National Cheng Kung University ● July 24, 2014 ● Tainan, TW

SATU Presidents' Forum of Southeast and South Asia and Taiwan Universities

MOOC Tool for Economic Growth

Dr Shoumen Palit Austin Datta

For additional information please visit http://bit.ly/MIT-Made-in-Taiwan

Dr Shoumen Palit Austin Datta ● SVP, Industrial Internet Consortium (www.iiconsortium.org) ● Research Affiliate, School of Engineering, Massachusetts Institute of Technology (MIT) ● http://bit.ly/S-Datta

DISCUSSION

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- History
- Context
- Purpose
- Economy
- Denominator
- Data
- Temporary Conclusion

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Made in Taiwan

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History of MOOCs

Why history ?

See three good reasons … C … C … C …

Study the past if you would define the future
— Confucius

Nescire autem quid antequam natus sis acciderit, id est semper esse puerum
To be ignorant of what occurred before you were born is to remain always a child
— Cicero

The farther backward you can look, the farther forward you are likely to see
— Churchill

The UC Berkeley Interactiv ×   ntiaotiant2.ntia.doc.gov/t ×

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96071 University of California/Berkeley

Executive Summary

This a Demonstration project intended for the Pre-School and K-12 Education primary application area and the Community-wide Networking secondary application area. The University of California, Berkeley, working in partnership with San Francisco and Oakland Unified School Districts, San Francisco and Oakland local government, community based organizations, and industry, will develop a model of how to use information infrastructure to best support K-12 students, their families, and teachers in disadvantaged urban communities. We will identify a set of Internet based outreach methods and partnerships that will enable us to help underserved students succeed in school and be prepared for college, careers, citizenship, and lifelong learning. We seek to develop a national model replicable by other universities and communities.

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1. Problem Definition

The broad *problem* we will address is how the University of California, Berkeley can best provide service to the community. In particular, we will focus on how to help K-12 students and their families in disadvantaged and diverse urban neighborhoods; and how to provide this assistance in a partnership of support with schools, local government, and community based organizations (CBOs).

This problem has two sides. In poor urban communities, the barriers students face to academic and career success are substantial. In the neighborhoods we will focus on---the South East Corridor of San Francisco and West Oakland---we see from 60-90% of students from AFDC families, on average 40% of students graduate high school, virtually no students have access to computers in the home, and those that do rarely have parents who can help them. In Oakland last year, as an example, only 12 African American students were eligible for UC, Berkeley. (See Appendix A for Target Area and Community Indicators.)

University outreach programs and other University faculty, students, and staff can make a difference. For example, UC systemwide studies show that well organized outreach programs can have a profound impact as indicated by the fact that 75% of current minority students at UC were participants in outreach efforts. The need for such interventions has become much more acute with the UC Regents' recent decision to eliminate affirmative action admissions criteria.

But University outreach activities face significant challenges; and this is the other side of the problem we address. The Berkeley campus, in response to elimination of affirmative action criteria, has initiated a major new campaign to preserve campus diversity and to provide a top quality education for students who are representative of California's diverse population: *the Berkeley Pledge*. The Pledge, in partnership with Superintendents from key Bay Area school districts, will work to create a "pipeline" of a small set of schools from elementary to middle to high school (to college) in economically disadvantaged and ethically diverse neighborhoods. But even with this renewed commitment, the campus faces barriers in delivering and organizing its rich human resources for service: barriers of distance, limited faculty and student time to participate, few channels to allow large numbers of interested volunteers to each contribute small amounts of time, gaps in outreach program focus, little coordination between outreach programs, and insufficient partnerships with other institutions.

The challenge then is how can a University with rich human resources and collections of materials best marshal its efforts to help the lives of disadvantaged students and families, to support teachers, and to assist neighborhoods? And how can it do this not on its own but with other critical community institutions?

Information infrastructure is a key to solving this problem. Properly deployed and applied, Internet tools may: allow a far larger number of campus members to interact with students and families; engender new types of effective service relationships; bring teachers curricular materials and tools for innovating teaching; link the campus and schools to community based projects; and facilitate the sharing of integrated information on outreach initiatives.

July 1, 1996
US Department of Commerce
National Telecommunications and Information Administration

The UC Berkeley Interactiv × | ntiaotiant2.ntia.doc.gov/t ×

ntiaotiant2.ntia.doc.gov/top/docs/nar/pdf/416096071n.pdf

We will use an Internet based network infrastructure to link together the University, schools, local government participants, and community based organizations. The local and wide area network infrastructure is principally in place; building this infrastructure is not the focus of this project. Pacific Bell's substantial contribution ($2 million) to the project will allow schools in San Francisco to upgrade many of their wide area connections to T1 speeds. IBM will commit half a million dollars in staff time and software to the San Francisco School District. Oakland schools will upgrade many of their Internet connections to higher speeds as well. Funding secured through HUD's Joint Community Development grant will allow us to hook up 24 CBOs in Oakland. San Francisco CBOs will be supported by Pacific Bell and with some contributions from the San Francisco Unified School District. We will install a limited number of Pentium and Apple computers (7 of the workstations funded by this grant) to set up at least two school/community computing centers for after school/community activities; and we will install 10 Internet desktop video conferencing systems. (See Appendix C for a table of network and computing resources used in the project.)

In our work, we will leverage a series of technology initiatives in the schools and communities such as school district technology plans, home computer programs, Net Day '96, IBM's reinventing schools program, and a HUD funded Joint Community Development project to build community information infrastructure in Oakland with CBOs. (See Appendix G for a description of important technology initiatives).

Building this project upon the Internet not only allows Berkeley and its partners to draw upon substantial experience with the Internet, but ensures *interoperability* of networks. Defining *scaleable* outreach methods is a principal aim of our examination. Providing a range of curricular resources on the WWW certainly scales, but, even more importantly, we plan to train teachers to train other teachers to use such curriculum in the classroom. It is also a principal focus of this project to determine how to *institutionalize* Internet interactive programs in schools and CBOs. At the end of this project Internet based outreach methods will be a central component of: the outreach activities of all 20 campus groups participating in this project, the Berkeley Pledge pipeline schools, and the participating CBOs. Each partner has made the commitment to make use of the best practices that are identified here. Finally, the Berkeley campus has embarked on major policy and technology analyses regarding *privacy of end user* information. We intend to join with the schools to share this work and ensure that clear policies, procedures, and safeguards are implemented.

The complex and substantial collaboration required for this project will be addressed by a robust project management structure and dedicated project staff from the University, schools, and government agencies. Key elements of this structure are a multi-institutional Steering Committee and Operations Committee; project management staff at Berkeley; a technologists' committee which will bring together campus Internet technology and service experts to provide the project leading edge Internet expertise; and a small set of collaborative pilot projects, each with its own project coordinator responsible for testing innovative strategies in partnership with campus outreach groups, schools, city government, and community partners. (See Appendix E for project management structure.)

July 1, 1996
US Department of Commerce

foundation of multi-institutional partnership. The uniqueness of our effort is heightened by seismic shifts in affirmative action policy, and consequent rethinking of outreach programs. We believe this project will be one of the first to identify a comprehensive program for the use of information infrastructure for University community service.

In urban and other communities, Universities are often one of the most important resources for public service. Faculty disciplinary experts, outreach programs, enthusiastic and intelligent students, and knowledgeable staff represent a vast pool for community assistance. As is the case with Berkeley, many of these Universities live in close proximity to communities with great need; and many are not doing near what they are capable of and would like to carry out. If we can develop a linked set of information infrastructure based methods, programs, collaborative strategies, volunteer channels, mentoring relationships, curricular delivery systems and the like, this will be of great benefit to a wide range of urban communities and higher education institutions.

The model is financially viable because it will allow Universities to provide more service at the same or decreased cost; because it will develop a range of Internet based strategies from limited efforts to full scale partnerships for service, enabling other institutions to choose their degree of cost; and because it should generate on-going support from industry and other partners.

4. Applicant Qualifications

UC, Berkeley is one of the world's leading research and teaching Universities with a distinguished history as a leader in public service. Berkeley's Interactive University project is a campus wide consortium of twenty campus academic departments and outreach programs---the Interactive University Partners---who are collaboratively exploring how to use information infrastructure for community service. Each of these campus groups are currently conducting community service projects, some with national reputations, and many of them are already making use of information infrastructure for outreach. These groups will bring to this project disciplinary experts (faculty, graduate students, and professional staff); outreach experts and staff; pedagogy specialists; experienced K-12 project evaluators; technical experts in Internet connectivity, transport technology, and Internet tools; and experienced project administrators. These individuals will participate in all areas of the project.

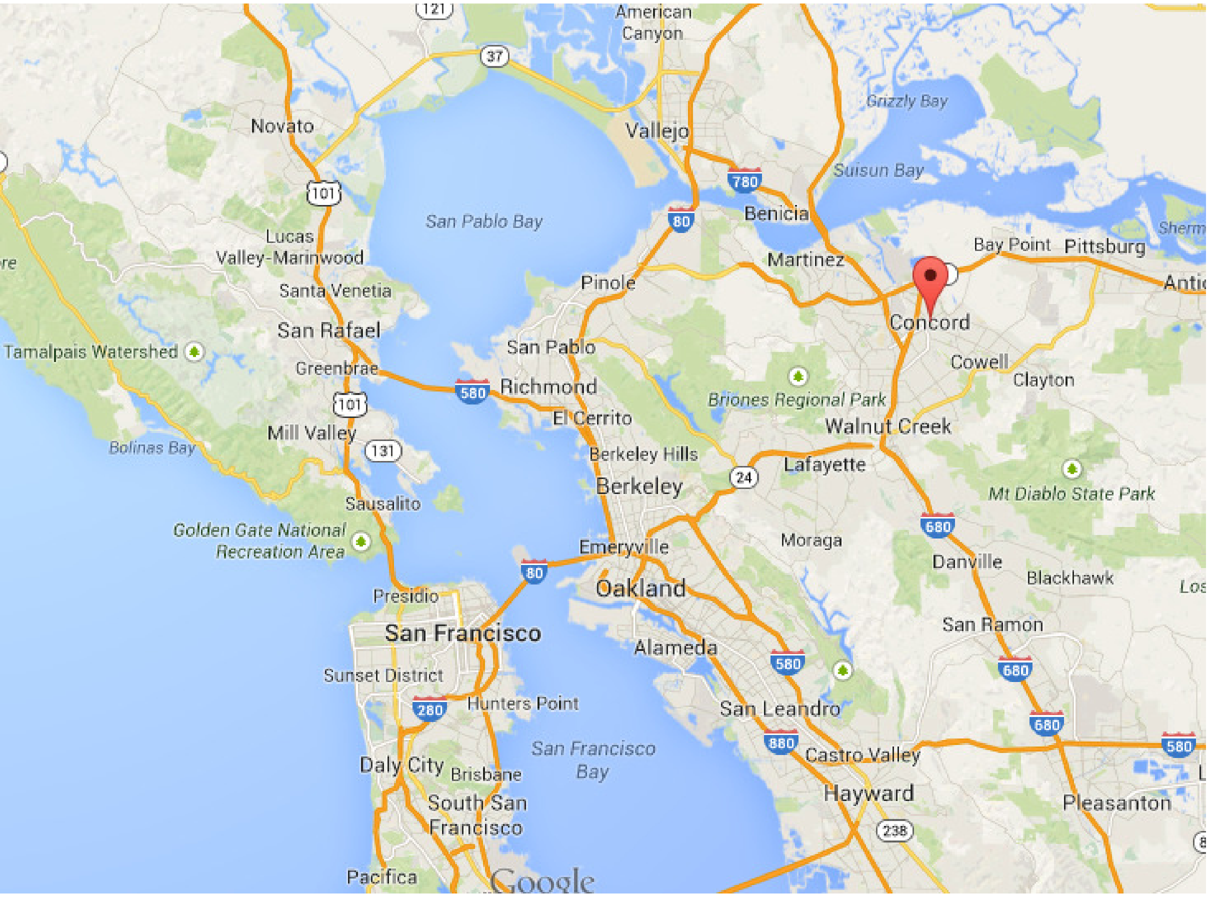
The project's sponsor and principal investigator is The Vice Chancellor and Provost Carol Christ, the chief academic officer on the campus, as well the leader of the Berkeley Pledge. A group of UC professors, in particular B.Sadoulet, A. Agogino, J. Innes, are closely involved with the project. The Interactive University Project Director is David Greenbaum, who has been leading Berkeley campus efforts to use the Internet for community service, and is directing or co-leading several federally and industry funded projects focused on K-12 schools and community based organizations. The Interactive University project is housed in the campus's Information Systems and Technology division, responsible for all computing and communications at the Berkeley campus. Berkeley will hire professional staff for project management, technology coordination, project evaluation, and administrative support. We will make substantial use of graduate and undergraduate students to act as pilot project evaluators, trainers, mentors, and support staff. (Please see Appendix F, for a detailed description of the new staff and participating campus groups.) The campus will be pledging over $1.5 million to this project, of which $350,000 will be direct monetary contributions.

5. Partnerships And Community Support

Project partners are the San Francisco Unified School District (SFUSD), the Oakland Unified

July 1, 1996
US Department of Commerce

NetDay 1996



President Bill Clinton installing computer cables with Vice President Al Gore on NetDay at Ygnacio Valley High School in Concord, CA. March 9, 1996.

EDITORIAL -- Tien's Alternative To Affirmative Action

Tuesday, January 2, 1996

http://www.sfgate.com/opinion/article/EDITORIAL-Tien-s-Alternative-To-Affirmative-2999656.php

IT WOULD HAVE been easy enough to accept the end of affirmative action at the University of California as a bad decision by the board of regents and leave it at that, but UC Berkeley Chancellor Chang- Lin Tien is not one to acquiesce quietly.

The public got a taste of the popular chancellor's polite but fierce determination at the July 20 meeting in which the regents voted 14-10 to abolish university hiring and admissions policies that consider race. Firmly but respectfully, Tien, a strong advocate of affirmative action, addressed Governor Wilson directly, challenging the chief executive's stance against policies that take ethnicity into account.

That confrontation may have hurt Tien's chances to be named the new UC president, but it held intact his well-earned reputation for valuing principle over expediency.

Keeping in character, Tien also did not wait for orders from on high before developing a plan to maintain a commitment to ethnic diversity at the prestigious Berkeley campus in spite of the regents' decision.

Two months after the regents' vote, Tien unveiled The Berkeley Pledge, a program designed to ensure that minority or low-income public school students will be eligible to attend Berkeley. Besides committing $1 million of university money to the program, Tien pledged $10,000 a year of his own salary, for at least three years.

San Francisco Chronicle

SFGate.com

How MOOC was born - forgotten facts

Tien and his family fled to Taiwan in 1949. Tien earned a BS in mechanical engineering from the National Taiwan University in 1955, MA and PhD in mech engineering from Princeton University in 1959. He served as the Chancellor of UC Berkeley from 1990-1997. He died (67) on Tue 10/29/2002.

Dr Shoumen Palit Austin Datta ▪ SVP, Industrial Internet Consortium
Research Affiliate, School of Engineering, MIT ▪ http://bit.ly/S-Datta

In addition, the Pledge calls for principals of elementary and high schools to identify promising students for whom UC Berkeley outreach efforts

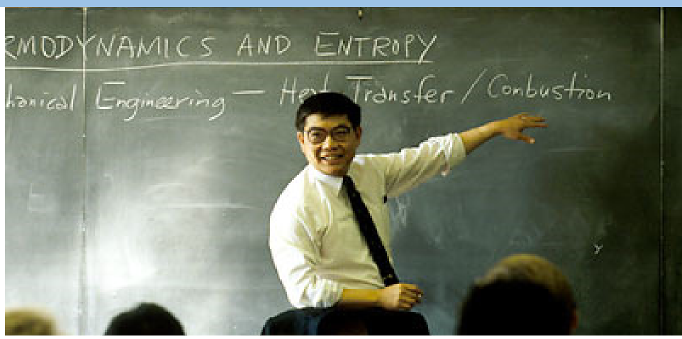
--such as special summer sessions, mentoring by professors and vigorous recruitment -- could make the difference between eligibility or ineligibility for admission to Berkeley.

And it includes a promise to try to raise $60 million for scholarships as well as to make sure that minority and poor students recruited and admitted to Berkeley get the academic support they need to prevent them from dropping out.

As reported by Chronicle staff writer Nanette Asimov, the philosophy behind the Pledge already is showing signs of working in San Francisco schools, thanks to Shoumen Datta, the district's creative director of development. Datta has created a board of 23 scholars -- including 17 Nobel Laureates -- to act as academic guides for both teachers and students. Taking the idea of the Pledge, Datta is molding it to the needs of San Francisco students who might otherwise have fallen through the cracks.

Officials at other UC campuses, as well as administrators and teachers at the elementary and secondary level, would do well to follow the examples of Tien and Datta, who are demonstrating a commitment to finding opportunities for minorities who are underrepresented at UC -- even while others make their jobs more difficult.

Conceptualization of MOOC



Professor Chang-Lin Tien at UC Berkeley

My Photos > **Gallery of Friends** > Photo 232 of 700

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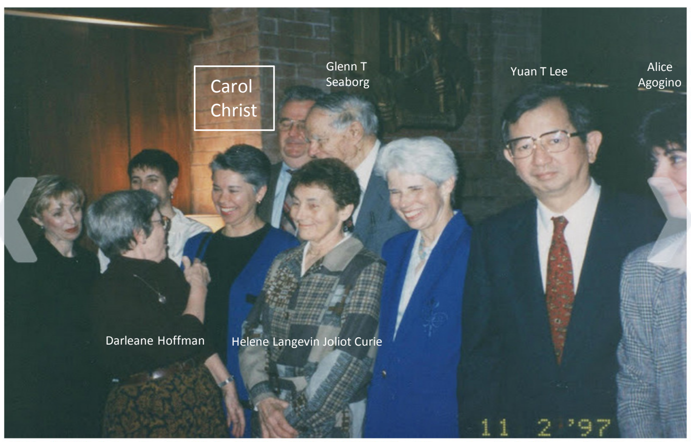


At the UC Berkeley Faculty Club with Carol Christ, UCB Vice Chancellor, Nobel Laureates Yuan T Lee and Glenn Seaborg, Helene Langevin Joliot-Curie, Professor Alice Agogino (extreme right, next to Yuan T Lee). Attache from the Consulate of France, Catherine Rodriguez, is at the extreme left. 11 February 1997. edit

UC Berkeley Interactive University Project

Building Connections To A World Of Ideas

Home | About | Current News | IU Archive | Projects | Support & Partners | Contact

Scholar's Box Project | CITY|*Watershed* Project | IU/CDL Collaboration | Digital Learning Materials

About The Interactive University Project

Our Mission

The Interactive University Project uses the Internet to open UC Berkeley's resources and people to California's K-12 schools and citizens. Our goal is to use technology for the improvement of teaching and learning while making accessible the knowledge in universities, museums and libraries.

What is the IU?

The Interactive University is a unique campus-wide initiative of UC Berkeley and K-12 community partnerships. Since 1996 the IU has:

- Organized and implemented more than three dozen campus/K-12 Projects in three successive phases;
- Provided grants and support to 40 Berkeley campus units;
- Received $4.8 million in grants;
- Established and sustained strong partnerships with Oakland and San Francisco Schools;
- Developed a model for large-scale campus involvement with public and K-12;
- Begun to implement a Scholar's Box Tool for teacher and student use in gathering, creating, sharing and saving curriculum components.
- The IU Team. Contact us here.

http://iu.berkeley.edu/IU/

Our Goals

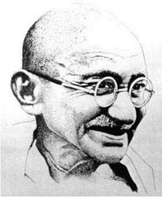
- Engage the academic core of the Berkeley Campus to add value to research, teaching and learning.
- Partner with K-12 teachers and support improvement in student achievement.
- Develop tools and environments in the Scholar's Box suite that enable university faculty, K-12 teachers, and all students and learners to gather, create and share digitized information.
- Create content, web-based events, and projects that will scale and be replicable.
- Learn from current campus and national partnerships to achieve our mission and support learning communities.

Statement from Director David Greenbaum

California's K-12 schools need support to improve student outcomes. The scope and challenge of meeting this need are daunting. In the San Fransicso Bay Area there are over 50,000 K-12 teachers and a million students. UC Berkeley has a diverse community of 40,000 faculty, students and staff, and houses growing repositories of digital content from all fields. But only a fraction of Berkeley's human and digital resources are easily available to UC faculty and K-12 teachers. The IU is working to make digital resources readily available to learners throughout California.

MOOC 1996 – It was / is not about the technology

In 1996, probably the 1st MOOC-esque activity was initiated when UC Berkeley started an online math tutorial to help students in San Francisco public schools.



Live as if you were to die tomorrow. Learn as if you were to live forever.

1996

Another First

1996
Another First in SF Public Schools

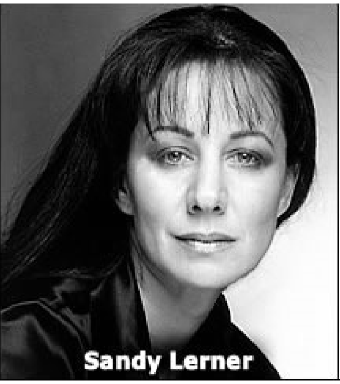
Felicia Voss, Student at Thurgood Marshall

CISCO SYSTEMS
NETWORKING ACADEMY

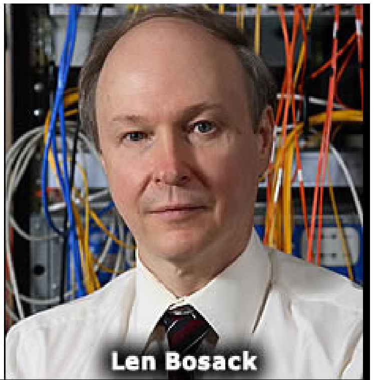
The Cisco Networking Academies program is in its first full year at schools. The pilot semester at one site, Thurgood Marshall Academic High School in San Francisco, provides an indication of the potential impact: more than 15 percent of the students involved in the school's semester program in spring 1997 secured summer jobs as a direct result of their one-semester experience.

And for teachers who have seen the early impact on students and their futures, the Academy stands as a model for school-to-work programs.

Dennis Frezzo technology instructor at Thurgood Marshall, says, "In one leap, Cisco has helped us have the most effective school-to-work program I've seen locally, and we're proud of that."



Co-founders of CISCO



George Ward, Co-Creator
Cisco Networking Academy

Cisco Networking Academies Program

Through an innovative partnership with school districts across the U.S., Cisco Systems is preparing students for the demands and enormous opportunities of the information economy while creating a qualified talent pool for building and maintaining education networks.

Network switches. Routers. Patch cables and punch-down blocks. RJ-45 jacks. Not your ordinary list of back-to-school supplies. Then again, for students across the country in a unique new curriculum known as Cisco Networking Academies, the Fall '97 semester was anything but your ordinary back-to-school experience.

Now in the early stages of a nationwide rollout leading to international participation, the Networking Academies is a cooperative venture between school districts and Cisco, the world leader in networking for the Internet. In a lab setting that closely corresponds to the real world, students get their hands on the building blocks of today's global information networks, learning by doing as they design and bring to life local and wide-area networks.

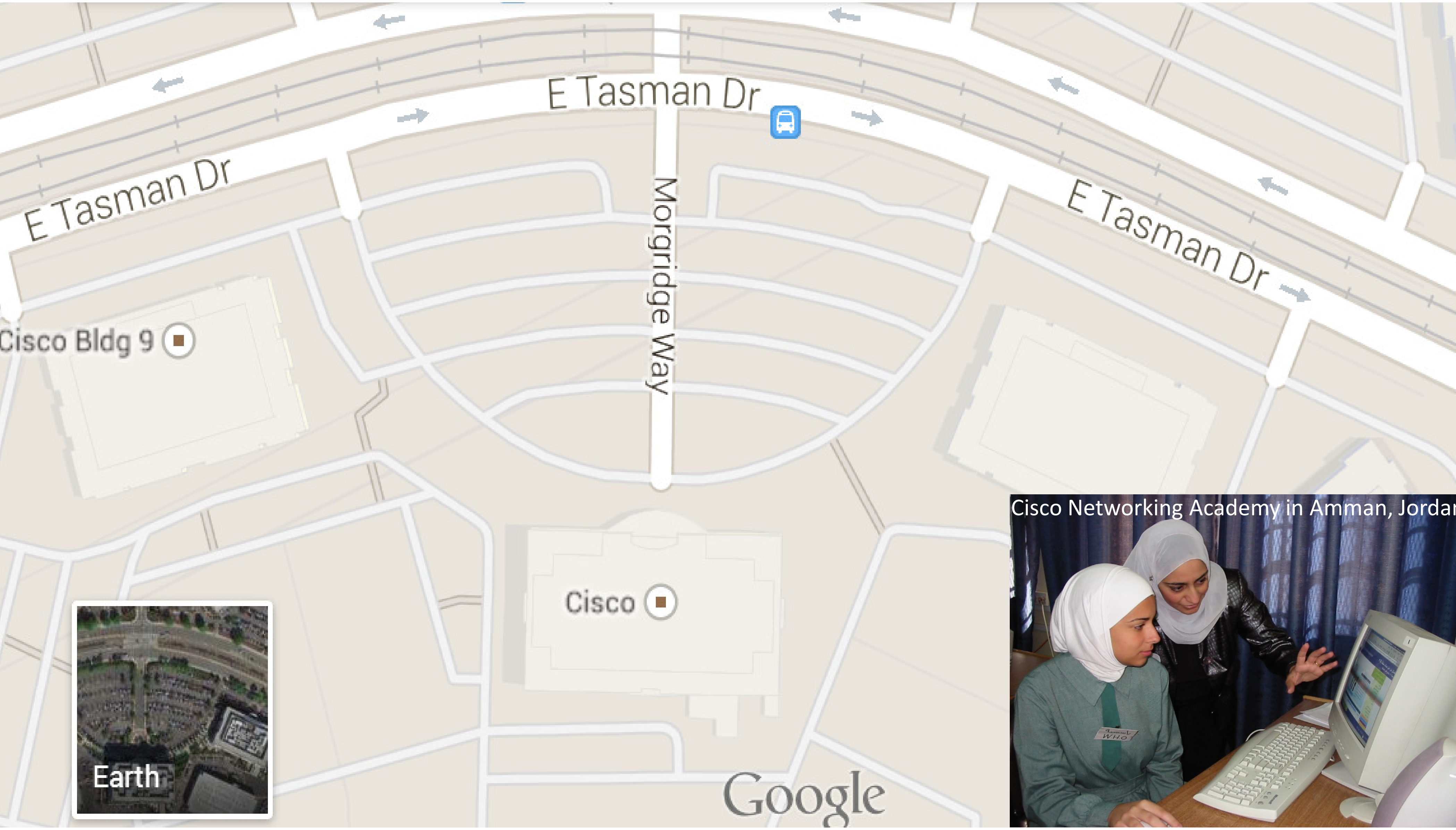
The Challenge

The information economy will demand an unprecedented level of technology literacy from tomorrow's workers. A few statistics foreshadow a potential crisis in the American workplace:

- Currently, mid- to large-sized companies in the U.S. alone have about 190,000 unfilled technology jobs. And 82 percent of technology companies expect to increase their information technology (IT) staffs in the next several years.
- Nearly 70 percent of technology companies cite a lack of skilled IT workers as a barrier to growth.
- As teachers around the world begin to integrate the vast resources available to them on the Internet and as networks become an important tool for boosting administrative efficiency

Cisco Networking Academy MOOC

The Forgotten Revolution ?



Cisco Networking Academy in Amman, Jordan

Teachers … not technology

Dr Dennis Frezzo, Teacher

Benefits and Results

The Cisco Networking Academies program is in its first full year at schools. The pilot semester at one site, Thurgood Marshall Academic High School in San Francisco, provides an indication of the potential impact: more than 15 percent of the students involved in the school's semester program in spring 1997 secured summer jobs as a direct result of their one-semester experience.

And for teachers who have seen the early impact on students and their futures, the Academy stands as a model for school-to-work programs.

Dennis Frezzo, technology instructor at Thurgood Marshall, says, "In one leap, Cisco has helped us have the most effective school-to-work program I've seen locally, and we're proud of that."

"The energy level of these students is so high, it's hard to find the words to describe it," says Barry Williams, who oversees Regional activities for the Round Valley School District in Springerville, Arizona. "Once, about half of my students had permission to leave school about 20 minutes early. But not a single one left. I talked topologies and media for 90 minutes without a break."

Close-Up: Thurgood Marshall Academic High School Section

San Francisco, California

Thurgood Marshall Academic High School (TMAHS) was established in 1994 in the economically underdeveloped southeast corner of San Francisco. Focusing on a math, science, and engineering curriculum, the school gives students a rigorous course of academic study with an abundance of college-prep math, science, and English classes, plus three semesters of computer and technology electives.

The Cisco Networking Academies curriculum has been integrated into one of three areas for concentrated study selected by all TMAHS students after they reach their junior year. Juniors take Cisco I and II, and seniors complete the program with Cisco III and IV, supplemented by projects and courses in related engineering disciplines. "This is above and beyond what we normally do, but we thought this was an incredible opportunity for the kids," says Frezzo.

According to Jai Gosine, another Academy teacher at TMAHS, "Certification is the biggest benefit" for the school's nearly 70 Cisco Networking Academies students, who are spread among three classes. "Potential employers of students who earn their Cisco Certified Networking Associate status will feel comfortable hiring them," he says, "because they'll know these students have acquired a set of practical, valuable skills."

The Networking Academies program is also project-based, with students addressing challenges drawn from the real world of networking and finding solutions that work, not only in theory but in the model networks built and tested in the lab.

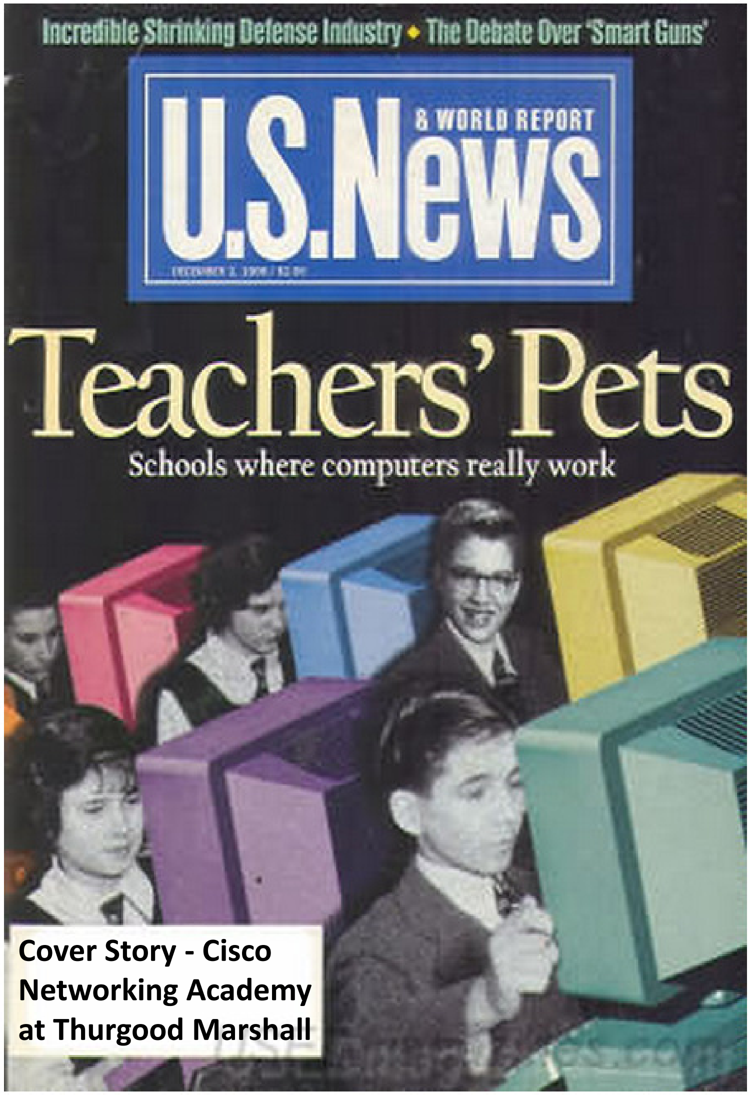
"A lot of people use these clichés, but they're really true," says Frezzo, "The old style of teaching was 'the sage on the stage.' Now we're trying to be the 'guide on the side,' helping in counseling and problem solving."

Senior Ricky Jackson notes, "The lessons aren't based on homework or tests so much. We do more hands-on work."

The project-based learning format helps truly instill skills that otherwise might be forgotten soon after the final exam, Jai Gosine explains. "A student's level of learning is determined by the form of assessment. In our case, it's not how much they can regurgitate, but how much they can do." Adds Frezzo: "Projects provide the ultimate in performance assessments. Was the job complete? Did the network work, with no excuses?"

Dr Dennis Frezzo (1996) with Jenica Lee at Cisco Networking Academy class in TMAHS

Report December 02, 1996



Cover Story - Cisco Networking Academy at Thurgood Marshall

A Role for the Internet in American Education? Lessons from Cisco Networking Academies

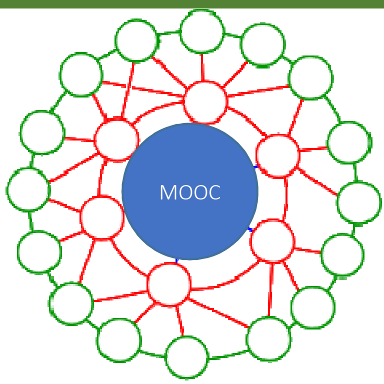
*Richard Murnane, Nancy Sharkey, and Frank Levy**

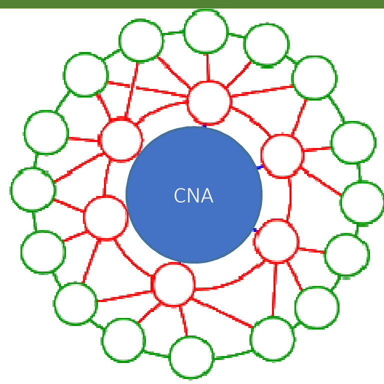
NATIONAL ACADEMY OF SCIENCES

As of July 2001, Cisco Networking Academies—located in all 50 states and 130 countries—were teaching more than 160,000 students how to design, build, and maintain computer networks. The students learn from a common curriculum offered that is in nine languages and delivered over the Internet. Since the majority of Cisco Networking Academies in the United States reside in public high schools and community colleges—institutions that educate the vast majority of American youth—the team developing the Academy program confronted many of the same problems that beset American education. This paper describes how the Cisco Academies team dealt with these problems and particularly the use it made of information technology in crafting solutions.

SAN FRANCISCO CHRONICLE – the complete newspaper article from December 25, 1995
www.sfgate.com/news/article/PAGE-ONE-UC-Berkeley-Is-Taking-The-Pledge-3017592.php

To have been an instrument, a wheel and a true catalyst in not one but two influential endeavors is serendipity as well as a miracle and a blessing.





Good to connect with you.

Kevin Warner

July 8, 2014 2:34 PM

I was just thinking about you last week when I was describing to my nephew how the Cisco Networking Academy launched in the fall of 1997. You played an important role in the success of that launch.

S.F. AHEAD OF THE GAME

Several Bay Area school districts -- including Oakland, West Contra Costa and Berkeley -- have expressed interest in joining with the university under the Berkeley Pledge. But Christ and others said San Francisco is already far ahead in this area, even though the details of the Pledge have not yet been worked out.

That is because San Francisco has a secret weapon: a molecular biologist named Shoumen Datta. Hired as the district's development director in March, Datta's goals coincide with those of the Berkeley Pledge: "To bridge the gap between university culture and public school culture," he said.

Born in Calcutta, where he lived on the same block as Mother Teresa, Datta grew up to study at Princeton and Rutgers, and to teach at Harvard and the Massachusetts Institute of Technology.

American universities are world-renowned, he said, but they rarely share their brains and resources with their country cousins, the public schools. Nor do schools, in desperate need of a scholarly infusion, take advantage often enough of a university's treasures.

Nanette Asimov, Chronicle Staff Writer
Published 4:00 am, Monday, December 25, 1995

"It is as if we have a golden dome with wobbly pillars," said Datta.

To help strengthen those pillars, the scientist has forsaken a lucrative career in industry.

"Doing this is not my job," he said. "This is my mission."

ADVISORY BOARD

The Berkeley Pledge is providing support, but Datta is helping to invent the Pledge as he goes along.

For example, he created an academic advisory board for San Francisco schools like none the district has ever had. Twenty-three noted scholars make up the list -- including 17 Nobel Laureates, from economist Kenneth Arrow of Stanford to physicist Kenneth Wilson of Ohio State.

This constellation of the nation's greatest brains comes straight from Datta's personal address book. Through him, all have agreed to make themselves available to teachers needing scholarly advice. And through him, teachers seeking grant money and curriculum assistance now have valuable friends directly connected to such academic societies as the American Physical Society and the National Academy of Sciences.

The challenge, said Datta, will be for urban teachers to take advantage of the offerings of these groups, as wealthy suburban school districts routinely do.

"You should see what they're doing with physics in the Palo Alto schools!" Datta said. "We can do that, too."

San Francisco Chronicle

NOBEL LAUREATE'S VISIT

Professor Charles Townes of UC Berkeley has already spent two days in San Francisco schools

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Research Affiliate, School of Engineering, Massachusetts Institute of Technology ● shoumen@mit.edu

Would you please allow me to digress?

Do you know who coordinated the visits?

