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Computers with Common Sense

35 INNOVATORS UNDER 35

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October 5 - 8, 2015

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A WATERSHED FOR WATERSHEDS.

Half of the Everglades has already disappeared. Now the remaining half of this fragile ecosystem is at risk from pollutants in stormwater runoff.

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From the Editor

Seven over 70

Every year we celebrate 35 innovators under the age of 35. We choose to write about the young simply because we want to introduce you to the most promising new technologists, researchers, and entrepreneurs.

But older people are, of course, just as capable of new thinking as the young. Below are seven innovators over the age of 70, still working.

1. Bob Kahn, who is 76, invented (with Vint Cerf) the Transmission Control Protocol (TCP) and the Internet Protocol (IP), the communication protocols that relay data around the Net, and was responsible for the systems design of the Arpanet, the first packet-switched network. Today he is the chairman and CEO of the Corporation for National Research Initiatives (CNRI), an organization he founded that funds and develops network-based technologies. His most recent research has focused on the development of a "digital object architecture," which enables various information systems and resources to work together.

2. Sidney Yip, born in 1936, is a professor emeritus of nuclear science and engineering at MIT. After notionally retiring in 2009—having taught for 44 years and published more than 300 papers and the *Handbook of Materials Modeling* (2005), the standard reference book in the field—he continues to do important research. For instance, he suggested (with MIT senior research scientist Roland Pellenq) a new recipe for concrete that increases its strength while reducing the carbon emissions associated with producing cement.

3. Judith Jarvis Thomson, 85, another of MIT's professors emeriti, is a philosopher best known for the elaboration of thought experiments called "trolley problems," which test our moral intuitions. In the most famous trolley problem of all, Thomson asks her readers to imagine pushing a fat man onto a track in order to stop a runaway trolley from running over five people. She remains keenly interested in questions of rights and normativity (whether, ethically, one *ought* to do or refrain from doing something). Trolley problems are useful in thinking how autonomous vehicles and military robots could be programmed to behave in ways consistent with most people's moral intuitions.

4. The great chemist **John Polanyi**, who was awarded the Nobel Prize in 1986 for his contributions toward understanding the dynamics of elementary chemical processes, is still busy at age 86. His work at the University of Toronto uses scanning tunneling microscopes to study chemical reactions that might help us build devices at very small scales. Polanyi's father, Michael, the Hungarian chemist, philosopher, and economist, defended the liberty of scientific thought; the son, too, is concerned with public affairs, and he often speaks or writes about nuclear weapons and social justice.

5. Paul Greengard, born in 1925 and a 2000 Nobel laureate in medicine, still works on average six days a week, from 9 A.M. to 10 P.M., at Rockefeller University, where he researches what causes brain disorders like Alzheimer's disease and schizophrenia. One major area of research in Greengard's lab is the search for the cellular and molecular basis of depression; his researchers recently described a protein that plays a central role in the regulation of moods.

6. Helen Murray Free, 92, developed a series of self-testing kits for diabetes while working at Miles Laboratories in the second half of the last century. The tests transformed the way people with diabetes monitor their disease, helping make it into a manageable condition. Since retiring in 1982, she has devoted herself to promoting science education, particularly for young women and minorities.

7. Rudolph A. Marcus, who is 92, is a Caltech chemist who was awarded the 1992 Nobel Prize "for his contributions to the theory of electron transfer reactions in chemical systems." The Marcus theory, named for him, describes the rates at which an electron can move or jump from one chemical species to another. Today the Marcus Group at Caltech researches a wide variety of chemical phenomena, including ozone gas formation and semiconductor quantum dots.

But write to me at jason.pontin@technologyreview.com, and tell me your favorite counterexamples to the prevailing youth chauvinism.

GUIDO VITTI

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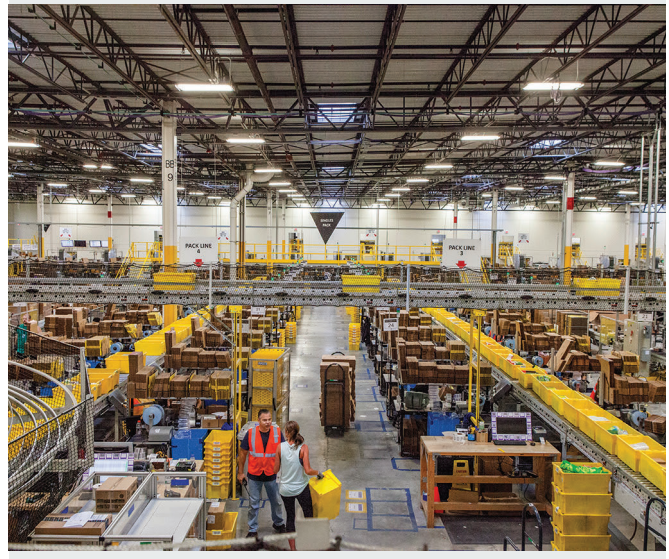

