly about what possesses them every day of their lives: the passion to question the status quo and invent the future.” The collected interviews include Gene Frantz (DSP chips), Robert Dennard (computer memory), Helen Greiner (robotics), Bob Loce (imaging systems), Martin Keen (footwear), and Steve Wozniak (PCs).

Rising to the Challenge: U.S. Innovation Policy for Global Economy; Charles W. Wessner and Alan Wm. Wolff, Editors; Committee on Comparative National Innovation Policies: Best Practice for the 21st Century; Board on Science, Technology, and Economic Policy; Policy and Global Affairs; National Research Council; 2012; 573 pp.,$72.00 (paper) from National Academies Press, www.nap.edu

Warning that “the pillars of the U.S. innovation system” are eroding “through wavering financial and policy support,” this committee report calls for paying “far more vigorous attention to capturing the outputs of innovation -- the commercial products, the industries, and particularly high-quality jobs to restore full employment.” It finds that the U.S. is losing “its once-overwhelming advantage in research,” as the nation’s share of global R&D spending dropped from 39% in 1999 to 34.4% in 2010.
Among its specific recommendations: Fund R&D at the higher levels authorized under the America COMPETES Act and sustain these levels while boosting private and public R&D expenditures to 3% of GDP by 2020. Also stabilize and then increase the state and federal funding for university research.

*Startup Ecosystem Report 2012, Part One;* Bjoern Lasse Herrmann, Max Marmer, Ertan Dogrultan, Danny Holtschke with academic contributors Steve Blank (Stanford University) and Ron Berman (UC Berkeley); 125pp; download from [http://blog.digital.telefonica.com/](http://blog.digital.telefonica.com/)

Twenty startup ecosystems worldwide are ranked and analyzed on the basis of research by Telefónica Digital (@tefdigital) and the Startup Genome (@startupgenome) using data from 50,000 users of StartupCompass.co. The study reveals that while Silicon Valley is still the largest and most-influential startup ecosystem, communities in Latin America, Europe, the Middle East, and Asia are beginning to challenge the Valley’s domination in technology innovation. For instance, the report finds that Tel Aviv, a highly advanced ecosystem, is the leading alternative to Silicon Valley, while flourishing communities in Los Angeles, Seattle and New York City rank 3, 4 and 5, respectively, in their ability to foster entrepreneurship.


This article summarizes and then dismisses the various assertions that innovation and new technology are failing to drive economic growth around the world. It argues that such models fail to account properly for the rise of the emerging world. However, “In the end, the main risk to advanced economies may not be that the pace of innovation is too low, but that institutions have become too rigid to accommodate truly revolutionary changes.”

“The University’s Dilemma”; Tim Laseter; *strategy+business*, Nov. 27, 2012; [www.strategy-business.com/article](http://www.strategy-business.com/article)

“In the face of disruptive change, higher education needs a new, more innovative business model,” writes this U. of Virginia Darden School professor and former Booz & Co, partner. He wants universities to rethink what they do, starting “with an explicit articulation of the customer value proposition and design a path forward that leverages technology to deliver it.”


The 19th annual forecast from Battelle and *R&D Magazine* sees global R&D spending growing by 3.7% in 2013 to $1.496 trillion. It expects the largest share of this increase, $22.9 billion, to come from China continuing its yearly double-digit hikes in R&D investments, while inflation-adjusted U.S. R&D declines 0.7% in 2013.

“Acting in these nine ways guarantees that there will be little or no innovation of any significance, because no one had the time, money or motivation,” writes this Harvard Business School professor. After reading her prescription, re-read “Ten Ways to Inhibit Innovation,” CIMS Innovation Management Report Jan/Feb 2013, pp.14-15.


This article reviews the outlook for “The Internet of Things,” when everything is interconnected without human intervention. With standards playing a critical role, emphasis is on relationships the Institute of Electrical and Electronic Engineers (IEEE) is forming with Chinese and other international groups and companies.

InnovationChart: SMEs Need Innovation Help

Small and medium enterprises (SMEs) “are the backbone of the European economy in terms of job creation and economic growth,” says a new report by an international consortium led by A.T Kearney for the European Commission’s IMP³rove initiative, which helps Europe’s SMEs manage innovation. Nevertheless, “many SMEs do not fully understand the importance of Innovation Management as a driver of long-term competitiveness.” These firms, many family-owned, need a systematic approach, the report asserts.

IMP³rove: High-Impact Innovation Management, Europe INNOVA paper No. 18, draws these conclusions from a database on innovation management and business performance among more than 3,000 SMEs. The data and chart below show that mature SMEs are less agile than young SMEs. They grow at a slower rate in terms of both income and the number of employees, and they achieve a lower profit margin than the younger SMEs.

While SMEs between 2 and 15 years of age grow their average income 27.4% annually, the income of mature SMEs in business for more than 15 years grows on average 8.6% annually. In addition, their income from innovation is lower (23.2% vs. 37.8% annually).

“Growth champions—those SMEs that show a higher growth rate in terms of income, profit and number of employees—rely on systematic Innovation Management at strategic, operational and cultural levels,” says the IMP³rove
“To survive in today’s highly volatile innovation landscape, SMEs need to create a continuous flow of new ideas and require managerial capabilities to turn these ideas into profitable growth.”

The report is available at www.improve-innovation.eu. There is also an online benchmarking questionnaire that SMEs in the United States can fill out to receive an individual report showing their innovation strengths and weaknesses.

The IMP³rove initiative has also provided the basis for a European model to develop the innovation management capabilities in Europe. This IMP³rove approach is described as “a comprehensive suite of Innovation Management support services for the different actors in the innovation eco-system. It combines Innovation Management assessment and benchmarking for SMEs with Innovation Management consulting services, with training and certification in Innovation Management and in Innovation Management consulting.”

The IMP³rove approach will be offered on a global scale by the non-profit IMP³rove—European Innovation Management Academy, according to Eva Diedrichs of the IMP³rove Core Team (Eva.Diedrichs@atkearney.com). In Europe, the Academy, which is supported by the European Commission, Directorate General Enterprise and Industry will help regions to integrate the IMP³rove tools in new programs that enhance the innovation management capacity of SMEs, Diedrichs says.