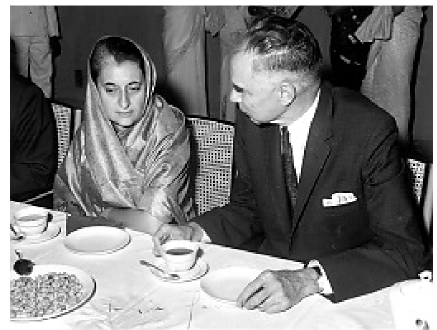
With Nobel Laureate Charles Hard Townes (center) and student Miss Sarah Spoon (right) during the visit of San Francisco schools by Nobel Prize winners for the Distingusihed Lecture Series 1995

Miss Sarah Spoon, 11th grade student at Thurgood Marshall Academic High School in Hunter's Point, San Francisco with Nobel Prize winner Glenn T Seaborg in his office in Lawrence Berkeley Laboratory, University of California (Berkeley). edit

















A Nation At Risk:



Niels Bohr, James Franck, Albert Einstein, Isador Rabi

Princeton, 1954

The General Advisory Committee to the United States Atomic Energy Commission meets for the first time at the War Department in Washington, D.C., 1947. From left to right, (seated): Professor Enrico Fermi, University of Chicago; Professor Glenn Seaborg, University of California; Hartley Rowe, Vice President, United Fruit Company; James B. Conant, President, Harvard University; (standing in back): Hood Worthington, chemical engineer; E.I. Dupont and Company; Cyril Stanley Smith, University of Chicago; and Professor I.I. Rabi, Columbia University

McMillan, Seaborg and Oppenheimer at UC Berkeley

Seaborgium – Sg 106

Discussing California Standards with Glenn Seaborg at his last (86th) birthday (Sunday 19 April 1998). His birthday reception was held on Monday 20 April 1998 at the Lawrence Berkeley Laboratory (Room 70A). Glenn passed away on Sunday 25 February 1999. edit

“My most important discovery”

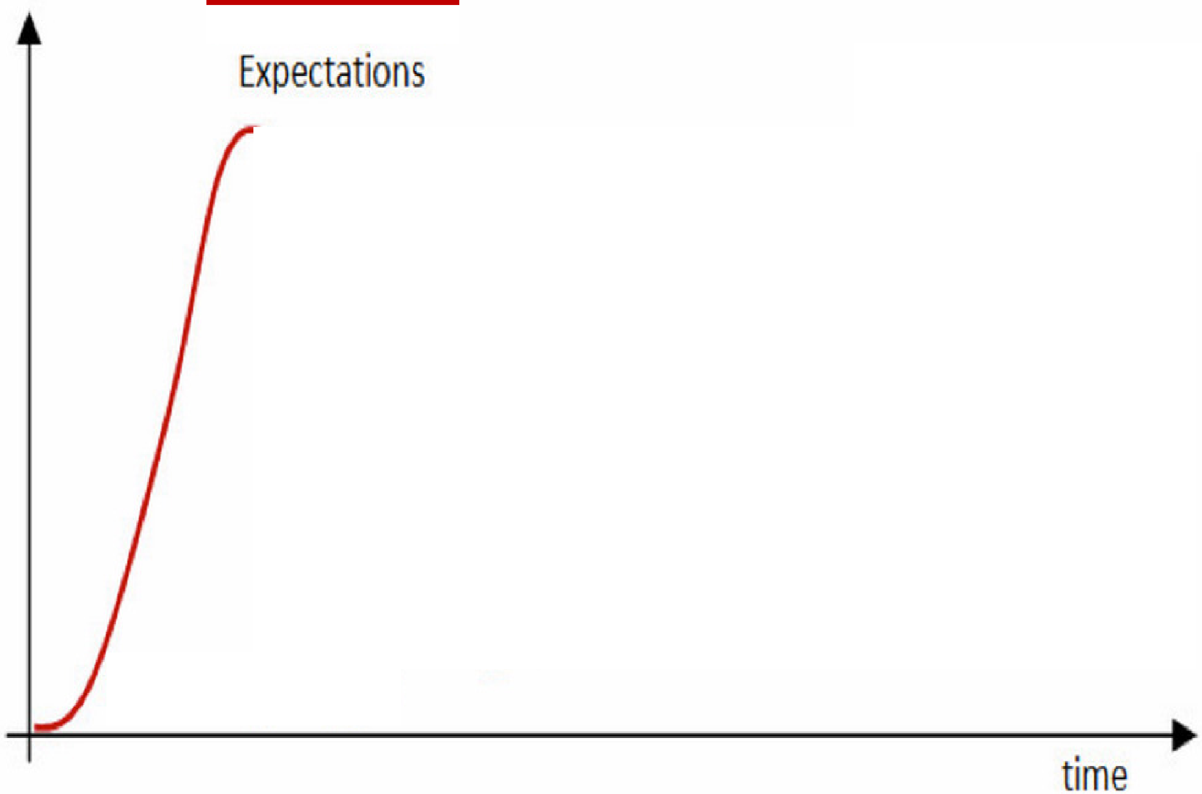
Glenn T Seaborg

fast forward

Fast Forward 2012

The New York Times

The Year of the MOOC



The Year of the MOOC

Clockwise, from top left: an online course in circuits and electronics with an M.I.T. professor (edX); statistics, Stanford (Udacity); machine learning, Stanford (Coursera); organic chemistry, University of Illinois, Urbana (Coursera).

By LAURA PAPPANO
Published: November 2, 2012

IN late September, as workers applied joint compound to new office walls, hoodie-clad colleagues who had just met were working together on deadline. Film editors, code-writing interns and "edX fellows" — grad students and postdocs versed in online education — were translating videotaped lectures into MOOCs, or massive open online courses. As if anyone needed reminding, a row of aqua Post-its gave the dates the courses would "go live."

Go to Education Life »

Related
The Big Three, at a Glance (November 4, 2012)

The paint is barely dry, yet edX, the nonprofit start-up from Harvard and the Massachusetts Institute of Technology, has 370,000 students this fall in its first official courses. That's nothing. Coursera, founded just last January, has reached more than 1.7 million — growing "faster than Facebook," boasts Andrew Ng, on leave from Stanford to run his for-profit MOOC provider.

"This has caught all of us by surprise," says David Stavens, who formed a company called Udacity with Sebastian Thrun and Michael Sokolsky after more than 150,000 signed up for Dr. Thrun's "Introduction to Artificial Intelligence" last fall, starting the revolution that has higher education gasping. A year ago, he marvels, "we were three guys in Sebastian's living room and now we have 40 employees full time."

"I like to call this the year of disruption," says Anant Agarwal, president of edX, "and the year is not over yet."

By TAMAR LEWIN
Published: December 10, 2013 | 337 Comments

Two years after a Stanford professor drew 160,000 students from around the globe to a free online course on artificial intelligence, starting what was widely viewed as a revolution in higher education, early results for such large-scale courses are disappointing, forcing a rethinking of how college instruction can best use the Internet.

Online education: MOOCs taken by educated few

Ezekiel J. Emanuel

Nature **503**, 342 (21 November 2013) | doi:10.1038/503342a
Published online 20 November 2013

A study of a million users of massive open online courses, known as MOOCs, released this month by the University of Pennsylvania Graduate School of Education found that, on average, only about half of those who registered for a course ever viewed a lecture, and only about 4 percent completed the courses.

Much of the hope — and hype — surrounding MOOCs has focused on the promise of courses for students in poor countries with little access to higher education. But a separate survey from the University of Pennsylvania released last month found that about 80 percent of those taking the university's MOOCs had already earned a degree of some kind.

2013

The New York Times

And perhaps the most publicized MOOC experiment, at San Jose State University, has turned into a flop. It was a partnership announced with great fanfare at a January news conference featuring Gov. Jerry Brown of California, a strong backer of online education. San Jose State and Udacity, a Silicon Valley company co-founded by a Stanford artificial-intelligence professor, Sebastian Thrun, would work together to offer three low-cost online introductory courses for college credit.

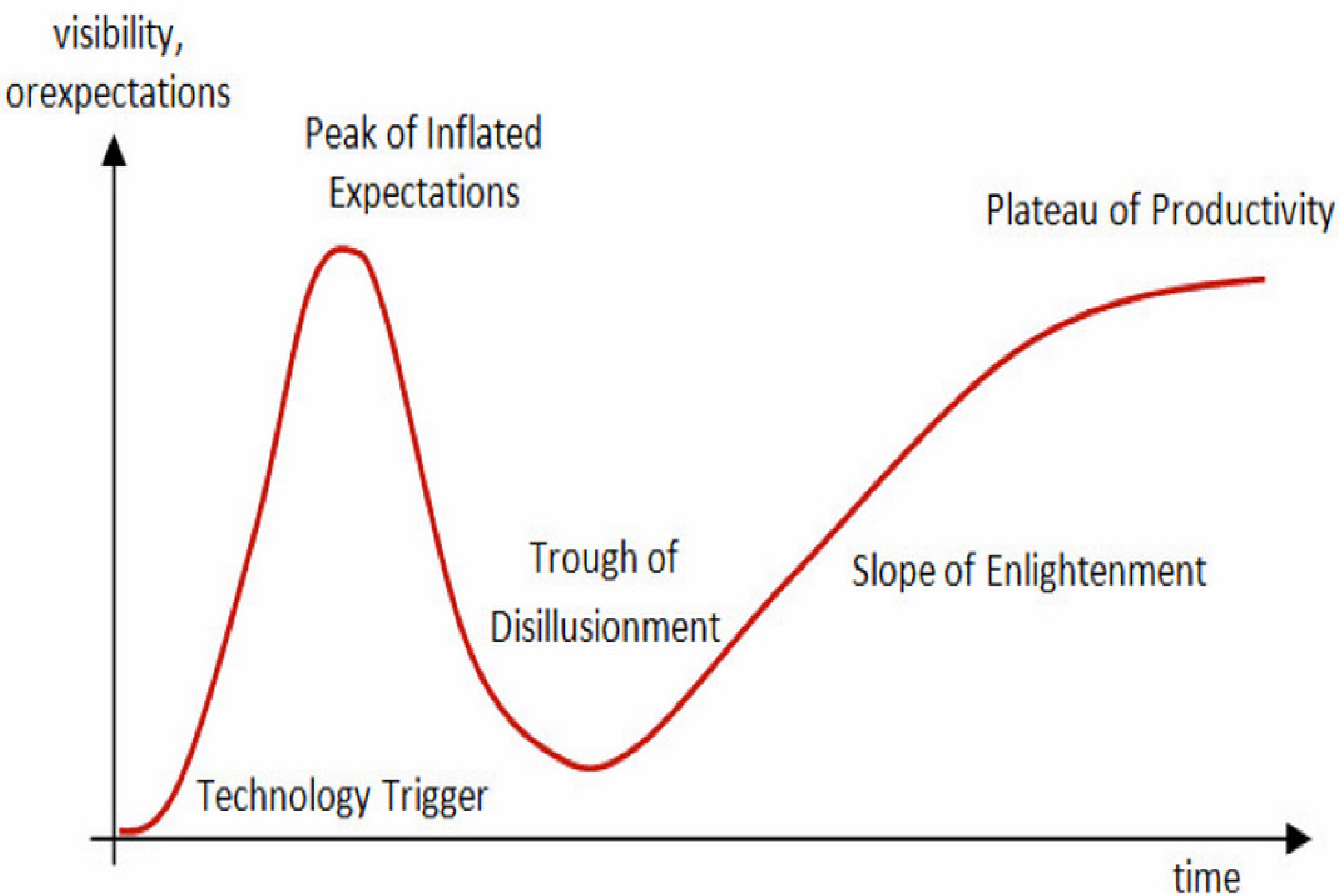
Mr. Thrun, who had been unhappy with the low completion rates in free MOOCs, hoped to increase them by hiring online mentors to help students stick with the classes. And the university, in the heart of Silicon Valley, hoped to show its leadership in online learning, and to reach more students.

But the pilot classes, of about 100 people each, failed. Despite access to the Udacity mentors, the online students last spring — including many from a charter high school in Oakland — did worse than those who took the classes on campus. In the algebra class, fewer than a quarter of the students — and only 12 percent of the high school students — earned a passing grade.

The program was suspended in July, and it is unclear when, if or how the program will resume. Neither the provost nor the president of San Jose State returned calls, and spokesmen said the university had no comment.

Whatever happens at San Jose, even the loudest critics of MOOCs do not expect them to fade away. More likely, they will morph into many different shapes: Already, San Jose State is getting good results using videos from edX, a nonprofit MOOC venture, to supplement some classroom sessions, and edX is producing videos to use in some high school Advanced Placement classes. And Coursera, the largest MOOC company, is experimenting with using its courses, along with a facilitator, in small discussion classes

Is MOOC a hype? Is MOOC really “BAD EDUCATION”?



BAD EDUCATION

Your Massively Open Offline College Is Broken

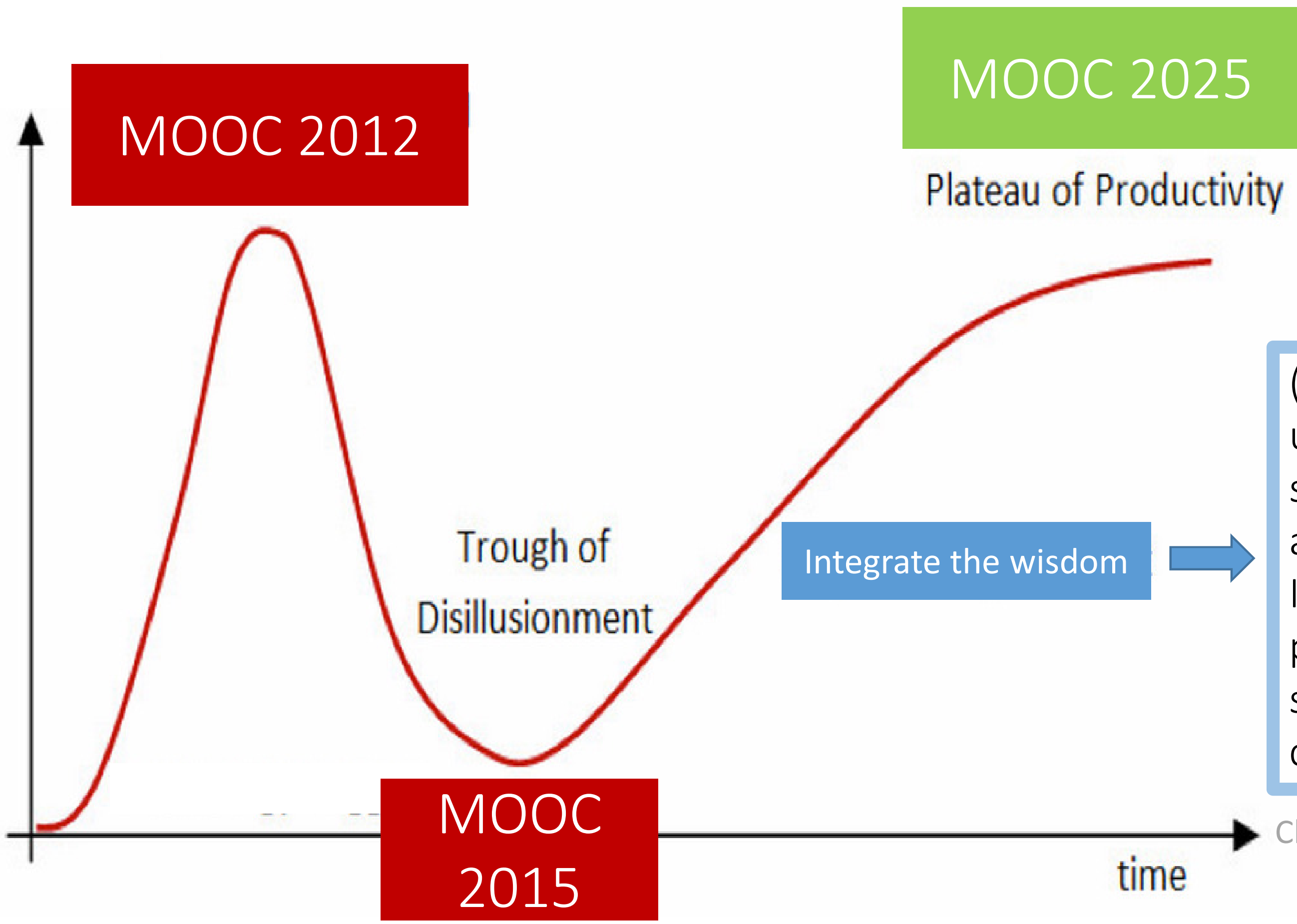
Clay Shirky | February 7th, 2013

Revision of MOOC with the vision expressed in 1996

(We) will develop a model of how to use information infrastructure to best support K-12 students, their families and teachers. We will identify a set of Internet based outreach methods and partnerships to help underserved students succeed in school and prepare for college, careers, citizenship and lifelong learning.

http://ntiaotiant2.ntia.doc.gov/top/docs/nar/pdf/416096071n.pdf

Rethink MOOC as a tool in the context of applications

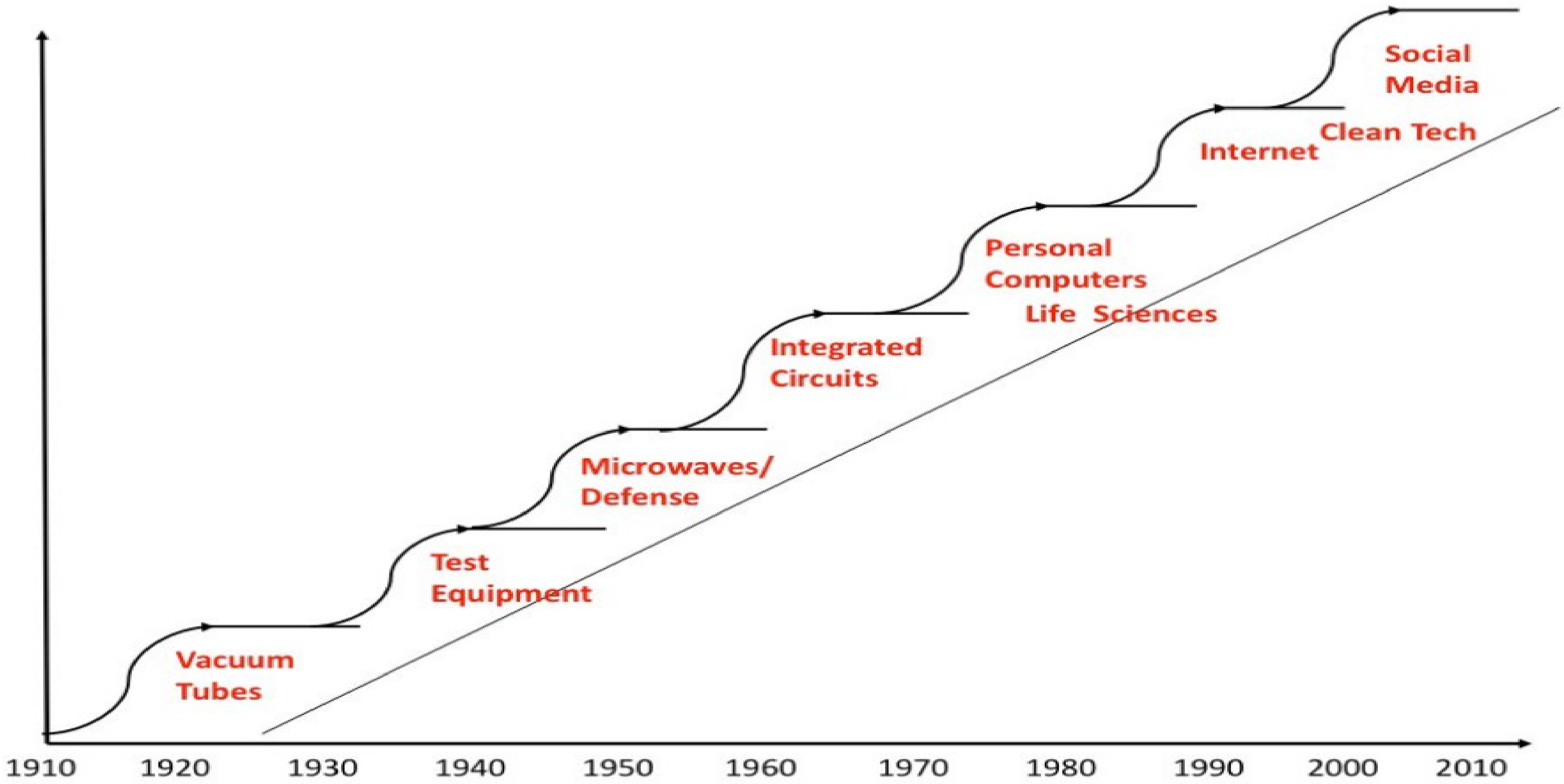


Why 2025?

(We) will develop a model of how to use information infrastructure to best support K-12 students, their families and teachers. We will identify a set of Internet based outreach methods and partnerships to help underserved students succeed in school, prepare for college, careers and lifelong learning.

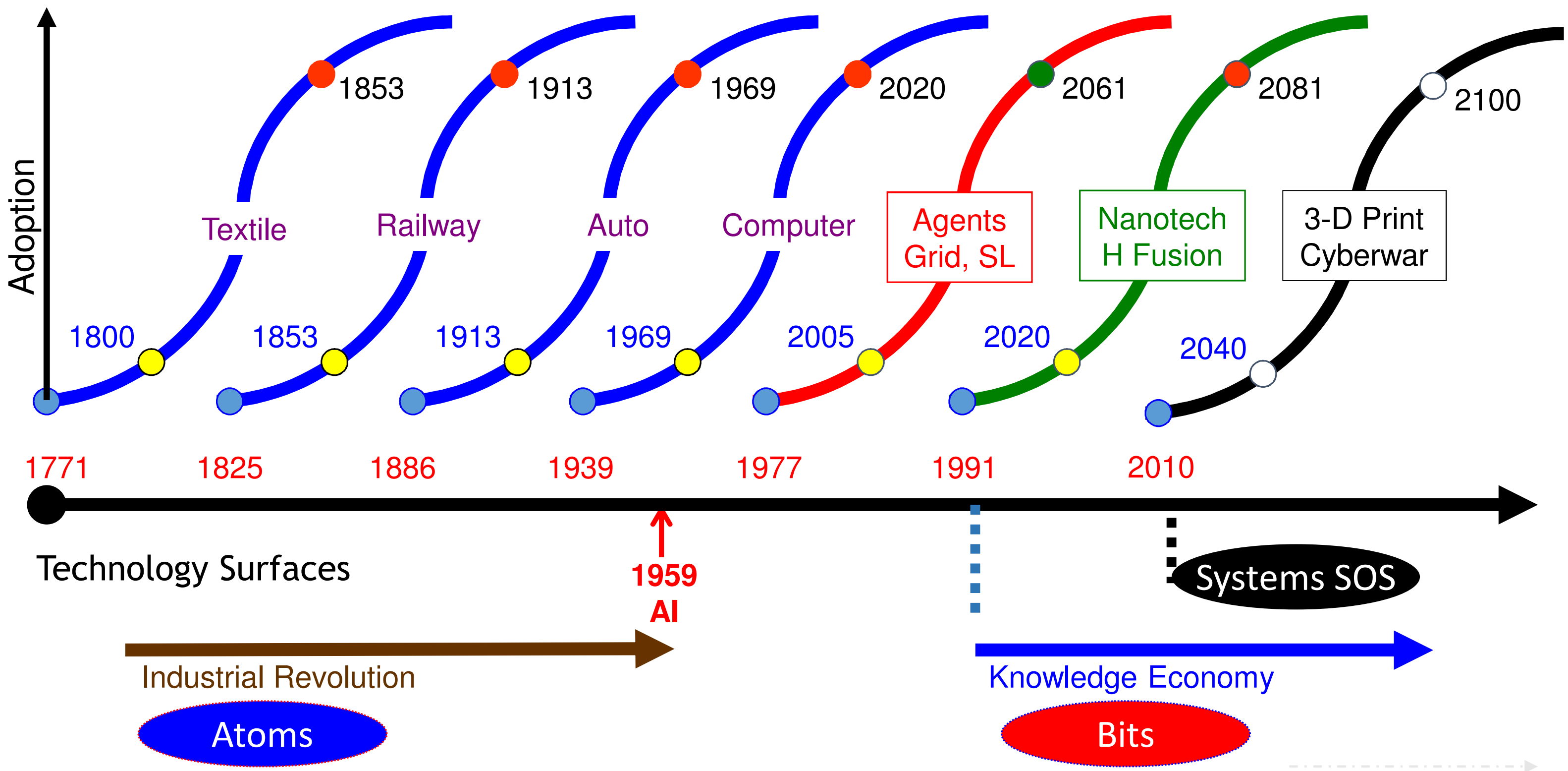
Chang Lin-Tien, Carol Christ and David Greenbaum

Rethink MOOC divorced from (the hype of) social media



MOOC 2025 – productive supplement and outreach tool for job training

Economic history data related to Textile, Railway, Automobiles and Computers provided by Norman Poire



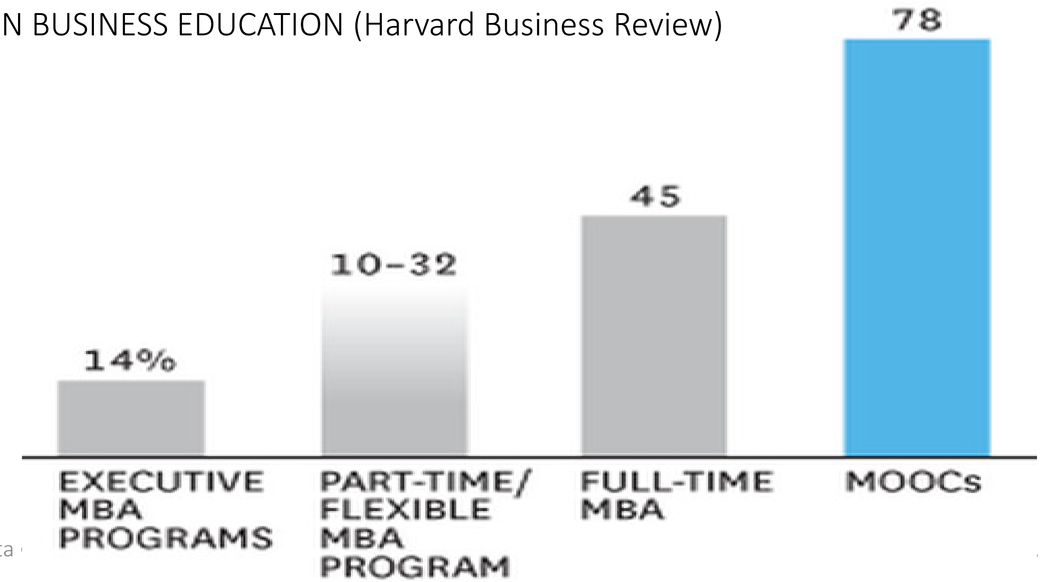
It takes about 28-30 years for an idea to be socialized before it is accepted and adopted. 1996 was the birth year for the MOOC concept. Hence, it matures for adoption in 2025.

Rethinking MOOC – incisive insight – “underserved”

“Underserved” was used in the context of the affirmative action policies in the US. The “underserved” stands to gain the most by gaining access to excellent online resources. But, it is a paradox that they benefit the least due to lack of motivation. Current trends in MOOC converts the paradox to a paradigm but for non-OECD nations and emerging economies where opportunities and resources are gravely constrained (China, India, SE Asia) but determination, dedication and motivation are at their peak. In the future, MOOCs may act as a tool for economic growth for most geographies but probably to a lesser degree for the EU and the Americas.

On the way to changing the world, there are few signposts.

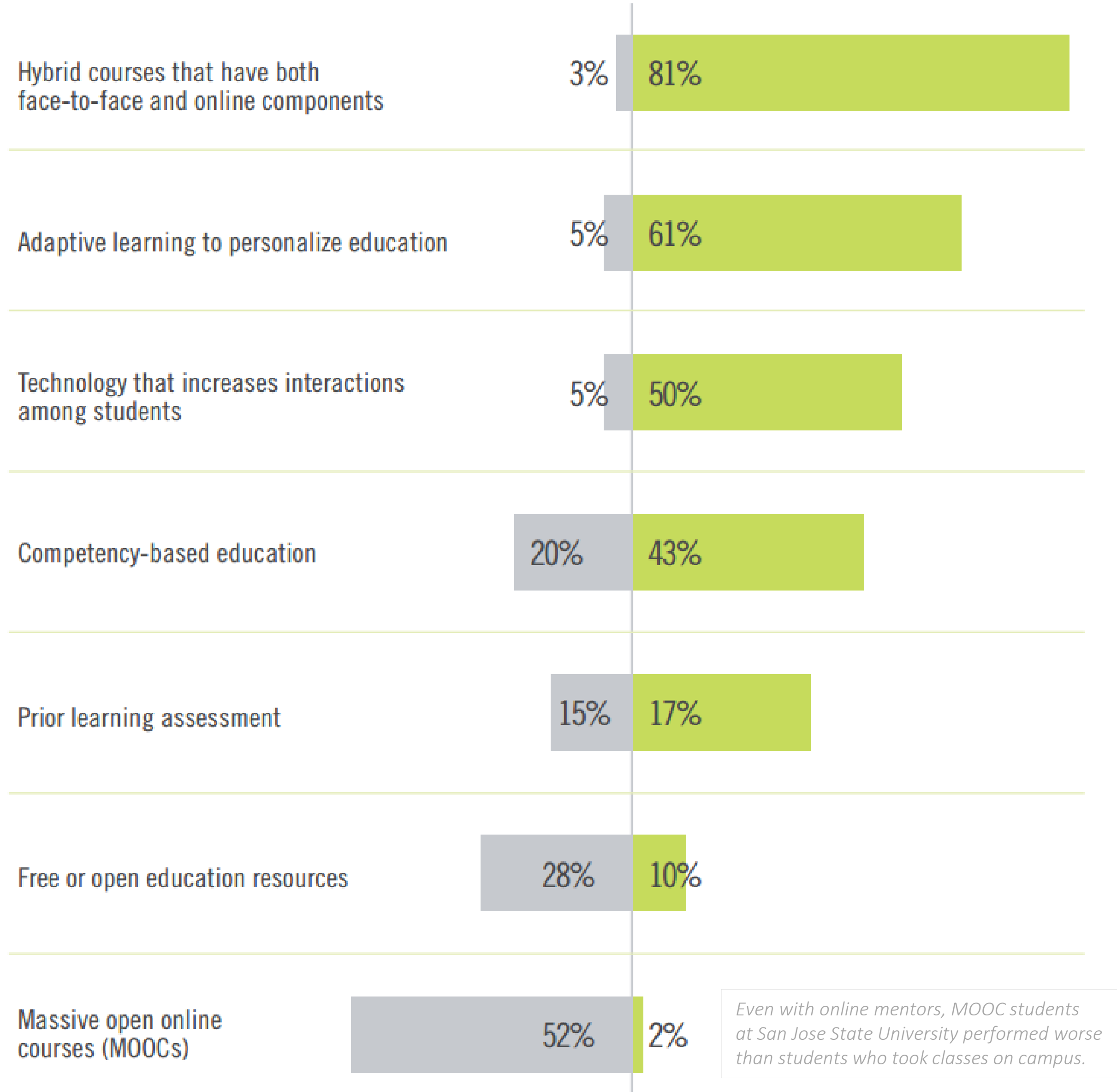
NON-US STUDENTS IN BUSINESS EDUCATION (Harvard Business Review)



(We) will develop a model of how to use information infrastructure to best support K-12 students, their families and teachers. We will identify a set of Internet based outreach methods and partnerships to help underserved students succeed in school, prepare for college, careers and lifelong learning.

What College Presidents Think about MOOC (January 2014)

The results of *The Innovative University: What College Presidents Think About Change in American Higher Education* are based on responses from presidents of four-year public and four-year private, not-for profit colleges and universities that fall into a selected group of classifications developed by the Carnegie Foundation for the Advancement of Teaching. Maguire Associates, of Concord, Mass, which conducted the online survey for The Chronicle, identified 1,728 institutions that met the survey criteria. Presidents of these institutions were invited to respond, and 349, or 20 percent did. The data collection took place in January 2014.



Therefore, the most important factor is

CONTEXT

Analysis of MOOC in context may be at the intersection of dull and boring

MOOC is a tool –

description, form and attributes may be

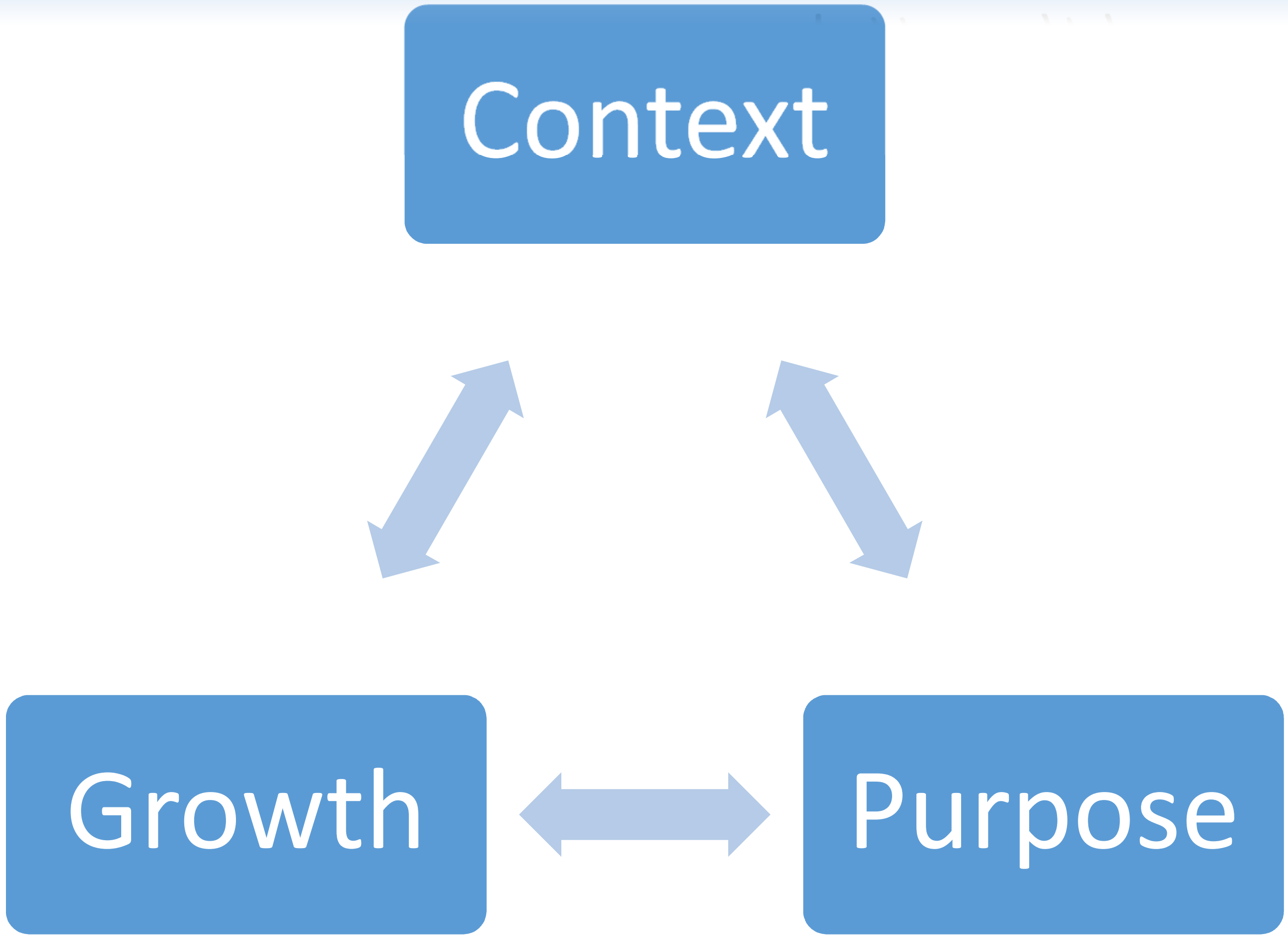
discussed *ad nauseam*, over and over …

but … on the way to changing the world, there are few signposts.

It is more important to know

How to use a tool and the context of the application.

MOOC is a tool – open resources are essential - http://ht.ly/yLAt2



Socio-Economic

For additional information visit http://bit.ly/MIT-Made-in-Taiwan

After two days of MOOC sessions, are you still unclear about MOOCs ?

MOOC

- is a tool for ambition
- is a tool for aspiration

Ambition vs Aspiration

Ambition (*icchāna*) is an eagerness to acquire personal advantage – wealth, power, status, fame, credit – while aspiration (*patthāna*) is a gentle but firm determination to achieve something of value. The English word ambition comes from the Latin *ambitionem* meaning 'going around' (think about the vicious cycle of wanting more and more) while aspiration is related to the Latin *spiritus*, breath, and originates from the French word *aspirare* meaning 'to breathe out.'

Ambition is not necessarily negative but it may have a tendency to override integrity in its drive to get what it wants. The so-called Self-Improvement Movement is a good example of a philosophy of life based on ambition. Behind all the talk of 'the passion for excellence' 'being the best you can be' and 'contributing to society' usually lies greed and selfishness. It is a self-serving, solipsistic and narcissistic view of life that makes one believe that one is special, unique and one-of-a-kind or gifted.

Aspiration is a form of desire tempered by thoughtfulness, integrity and takes into account the interests of others (service above self). While ambition is focused totally on the goal, aspiration never loses sight of either the goal or the means used to attain it. Aspiration allows us to 'breathe freely' (*assāsa*) after we have achieved our goal, because we know we have not compromised our values or denigrated others. Aspiration balances material goals with spiritual goals and advocates gentle moderation in desires with a focus toward *Nirvāna*. We should aspire towards worthwhile goals without allowing our aspiration to degenerate into ambition, to paraphrase Buddha.