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BUSINESS REPORT

REVIEWS

54 YEARS AGO

ON THE COVER:

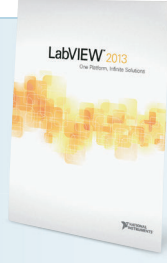
Illustration by Bendik Kaltenborn

PHOTOGRAPH BY LAUREN LANCASTER

Smarter Embedded Designs,
Faster Deployment

The combination of NI LabVIEW system design software and reconfigurable I/O (RIO) hardware helps small design teams with varied expertise develop demanding embedded applications in less time. Using this graphical system design approach, you can take advantage of the same integrated platform to program embedded processors and FPGAs for faster application development in industries ranging from energy to transportation, manufacturing, and life sciences.

LabVIEW system design software offers ultimate flexibility through FPGA programming, simplifies code reuse, and helps you program the way you think–graphically.



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Technology Review
One Main Street, 13th Floor
Cambridge, MA 02142
Tel: 617-475-8000

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De Technologia non multum scimus. Scimus autem, quid nobis placeat.

REPUBLIC OF TURKEY PRIME MINISTRY
INVESTMENT SUPPORT AND
PROMOTION AGENCY

R&D, Innovation, and Turkey's Technology Ecosystem

Over the past 13 years, the Turkish economy has more than tripled, achieving a gross domestic product (GDP) of $800 billion in U.S. dollars in 2014. This remarkable performance, a culmination of more than a decade of steady growth, resulted from a sound macroeconomic strategy combining prudent fiscal policies with major structural reforms.

An increase in both public and private R&D expenditures accompanied that growth, with the nation's gross domestic expenditure on research and development (GERD) increasing to $6.5 billion in 2013. While Turkey's business R&D spending as a percentage of GDP—0.95 percent in 2013—is below the European Union average of 1.26 percent, Turkey's leaders believe the country's average annual growth rate of 12.5 percent over the last decade will narrow that gap soon.

In fact, Turkey has set an ambitious target of reaching a GERD/GDP ratio of 3 percent by 2023, a goal that takes into full account the net positive impacts of technology, R&D, and innovation in achieving long-term economic and social development. To facilitate that effort, the Turkish government is actively working toward a structural transformation to help companies design, develop, manufacture, and sell higher-value products in global markets.

INCENTIVE TO INNOVATE

One catalyst for this transformation will be a range of support and incentive programs currently being prepared to greatly encourage the manufacturing of technology products. Among those offering such support and incentive packages are the Scientific and Technological Research Council of Turkey (TUBITAK), the Small and Medium Enterprises Development Organization (KOSGEB), the Ministry of Science, Industry, and Technology (MoSIT), and local development agencies.

TUBITAK, which advises the government on scientific matters, plays a leading role in improving Turkey's research environment. To that end, TUBITAK offers a rich variety of grant-based support programs designed to increase the number of Technology Development Zones (or "technoparks"), R&D centers, and related projects in Turkey, which, in turn, will ensure ongoing dynamic innovation in the coming years.

Technoparks: Turkey's Technology Development Zones

Turkey's technoparks were established to support the development and production of software and other technologies through effective cooperation among universities, research institutions, and the private sector. One prominent example is the ITU Arı Teknokent in Istanbul, which draws on the resources of nearby Istanbul Technical University, a 242-year-old institution that offers more than 30 engineering degrees.

The technoparks also aim to attract qualified foreign direct investment that will increase Turkey's R&D potential, allow technology transfer, and commercialize R&D projects and innovative ideas. As of June 2015, 3,325 companies in 61 technoparks employed 33,380 staff engaged in R&D and innovation activities, with software and information and communication technology representing the most active sectors.

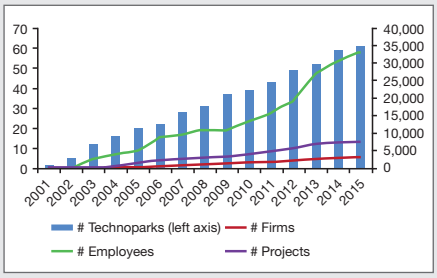
For more information, visit: invest.gov.tr

The ITU Arı Teknokent in Istanbul is among Turkey's 61 "technoparks."

Overview of Incentive and Support Programs

Republic of Turkey R&D Center Support	A company's R&D expenditures during a fiscal year are tax-deductible. An employee with a doctoral degree is subject to a 90 percent income-tax reduction. An employee with a master's degree is subject to an 80 percent income-tax reduction. Half of an employer's share of insurance premiums for R&D and support staff is covered by the Ministry of Finance for five years. New scientists can receive capital grants of up to TRY100,000 (about $37,000) for technology initiatives.
Scientific and Technological Research Council of Turkey (TUBITAK)	Grants cover all project-related expenses, including: • Overhead. • Travel. • Equipment, software, and publications. • Supplies and consumables. • Consulting from private and public sectors both in and outside Turkey.
Ministry of Science, Industry, and Technology (MoSIT)	MoSIT offers financial support via grants of up to 75 percent of a project's budget. Testing and laboratory services are provided by the universities where projects are being carried out.