Context

Taiwan Economic Indicators

Education

Taiwan - Overview of Higher Education

Key Economic and Social Indicators(cont. Jun. 30, 2014)

http://eng.stat.gov.tw/		2014				2013				2012	2011
Banking	1.Foreign exchange (end of period)	29.915	(Jun. 30)			29.950				29.136	30.290
	2.Foreign exchange reserves(100 Million US$) (end of period)	4,217	(May)	USD 0.4217 Trillion		4,168				4,032	3,855
	3.Past-due loan ratio of domestic banks (%)(end of period)	0.32	(Apr.)			0.38	(Dec.)			0.40	0.43
	4.Annual changes of M2 (%)(daily average)	5.9	(May)	5.9	(Jan.-May)	5.8	(Dec.)	4.8	(Jan.-Dec.)	4.2	5.8
Labor Force	1.Labor force participation rate(%)	58.39	(May)	58.43	(Jan.-May)	58.55	(Dec.)	58.43	(Jan.-Dec.)	58.35	58.17
		(M66.62,F50.50)		(M66.68,F50.53)		(M66.86,F50.57)		(M66.74,F50.46)		(M66.83,F50.19)	(M66.67,F49.97)
	2.No. of employed persons(10 thousand)	1,105.2	(May)	1,103.5	(Jan.-May)	1,102.9	(Dec.)	1,096.7	(Jan.-Dec.)	1,086.0	1,070.9
	3.No. of unemployed persons(10 thousand)	44.3	(May)	45.7	(Jan.-May)	46.9	(Dec.)	47.8	(Jan.-Dec.)	48.1	49.1
	4.Unemployment rate(%)	3.85	(May)	3.98	(Jan.-May)	4.08	(Dec.)	4.18	(Jan.-Dec.)	4.24	4.39
	5.Annual changes of labor productivity of manufacturing establishments (%)	1.18	(Apr.)	0.80	(Jan.-Apr.)	-0.77	(Dec.)	0.03	(Jan.-Dec.)	-0.66	3.22
	6.Annual changes of average monthly earnings of non-farm employees(%)	1.60	(Apr.)	4.73	(Jan.-Apr.)	-2.35	(Dec.)	0.16	(Jan.-Dec.)	0.18	2.59
II. Social Indicators											
Police Forces	1.Rate of criminal case increased (%)	8.1	(May)	11.1	(Jan.-May)	13.1	(Dec.)	-5.8	(Jan.-Dec.)	-8.7	-6.5
	2.No. of violent crimes (cases)	175	(May)	967	(Jan.-May)	188	(Dec.)	2,525	(Jan.-Dec.)	3,461	4,190
	3.Percentage of criminal cases cleared (%)	81.0	(May)	86.3	(Jan.-May)	70.8	(Dec.)	86.6	(Jan.-Dec.)	84.0	79.5
Environment	1.Refuse incinerators (Sets)(end of period)					26	(Dec.)			26	26
	2.Designed capacity of Waste Incinerated(10 thousand tons)	52.0	(Mar.)			55.6	(Dec.)	635.0	(Jan.-Dec.)	640.5	635.5
	3.Percentage of public sewerage system(%)	36.1	(May)			35.1	(Dec.)			32.1	29.0
Education	1.Pupil-teacher ratio at elementary and junior high school levels(persons)(school year)					13.0				13.7	14.4
	2.Higher education gross enrollment rate (%)(school year)					83.9				84.4	83.4
	3.No. of university and college(school year)					147				148	148
	4.Increased rate of students in university and college(%) (school year)					-0.8				0.2	0.8
	5.R & D expenditure/GDP(%)									3.1	3.0

Purpose

one of many

Taiwan Economic Indicators

Operating Efficiency in Manufacturing

Taiwan – Operating Efficiency in Manufacturing vs Profit Rate

TABLE 23 Operating Efficiency of Enterprise Units of All Industries, by Industry Group

2011 Unit: %

利潤 / 生產淨額 (按要素成本) Profits / Net value of prod. (at factor cost)	存貨及存料週轉率 Turnover ratio of inventory	實際運用固定資產淨額週轉率 Turnover ratio of net value of fixed assets in operation	總資產週轉率 Turnover ratio of total assets	實際運用資產淨額週轉率 Turnover ratio of net value of assets in operation	利潤率 Profits rate	
43.43	996.81	283.96	101.70	98.13	4.79	**Manufacturing**
45.31	785.53	92.10	48.71	53.57	6.81	Manufacture of Food Products
19.98	803.94	253.28	156.92	127.95	2.33	Processing and Preserving of Meat
31.40	539.30	231.11	122.17	111.21	4.76	Processing and Preserving of Fish, Crustaceans, Molluscs and Related Products
23.17	1009.93	158.00	108.61	94.33	5.48	Processing and Preserving of Fruit and Vegetables
55.21	916.77	387.37	161.40	154.86	4.57	Manufacture of Edible Oils and Fats
79.21	1519.11	282.15	55.35	56.05	12.35	Manufacture of Dairy Products
60.72	591.48	169.59	62.89	61.68	6.37	Grain Husking, Manufacture of Grain Mill Products, Starches and Starch Products
45.21	994.16	553.88	154.28	151.96	3.00	Manufacture of Prepared Animal Feeds
39.47	636.06	42.74	26.49	31.07	8.42	Manufacture of Other Food Products
36.09	501.80	134.64	68.52	64.09	8.67	Manufacture of Beverages & Tobacco Products
38.40	437.24	124.02	67.28	61.99	11.79	Manufacture of Alcoholic Beverages & Tobacco Products
26.47	675.35	158.19	70.80	68.10	3.33	Manufacture of Non-alcoholic Beverages
35.88	673.47	204.54	75.88	73.35	5.82	Manufacture of Textiles
38.17	549.31	183.37	62.42	65.38	5.06	Spinning of Yarn
42.23	643.31	230.47	75.38	71.85	6.25	Weaving of Textiles
37.19	870.24	206.43	90.63	87.72	6.60	Manufacture of Non-woven Fabrics
22.99	1029.51	155.75	86.53	76.36	5.00	Finishing of Textiles
30.19	844.28	233.95	102.98	92.41	6.40	Manufacture of Textile Products
32.59	758.28	232.28	123.81	98.24	7.09	Manufacture of Wearing Apparel & Clothing Accessories
35.62	762.08	259.00	120.77	102.64	7.23	Manufacture of Woven Wearing Apparel
29.96	711.80	212.54	122.29	89.95	6.86	Manufacture of Knitted & Crocheted Wearing Apparel
30.56	1028.47	208.30	151.59	121.01	7.37	Manufacture of Clothing Accessories
60.03	944.08	321.02	59.93	59.05	11.68	Manufacture of Leather, Fur and Related Products

7.38	Manufacture of Wood & of Products of Wood & Bamboo
5.34	Manufacture of Paper and Paper Products
4.21	Manufacture of Pulp, Paper and Paperboard
6.57	Manufacture of Containers of Paper and Paperboard
5.41	Manufacture of Other Paper Products
9.88	Printing and Reproduction of Recorded Media
9.88	Printing and Service Activities Related to Printing
7.84	Reproduction of Recorded Media
-1.65	Manufacture of Petroleum and Coal Products
9.84	Manufacture of Chemical Material
4.57	Manufacture of Basic Chemical Material
12.10	Manufacture of Petrochemicals
13.89	Manufacture of Fertilizers
9.59	Manufacture of Synthetic Resin, Plastic & Rubber Materials
10.88	Manufacture of Man-made Fibers
8.28	Manufacture of Chemical Products
5.81	Manufacture of Pesticides & Environmental Agents
6.39	Manufacture of Coatings, Dyes and Pigments
6.56	Manufacture of Cleaning Preparations
7.58	Manufacture of Cosmetics

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24.53	Manufacture of Glass and Glass Products
9.43	Manufacture of Refractory Products, Clay Building Materials, Porcelain & Ceramic Products
13.38	Manufacture of Cement and Cement Products
6.57	Cutting, Shaping and Finishing of Stone
12.54	Manufacture of Other Non-metallic Mineral Products
4.56	Manufacture of Basic Metals
3.69	Manufacture of Basic Iron and Steel
5.78	Manufacture of Aluminum
5.06	Manufacture of Copper
9.01	Manufacture of Other Basic Metals
7.64	Manufacture of Fabricated Metal Products
9.60	Manufacture of Metal Hand tools and Die
6.90	Manufacture of Metal Structure & Architectural Components
8.13	Manufacture of Metal Containers
5.71	Metalworking Activities
7.81	Manufacture of Other Fabricated Metal Products
0.96	Manufacture of Electronic Parts & Components
7.89	Manufacture of Semi-conductors
5.52	Manufacture of Electronic Passive Devices
8.46	Manufacture of Bare Printed Circuit Boards
-9.00	Manufacture of Optoelectronic Materials and Components
4.03	Manufacture of Other Electronic Parts & Components
3.52	Manufacture of Computers, Electronic & Optical Products
2.56	Manufacture of Computers & Peripheral Equipment
10.74	Manufacture of Communication Equipment
4.60	Manufacture of Audio and Video Equipment
-2.31	Manufacture of Magnetic and Optical Media
6.20	Manufacture of Measuring, Navigating, Control Equipment, Watches and Clocks
7.76	Manufacture of Irradiation & Electromedical Equipment
6.88	Manufacture of Optical Instruments & Equipment
5.18	Manufacture of Electrical Equipment
6.70	Manufacture of Power Generation, Transmission and Distribution Machinery
4.52	Manufacture of Batteries
1.04	Manufacture of Wiring and Wiring Devices
-2.61	Manufacture of Lighting Equipment
7.53	Manufacture of Domestic Appliances
8.90	Manufacture of Other Electrical Equipment
9.49	Manufacture of Machinery and Equipment
9.00	Manufacture of Metalworking Machinery
8.82	Manufacture of Other Special-purpose Machinery
10.27	Manufacture of General-purpose Machinery
6.60	Manufacture of Motor Vehicles and Parts
5.54	Manufacture of Motor Vehicles

9.41	Manufacture of Bicycles and Parts
5.44	Manufacture of Other Transport Equipment & Parts Not Elsewhere Classified
6.45	Manufacture of Furniture
6.92	Manufacture of Non-metallic Furniture
6.18	Manufacture of Metallic Furniture
7.52	Other Manufacturing
6.55	Manufacture of Sport and Recreational Goods
10.31	Manufacture of Medical Instruments and Supplies
6.55	Manufacturing Not Elsewhere Classified
8.49	Repair and Installation of Industrial Machinery and Equipment
-3.12	Electricity and Gas Supply
-4.37	Electricity Supply
6.56	Gas Supply
-0.75	Steam Supply
9.31	Water Supply and Remediation Activities
1.35	Water Supply
14.58	Wastewater (Sewage) Treatment
12.36	Waste Collection, Treatment & Disposal Activities; Materials Recovery
11.41	Waste Collection
20.04	Waste Treatment & Disposal
6.69	Materials Recovery
13.44	Remediation Activities & Other Waste Management Services
8.88	Construction
6.54	Construction of Buildings
5.77	Civil Engineering
6.33	Construction of Roads and Railways
8.94	Construction of Utility Projects
3.23	Construction of Other Civil Engineering Projects
11.78	Specialized Construction Activities
14.83	Site Preparation, Foundation and Structure Construction
12.82	Landscape Construction
8.94	Electrical, Plumbing and Other Construction Installation Activities
10.82	Building Completion and Finishing
20.18	Other Specialized Construction Activities
5.33	Wholesale and Retail Trade
5.26	Wholesale Trade
11.31	Merchandise Brokers
5.61	Wholesale of General Merchandise
-3.69	Wholesale of Agricultural Raw Materials and Live Animals
5.33	Wholesale of Food, Beverages and Tobacco
5.94	Wholesale of Fabrics and Clothing Accessories
4.71	Wholesale of Household Appliances and Goods
8.48	Wholesale of Pharmaceutical and Medical Goods and Cosmetics
6.73	Wholesale of Cultural and Recreation Goods
5.27	Wholesale of Construction Materials

Rates > 20%

5.54	Retail Trade
4.16	Retail Sale in Non-specialized Stores
8.40	Retail Sale of Food, Beverages and Tobacco in Specialized Stores
8.20	Retail Sale of Fabrics and Clothing Accessories in Specialized Stores
6.83	Retail Sale of Household Appliances and Goods in Specialized Stores
6.69	Retail Sale of Pharmaceutical and Medical Goods and Cosmetics in Specialized Stores
6.36	Retail Sale of Cultural and Recreation Goods in Specialized Stores
6.25	Retail Sale of Construction Materials in Specialized Stores
3.50	Retail Sale of Fuel in Specialized Stores
6.06	Retail Sale of Information and Communications Equipment in Specialized Stores
4.17	Retail Sale of Motor Vehicles, Motorcycles and Related Parts and Accessories in Specialized Stores
10.17	Other Retail Sale in Specialized Stores
7.17	Retail Trade not in Stores or Stalls
5.16	Transportation and Storage
6.21	Land Transportation
(D)	Transport via Railways
(D)	Public Rapid Transit
3.08	Bus Transportation
7.95	Freight Truck Transport
34.93	Other Land Transportation
-0.65	Water Transportation
-0.67	Ocean Transportation
2.13	Inland and Lake Transportation
-0.63	Air Transport
14.19	Support Activities for Transportation
14.70	Customs Clearance Services
12.17	Shipping Agency Services
7.57	Freight Transportation Forwarding Services
19.50	Service Activities Incidental to Land Transportation
25.44	Service Activities Incidental to Water Transportation
30.09	Service Activities Incidental to Air Transportation
9.91	Other Transportation Support Activities
14.37	Warehousing and Storage
1.59	Postal and Courier Activities
-1.85	Postal Activities
3.98	Courier Activities
13.27	Accommodation and Food Service Activities
13.17	Accommodation
13.15	Short Term Accommodation Activities
17.82	Other Accommodation
13.30	Food and Beverage Service Activities
13.34	Restaurants
15.13	Beverage Service Activities via Shops
9.86	Other Food and Beverage Service Activities

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	Recording & Music Publishing Activities
11.55	Motion Picture, Video and Television Programme Activities
11.57	Sound Recording and Music Publishing Activities
8.90	Programming and Broadcasting Activities
4.82	Radio Broadcasting
9.11	Television Broadcasting and Subscription Programming
23.08	Telecommunications
8.30	Computer Systems Design Services
10.44	Information Service Activities
11.63	Web Portals, Data Processing, Hosting and Related Activities
2.64	Other Information Service Activities
10.15	Financial and Insurance Activities, Social Security Activities
29.49	Financial Intermediation
24.44	Deposit Institutions
91.68	Financial Holding Companies
29.79	Other Financial Intermediation
-0.47	Insurance；Compulsory Social Security Activities
-1.02	Personal Insurance；Compulsory Social Security Activities
4.39	Property Insurance
(D)	Reinsurance
(D)	Activities Auxiliary to Insurance and Pension Funding
19.87	Securities, Futures and Other Financing
16.74	Securities
16.10	Futures
28.73	Activities Auxiliary to Financial Service Activities
29.10	Fund Management Activities
18.45	Real Estate Activities
17.52	Real Estate Development Activities
21.36	Real Estate Operation and Related Activities
22.40	Real Estate Operation Activities
10.52	Other Real Estate Activities
11.79	Professional, Scientific and Technical Activities
19.02	Legal and Accounting Activities
21.33	Legal Activities
17.16	Accounting, Book-keeping, Tax Consultancy
12.31	Activities of Head Offices; Management Consultancy Activities
-	Activities of Head Offices
12.31	Management Consultancy Activities
10.61	Architecture and Engineering - Technical Testing and Analysis
9.45	Architecture and Engineering Activities & Related Technical Consultancy
14.68	Technical Testing and Analysis
8.23	Advertising and Market Research
8.14	Advertising
12.40	Market Research and Public Opinion Polling

Rates > 20%

12.52	Renting and Leasing of Machinery and Equipment
5.38	Renting and Leasing of Transport Equipment
15.65	Renting and Leasing of Personal and Household Goods
-3.31	Leasing of Intellectual Property and Similar Products, Except
	Copyrighted Works
7.44	Employment Activities
14.79	Activities of Employment Placement Agencies
5.55	Human Resources Provision Activities
11.70	Travel agency, Tour Operator, Reservation Service and Related Activities
11.55	Security and Investigation Activities
10.34	Services to Buildings and Landscape Activities
7.83	Combined Facilities Support Activities
10.39	Cleaning Activities
11.26	Landscape Care and Maintenance Service Activities
11.38	Business and Office Support Activities
14.69	Education
14.71	Other Education
13.99	Educational Support Activities
9.21	Human Health and Social Work Activities
8.87	Human Health Activities
4.04	Hospital Activities
21.75	Clinic Activities
11.21	Other Human Health Activities
16.03	Residential Care Activities
10.88	Social Work Activities without Accommodation
11.89	Arts, Entertainment and Recreation
10.96	Creative, Arts and Entertainment Activities
14.57	Performing Arts
9.16	Support Activities to Performing Arts
4.55	Museums and Other Cultural Activities
14.31	Gambling and Betting Activities
12.56	Sports Activities and Amusement and Recreation Activities
6.70	Sports Activities
14.31	Amusement and Recreation Activities
17.04	Other Service Activities
15.32	Maintenance and Repair of Personal and Household Goods
14.49	Maintenance & Repair of Motor Vehicles & Motor Vehicle Beauty Shops
12.39	Repair of Computers, Communication Equipment & Electronic Products
19.09	Maintenance and Repair of Other Personal and Household Goods
18.61	Other Personal Service Activities
15.15	Washing and (Dry-) Cleaning of Textile and Fur Products
18.69	Hairdressing and Other Beauty Treatment
21.74	Funeral and Related Activities
16.71	Other Personal Service Activities Not Elsewhere Classified

http://eng.stat.gov.tw/

Profit Rate – What does it indicate?

Taiwan Economic Indicators

Operating Efficiency in Manufacturing

Money left on the table ?

For additional information visit http://bit.ly/MIT-Made-in-Taiwan

Operating Efficiency in Manufacturing

Can you improve profit rate by improving operating efficiency?

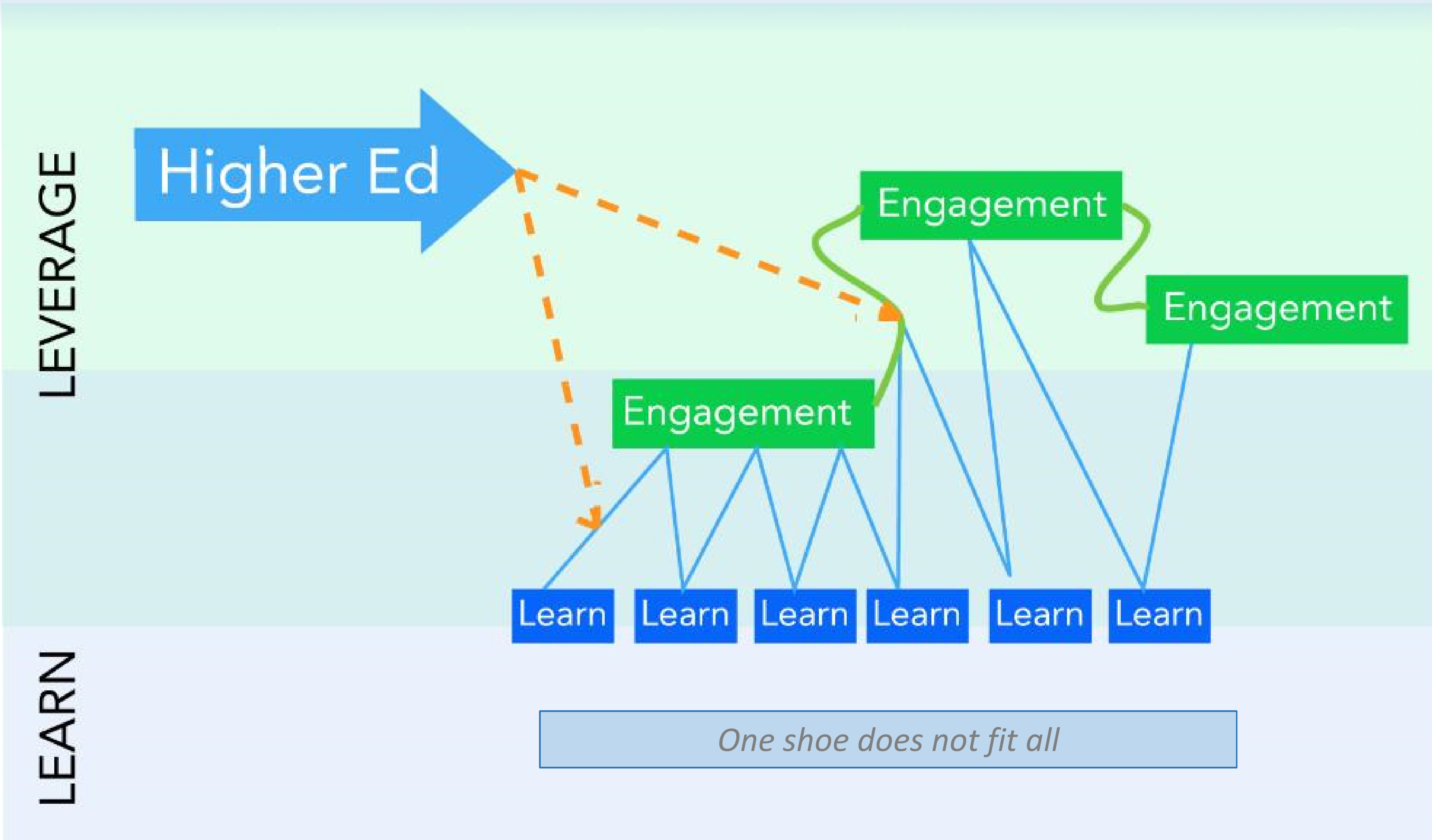
What skill sets do you need to improve operating efficiencies?

Are these skills attainable using online education or training?

Are we asking the correct questions? Is this at all about MOOC? Are we acting as a hammer always in search of a nail?

For additional information visit http://bit.ly/MIT-Made-in-Taiwan

How to improve operating efficiency in manufacturing?



Apprentice?
Internship?
Job Training?

MOOC?
School?
College?

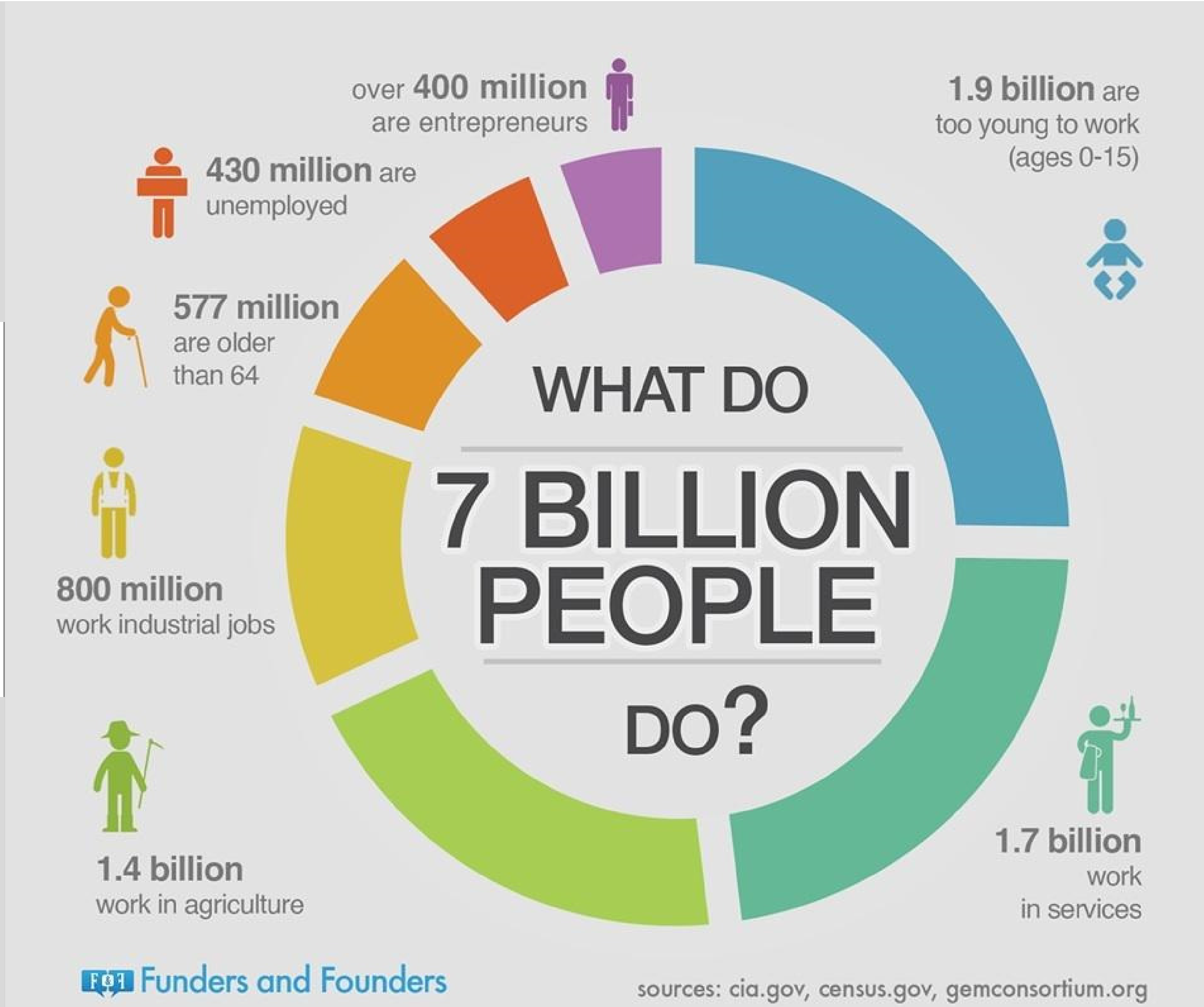
Where are the jobs ?

Should Taiwan Emulate the US ?

Almost half are jobless

The richest 300 people are worth as much as the poorest 3 billion in terms of global wealth

About half are H2M



Jobs ?

PUBLISHED JULY 08, 2014

Robot that can park hospital beds in tight spots wins $250,000 grant

BY JACQUELYN CHEOK
jaccheok@sph.com.sg @JacCheokBT

Improving productivity: (from left) Lee Chuen Neng, head of Department of Surgery, NUS; Melvin Loh and Rachel Hong, directors of medical engineering research & commercialisation initiative, Department of Surgery, NUS; Prof Yu, Department of Biomedical Engineering, NUS; and Ng Kiang Loong, programme director of Hope Technik with the grant-winning robot

Google bought Boston Dynamics which designed LS3 'robot mules'

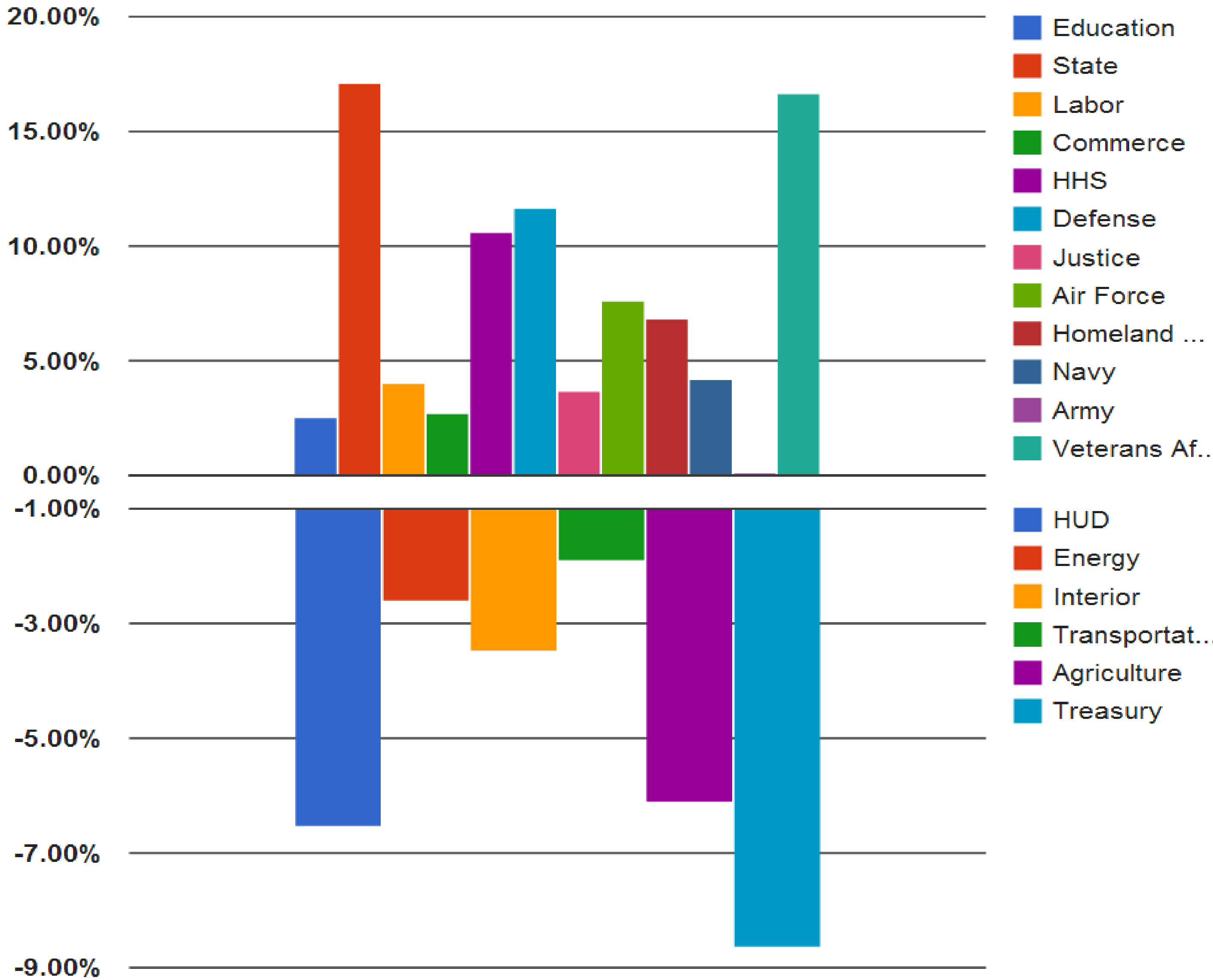
US Bureau of Labor Statistics

US Jobs and Predictions

2012-2022

Taiwan must develop its own model and provide leadership for the future of the innovation society in a networked global economy. Taiwan must be cautious about emulating US trends.

US Government



UNITED STATES OFFICE OF PERSONNEL MANAGEMENT

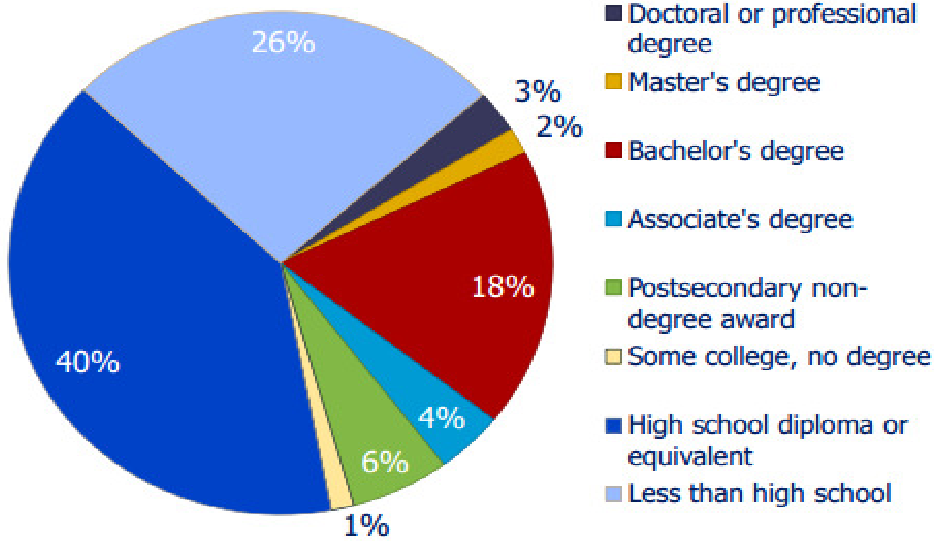
Education and training outlook for occupations, 2012–22

BLS
U.S. BUREAU OF LABOR STATISTICS

The 820 occupations for which BLS prepared 2012–22 employment projections received assignments in three categories: typical entry-level education, work experience in a related occupation, and typical on-the-job training needed to attain competency. In 2012, about one-third of jobs were in occupations that typically require postsecondary education for entry. [1] *The largest share among the postsecondary groups was bachelor's degree. A bachelor's degree was the typical entry-level education for 18 percent of jobs in 2012. Most jobs in 2012 were classified as high school diploma or equivalent or less than high school.*

[1] *These data are for 2012 employment summed by typical entry-level education assignment. The actual educational attainment of workers is different. Neither the 2012 data nor the projected 2022 data reflect actual or estimated numbers of workers by educational attainment.*

In 2012, about one-third of jobs were in occupations that typically require postsecondary education for entry



Source: U.S. Bureau of Labor Statistics, Employment Projections Program.

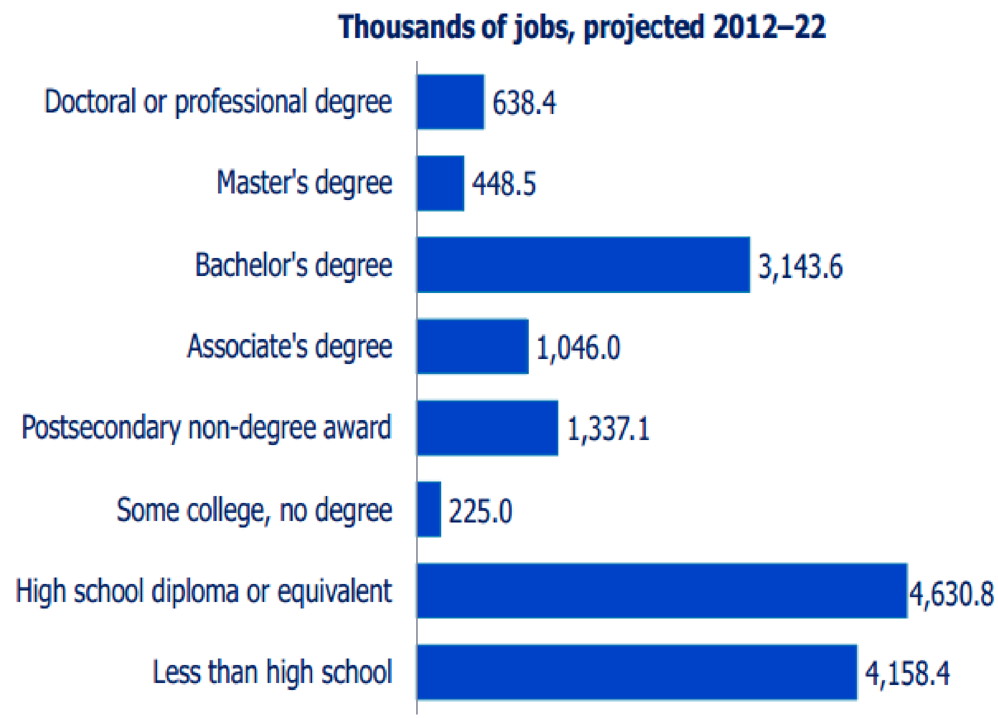
For additional information visit http://bit.ly/MIT-Made-in-Taiwan

Facts of Life ?

Most new jobs from 2012 to 2022 will not require a college degree. *About 4.6 million new jobs will require only a high school diploma or equivalent and 4.2 million new jobs will require less than a high school diploma. About 3.1 million new jobs are projected to be in occupations requiring a bachelor's degree for entry.*

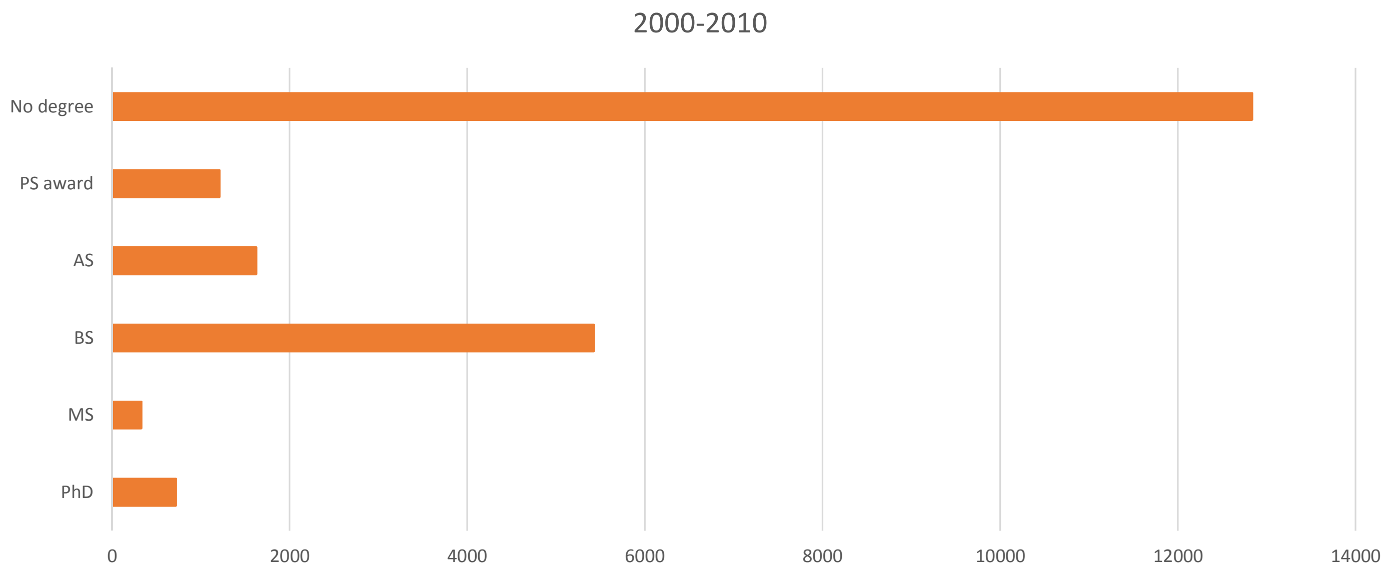
Occupations requiring a high school diploma or less than high school as the typical entry-level education include very large occupations that are projected to add many jobs. *These occupations include retail salespersons; combined food preparation and serving workers, including fast food; and secretaries and administrative assistants.*

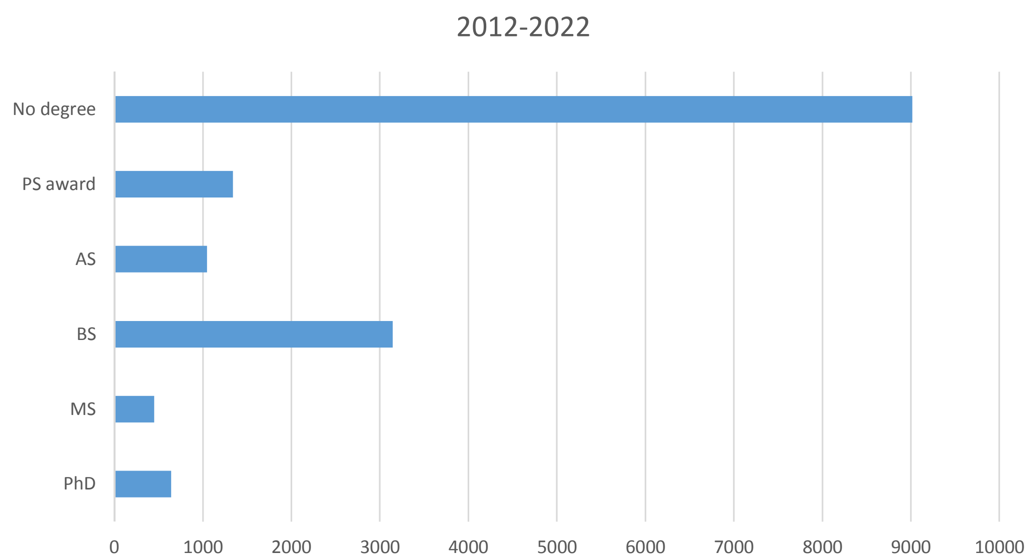
The most new jobs from 2012 to 2022 are projected to be in occupations that typically can be entered with a high school diploma



Source: U.S. Bureau of Labor Statistics, Employment Projections Program.

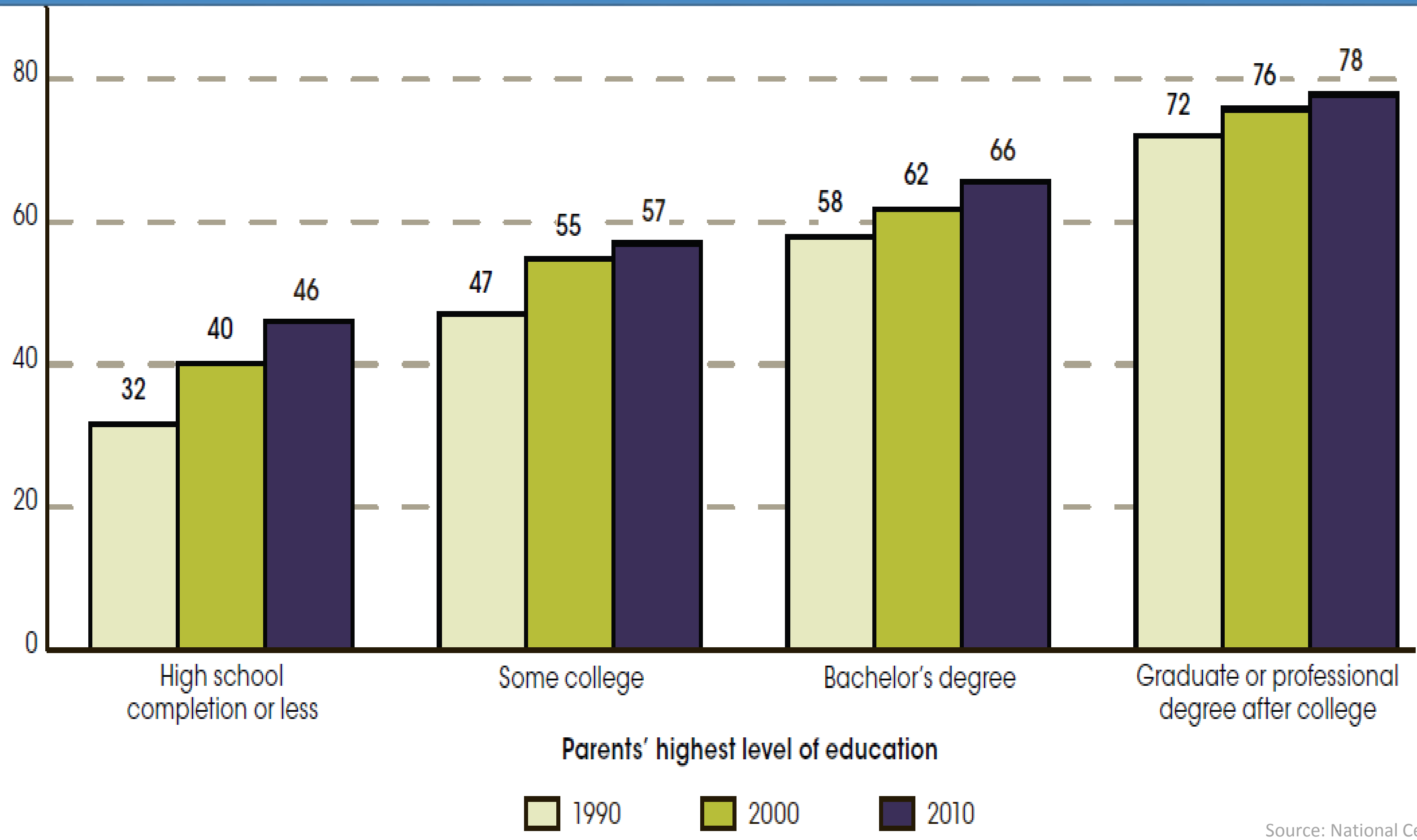
US Predictions





(000s) US Bureau of Labor Statistics	2012-2022		2000-2010	
PhD	638.4	4.1%	723	3.3%
MS	448.5	2.9%	333	1.5%
BS	3143.6	20.1%	5428	24.5%
AS	1046	6.7%	1626	7.3%
PS award	1337.1	8.6%	1213	5.5%
Some College	225	1.4%		0.0%
HS	4630.8	29.6%		0.0%
<HS	4158.4	26.6%		0.0%
No degree	9014.2	57.7%	12837	57.9%
	15627.8		22160	

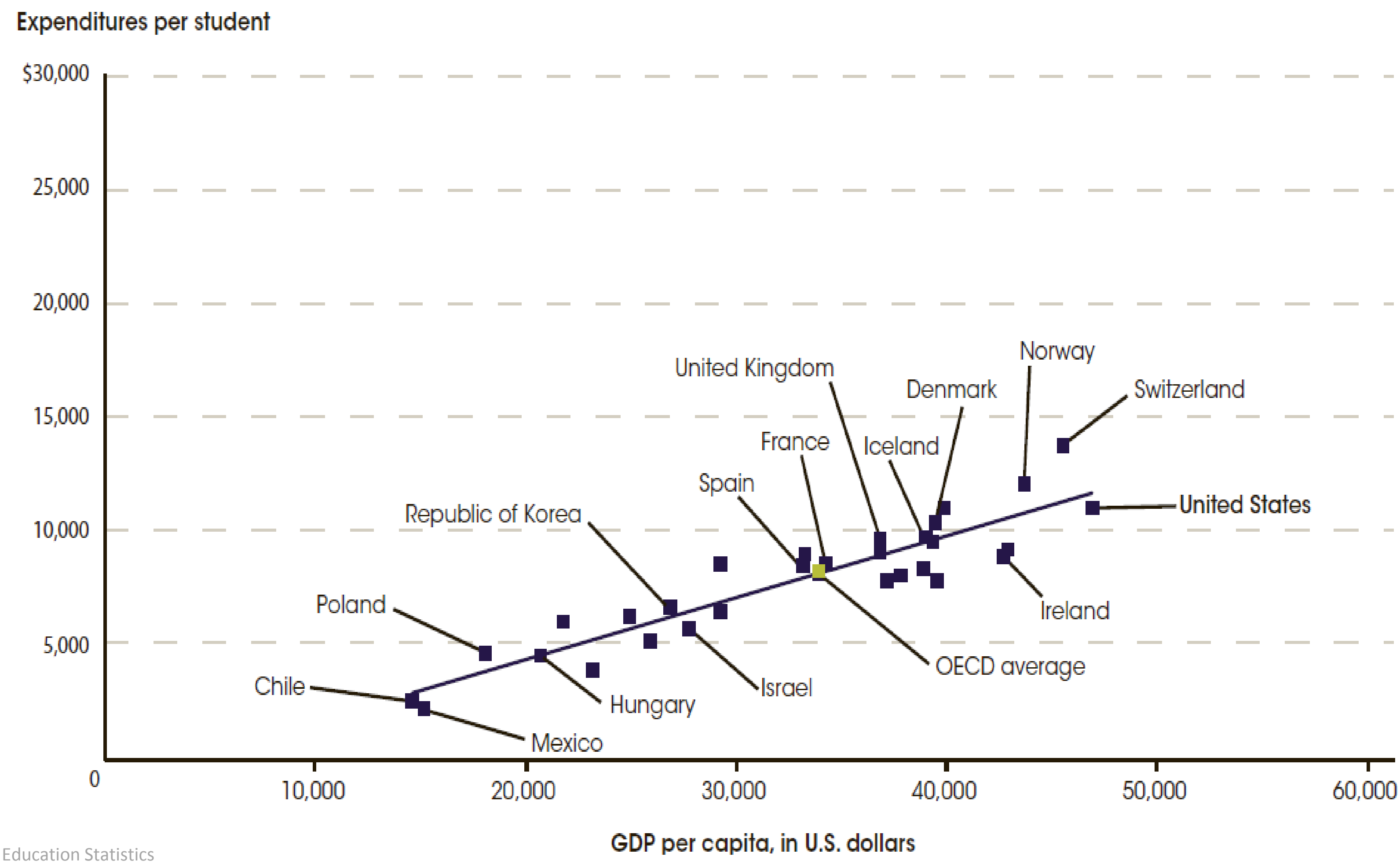
Environmental Impact (on Aspiration and Ambition) in Education?



Source: National Center for Education Statistics

12th grade (US high school) students with plans to graduate from a 4-year degree granting college

Investment in Pre-College Education



Source: National Center for Education Statistics

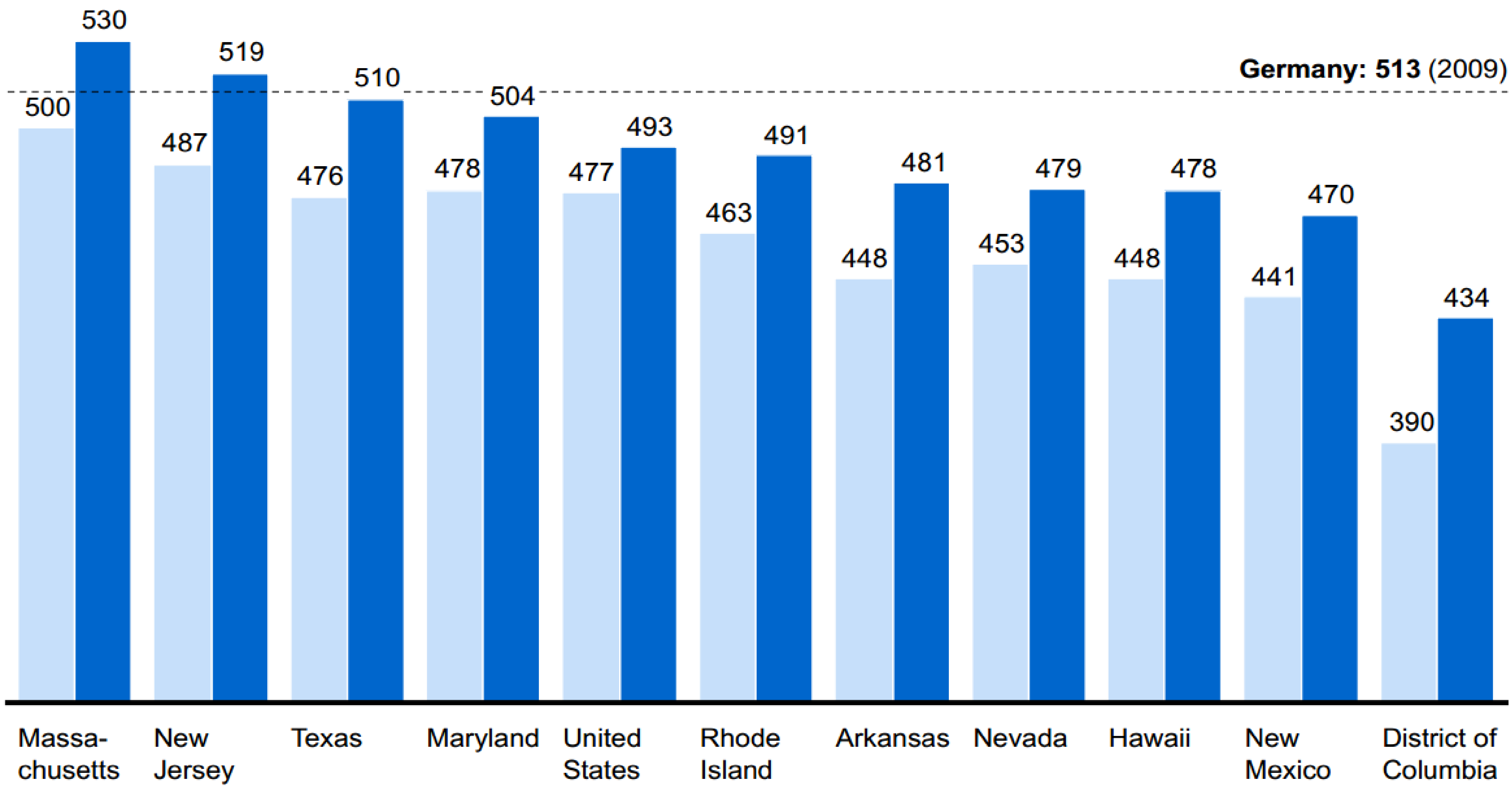
US High School Teachers are Lacking in Rigor in Mathematics and Science

Source: National Center for Education Statistics

Number and percentage of grade 9–12 public school classes of various subjects taught by a teacher with a major and certification in that subject area, by selected subject areas: 2007–08

Selected subject area	Number of classes	Major in subject area			No major in subject area			Total certified
		Total	Certified	Not certified	Total	Certified	Not certified	
English	770,200	79.1	68.3	10.9	20.9	10.4	10.5	78.6
Mathematics	676,900	70.4	62.0	8.4	29.6	15.7	14.0	77.6
Science	562,700	81.7	71.2	10.4	18.3	11.4	6.9	82.7
Biology/life sciences	245,000	72.9	57.2	15.7	27.1	17.2	10.0	74.4
Physical science	289,300	43.2	35.4	7.8	56.8	29.1	27.7	64.5
Chemistry	106,900	46.0	35.3	10.7	54.0	33.9	20.1	69.2
Earth sciences	53,100	23.7	18.0	5.7!	76.3	22.1	54.2	40.1
Physics	43,200	46.7	31.4	15.4	53.3	28.3	25.0	59.6
Social science	565,000	81.2	70.6	10.6	18.8	11.0	7.8	81.6
Economics	39,800	11.0!	‡	‡	89.0	10.6	78.4	14.5
Geography	45,400	8.3!	‡	‡	91.7	16.2!	75.5	21.8
Government/civics	86,600	5.1	1.9!	3.2!	94.9	12.0	82.8	14.0
History	297,200	60.8	28.0	32.8	39.2	6.4	32.8	34.4
French	51,000	80.0	71.6	8.4!	20.0	13.7	‡	85.2
German	13,400	78.3	69.3	‡	21.7!	20.6!	‡	89.9
Latin	9,200	73.1	58.3	‡	26.9!	‡	‡	79.2
Spanish	189,700	73.3	57.4	15.9	26.7	19.4	7.3	76.8
Art/arts and crafts	139,800	88.9	79.6	9.3	11.1!	‡	3.4	87.2
Music	103,100	94.1	85.4	8.8	5.9	1.8!	4.0!	87.2
Dance/drama or theater	37,000	58.6	49.2	9.3!	41.4	16.6	24.9	65.8

Math PISA equivalent scores for 13-year-olds ◦ 2003 vs 2011 (dark blue)



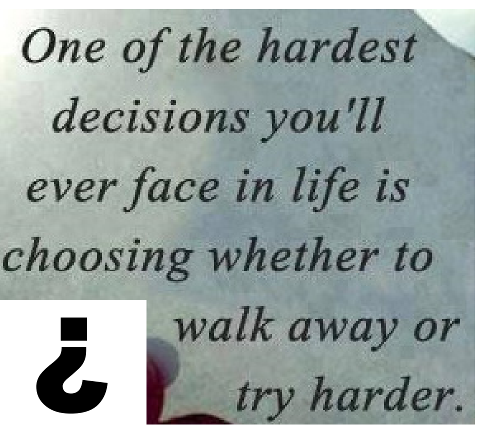
US High School Teachers are Lacking in Rigor in Mathematics and Science

Not a problem – we have the best app

US High School Teachers are Lacking in Rigor in Mathematics and Science

Not a problem – we have the best – Dr Salman Khan – just MOOC him !!

M is for Motivation



For information visit http://bit.ly/MIT-Made-in-Taiwan

Harvard, MIT Online Courses Dropped by 95% of Registrants

By John Lauerman | Jan 21, 2014 4:08 PM ET | **29 Comments** **Email** **Print**

About 95 percent of students enrolled in free, online courses from **Harvard University** and the **Massachusetts Institute of Technology** dropped them before getting a completion certificate.

Photographer: Michael Fein/Bloomberg

Harvard University and the Massachusetts Institute of Technology began the $60 million... **Read More**

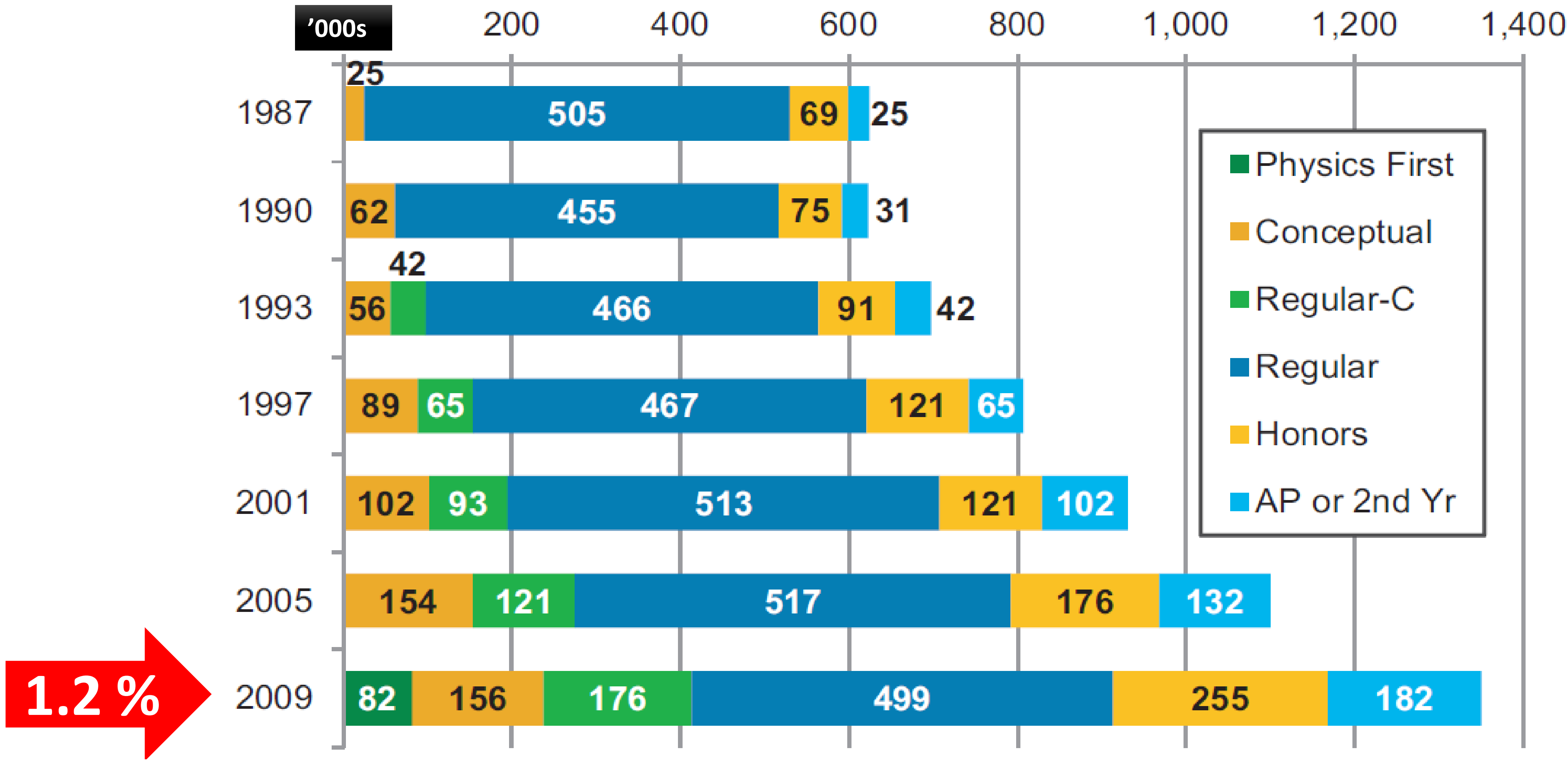
Out of 841,687 registrants in 17 courses offered in 2012 and 2013 by the universities' joint **EdX** program, 43,196 saw the classes to conclusion, according to an e-mailed statement from the Cambridge, Massachusetts-based schools. Some of the students signed up for multiple courses, according to the statement.

Harvard and MIT began the $60 million EdX project in 2012 as an experiment to research the potential of massive open online courses, or MOOCs. The data released today show that while there's broad interest in the classes, people are accessing them for many other reasons besides obtaining a certificate of completion, said **Andrew Ho**, an associate professor in Harvard's Graduate School of Education.

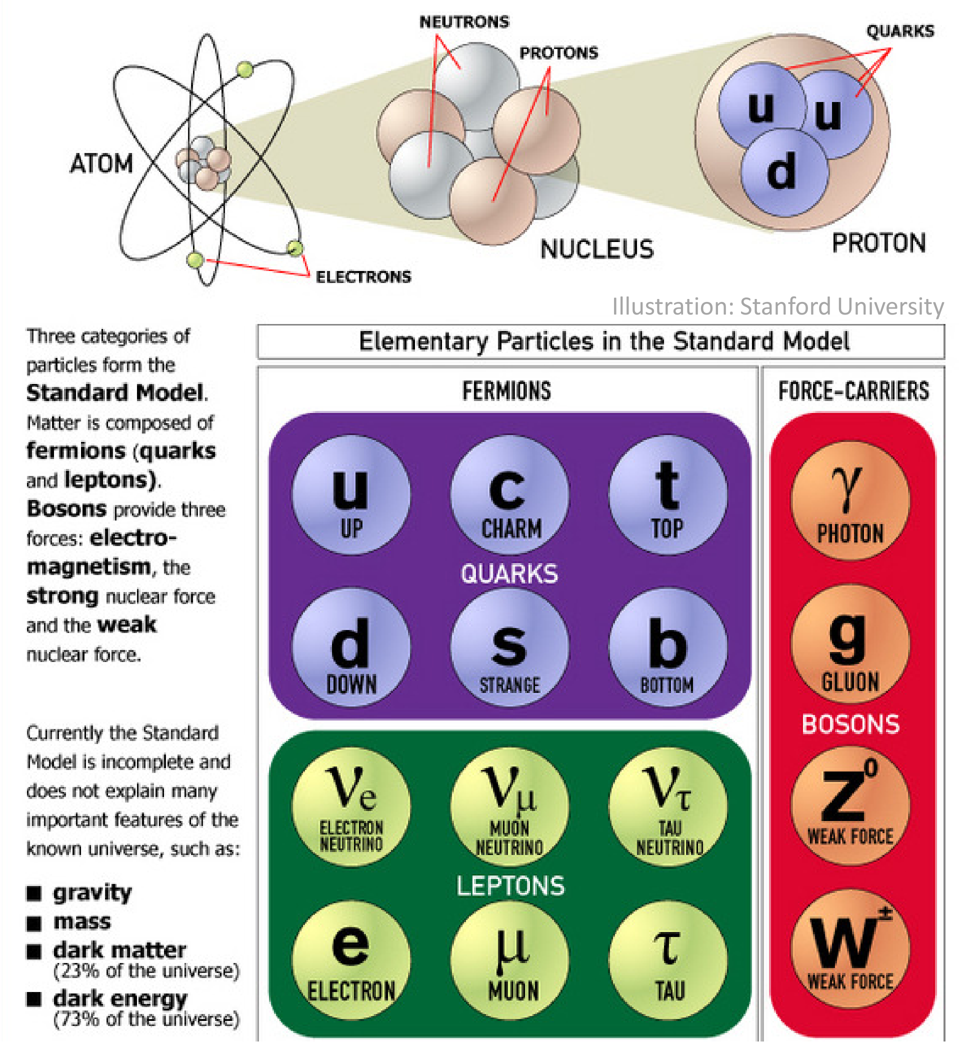
For additional information visit http://bit.ly/MIT-Made-in-Taiwan

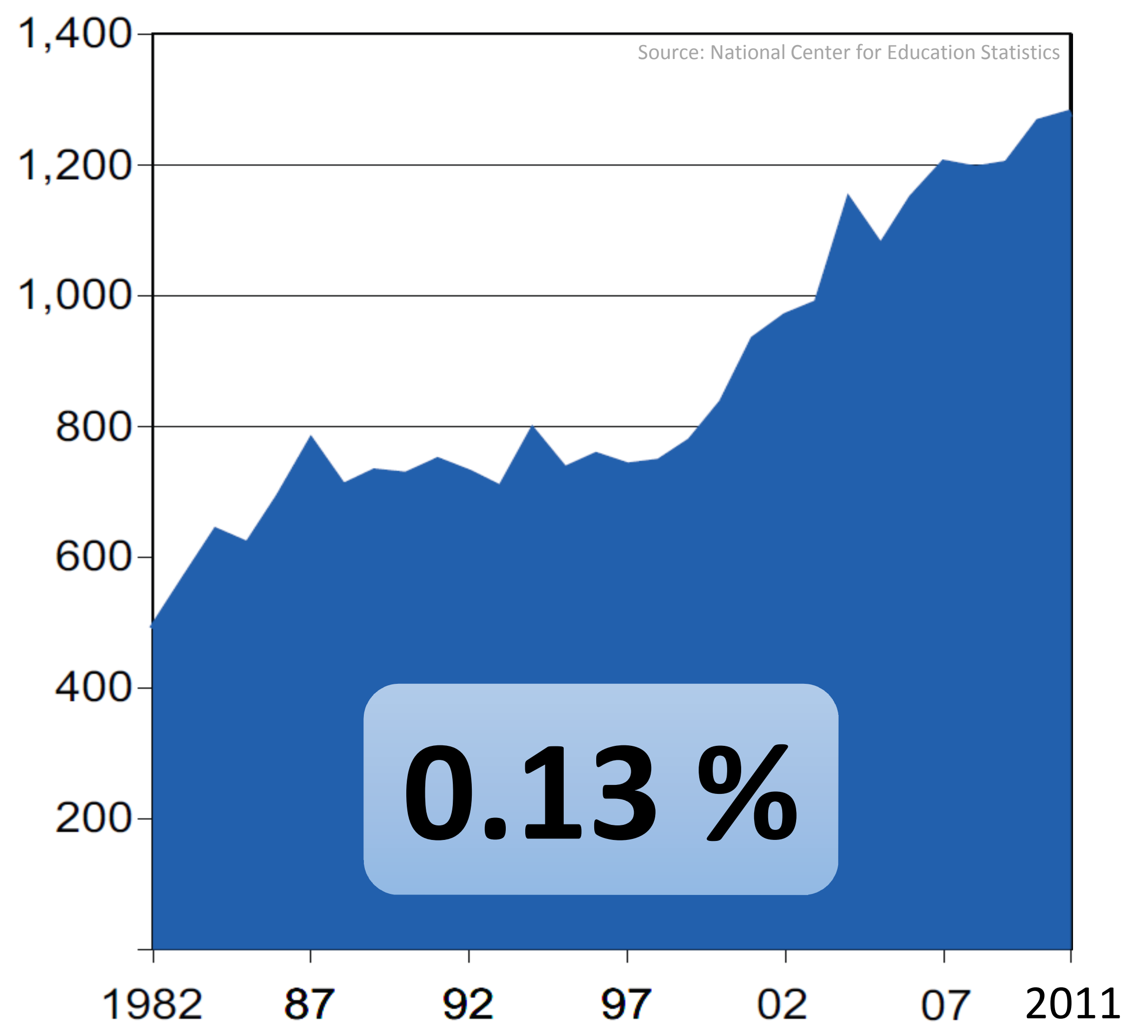
US High School AP Physics → 182,000 out of 15,000,000 (grades 9-12)

Source: National Center for Education Statistics



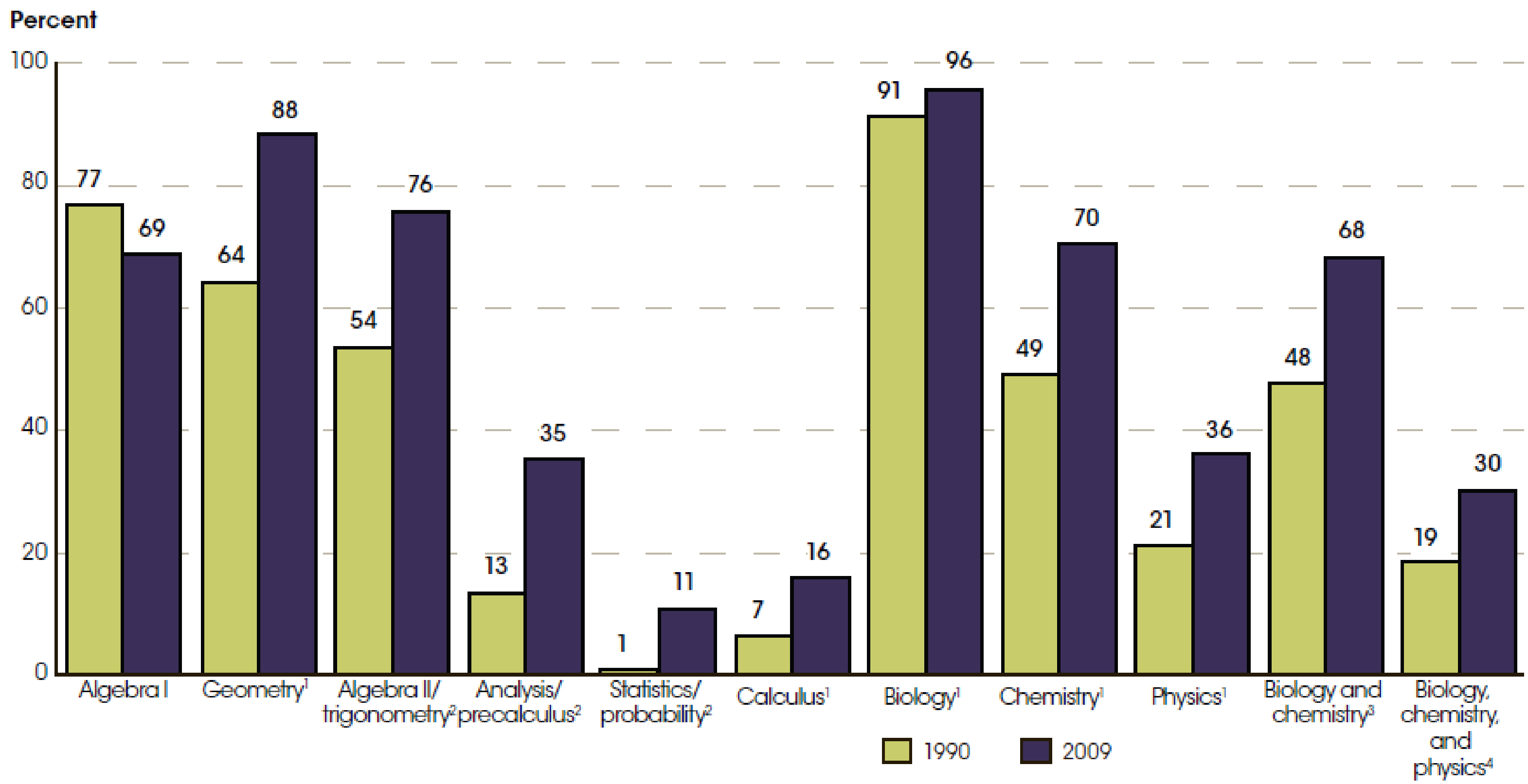
US Math-Science → Women BS Physics → 1,300 out of 1,000,000 (2011)





US High Schools Teach Biology divorced from Chemistry and Mathematics

Source: National Center for Education Statistics

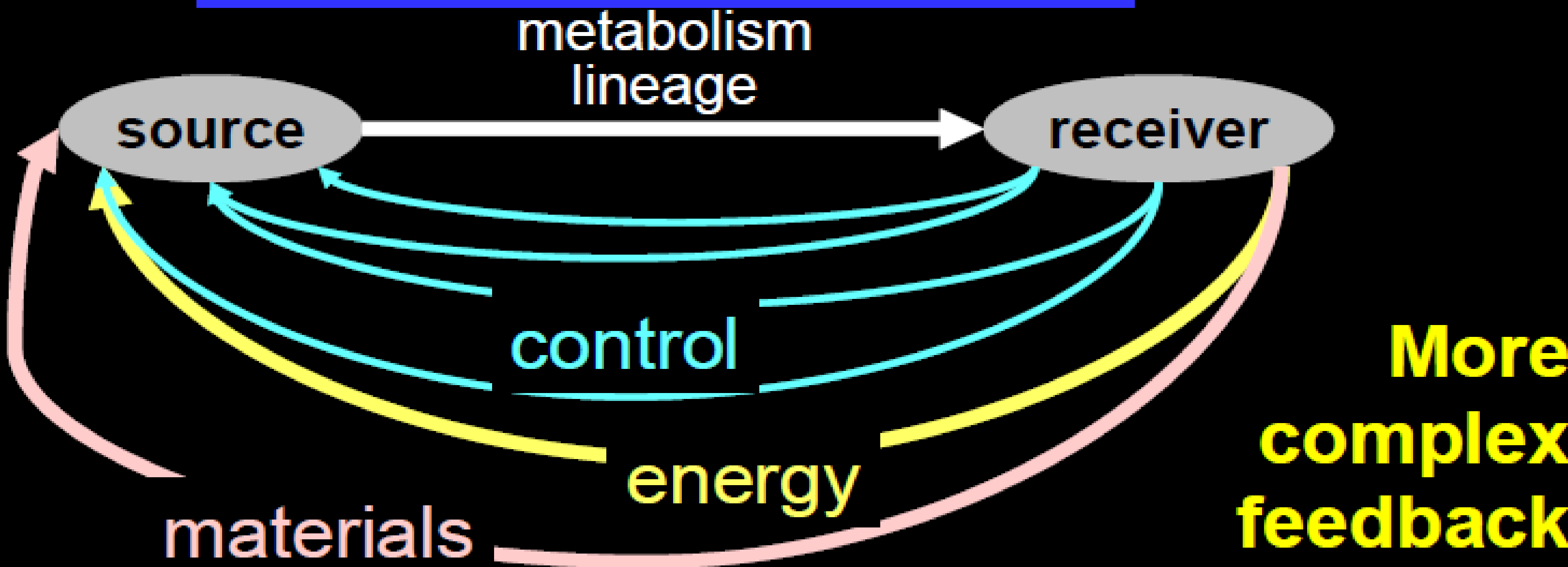


Enrollment of high school graduates in science and mathematics courses

Dumbed-down descriptive biology infecting schools and general colleges

Understanding bio-systems and bio-networks may aid complex problems

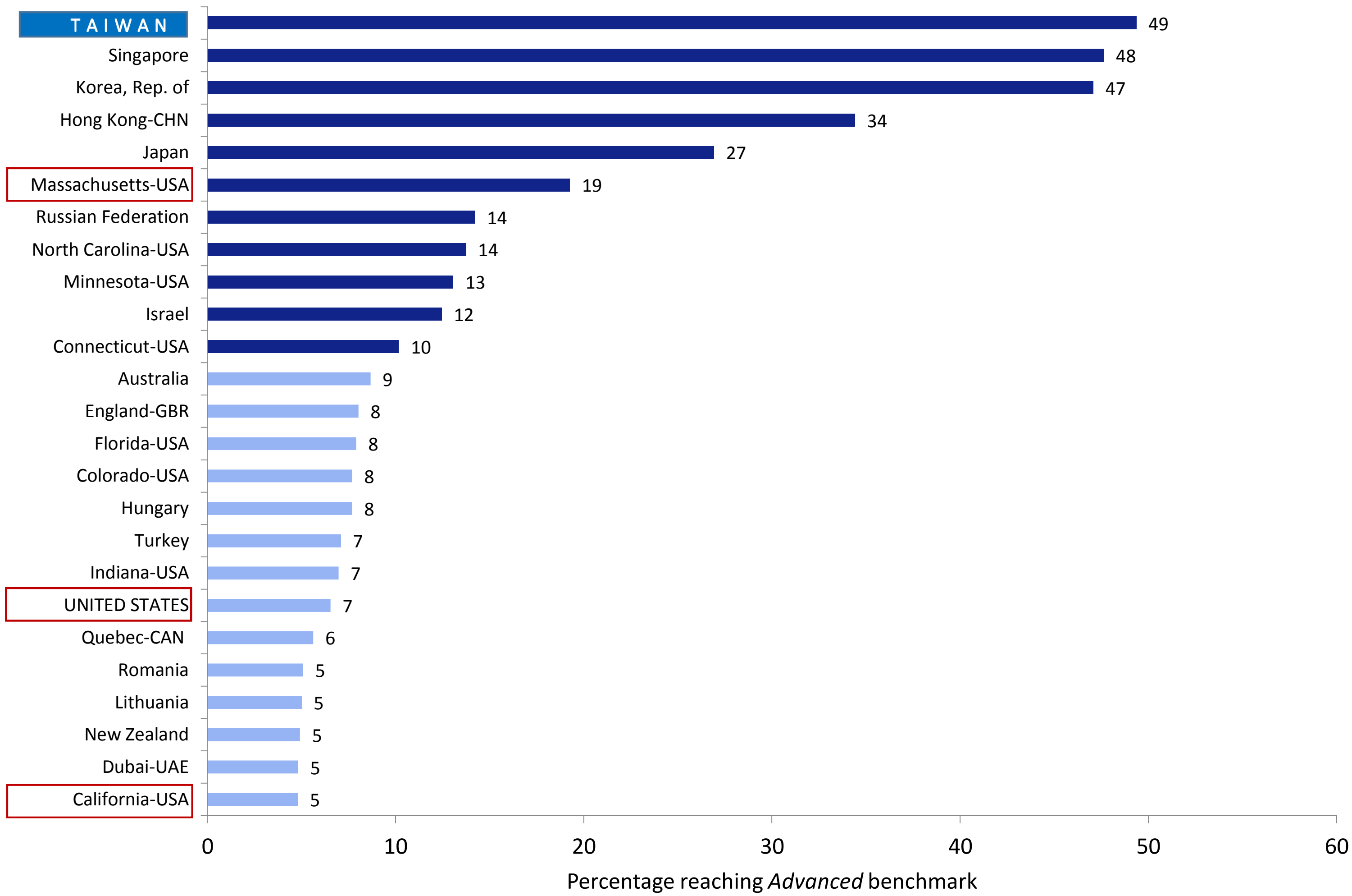
$$\frac{1}{\pi}\int_0^\infty \ln\left|S(j\omega)\right|\frac{z}{z^2+\omega^2}d\omega \geq \ln\left|\frac{z+p}{z-p}\right|$$



Taiwan Public Education

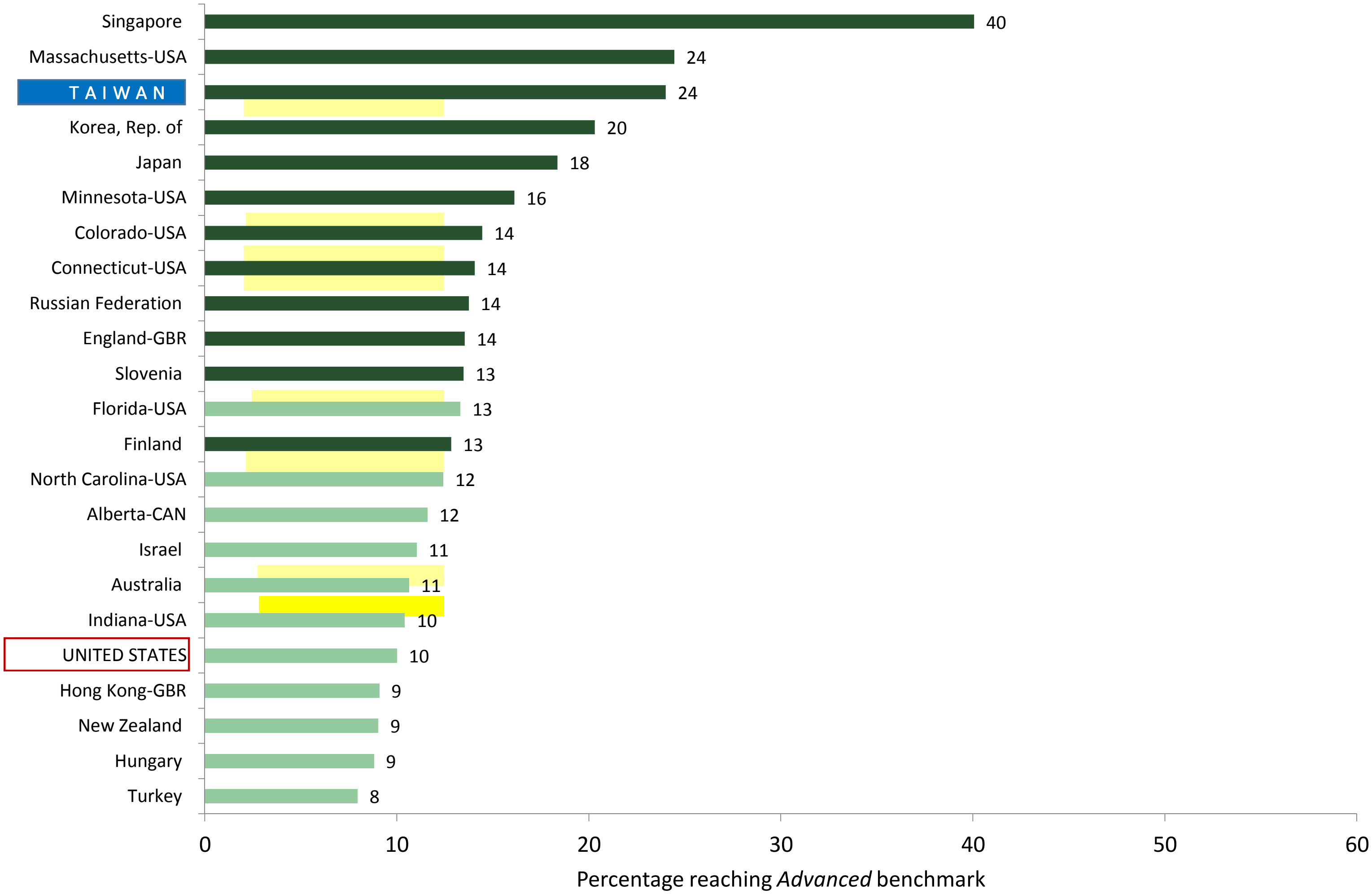
Excellence in Classroom Performance vs Imagination, Invention and Innovation

Taiwan Ranks No. 1 in Global Performance in Mathematics by 8th Graders



Source: National Center for Education Statistics

Taiwan Ranks No. 2 in National Performance in Science by 8th Graders



Source: National Center for Education Statistics

Analyze this - 60% of the world's most innovative companies are from the US But the performance of public school students in the US are near-abysmal.