Growth of Turkish Technoparks, 2001-2015



Source: Turkish Ministry of Science, Industry, & Technology

Feedback

E-mail letters@technologyreview.com

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Letters and comments may be edited for both clarity and length.

Five Most Popular Stories

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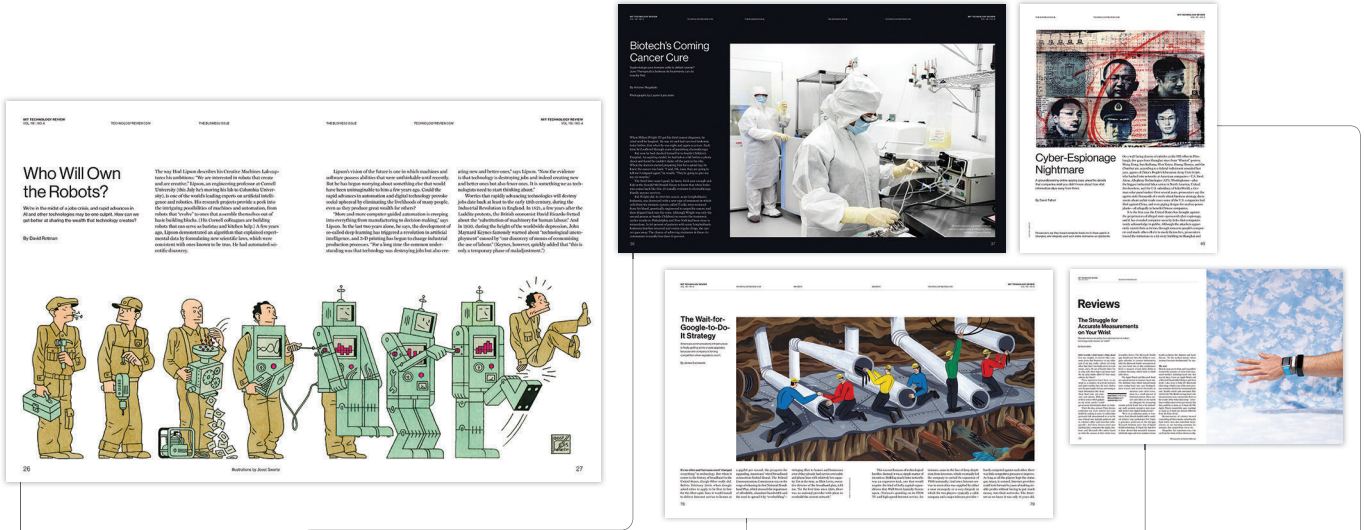
Volume 118, Number 4



1 Who Will Own the Robots?

One possible outcome is that people will adopt a protectionist stance against goods and services produced via highly automated processes. Instead, they will create and participate exclusively in markets for goods and services that maintain a significant human component throughout the production process (the new "organic"). People are clearly willing to pay more for sustainable products in the interest of preserving the environment. How much will they be willing to expend in the interest of preserving themselves?
—**QEV_N_NY**

2 The Coming Cancer Cure

Any approach that relies upon the immune system is going to have a lot of individual variability, and unfortunately, I suspect that many individuals in need of these treatments will have less than perfect immune systems going in. For now, it seems that this is far more of a niche treatment than a widely applicable approach. And of course, "curing cancer" in a general sense has always been a misnomer—it's not a single disease and there is not, therefore, a single cure. —**acowan**

3 The Wait-for-Google-to-Do-It Strategy

Here in India we may have pathetically slow Internet connectivity, but one thing we don't have is a monopoly or duopoly. In practically every part of the country we have something like six or seven service providers to choose from. This keeps the prices down. —**pmshah1946**

Take a look at the neighborhoods that Google Fiber is operating in. They are all areas of affluence that already had top-tier service with great speeds. Google isn't trying to "save broadband for the people." They are testing markets for profitability. —**mg1989**

4 The Struggle for Accurate Measurements on Your Wrist

In the case of diabetes, better testing via wearable sensors could relate to tighter glucose control, but this is a medical issue, not just a "health" issue, and once you cross the line to a medical issue, you are held to a higher standard. If the glucose reads 150 on a device when it's really 45 and the patient drives and crashes his car, the company can be held liable for making a defective device.
—**garygech**

5 Cyber-Espionage Nightmare

If we buy hardware from China, we may be purchasing spyware embedded into the hardware itself. Recently, the NSA has been accused of this. It would make sense for the Chinese to do it also. Back to the days of extranets?
—**wood.22mark**

Some of the remedies suggested sound useful, but none are feasible under current conditions. The very companies most vulnerable to the hackers might find reasons to keep doing business with a state actor such as China—what would their bottom lines look like without Chinese suppliers? —**ka5s**