The World's Most Innovative Companies

« The World's Most Innovative Companies Home | Methodology

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Search

FILTERS

Filter by region: All regions

Filter by industry: All industries

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The World's Billionaires

World's Most Powerful People

Forbes 400 Richest Americans

Global 2000 Leading Companies

World's Most Powerful Women

LICENSE THE LOGO

Forbes | 2013 WORLD'S MOST

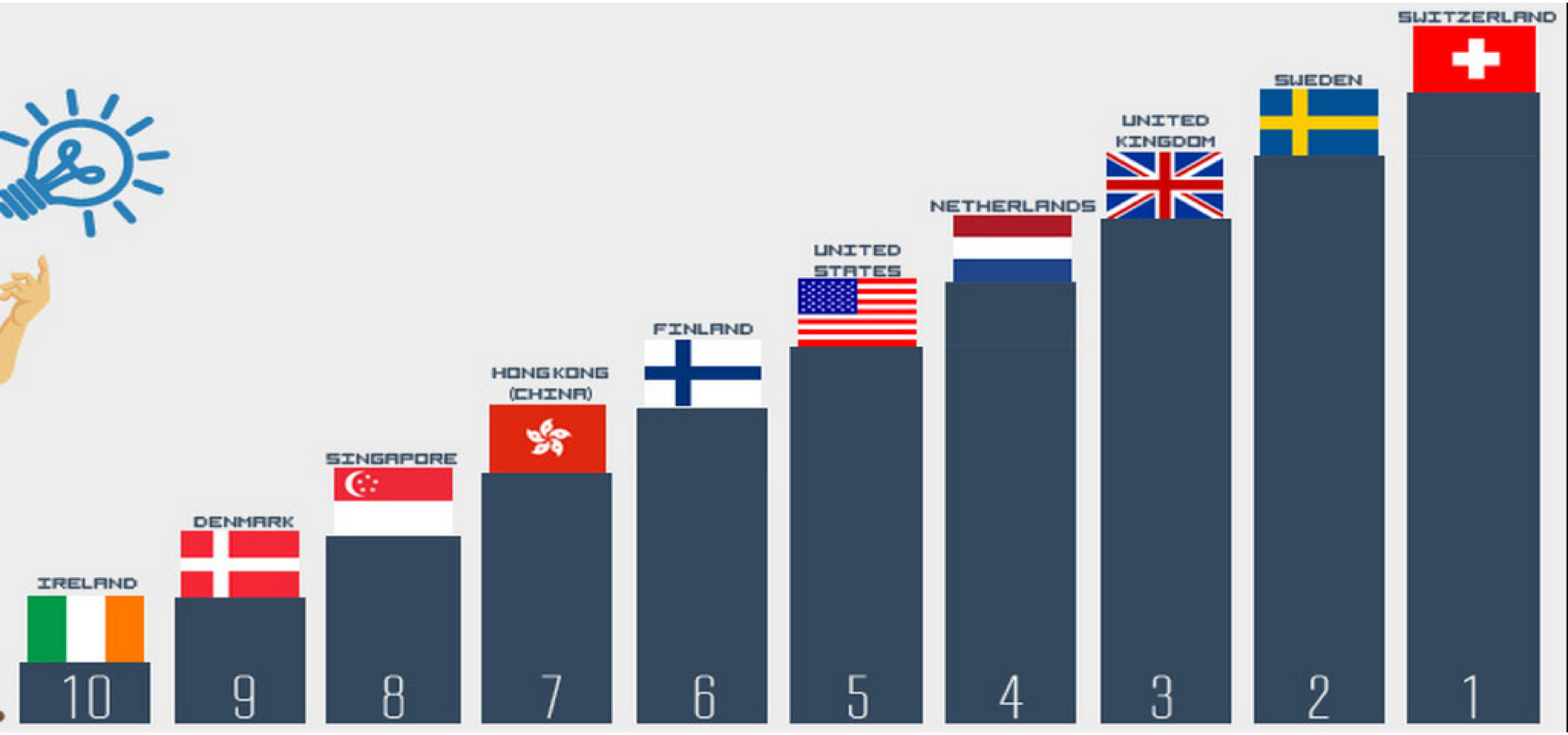
BROWSE THE LIST

Values calculated August 2013

Rank	Company	Country	12-Month Sales Growth (%)	5-Year Annualized Total Return (%)	Innovation Premium* (%)
1	Salesforce.com	United States	32.1	21.6	72.8
2	Alexion Pharmaceuticals	United States	39.2	38.4	72.3
3	VMware	United States	16.3	19.0	63.7
4	Regeneron Pharmaceuticals	United States	128.3	65.8	63.1
5	ARM Holdings	United Kingdom	22.5	47.9	61.2
6	Baidu	China	44.6	32.8	60.6
7	Amazon.com	United States	23.0	31.0	60.2
8	Intuitive Surgical	United States	18.3	5.2	53.9
9	Rakuten	Japan	14.1	23.1	50.7
10	Natura Cosmeticos	Brazil	-3.9	14.5	48.5

For additional information visit http://bit.ly/MIT-Made-in-Taiwan

Most Innovative Countries - Top 10 List



Next Generation of Emerging Movers and Shakers

Alex Bard
Salesforce.com

Mayank Bawa & Tasso Argyros
Teradata

Oliver Beck
SAP

Billy Biggs
Google

Catherine Courage
Citrix Systems

Craig Federighi
Apple

Timothy Young
VMWare

Amy Padour
Kellogg

Tiffany Sepanski
Mondelēz International

Phoong Tang
Monsanto

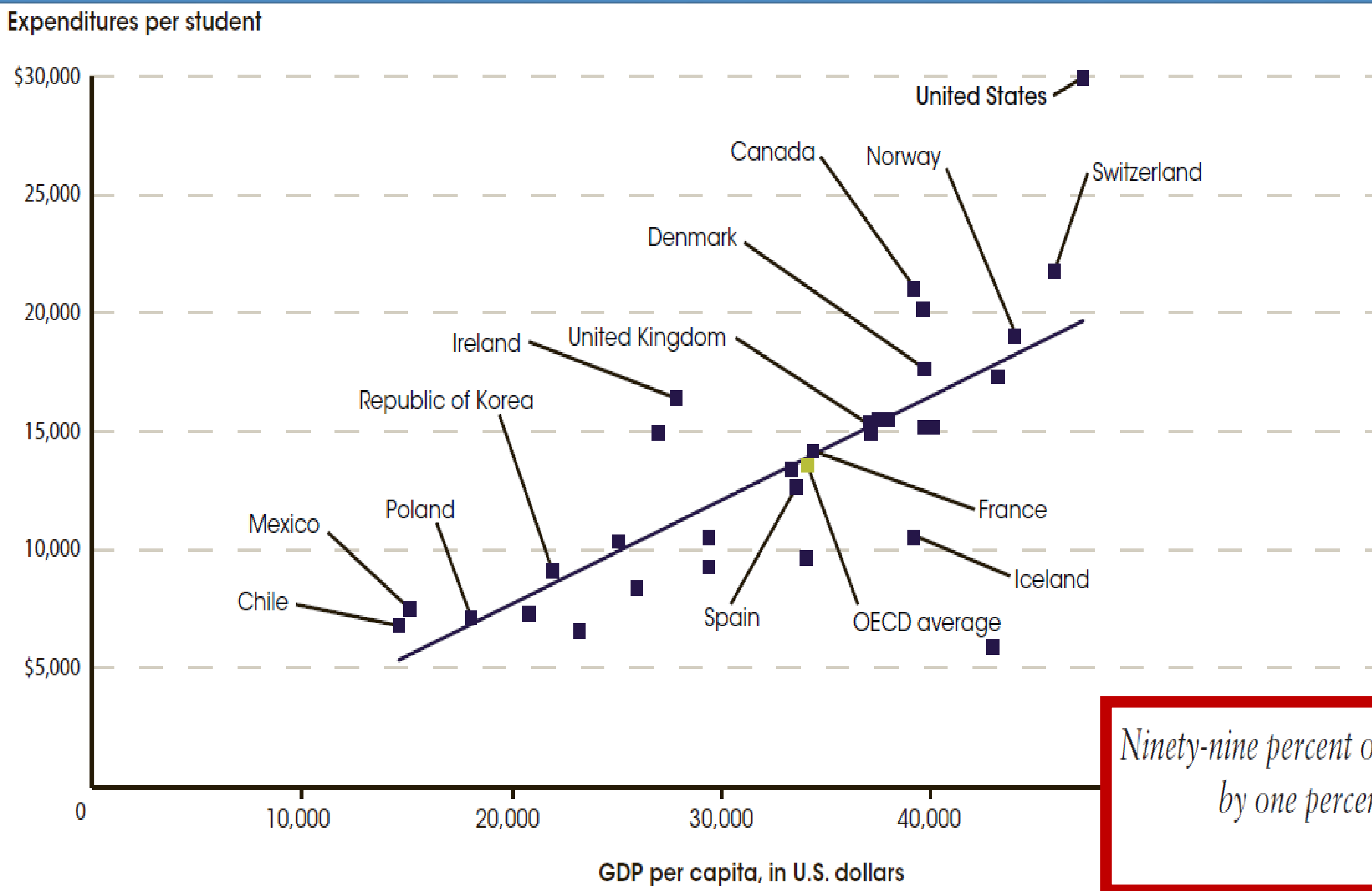
FORBES 2013

Founders / Co-Founders of Top 25 U.S. Public Tech Companies, Ranked by Market Capitalization

Rank	Company	Mkt Cap ($MM)	LTM Rev ($MM)	Employees	1st or 2nd Gen Immigrant Founder / Co-Founder	Generation
1	Apple	$416,622	$164,346	76,100	Steve Jobs	2nd-Gen, Syria
2	Google	268,445	49,958	53,861	Sergey Brin	1st-Gen, Russia
3	IBM	239,530	104,507	434,246	Herman Hollerith	2nd-Gen, Germany
4	Microsoft	234,828	72,764	94,000	--	--
5	Oracle	172,044	37,230	115,000	Larry Ellison / Bob Miner	2nd-Gen, Russia / 2nd-Gen, Iran
6	Amazon.com	119,011	61,093	88,400	Jeff Bezos	2nd-Gen, Cuba
7	Cisco	116,904	47,252	66,639	--	--
8	Intel	105,721	53,341	105,000	**Andy Grove**	**1st-Gen, Hungary**
9	Ebay	65,357	14,028	31,500	Pierre Omidyar	1st-Gen, France
10	Facebook	63,472	5,089	4,619	Eduardo Saverin	1st-Gen, Brazil
11	EMC	53,347	21,714	60,000	Roger Marino	2nd-Gen, Italy
12	Hewlett-Packard	43,118	118,397	331,800	--	--
13	Texas Instruments	38,756	12,690	34,151	Cecil Green / J. Erik Jonsson	1st-Gen, UK / 2nd-Gen, Sweden
14	VMware	35,917	4,605	13,800	Edouard Bugnion	1st-Gen, Switzerland
15	Priceline	35,583	5,261	7,000	--	--
16	Automatic Data Processing	31,274	10,945	57,000	Henry Taub	2nd-Gen, Poland
17	salesforce.com	25,840	3,050	9,800	--	--
18	Dell	25,003	56,982	111,300	--	--
19	Yahoo!	24,306	4,987	11,700	Jerry Yang	1st-Gen, Taiwan
20	Cognizant Technology	23,648	7,346	156,700	Francisco D'souza / Kumar Mahadeva	1st-Gen, India** / 1st-Gen, Sri Lanka
21	Adobe Systems	20,640	4,373	11,144	--	--
22	Broadcom	19,713	8,006	11,300	Henry Samueli	2nd-Gen, Poland
23	Intuit	19,393	4,153	8,500	--	--
24	LinkedIn	19,357	972	3,458	Konstantin Guericke / Jean-Luc Vaillant	1st-Gen, Germany / 1st-Gen, France
25	Symantec	16,916	6,839	20,500	--	--
Total Founded by 1st or 2nd Gen Immigrants		**$1,590,800**	**$507,516**	**1,151,835**		

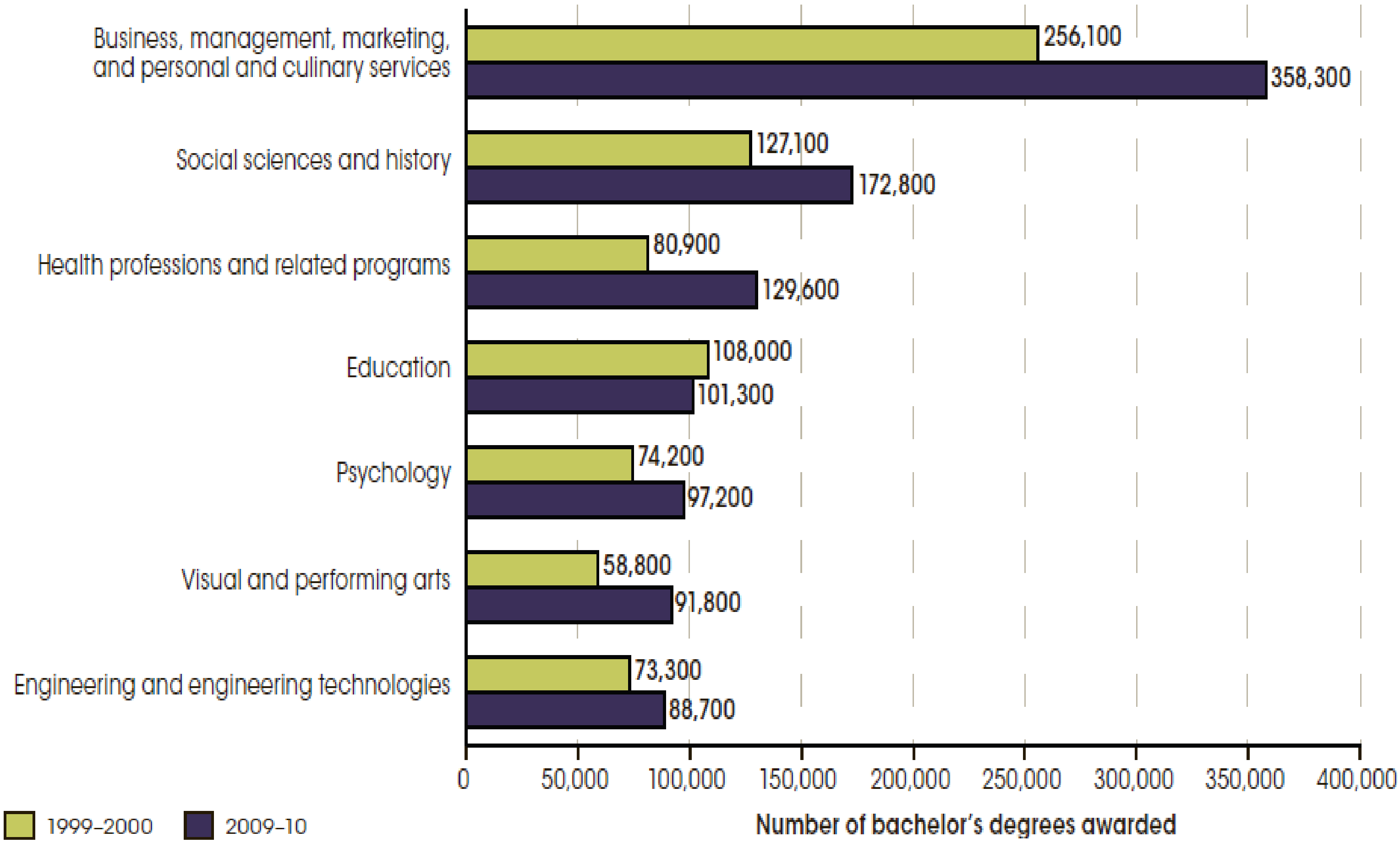
KPCB

Comparative Investment in Post-Secondary Education



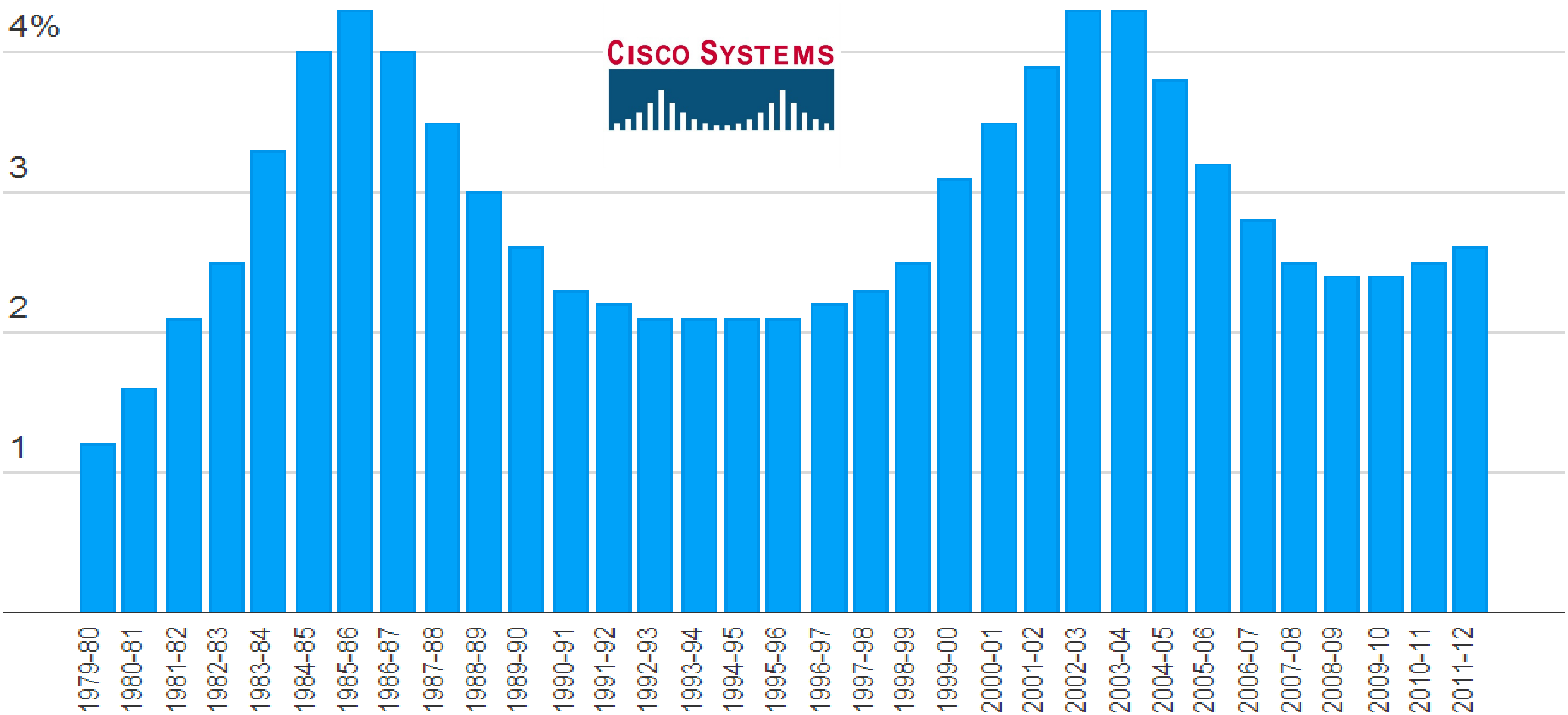
Ninety-nine percent of the discoveries are made by one percent of the scientists.
Julius Axelrod, Nobel Laureate

Slippery Slope → one result of poor math & science in US public schools

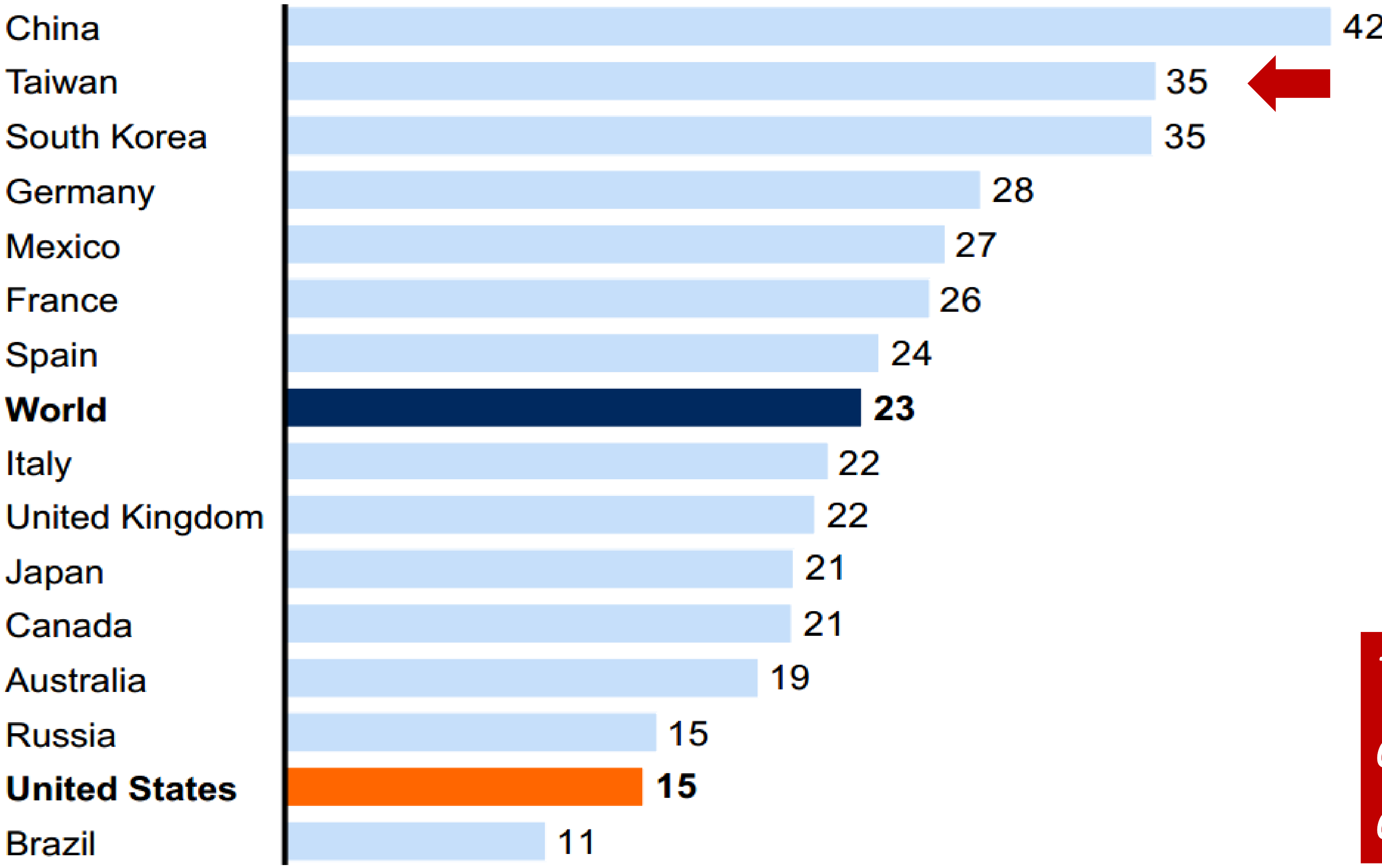


Source: National Center for Education Statistics

Computer Science degrees as a share of all bachelor's degrees awarded

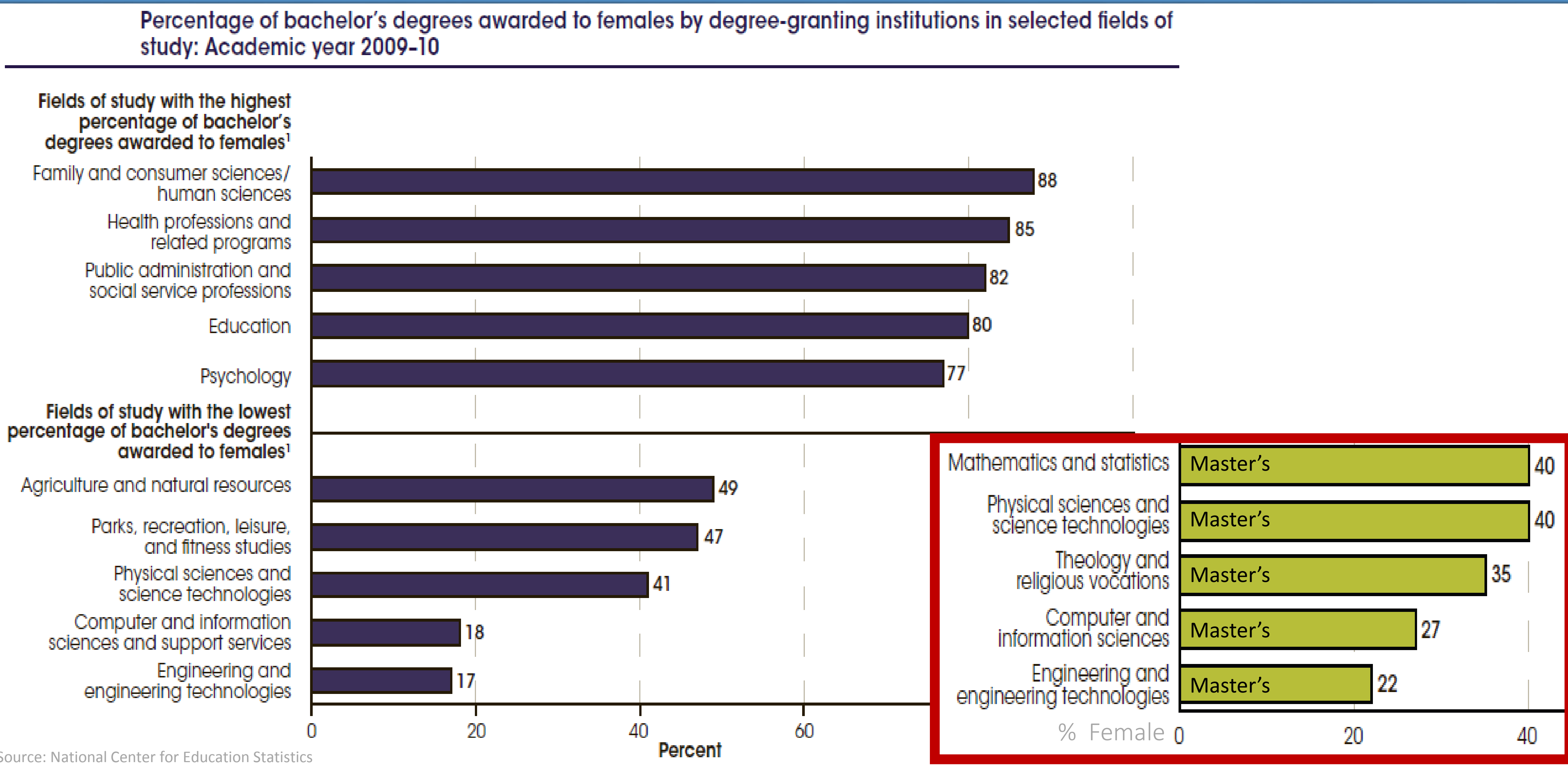


STEM degrees as a percentage of bachelor's degrees awarded (in 2008)



Tools for Taiwan are going to be quite different.

Gender Gap → another result of poor math & science in K-12 education



Source: National Center for Education Statistics

Gender Gap in Taiwan – How much did it shrink after thirteen years?

Appendix table 2-35

First university degrees and ratio of first university degrees and S&E degrees to 24-year-old population, by sex, in selected locations, by region: 2000 or most recent year (revised)

Source: US National Science Foundation

Sex, region and location	All first university degrees	All S&E	Natural sciences[a]	Mathematics/ computer sciences	Agricultural sciences	Social/ behavioral sciences[b]	Engineering	24-year-olds	First university degrees	NS&E degrees	Social/ behavioral science degrees
	Number								Ratio to 24-year-old population[c]		
Male											
Asia											
Cambodia	1,817	415	67	98	64	109	77	77,800	2.3	0.39	0.14
Japan (2001)	335,850	275,451	10,110	3,761	7,854	160,525	93,201	880,400	38.1	13.05	18.23
Kyrgyzstan	7,915	3,281	805	171	297	710	1,298	44,000	18.0	5.84	1.61
Laos	1,135	314	42	20	81	15	156	47,400	2.4	0.63	0.03
South Korea	113,573	63,881	6,843	4,289	3,805	6,729	42,215	403,200	28.2	14.17	1.67
Taiwan (2001)	59,091	35,661	2,466	6,268	1,482	2,225	23,220	197,531	29.9	16.93	1.13
Europe											
Austria	7,939	3,487	407	442	138	355	2,145	47,600	16.7	6.58	0.75
Belgium	11,273	5,052	829	391	292	859	2,681	63,600	17.7	6.59	1.35
Denmark	3,277	1,291	238	145	85	800	23	33,200	9.9	1.48	2.41
Finland	10,319	6,940	432	542	308	521	5,137	33,400	30.9	19.22	1.56
France	119,281	64,647	16,616	10,002	1,031	10,427	26,571	388,600	30.7	13.95	2.68
Germany (2001)	96,418	60,037	5,536	6,584	2,218	21,839	23,860	460,200	21.0	8.30	4.75
Hungary	18,810	6,314	278	461	868	868	3,839	84,800	22.2	6.42	1.02
Iceland	469	192	30	45	9	38	70	2,200	21.3	7.00	1.73
Ireland	8,640	3,824	955	887	130	213	1,639	35,200	24.5	10.26	0.61
Italy	66,568	32,883	3,910	2,354	946	5,350	20,323	370,200	18.0	7.44	1.45
Netherlands	32,084	13,001	1,440	1,121	960	2,692	6,788	95,400	33.6	10.81	2.82
Norway	8,041	3,147	77	657	108	1,071	1,234	27,800	28.9	7.47	3.85
Spain	85,347	37,984	4,696	5,919	2,717	4,829	19,823	325,600	26.2	10.18	1.48
Sweden	13,551	7,333	513	740	121	772	5,187	52,400	25.9	12.52	1.47
Switzerland	11,084	4,581	775	281	134	421	2,970	39,200	28.3	10.61	1.07
United Kingdom[d] (1999)	121,680	54,990	15,450	10,750	1,260	8,770	18,760	357,800	34.0	12.92	2.45
North America											
Canada	51,805	25,434	4,470	3,886	644	8,937	7,497	210,000	24.7	7.86	4.26
Costa Rica	1,749	702	58	149	127	107	261	36,200	4.8	1.64	0.30
Cuba	5,702	1,802	208	155	267	136	1,036	76,200	7.5	2.19	0.18
Mexico	66,488	28,961	867	5,103	2,499	2,259	18,233	972,000	6.8	2.75	0.23
United States	536,158	197,669	37,966	33,045	9,780	69,558	47,320	1,889,200	28.4	6.78	3.68
Oceania											
Australia	48,187	18,178	3,942	4,214	657	1,872	7,493	137,600	35.0	11.85	1.36
New Zealand	7,572	2,403	1,259	265	137	110	632	25,400	29.8	9.03	0.43

Need current data for number of female engineering graduates in TW

Appendix table 2-35

First university degrees and ratio of first university degrees and S&E degrees to 24-year-old population, by sex, in selected locations, by region: 2000 or most recent year (revised)

Source: US National Science Foundation

Sex, region and location	All first university degrees	All S&E	Natural sciences[a]	Mathematics/ computer sciences	Agricultural sciences	Social/ behavioral sciences[b]	Engineering	24-year-olds	First university degrees	NS&E degrees	Social/ behavioral science degrees
	Number								Ratio to 24-year-old population[c]		
Female											
Asia											
Cambodia	745	110	39	27	4	39	1	79,200	0.9	0.09	0.05
Japan (2001)	209,632	83,826	4,082	1,204	6,488	60,775	11,277	839,000	25.0	2.75	7.24
Kyrgyzstan	8,839	3,229	1,231	303	65	903	727	43,600	20.3	5.33	2.07
Laos	591	75	21	10	19	8	17	46,600	1.3	0.14	0.02
South Korea	100,925	32,978	6,584	5,010	2,054	5,037	14,293	380,400	26.5	7.35	1.32
Taiwan (2001)	58,339	12,963	1,218	3,123	1,718	3,537	3,367	187,363	31.1	5.03	1.89
Europe											
Austria	7,193	1,691	345	80	98	702	466	44,800	16.1	2.21	1.57
Belgium	11,253	3,159	622	128	206	1,537	666	61,600	18.3	2.63	2.50
Denmark	3,458	1,073	221	64	86	684	18	31,800	10.9	1.22	2.15
Finland	14,950	3,243	563	304	224	996	1,156	32,200	46.4	6.98	3.09
France	156,035	51,513	16,895	5,040	1,226	20,630	7,722	373,600	41.8	8.27	5.52
Germany (2001)	86,909	29,953	5,007	2,603	2,660	16,341	3,342	432,600	20.1	3.15	3.78
Hungary	28,168	3,309	238	89	791	1,155	1,036	81,000	34.8	2.66	1.43
Iceland	971	177	57	13	0	84	23	2,000	48.6	4.65	4.20
Ireland	10,767	2,856	1,276	518	66	577	419	33,800	31.9	6.74	1.71
Italy	84,109	24,380	4,975	2,473	399	9,171	7,362	356,400	23.6	4.27	2.57
Netherlands	37,725	5,192	797	214	451	2,769	961	91,600	41.2	2.65	3.02
Norway	14,380	1,707	63	116	98	973	457	26,600	54.1	2.76	3.66
Spain	122,231	27,829	6,212	3,091	2,022	9,146	7,358	311,600	39.2	6.00	2.94
Sweden	20,546	4,521	743	523	110	1,398	1,747	49,800	41.3	6.27	2.81
Switzerland	7,944	1,564	365	56	39	775	329	37,400	21.2	2.11	2.07
United Kingdom[d] (1999)	142,000	37,390	16,780	3,880	1,600	11,890	3,250	338,800	41.9	7.53	3.51
North America											
Canada	75,326	27,916	5,883	1,538	592	17,723	2,180	200,600	37.6	5.08	8.83
Costa Rica	2,644	372	46	65	40	157	64	34,600	7.6	0.62	0.45
Cuba	11,067	958	187	64	117	272	318	73,000	15.2	0.94	0.37
Mexico	68,745	13,088	834	4,486	738	1,079	5,951	1,007,000	6.8	1.19	0.11
United States	716,963	200,953	45,565	16,078	8,464	118,630	12,216	1,822,200	39.3	4.52	6.51
Oceania											
Australia	64,558	11,681	4,581	1,551	459	3,046	2,044	131,600	49.1	6.56	2.31
New Zealand	13,396	1,926	1,089	127	59	298	353	24,000	55.8	6.78	1.24

Can MOOC shrink TW's gender gap?

	All first university degrees	All S&E	Natural sciences[a]	Mathematics/ computer sciences	Agricultural sciences	Social/ behavioral sciences[b]	Engineering	24-year-olds
	Number							
Male								
Asia								
Cambodia	1,817	415	67	98	64	109	77	77,800
Japan (2001)	335,850	275,451	10,110	3,761	7,854	160,525	93,201	880,400
Kyrgyzstan	7,915	3,281	805	171	297	710	1,298	44,000
Laos	1,135	314	42	20	81	15	156	47,400
South Korea	113,573	63,881	6,843	4,289	3,805	6,729	42,215	403,200
Taiwan (2001)	59,091	35,661	2,466	6,268	1,482	2,225	23,220	197,531
Female								
Asia								
Cambodia	745	110	39	27	4	39	1	79,200
Japan (2001)	209,632	83,826	4,082	1,204	6,488	60,775	11,277	839,000
Kyrgyzstan	8,839	3,229	1,231	303	65	903	727	43,600
Laos	591	75	21	10	19	8	17	46,600
South Korea	100,925	32,978	6,584	5,010	2,054	5,037	14,293	380,400
Taiwan (2001)	58,339	12,963	1,218	3,123	1,718	3,537	3,367	187,363

For additional information visit http://bit.ly/MIT-Made-in-Taiwan

0.018%

24 year old females (11.8% males) have engineering degree

Taiwan's Immense Untapped Potential?

12.66%

of students with engineering degree were female (2001)

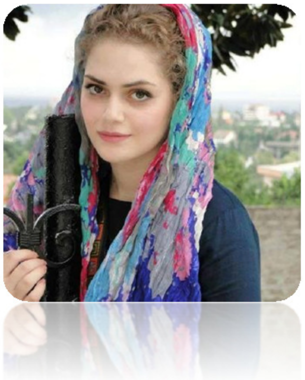
Gender Gap vs Collective IQ – MIT Center for Collective Intelligence

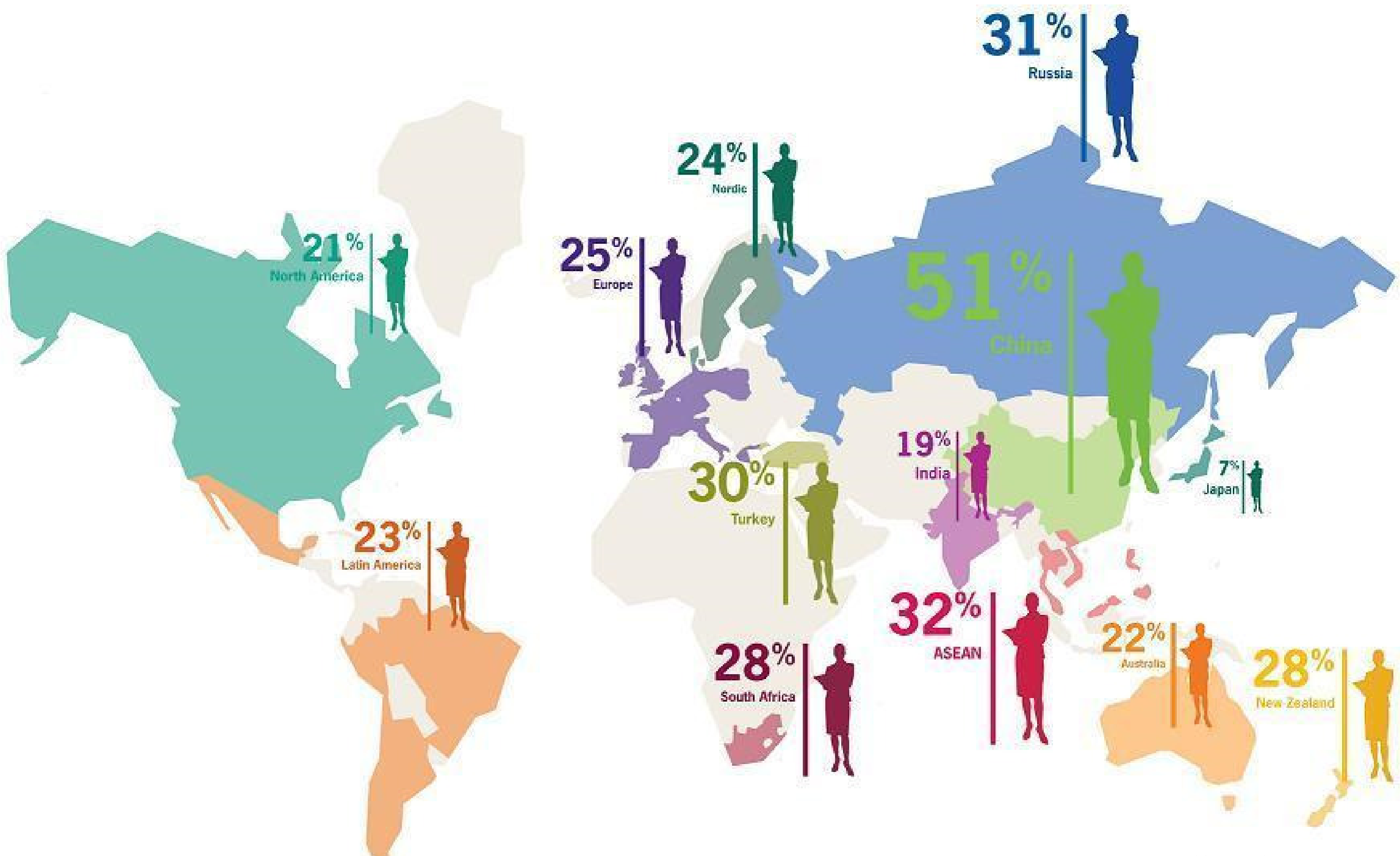
7. How can companies make their teams smarter?

Essa suggested taking a look at the research of Thomas W. Malone, a professor of management at the MIT Sloan School of Management and the founding director of the MIT Center for Collective Intelligence. Malone has been researching collective IQ for years. One of his findings? Hire more women. "Just by adding more women to your team, the group IQ will go up," Essa said.

http://searchcio.techtarget.com/tip/Seven-data-science-lessons-from-McGraw-Hill-Education-analytics-guru

Women in Senior Management, 2013





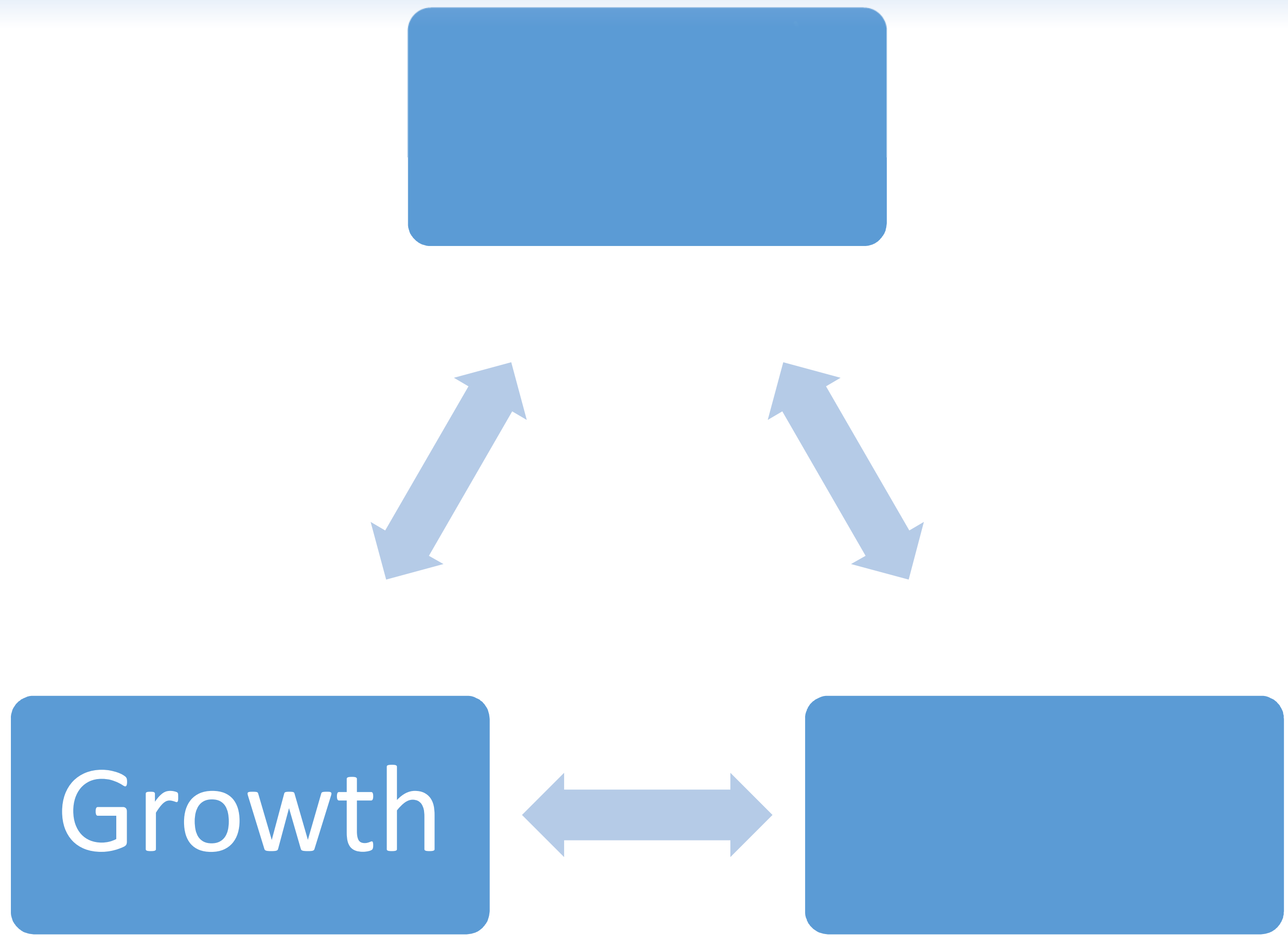
www.internationalbusinessreport.com/files/ibr2013_wib_report_final.pdf

For additional information visit http://bit.ly/MIT-Made-in-Taiwan

Discussion

- History
- Context
- Purpose
- Economy
- Denominator
- Data
- Conclusion

We have thus far analyzed the context where MOOC may be instrumental

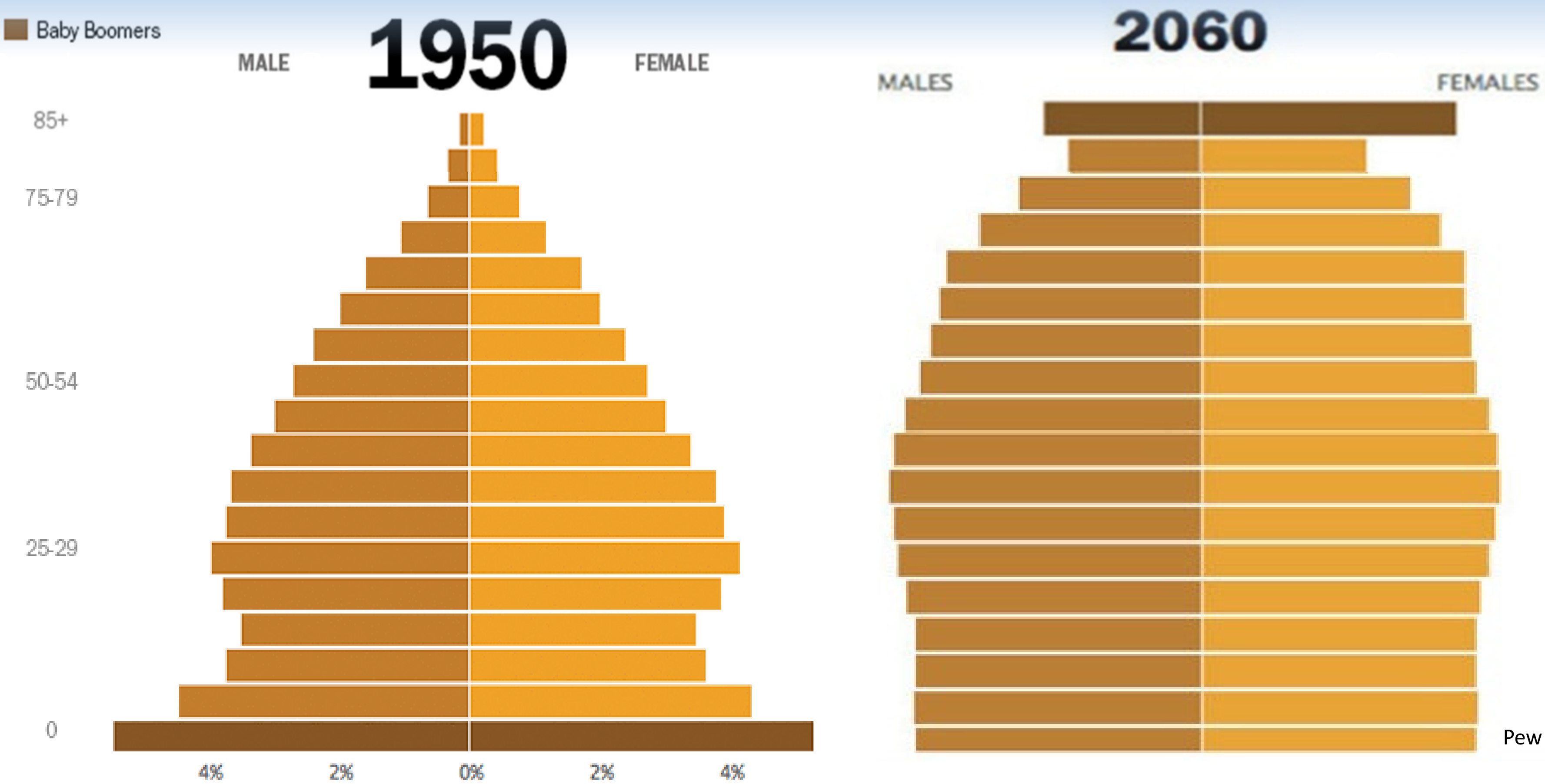


Socio-Economic

For additional information visit http://bit.ly/MIT-Made-in-Taiwan

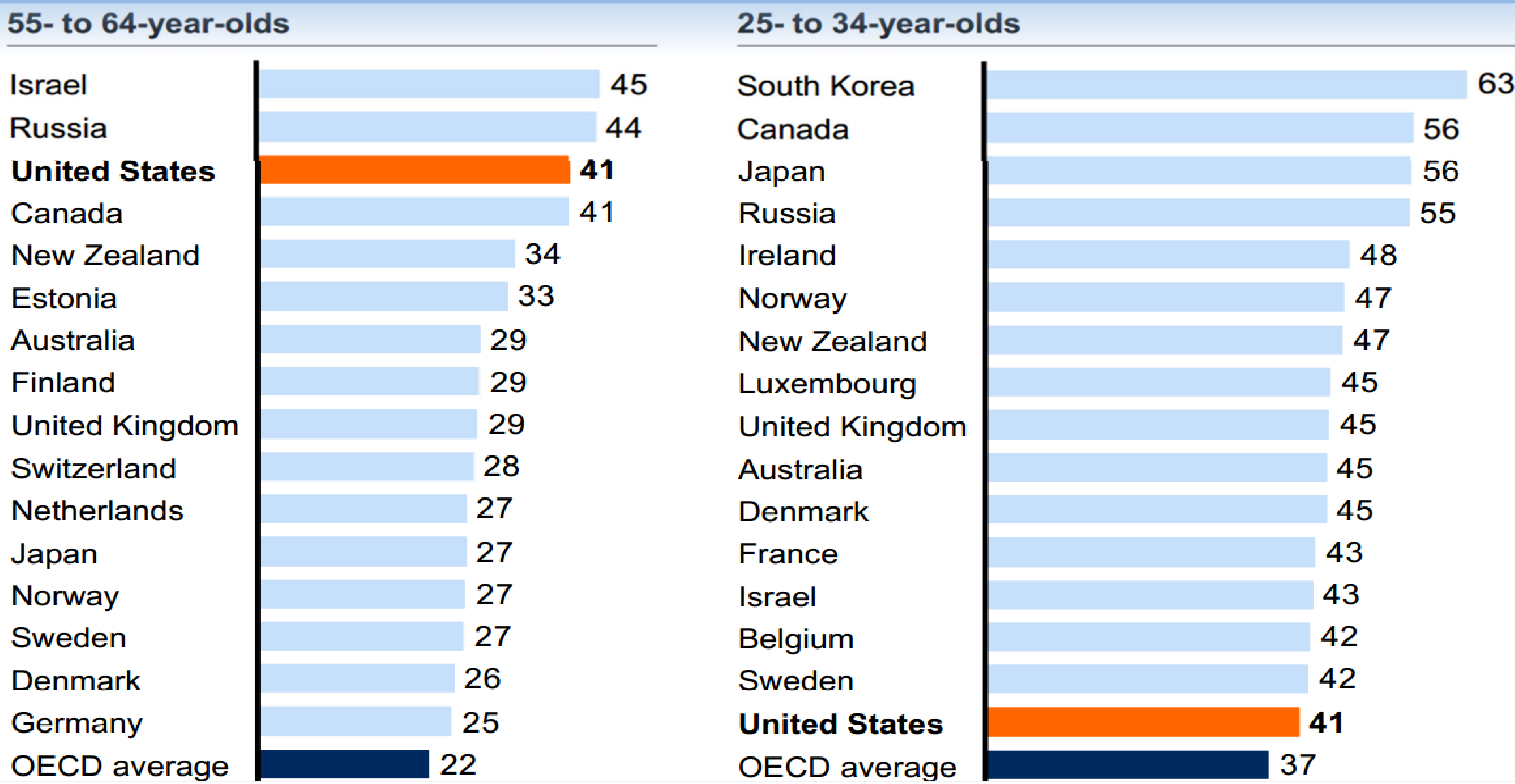
Demographic changes influence the nature of socio-economic growth

US Population



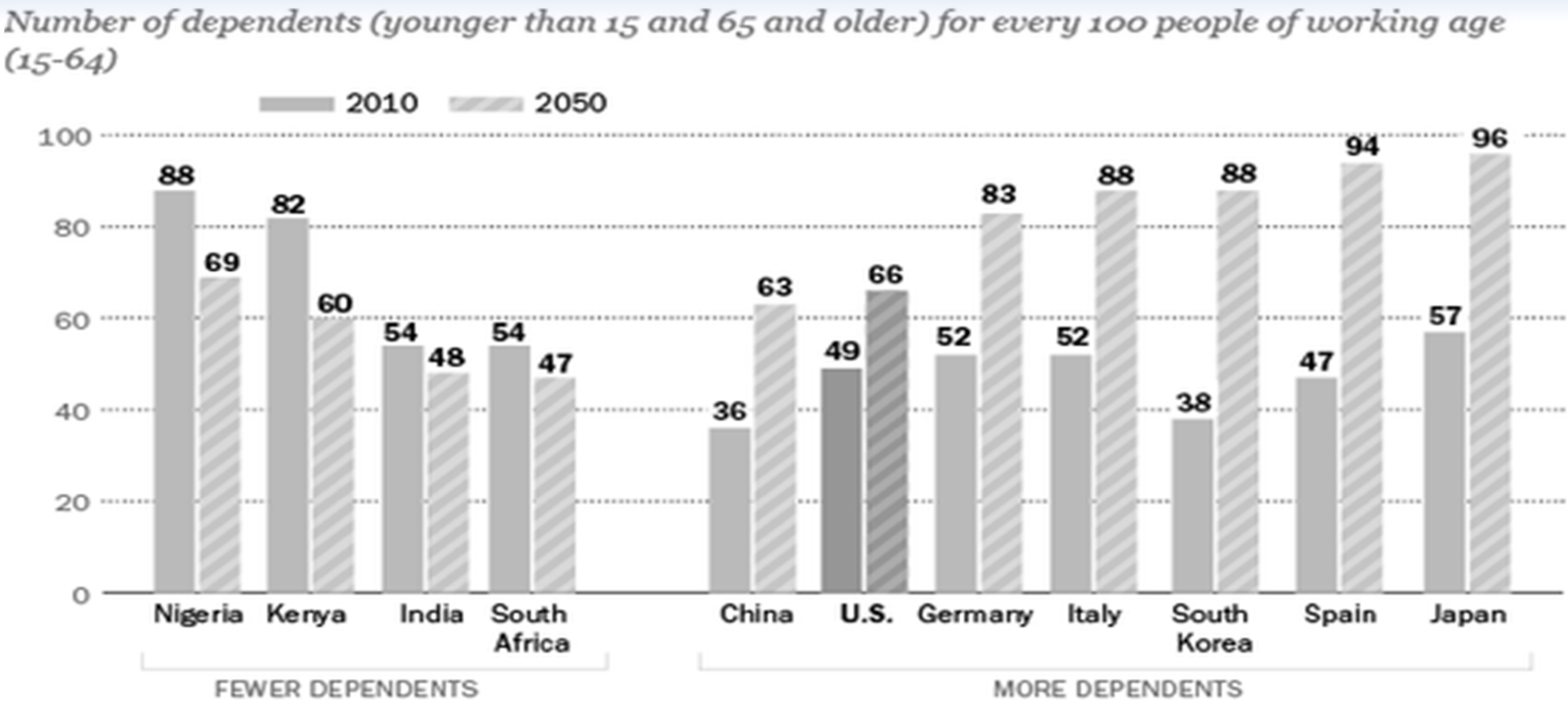
Pew Research

Demographics of tertiary education (%) influences workforce availability

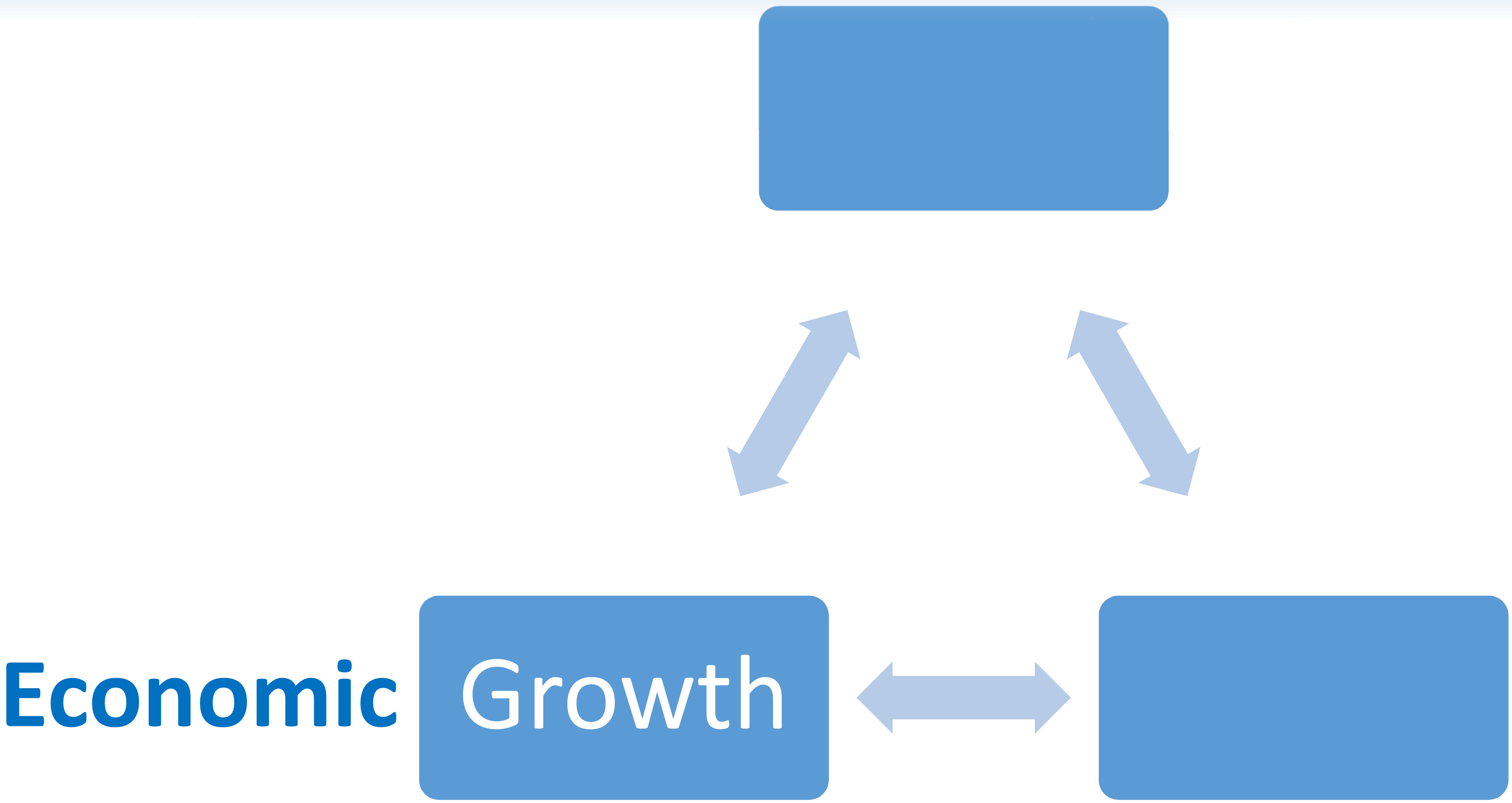


Demographic change influences the potential for socio-economic growth

http://esa.un.org/unpd/wpp/index.htm



Is education a catalyst for GDP? Then education must complement growth.



Context

Taiwan Economic Indicators

How can MOOC contribute to increase the Gross Domestic Product?

GDP - composition, by sector of origin:

agriculture: 2%
industry: 29.4%
services: 68.6% (2013 est.) US & UK ~ 80/20

Agriculture - products:

rice, vegetables, fruit, tea, flowers; pigs, poultry; fish

Industries:

electronics, communications and information technology products, petroleum refining, chemicals, machinery, cement, food processing, vehicles, consumer products, pharmaceuticals

Industrial production growth rate:

1.8% (2013 est.)
country comparison to the world: 129

Labor force:

11.55 million (2013 est.)
country comparison to the world: 47

Labor force - by occupation:

agriculture: 5%
industry: 36.2%
services: 58.8% (2012 est.)

Service economies are catalyzed by knowledge and deep analytical skills.

Unemployment rate:

4.1% (2013 est.)
country comparison to the world: 33
4.2% (2012 est.)

Population below poverty line:

1.5% (2012 est.)

Household income or consumption by percentage share:

lowest 10%: 6.4%
highest 10%: 40.3% (2010)

Exports - commodities:

electronics, flat panels, machinery; metals; textiles, plastics, chemicals; optical, photographic, measuring, and medical i

Exports - partners:

China 27.1%, Hong Kong 13.2%, US 10.3%, Japan 6.4%, Singapore 4.4% (2012 est.)

Exports must serve global demand (sectors projected for rapid economic growth)

Imports:

$268.5 billion (2013 est.)
country comparison to the world: 19
$268.8 billion (2012 est.)

Imports - commodities:

electronics, machinery, crude petroleum, precision instruments, organic chemicals, metals

Imports - partners:

Japan 17.6%, China 16.1%, US 9.5% (2012 est.)

Reserves of foreign exchange and gold:

$414.5 billion (31 December 2013 est.)
country comparison to the world: 7
$408.5 billion (31 December 2012 est.)

Debt - external:

$146.8 billion (31 December 2013 est.)
country comparison to the world: 38
$130.8 billion (31 December 2012 est.)

Stock of direct foreign investment - at home:

$62.94 billion (31 December 2013 est.)
country comparison to the world: 51
$59.36 billion (31 December 2012 est.)

Stock of direct foreign investment - abroad:

$240.3 billion (31 December 2013 est.)
country comparison to the world: 22
$226.1 billion (31 December 2012 est.)

GDP (purchasing power parity):

$926.4 billion (2013 est.)
country comparison to the world: 21
$906.6 billion (2012 est.)
$894.7 billion (2011 est.)
note: data are in 2013 US dollars

GDP (official exchange rate):

$484.7 billion (2013 est.)

GDP - real growth rate:

2.2% (2013 est.)
country comparison to the world: 138
1.3% (2012 est.)
4.1% (2011 est.)

GDP - per capita (PPP):

$39,600 (2013 est.)
country comparison to the world: 28
$38,900 (2012 est.)
$38,500 (2011 est.)
note: data are in 2013 US dollars

To increase GDP

Match Education to Demand

For service economy – knowledge plus analytical skills

For export earnings – target global projected growth

Future Economic Growth

High impact companies (~5%) may be few but are influential

High Impact MIT TLO Manufacturing Companies (1997-2008)

Industry	# of Firms Started	% of Total	% Receiving Venture Capital*	% Operating^	% Closed	% Merged
Advanced Materials and Energy	15	10	33	73	27	0
Biopharma	58	39	59	55	26	19
Medical Devices	31	21	52	65	3	32
Robotics	5	3	0	60	20	20
Semiconductors and electronics	26	17	85	62	19	19
Other	15	10	33	47	27	27
All Production	**150**	**100**	**55**	**59**	**20**	**21**

Excludes 39 software companies because they fail to categorize as manufacturing ● MIT TLO refers to Technology Licensing Office

Employee-Size Segment	Period	Total High Impact Companies (HIC)	Total HIC Job Change
1-19	1994-1998	327,397	3,170,729
	1998-2002	278,190	3,577,111
	2002-2006	359,289	4,041,099
	2004-2008	350,996	4,119,926
20-499	1994-1998	23,464	2,788,969
	1998-2002	20,601	2,966,647
	2002-2006	16,523	2,001,835
	2004-2008	16,424	1,845,198
500-plus	1994-1998	1,253	5,501,049
	1998-2002	1,182	5,192,558
	2002-2006	793	2,966,826
	2004-2008	842	4,762,494
Total	1994-1998	352,114	11,460,747
	1998-2002	299,973	11,736,316
	2002-2006	376,605	9,009,760
	2004-2008	368,262	10,727,618

www/sba.gov/sites/default/files/HighImpactReport.pdf

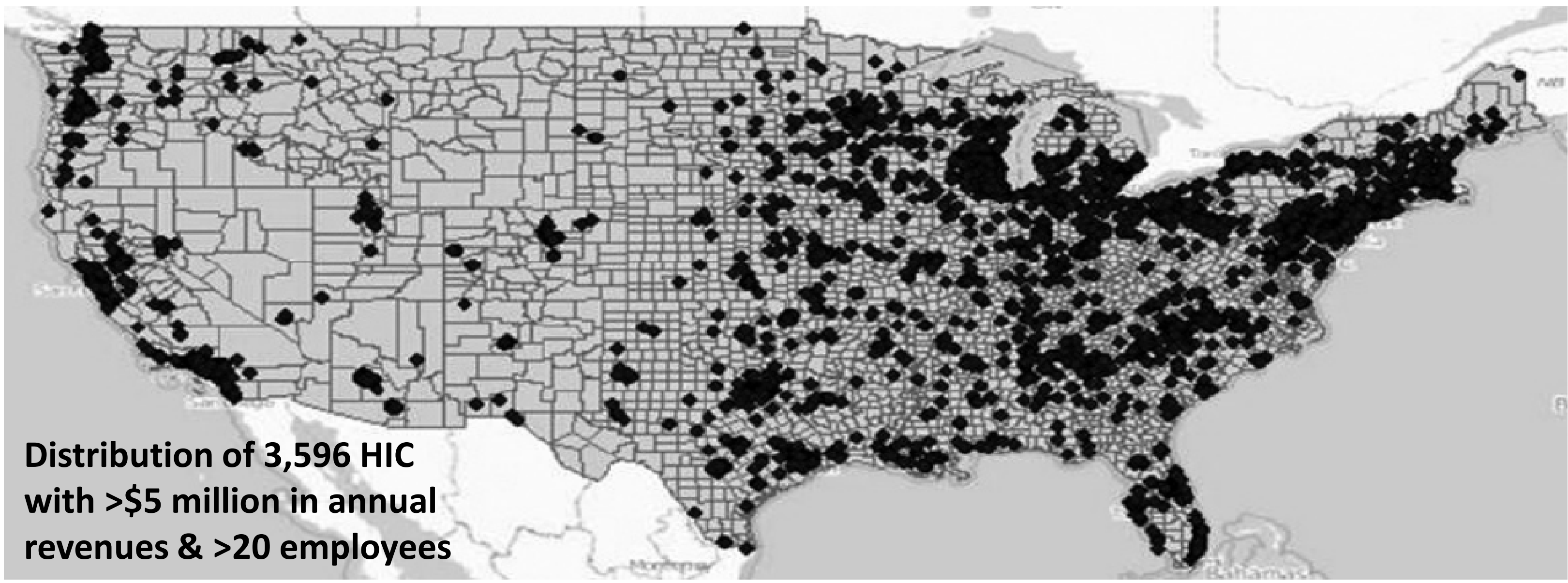
High Impact Companies: Job Creation is Immune from Volatility of Business Cycles

Period	Total High Impact Companies (HIC)	Total HIC Job Change	Total US Job Change	Total US Non-HIC Job Change
1994-1998	352,114	11,460,747	11,302,000	-158,747
1998-2002	299,973	11,736,316	2,824,000	-8,912,316
2002-2006	376,605	9,009,760	6,690,000	-2,319,760
2004-2008	368,262	10,727,618	5,843,000	-4,884,618

	1994-1998	1998-2002	2002-2006	2004-2008
High Impact Companies	352,114	299,973	376,605	368,262
All Other Companies	5,276,964	5,579,177	5,697,759	5,885,784
HIC Ratio	6.7	5.5	6.6	6.3

High Impact Companies: Job Creation is Immune from Volatility of Business Cycles

SBA Region	Total Region HICs		Urban HICs		Rural HICs	
	HICs	HIC Jobs	HICs	HIC Jobs	HICs	HIC Jobs
Region 1 – New England	17,202	652,312	14,901	604,288	2,301	48,024
Region 2 – Northeast	28,958	1,735,387	27,642	1,720,998	1,316	14,389
Region 3 – Mid Atlantic	31,744	889,570	27,111	828,709	4,633	60,861
Region 4 – Southeast	87,915	1,699,080	73,769	1,535,625	14,146	163,455
Region 5 – Great Lakes	52,964	1,595,609	42,153	1,436,436	10,811	159,173
Region 6 – South Central	41,057	1,530,033	34,137	1,442,068	6,920	87,965
Region 7 – Midwest	15,181	429,093	9,302	355,190	5,879	73,903
Region 8 – Rocky Mountain	15,658	280,982	10,612	223,160	5,046	57,822
Region 9 – Southwest	59,888	1,482,878	57,282	1,452,069	2,606	30,809
Region 10 – Pacific Northwest	17,515	430,103	12,770	366,833	4,745	63,270
Total U.S.	368,082	10,725,047	309,679	9,965,376	58,403	759,671



Distribution of 3,596 HIC with >$5 million in annual revenues & >20 employees

Industrial Productivity of High Impact Companies (top panel) and all other companies (bottom panel) expressed as ($) Revenue per Employee (USD)

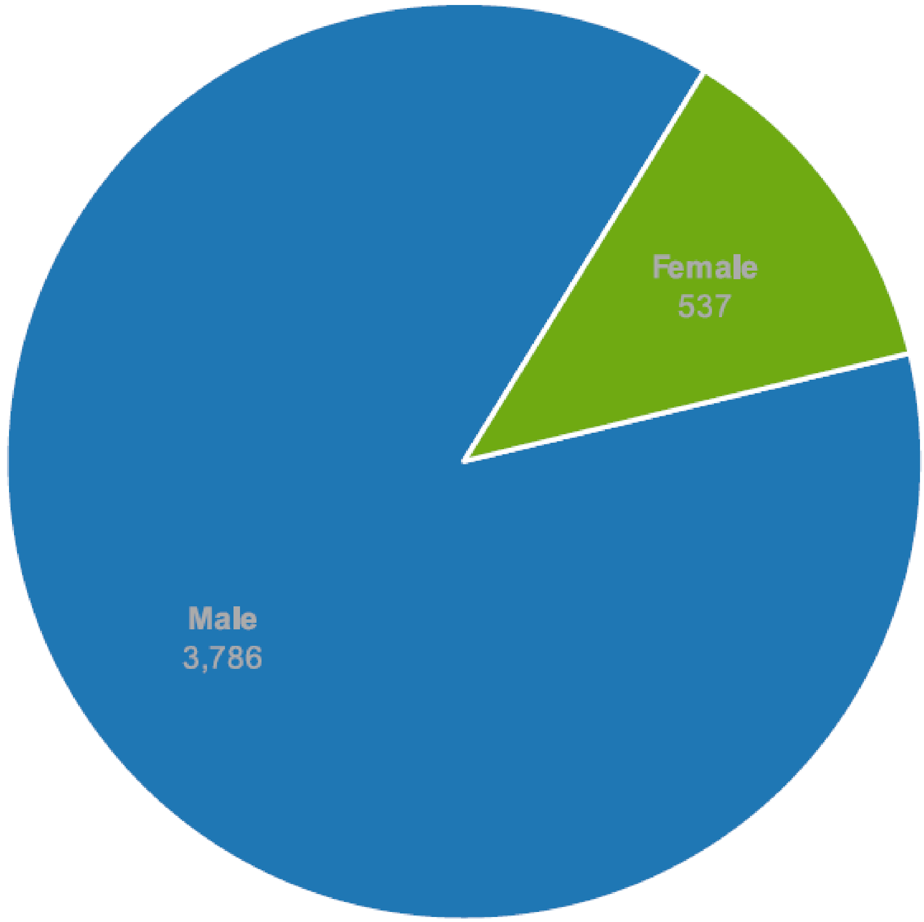
Industry	1994-1998			1998-2002			2002-2006			2004-2008		
	1-19	20-499	500+	1-19	20-499	500+	1-19	20-499	500+	1-19	20-499	500+
Agriculture/Forest/Mining	63,261	190,960	159,502	68,201	246,583	407,686	90,296	637,717	832,423	76,136	467,104	1,146,641
Construction	119,666	199,275	230,306	144,676	159,947	295,062	125,695	210,304	862,301	127,130	226,094	271,751
Manufacturing	110,088	152,111	189,864	117,459	164,352	239,157	124,650	185,090	332,381	125,478	205,941	383,849
High-Tech Manufacturing	141,864	182,385	277,861	137,892	181,061	321,520	120,804	247,600	233,813	161,540	258,818	256,798
Communication/Utilities	170,285	173,002	278,806	150,986	304,959	616,504	138,257	420,215	447,272	135,299	606,389	388,647
Distribution/Wholesale	246,372	363,533	467,522	247,555	388,998	535,783	210,523	409,630	335,306	192,236	418,582	356,458
Retail	118,617	234,587	142,693	142,752	261,964	167,608	113,105	242,743	270,135	118,476	273,013	212,104
Eating/Drinking Retail	28,384	28,851	32,729	29,694	42,453	40,055	27,833	29,396	52,820	26,955	29,541	46,320
Finance/Ins/Real Estate	110,054	247,777	288,713	142,788	242,752	323,609	125,605	396,144	388,101	122,880	301,162	626,156
Services	42,013	58,352	65,247	43,978	51,531	66,536	43,369	84,323	64,560	41,676	83,088	85,897
Professional Services	76,313	74,147	71,295	82,616	114,214	110,006	76,327	113,110	104,370	75,289	101,305	68,184
Total	**101,690**	**156,440**	**177,123**	**110,745**	**168,396**	**254,923**	**99,439**	**224,786**	**286,082**	**99,745**	**225,729**	**276,634**

Industry	1994-1998			1998-2002			2002-2006			2004-2008		
	1-19	20-499	500+	1-19	20-499	500+	1-19	20-499	500+	1-19	20-499	500+
Agriculture/Forest/Mining	70,556	111,179	455,757	67,556	79,248	419,929	65,961	96,816	712,840	73,077	107,887	840,025
Construction	109,846	153,937	196,926	117,275	158,409	228,623	107,255	149,299	226,547	110,328	150,562	301,512
Manufacturing	92,728	119,540	230,444	93,776	123,052	223,765	90,278	131,763	299,925	90,845	124,549	311,310
High-Tech Manufacturing	120,996	121,763	196,965	125,700	133,755	199,144	118,552	146,213	263,381	118,906	155,616	295,517
Communication/Utilities	158,279	162,402	239,795	166,682	167,381	259,133	131,806	175,954	343,362	141,227	184,598	379,340
Distribution/Wholesale	226,412	269,776	285,932	225,429	262,393	251,320	190,581	259,461	378,686	193,160	271,071	412,439
Retail	99,983	206,568	129,583	100,803	210,192	172,644	96,164	213,054	186,133	93,648	201,671	198,614
Eating/Drinking Retail	28,239	26,593	35,477	28,645	26,448	33,468	28,909	27,776	36,953	29,486	26,476	37,464
Finance/Ins/Real Estate	115,789	189,815	338,076	121,797	204,664	351,986	113,928	181,577	376,204	115,803	184,197	415,854
Services	39,880	49,345	63,745	42,329	54,457	66,536	42,189	52,709	61,738	42,328	54,859	67,676
Professional Services	70,621	63,826	71,308	75,377	70,988	92,090	72,244	73,186	95,923	73,885	79,291	99,726
Total	**92,867**	**113,744**	**163,316**	**93,656**	**117,306**	**170,733**	**85,691**	**116,145**	**203,892**	**86,683**	**117,541**	**220,041**

Back-to-Back High Impact Companies, by Segment and Industry (2004-2008)			
Industry	**1-19**	**20-499**	**500-plus**
Agriculture/Forest/Mining	246	23	3
Construction	1,154	82	9
Manufacturing	546	72	4
High-Tech Manufacturing	112	62	11
Transport/Comm/Utilities	176	27	5
Distribution/Wholesale	649	69	4
Retail	513	26	11
Eating/Drinking Retail	73	12	6
Finance/Ins/Real Estate	501	75	12
Services	680	37	6
Professional Services	1,556	176	16
Acquisitions	48	29	7
Deaths	162	13	1
Incomplete Industry Data	3	0	0
www/sba.gov/sites/default/files/HighImpactReport.pdf	**6,419**	**703**	**95**

Segment	**High Impact Companies**				**All Other Companies**			
	Woman-Owned		**Man-Owned**		**Woman-Owned**		**Man-Owned**	
	Absolute	**Percent**	**Absolute**	**Percent**	**Absolute**	**Percent**	**Absolute**	**Percent**
1-19	36,069	12.4	255,965	87.6	1,210,832	13.2	7,975,531	86.8
20-499	6,962	9.4	67,216	90.6	47,493	7.8	563,826	92.2
500-plus	78	3.8	1,972	96.2	418	2.3	17,476	97.7

Silicon Valley's Gender Imbalance – Limits Creativity & Entrepreneurship



Women in Engineering Roles in Leadership and/or Management (updated 02-14-2014)

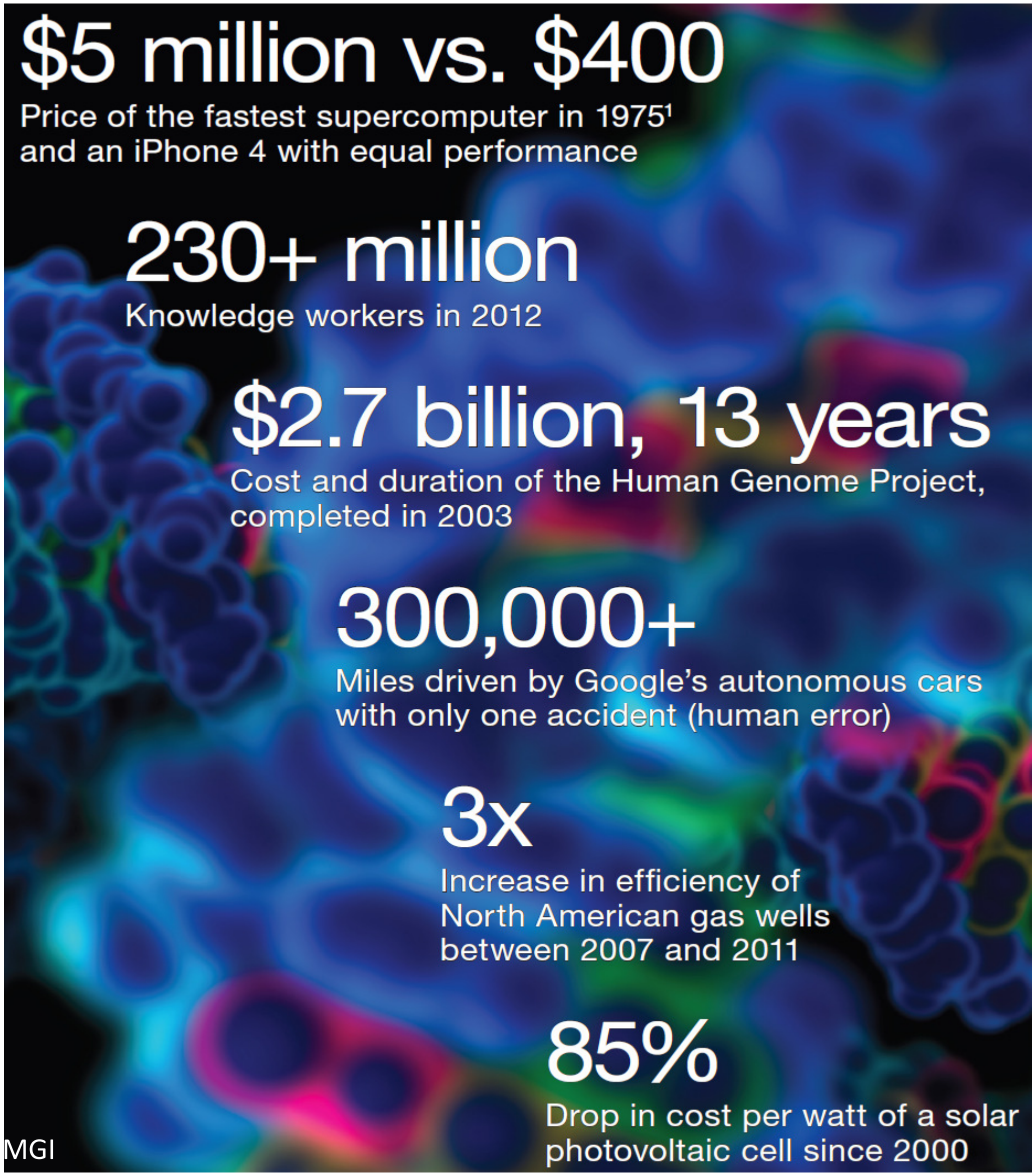
Emerging Economic Growth

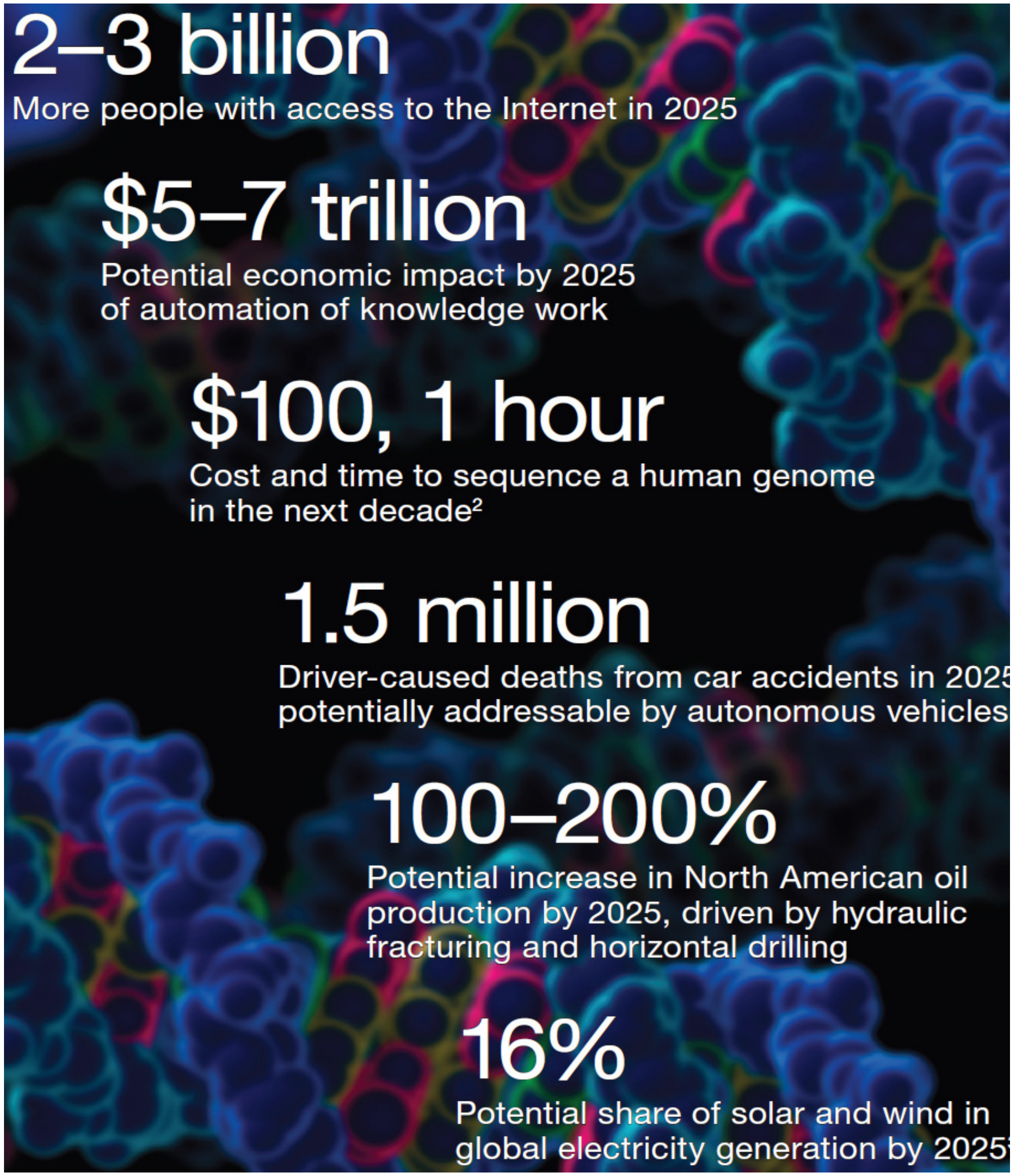
Understanding emerging trends in economic development is essential to develop the structure of educational infrastructure.

5 ECONOMIC GROWTH SECTORS + 12 DOMAINS OF RAPID ADVANCES

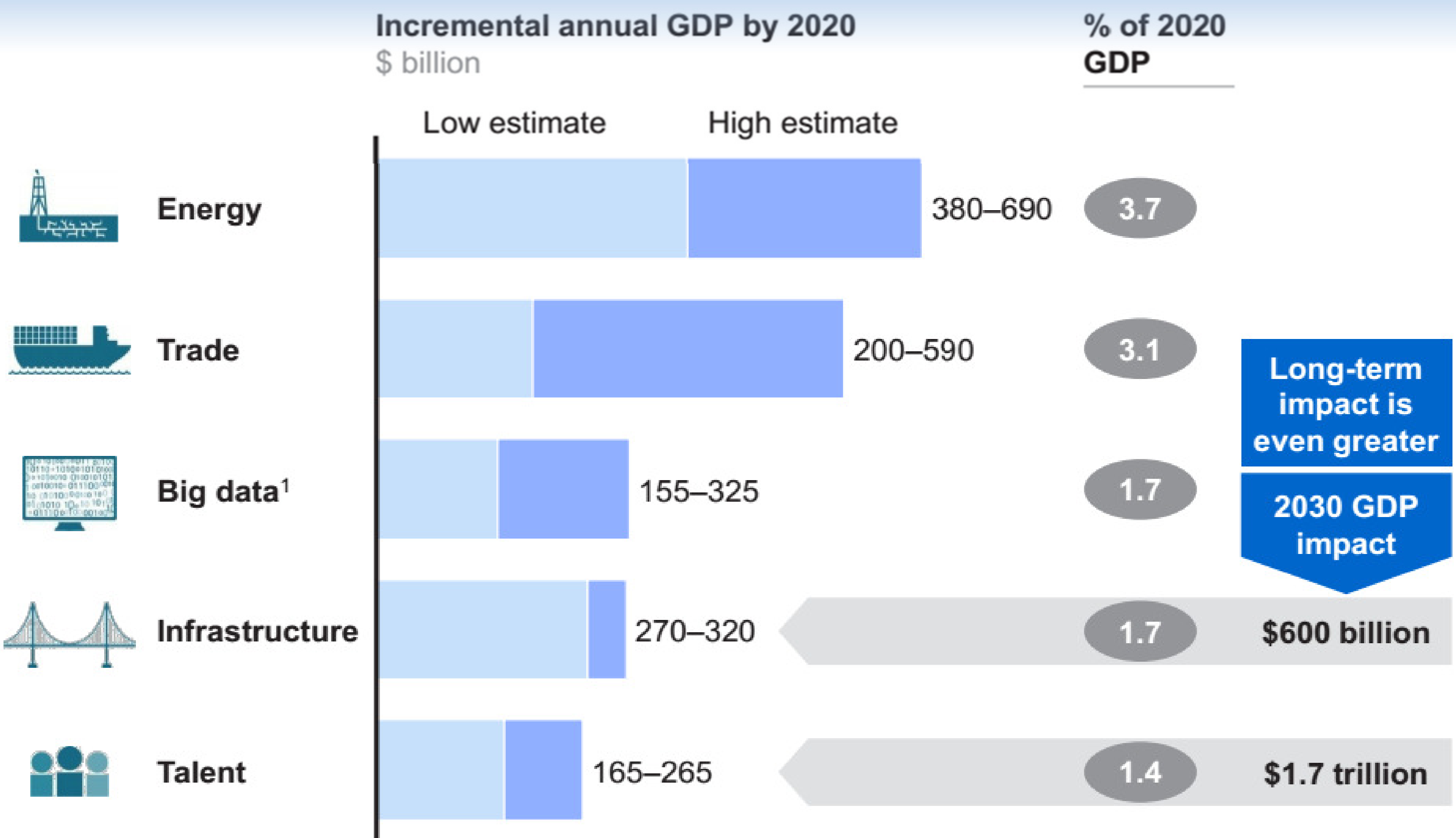
- Energy
- Trade
- Big data[1]
- Infrastructure
- Talent

FIVE SECTORS + **12 DOMAINS**


$5 million vs. $400
Price of the fastest supercomputer in 1975[1] and an iPhone 4 with equal performance
230+ million
Knowledge workers in 2012
$2.7 billion, 13 years
Cost and duration of the Human Genome Project, completed in 2003
300,000+
Miles driven by Google's autonomous cars with only one accident (human error)
3x
Increase in efficiency of North American gas wells between 2007 and 2011
85%
Drop in cost per watt of a solar photovoltaic cell since 2000
MGI


2–3 billion
More people with access to the Internet in 2025
$5–7 trillion
Potential economic impact by 2025 of automation of knowledge work
$100, 1 hour
Cost and time to sequence a human genome in the next decade[2]
1.5 million
Driver-caused deaths from car accidents in 2025 potentially addressable by autonomous vehicles
100–200%
Potential increase in North American oil production by 2025, driven by hydraulic fracturing and horizontal drilling
16%
Potential share of solar and wind in global electricity generation by 2025

Sectors Predicted to Influence US GDP Growth over the next few decades



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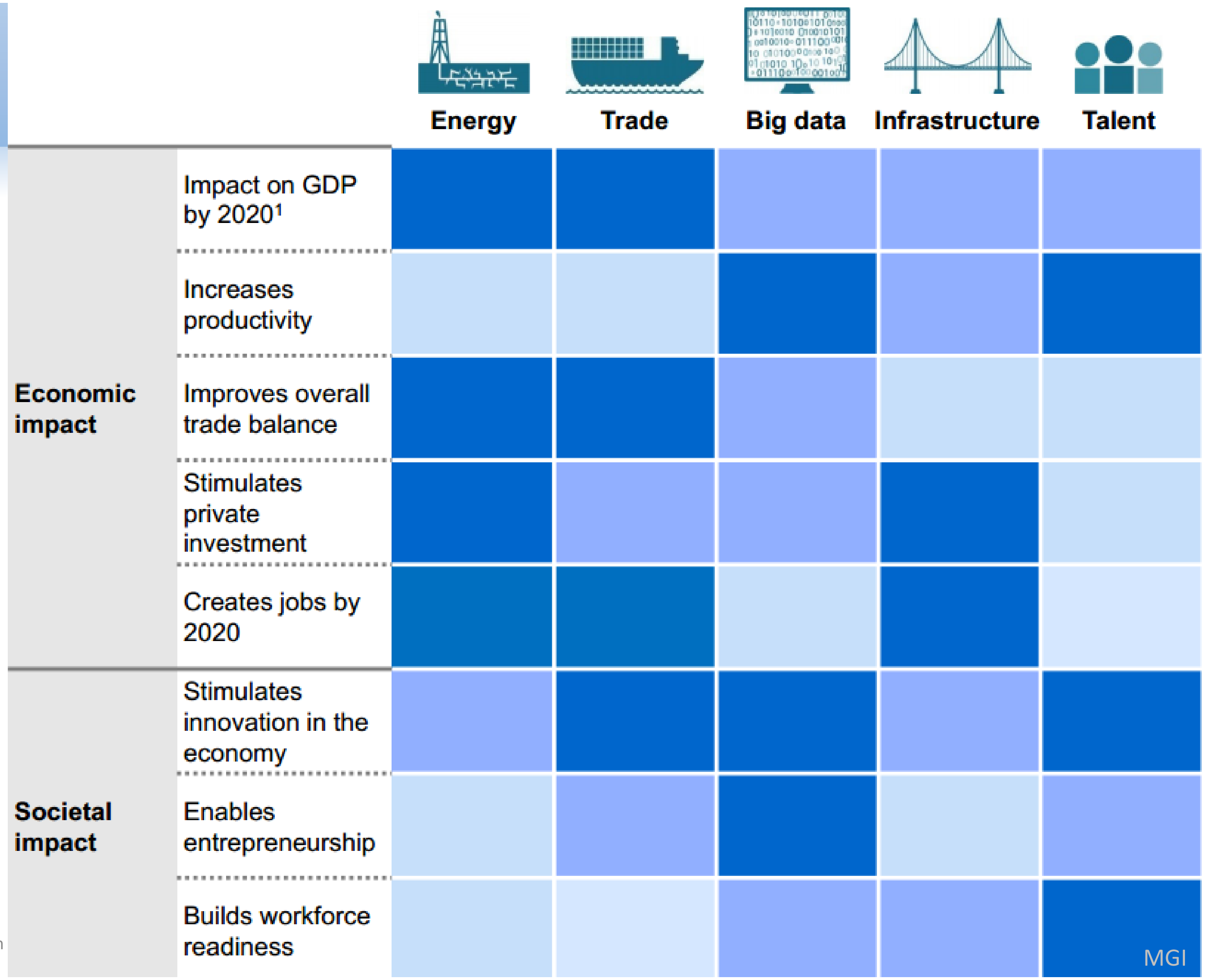
http://bit.ly/S-Datta

Segments of the US economy likely to be influenced over the next decades

US Bureau of Labor Statistics

Sectors of the economy	GDP, 2012 $ billion	Jobs, 2012[1] Million	Energy	Trade	Big data	Infrastructure	Talent
Resource extraction (e.g., oil and gas, mining, agriculture)	453.8	2.9	●			●	○
Knowledge-intensive manufacturing (e.g., autos, aerospace, chemicals)	894.3	4.8	○	●	●	●	●
Resource-intensive manufacturing (e.g., metals, pulp, refinery products)	427.8	3.1	●	○	○	●	○
Labor-intensive manufacturing (e.g., apparel, furniture)	544.6	4.1		○	○	●	○
Construction and utilities	863.0	6.3	●			●	
Retail	949.1	15.0		○	●	○	○
Wholesale, transport, and logistics	1,367.2	10.2	○	○	●	●	●
Information and media	690.6	2.7		○	●		●
Financial, legal, and technical services	2,730.2	15.9	○	●	●		●
Real estate	1,926.3	1.9			●	●	
Hospitality and other services[2]	1,466.1	27.5					○
Education and health care	1,344.7	20.5			●		●
Government	2,026.2	21.9			●		●

Socio-Economic Impact



US Growth fueled by investment (%) from federal, state & private sources

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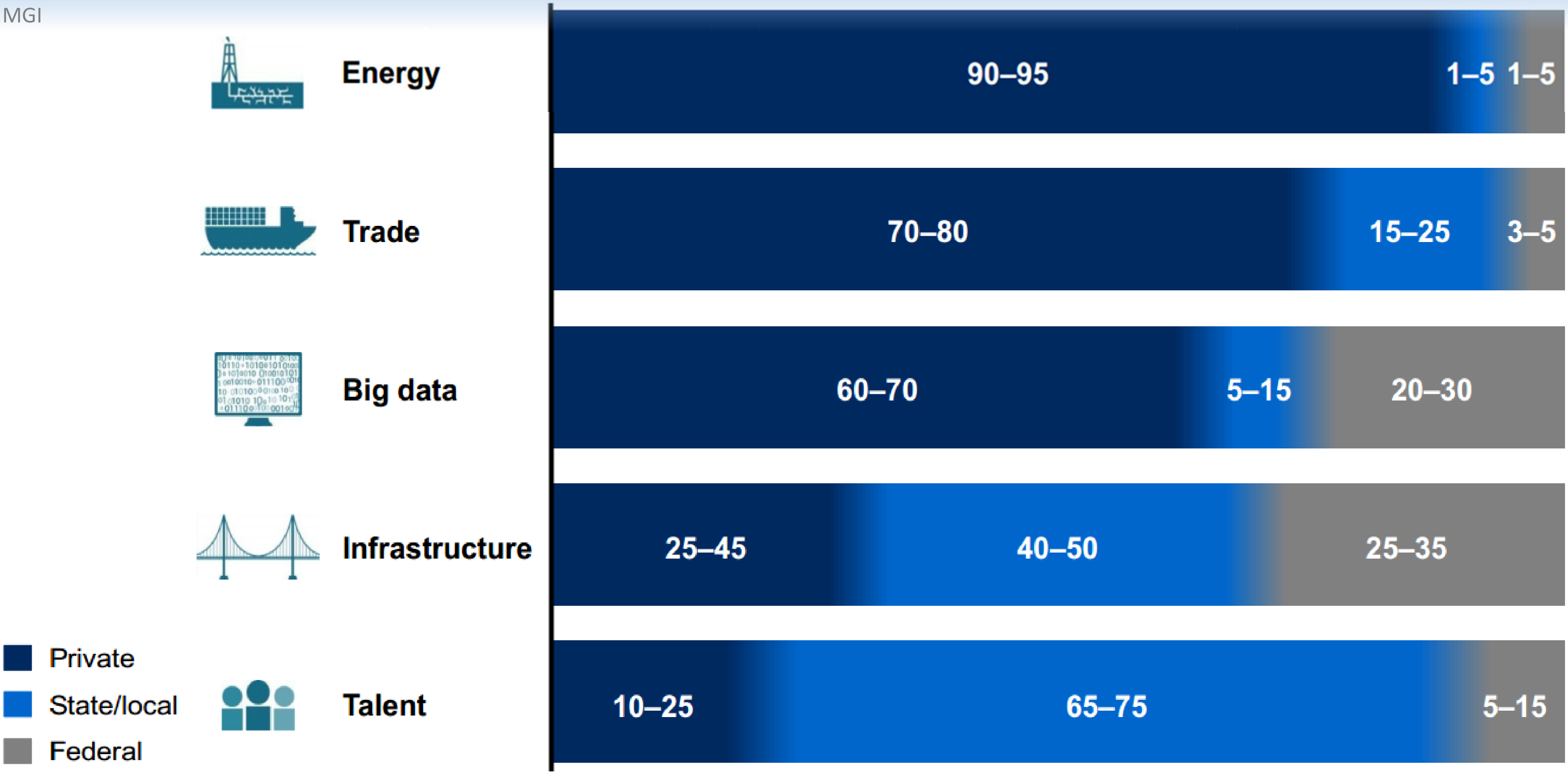
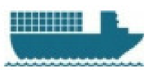
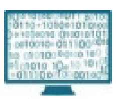


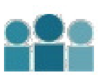
FUTURE ECONOMIC GROWTH SECTORS (PROJECTIONS ARE NOT FACTS)


Energy

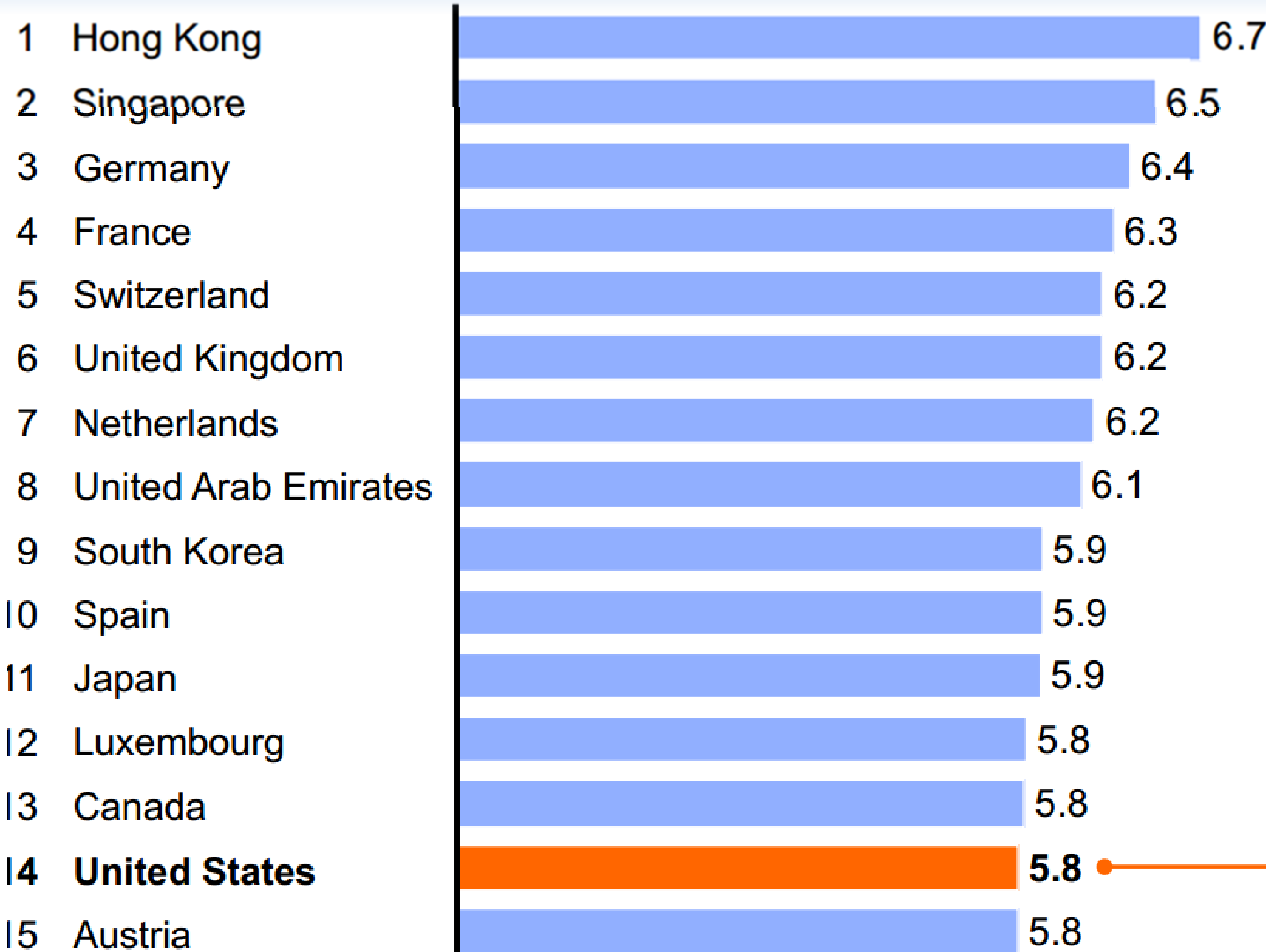

Trade


Big data[1]


Infrastructure


Talent

Infrastructure – *Where is Taiwan on this list ?*



Sector-specific indexes, 2012–13
Out of all 144 countries

Ports
United States
#19

Roads
United States
#20

Power and telephony
United States
#21

For additional information visit http://bit.ly/MIT-Made-in-Taiwan

Connectivity Cost v Mobile MOOC ▪ The elusive quest for business model

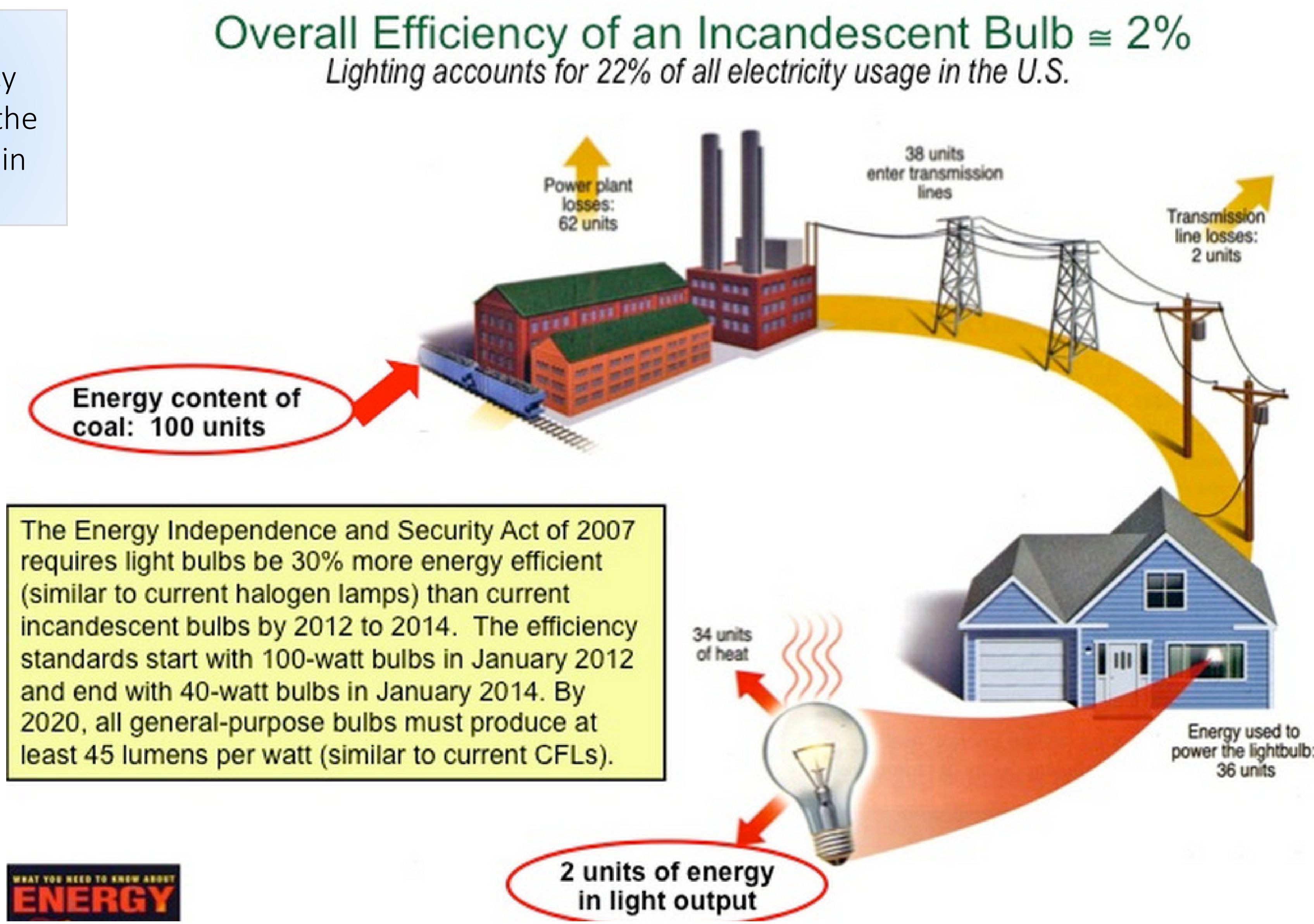
	Total pop. living on less than $2 per day	Fixed Broadband as % of Income at $2 per day	Mobile Broadband as % of income at $2 per day
China	359,575,234 (~27%)	38.0	25.4
Colombia	7,016,538	30.7	48.9
Nigeria	124,159,302	63.9	21.3
Peru	3,577,091	29.5	23.5
Philippines	38,817,437	37.5	18.9
Zambia	10,444,784 (~87%)	134.9	35.4

ITU

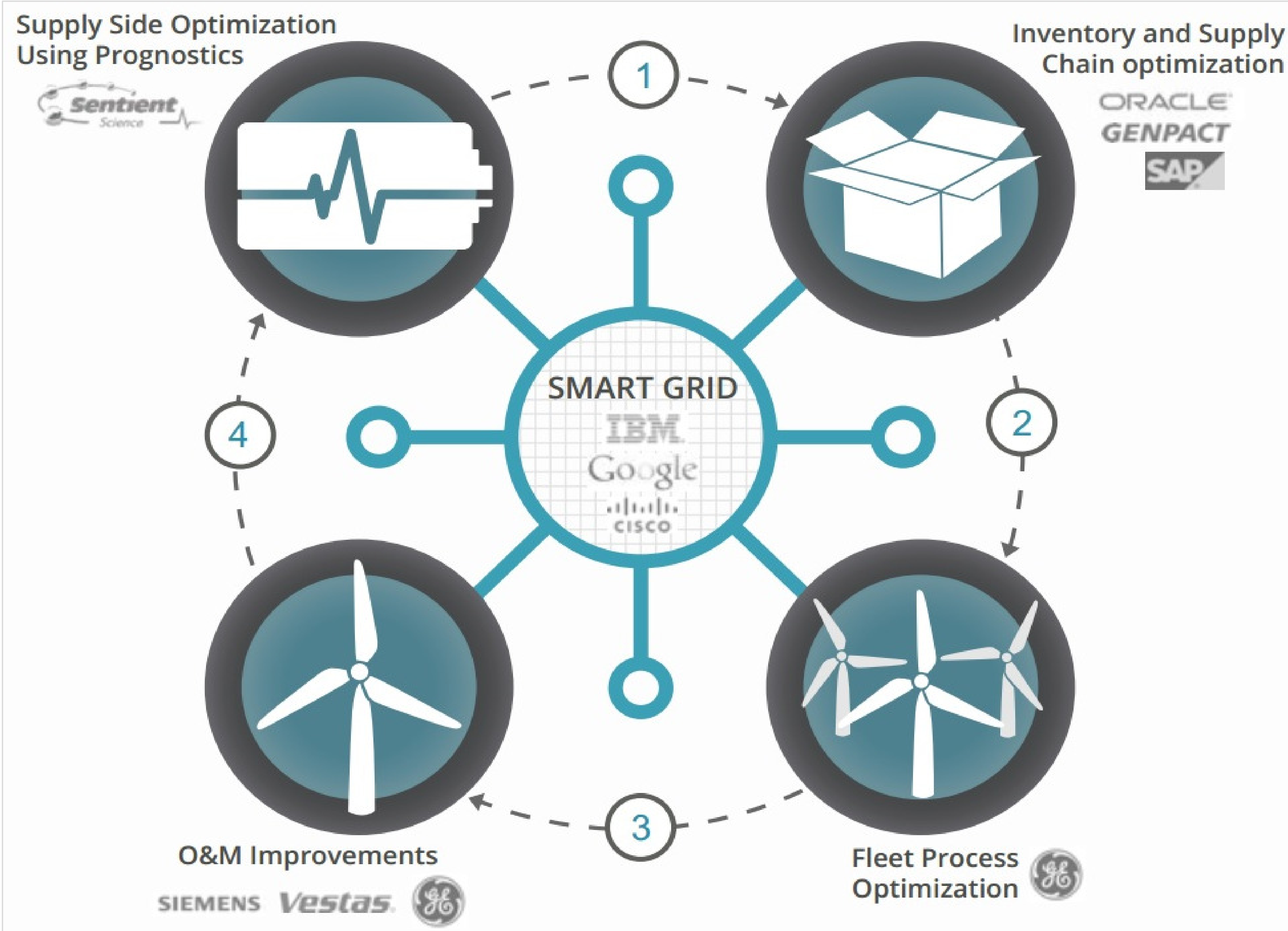
FUTURE ECONOMIC GROWTH SECTORS (PROJECTIONS ARE NOT FACTS)

- **Energy**
- **Trade**
- **Big data**[1]
- **Infrastructure**
- **Talent**

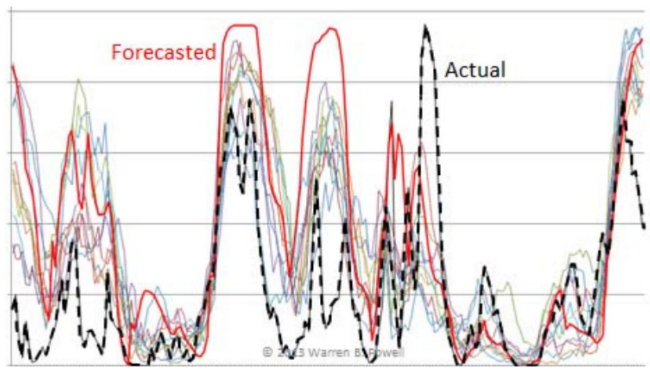
Energy inefficiency prevalent today in the Energy Supply Chain



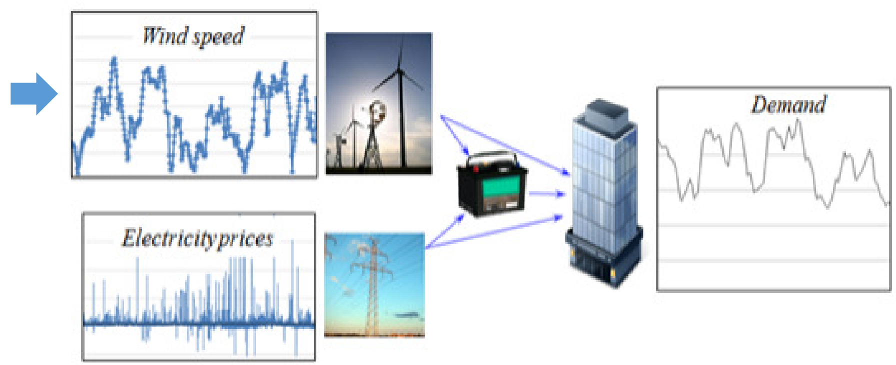
Multi-directional Flow in the future Energy Supply Chain



Load Balancing - energy from wind & grid to meet time-varying demand

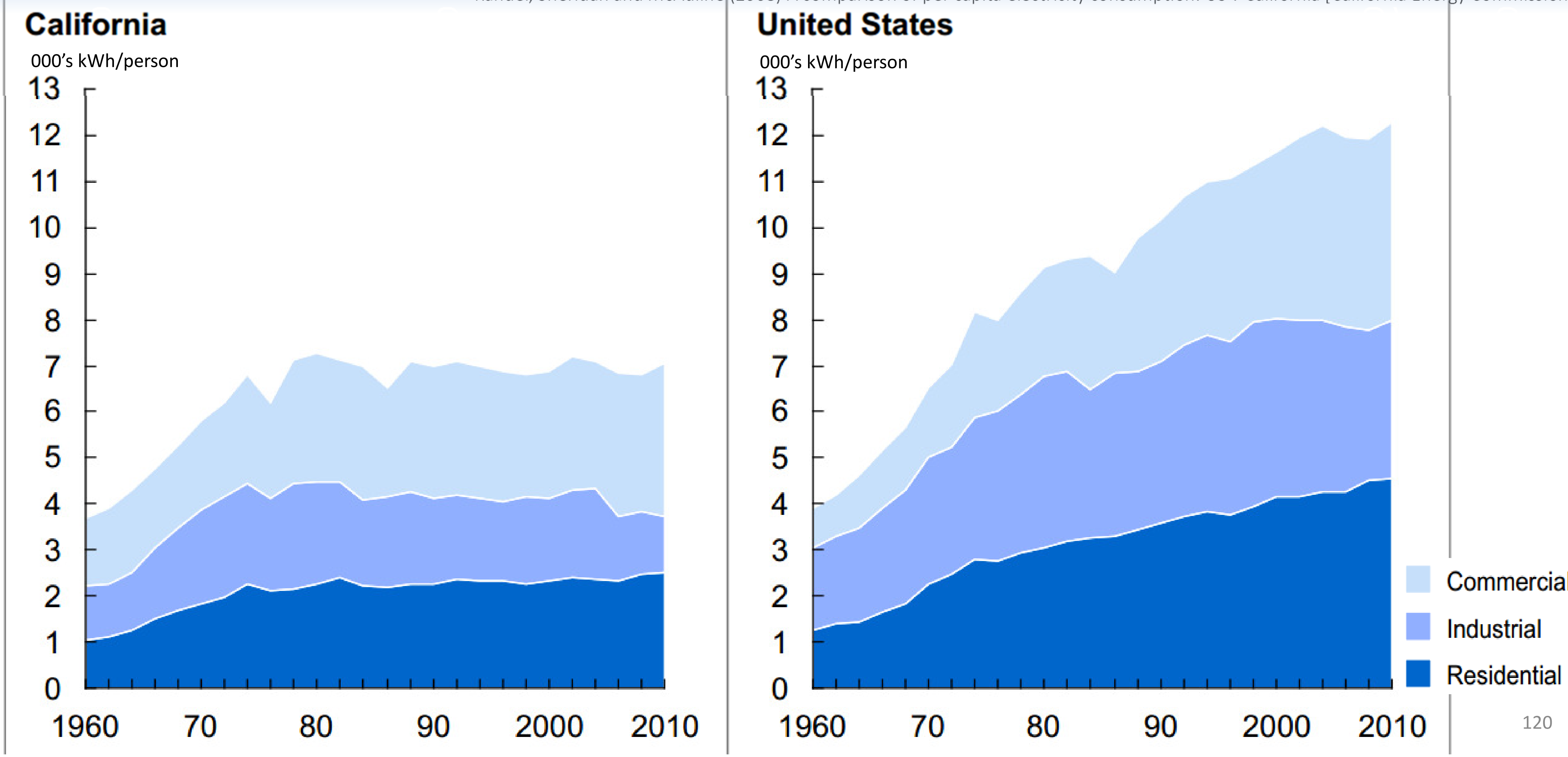


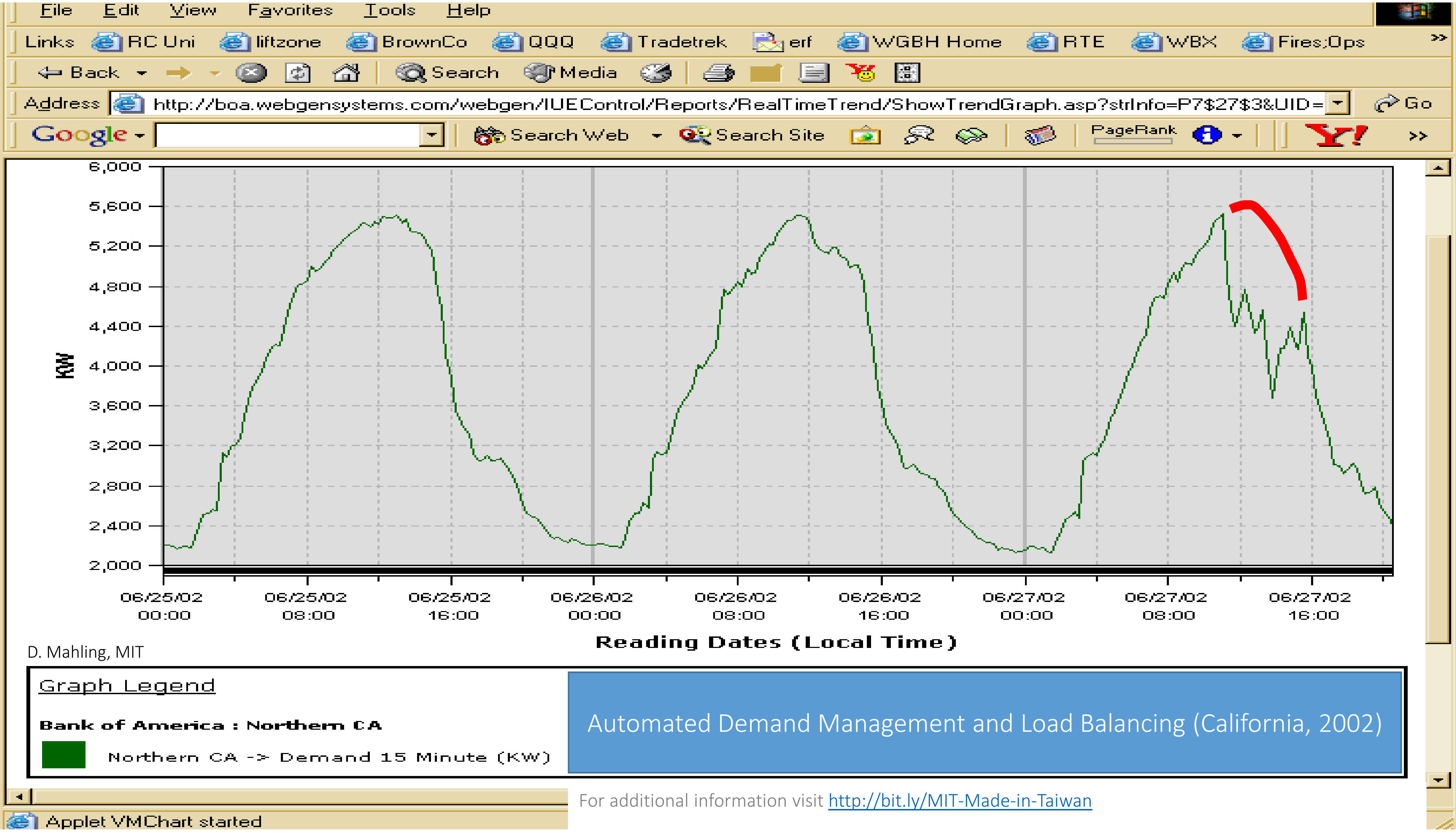
Warren Powell, Princeton University (Stochastic Optimization)



Using demand management techniques California reduced energy usage

Kandel, Sheridan and McAuliffe (2008) A comparison of per capita electricity consumption: US v California [California Energy Commission]





D. Mahling, MIT

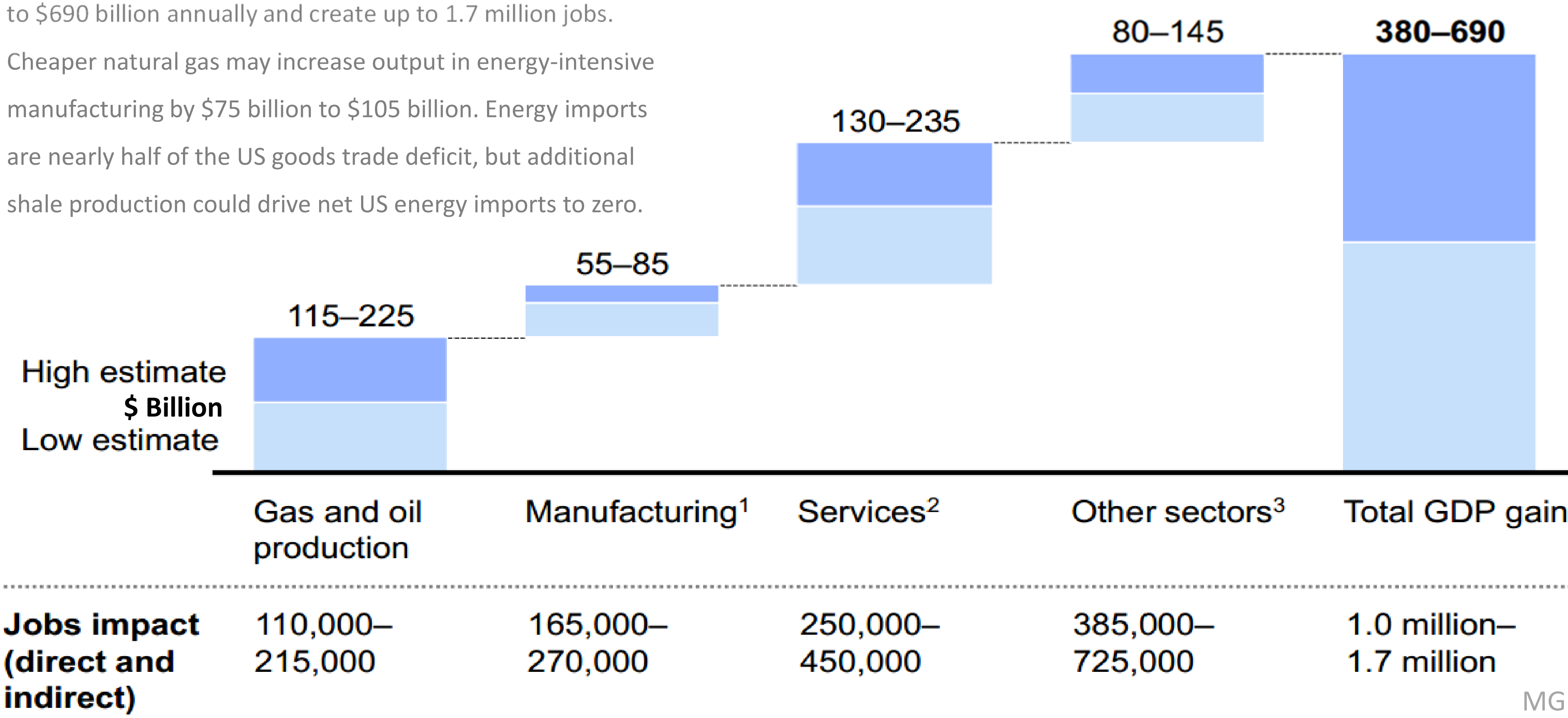
Automated Demand Management and Load Balancing (California, 2002)

For additional information visit http://bit.ly/MIT-Made-in-Taiwan

US Energy Sector – Potential Impact of Shale Gas Production by 2020

http://www.eia.gov/forecasts/aeo/pdf/0383(2014).pdf

By 2020, shale gas and oil could boost US GDP by $380 billion to $690 billion annually and create up to 1.7 million jobs. Cheaper natural gas may increase output in energy-intensive manufacturing by $75 billion to $105 billion. Energy imports are nearly half of the US goods trade deficit, but additional shale production could drive net US energy imports to zero.



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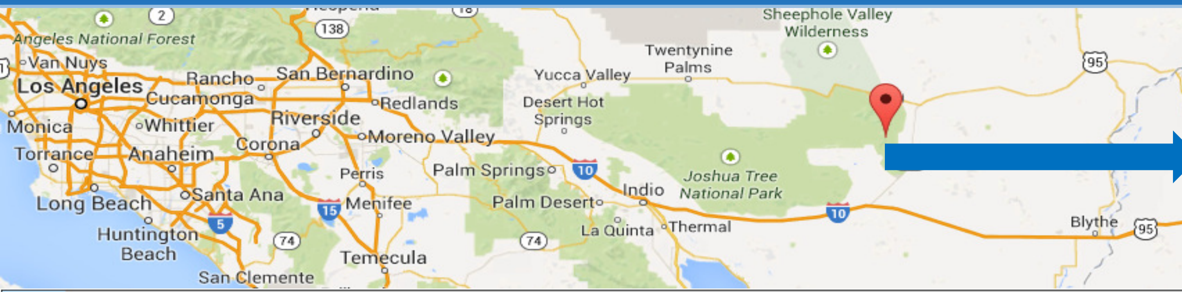
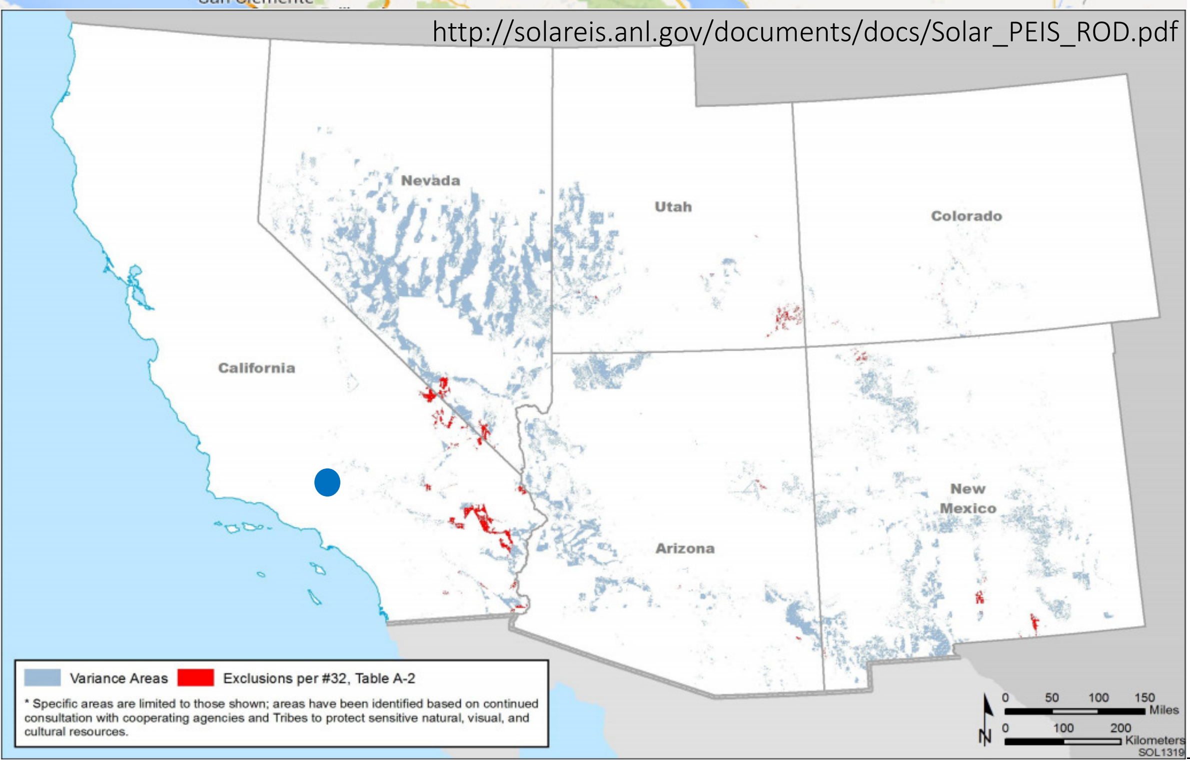
US Solar Energy planning for 285,000 acres



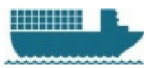
http://solareis.anl.gov/documents/docs/Solar_PEIS_ROD.pdf



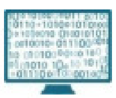
SEZ (BLM Office/County)	Approximate Acreage
Arizona	
Brenda (Lake Havasu/La Paz)	3,348
Gillespie (Lower Sonoran/Maricopa)	2,618
Total	5,966
California	
Imperial East (El Centro/Imperial)	5,717
Riverside East (Palm Springs–South Coast/Riverside)	147,910
Total	153,627
Colorado	
Antonito Southeast (La Jara/Conejos)	9,712
De Tilla Gulch (Saguache/Saguache)	1,064
Fourmile East (La Jara/Alamosa)	2,882
Los Mogotes East (La Jara/Conejos)	2,650
Total	16,308
Nevada	
Amargosa Valley (Southern Nevada/Nye)	8,479
Dry Lake (Southern Nevada/Clark)	5,717
Dry Lake Valley North (Ely/Lincoln)	25,069
Gold Point (Battle Mountain/Esmeralda)	4,596
Millers (Battle Mountain/Esmeralda)	16,534
Total	60,395
New Mexico	
Afton (Las Cruces/Dona Ana)	29,964
Total	29,964
Utah	
Escalante Valley (Cedar City/Iron)	6,533
Milford Flats South (Cedar City/Beaver)	6,252
Wah Wah Valley (Cedar City/Beaver)	5,873
Total	18,658
Total	284,918

FUTURE ECONOMIC GROWTH SECTORS (PROJECTIONS ARE NOT FACTS)

Energy

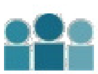


Trade



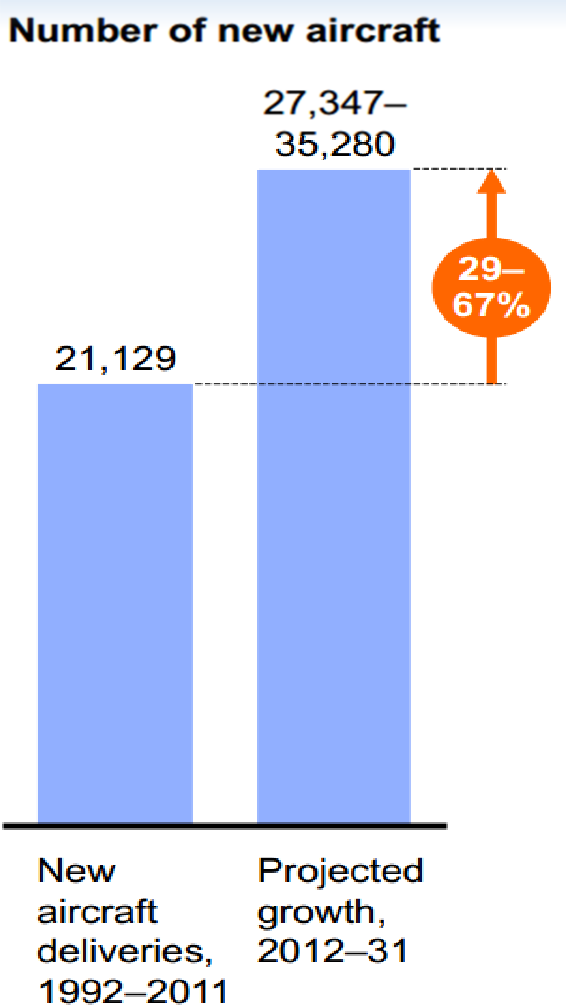
Big data[1]

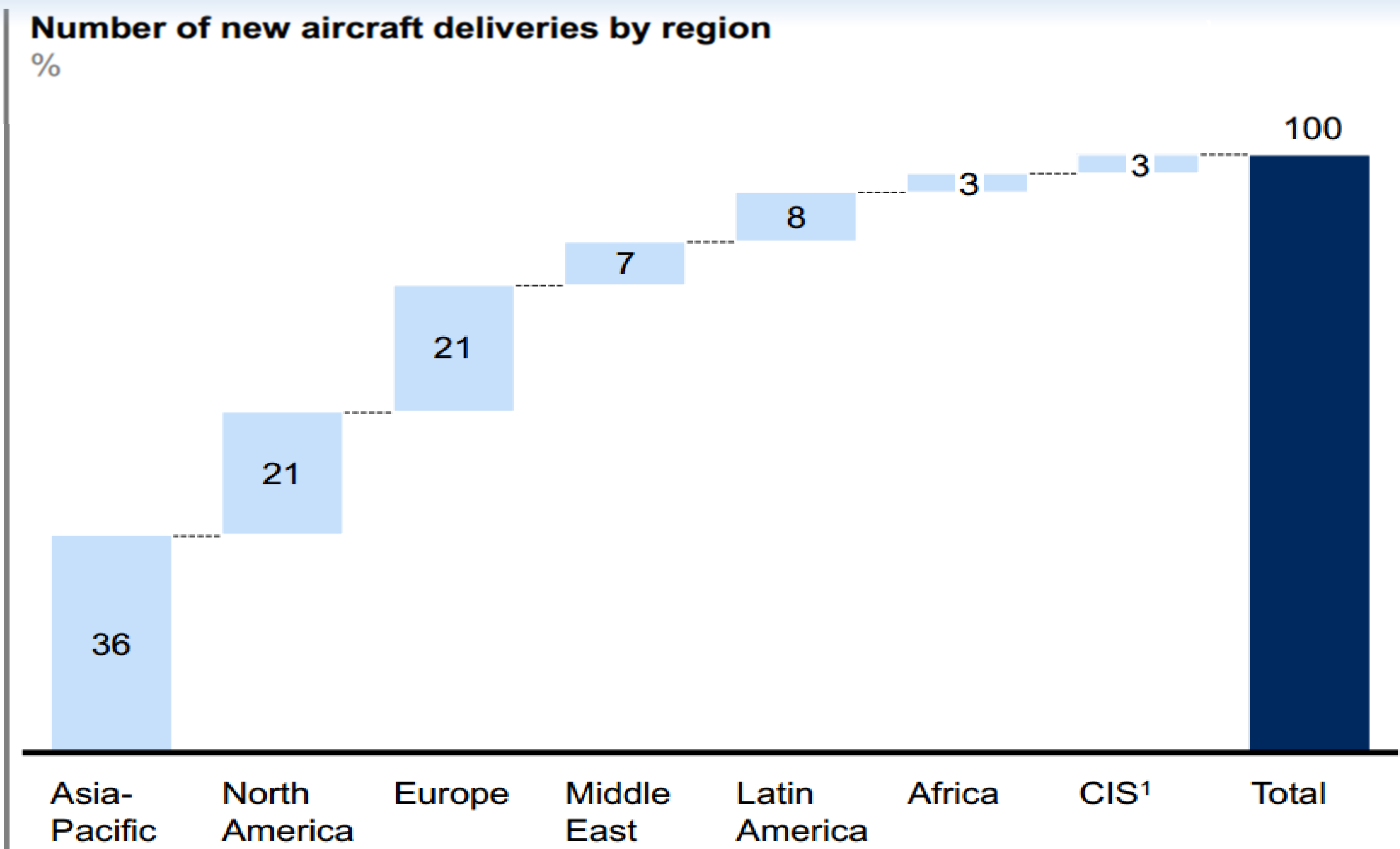
Infrastructure



Talent

Commercial aircraft forecast → 27,000 to 35,000 over the next 20 years





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The HondaJet Just Got New Engines. Is the Flying Car Next?

May 26, 2014

GE Report

% Share of US and Canadian content in production of autos sold in the US

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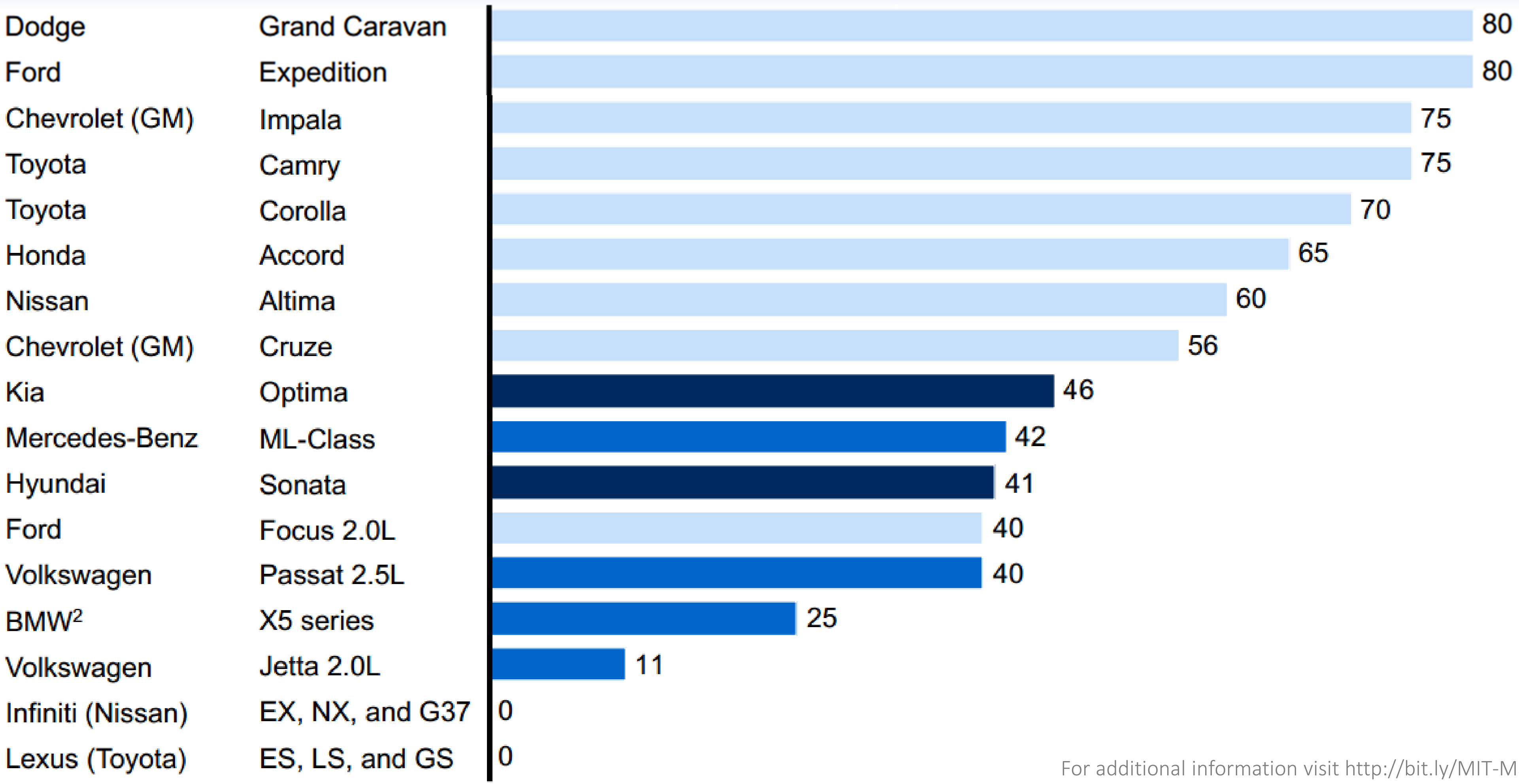


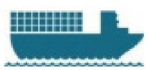
For additional information visit http://bit.ly/MIT-Made-in-Taiwan

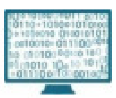
Temporary Questions

What skill sets and training are necessary for the workforce to unleash the economic potential of the ecosystems that include energy sector, aviation industry and automobile manufacturing?

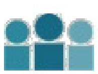
FUTURE ECONOMIC GROWTH SECTORS (PROJECTIONS ARE NOT FACTS)

 **Energy**

 **Trade**

 **Big data**[1]

 **Infrastructure**

 **Talent**

Why is India a global Asian CEO factory?

July 09, 2014 | 951 88 13

Talent

Think Indira Nooyi of PepsiCo, Satya Nadella of Microsoft, Anshu Jain of Deutsche Bank, Shantanu Narayen of Adobe. The list is not short. The question is increasingly intriguing.

Few answers –

[1] Competition

[2] Middle class values

[3] Lack of infrastructure

[4] Obstructionist bureaucracy

[5] Large population at the bottom

[6] Lack of public systems and security

WORKFORCE DEVELOPMENT

How can MOOC help?
What types of courses?
What forms of training?
What are the pre-requisites?
How relevant is this to Taiwan?

WORKFORCE DEVELOPMENT

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OCCUPATION	GROWTH RATE, 2012-22	2012 MEDIAN PAY
Physician assistants	38%	$90,930 per year
Information security analysts	37%	$86,170 per year
Industrial-organizational psychologists	53%	$83,580 per year
Health specialties teachers, postsecondary	36%	$81,140 per year
Physical therapists	36%	$79,860 per year
Diagnostic medical sonographers	46%	$65,860 per year
Genetic counselors	41%	$56,800 per year
Occupational therapy assistants	43%	$53,240 per year
Physical therapist assistants	41%	$52,160 per year
Interpreters and translators	46%	$45,430 per year
Insulation workers, mechanical	47%	$39,170 per year
Segmental pavers	38%	$33,720 per year
Medical secretaries	36%	$31,350 per year
Skincare specialists	40%	$28,640 per year
Helpers--brickmasons, blockmasons, stonemasons, and tile and marble setters	43%	$28,220 per year
Helpers--electricians	37%	$27,670 per year
Occupational therapy aides	36%	$26,850 per year
Physical therapist aides	40%	$23,880 per year

US BLS

WORKFORCE DEVELOPMENT

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What types of courses?
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General and operations managers	244,100	$95,440 per year
Registered nurses	526,800	$65,470 per year
Licensed practical and licensed vocational nurses	182,900	$41,540 per year
Carpenters	218,200	$39,940 per year
Heavy and tractor-trailer truck drivers	192,600	$38,200 per year
Bookkeeping, accounting, and auditing clerks	204,600	$35,170 per year
Secretaries and administrative assistants, except legal, medical, and executive	307,800	$32,410 per year
Medical secretaries	189,200	$31,350 per year
Customer service representatives	298,700	$30,580 per year
Construction laborers	259,800	$29,990 per year
Office clerks, general	184,100	$27,470 per year
Nursing assistants	312,200	$24,420 per year
Laborers and freight, stock, and material movers, hand	241,900	$23,890 per year
Janitors and cleaners, except maids and housekeeping cleaners	280,000	$22,320 per year
Retail salespersons	434,700	$21,110 per year
Home health aides	424,200	$20,820 per year
Personal care aides	580,800	$19,910 per year
Maids and housekeeping cleaners	183,400	$19,570 per year
Childcare workers	184,100	$19,510 per year

US BLS

WORKFORCE DEVELOPMENT

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How relevant is this to Taiwan?

Employment by summary education and training assignment, 2012 and projected 2022
(Numbers in thousands)

Education, work experience, and on-the-job training	Employment: Number 2012	Employment: Number 2022	Employment: Percent distribution 2012	Employment: Percent distribution 2022	Change 2012—22: Number	Change 2012—22: Percent	Total job openings due to growth and replacement needs, 2012—22: Number	Total job openings due to growth and replacement needs, 2012—22: Percent distribution	Median annual wage, 2012 (1)
Total, all occupations	145,355.8	160,983.7	100.0	100.0	15,628.0	10.8	50,557.3	100.0	$34,750
Doctoral or professional degree	4,002.4	4,640.8	2.8	2.9	638.4	16.0	1,426.8	2.8	$96,420
Internship/residency	868.2	1,013.1	0.6	0.6	144.9	16.7	364.8	0.7	$172,270
Apprenticeship	-	-	-	-	-	-	-	-	-
Long-term on-the-job training	-	-	-	-	-	-	-	-	-
Moderate-term on-the-job training	-	-	-	-	-	-	-	-	-
Short-term on-the-job training	43.2	43.6	0.0	0.0	0.4	0.9	7.6	0.0	$102,980
None	3,090.9	3,584.1	2.1	2.2	493.2	16.0	1,054.5	2.1	$87,860
Master's degree	2,432.2	2,880.7	1.7	1.8	448.5	18.4	950.8	1.9	$63,400
Internship/residency	189.8	243.4	0.1	0.2	53.6	28.2	93.9	0.2	$43,340
Apprenticeship	-	-	-	-	-	-	-	-	-
Long-term on-the-job training	-	-	-	-	-	-	-	-	-
Moderate-term on-the-job training	-	-	-	-	-	-	-	-	-
Short-term on-the-job training	-	-	-	-	-	-	-	-	-
None	2,242.3	2,637.3	1.5	1.6	395.0	17.6	856.9	1.7	$65,420
Bachelor's degree	26,033.0	29,176.7	17.9	18.1	3,143.6	12.1	8,618.7	17.0	$67,140
Internship/residency	4,931.1	5,402.5	3.4	3.4	471.4	9.6	1,539.2	3.0	$50,610
Apprenticeship	-	-	-	-	-	-	-	-	-
Long-term on-the-job training	108.0	119.0	0.1	0.1	11.0	10.2	25.3	0.1	$58,950
Moderate-term on-the-job training	2,758.7	2,990.8	1.9	1.9	232.2	8.4	796.0	1.6	$67,760
Short-term on-the-job training	266.3	306.3	0.2	0.2	39.9	15.0	105.5	0.2	$55,460
None	17,969.0	20,358.2	12.4	12.6	2,389.2	13.3	6,152.7	12.2	$74,710
Associate's degree	5,954.9	7,000.9	4.1	4.3	1,046.0	17.6	2,269.5	4.5	$57,590
Internship/residency	-	-	-	-	-	-	-	-	-
Apprenticeship	-	-	-	-	-	-	-	-	-
Long-term on-the-job training	51.5	54.8	0.0	0.0	3.3	6.4	20.2	0.0	$69,570
Moderate-term on-the-job training	207.0	227.8	0.1	0.1	20.8	10.0	80.5	0.2	$42,280
Short-term on-the-job training	53.2	53.4	0.0	0.0	0.3	0.5	10.9	0.0	$37,450
None	5,643.2	6,664.8	3.9	4.1	1,021.7	18.1	2,157.9	4.3	$58,150

WORKFORCE DEVELOPMENT

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What forms of training?
What are the pre-requisites?
How relevant is this to Taiwan?

Postsecondary non-degree award	8,554.2	9,891.2	5.9	6.1	1,337.1	15.6	3,067.2	6.1	$34,760
Internship/residency	-	-	-	-	-	-	-	-	-
Apprenticeship	-	-	-	-	-	-	-	-	-
Long-term on-the-job training	704.7	782.7	0.5	0.5	78.0	11.1	256.1	0.5	$46,100
Moderate-term on-the-job training	296.7	309.4	0.2	0.2	12.7	4.3	73.8	0.1	$57,410
Short-term on-the-job training	1,898.0	2,103.2	1.3	1.3	205.2	10.8	507.1	1.0	$38,030
None	5,654.8	6,696.0	3.9	4.2	1,041.2	18.4	2,230.2	4.4	$31,580
Some college, no degree	1,987.2	2,212.2	1.4	1.4	225.0	11.3	642.6	1.3	$28,730
Internship/residency	-	-	-	-	-	-	-	-	-
Apprenticeship	-	-	-	-	-	-	-	-	-
Long-term on-the-job training	83.0	87.1	0.1	0.1	4.1	4.9	30.3	0.1	$42,570
Moderate-term on-the-job training	547.7	658.5	0.4	0.4	110.8	20.2	196.9	0.4	$46,420
Short-term on-the-job training	-	-	-	-	-	-	-	-	-
None	1,356.5	1,466.6	0.9	0.9	110.1	8.1	415.4	0.8	$24,310
High school diploma or equivalent	58,264.4	62,895.2	40.1	39.1	4,630.8	7.9	17,667.4	34.9	$35,170
Internship/residency	-	-	-	-	-	-	-	-	-
Apprenticeship	2,336.9	2,855.2	1.6	1.8	518.3	22.2	879.8	1.7	$45,440
Long-term on-the-job training	5,562.1	6,012.8	3.8	3.7	450.7	8.1	1,723.9	3.4	$42,110
Moderate-term on-the-job training	16,818.6	18,003.8	11.6	11.2	1,185.3	7.0	4,848.3	9.6	$35,970
Short-term on-the-job training	21,688.5	23,423.6	14.9	14.6	1,735.1	8.0	6,964.1	13.8	$28,920
None	11,858.4	12,599.8	8.2	7.8	741.4	6.3	3,251.3	6.4	$46,880
Less than high school	38,127.6	42,286.0	26.2	26.3	4,158.4	10.9	15,914.3	31.5	$20,110
Internship/residency	-	-	-	-	-	-	-	-	-
Apprenticeship	-	-	-	-	-	-	-	-	-
Long-term on-the-job training	367.2	392.3	0.3	0.2	25.1	6.8	107.8	0.2	$26,630
Moderate-term on-the-job training	2,429.1	2,778.2	1.7	1.7	349.1	14.4	845.4	1.7	$26,710
Short-term on-the-job training	34,979.2	38,743.6	24.1	24.1	3,764.4	10.8	14,678.6	29.0	$19,750
None	352.1	371.9	0.2	0.2	19.8	5.6	282.4	0.6	$18,580

Is there a role for MOOCs in the context of GDP growth for Taiwan?

Match Education to Demand

For service economy – knowledge plus analytical skills

For export earnings – target global projected growth

FUTURE ECONOMIC GROWTH SECTORS (PROJECTIONS ARE NOT FACTS)

Energy

Trade

Big data[1]

Infrastructure

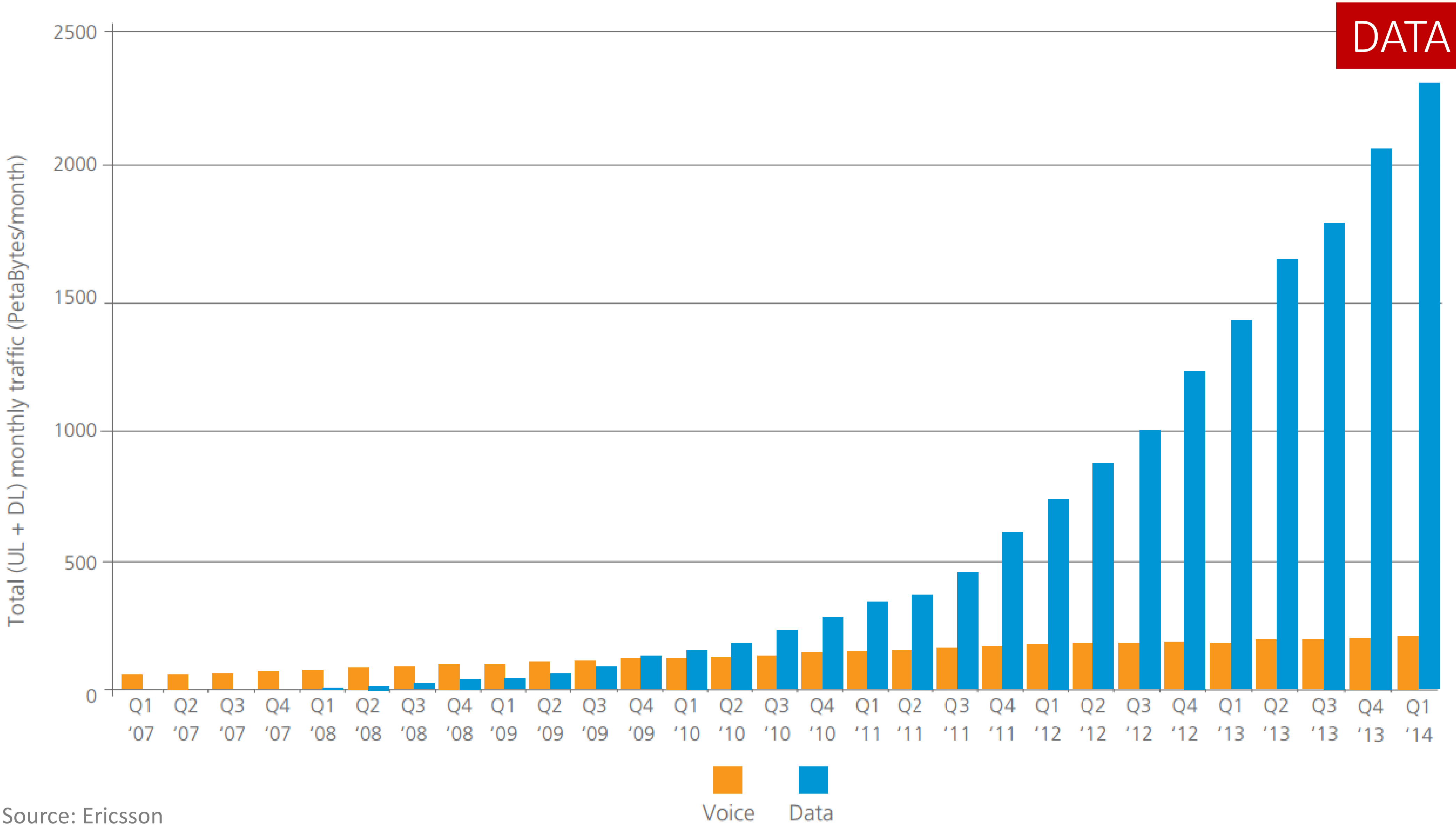
Talent

Identifying new lines of business due to emerging global demand pattern

Energy, Trade, Infrastructure, Talent are obvious and well known entities

But "data" is gaining momentum as a "new" dimension for economic growth

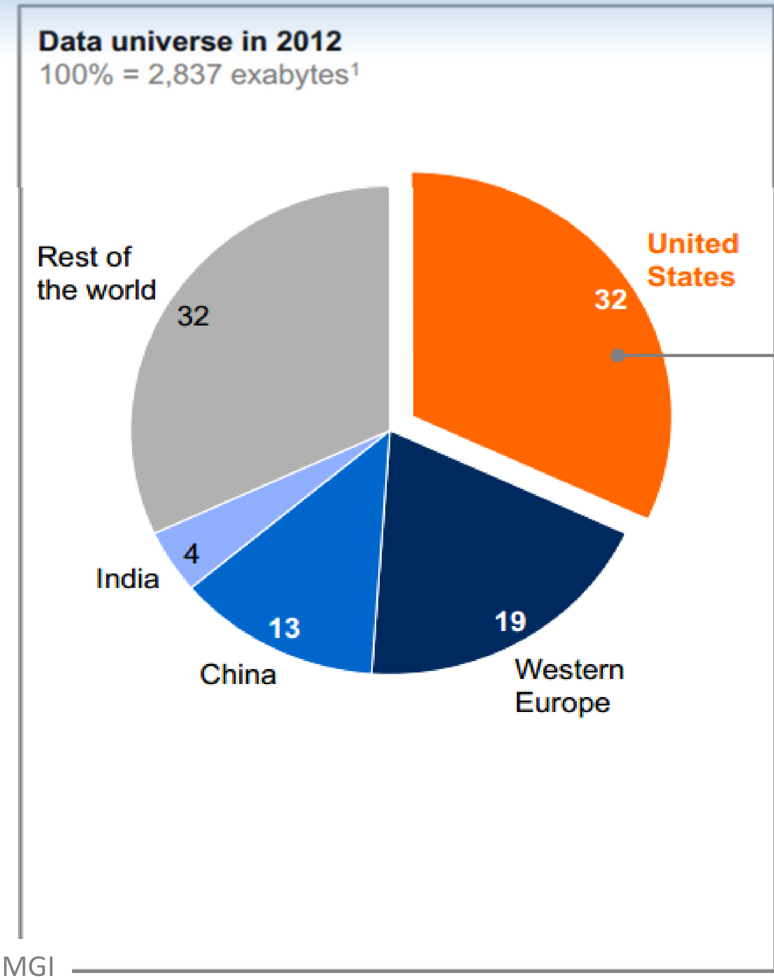
Data by Datta

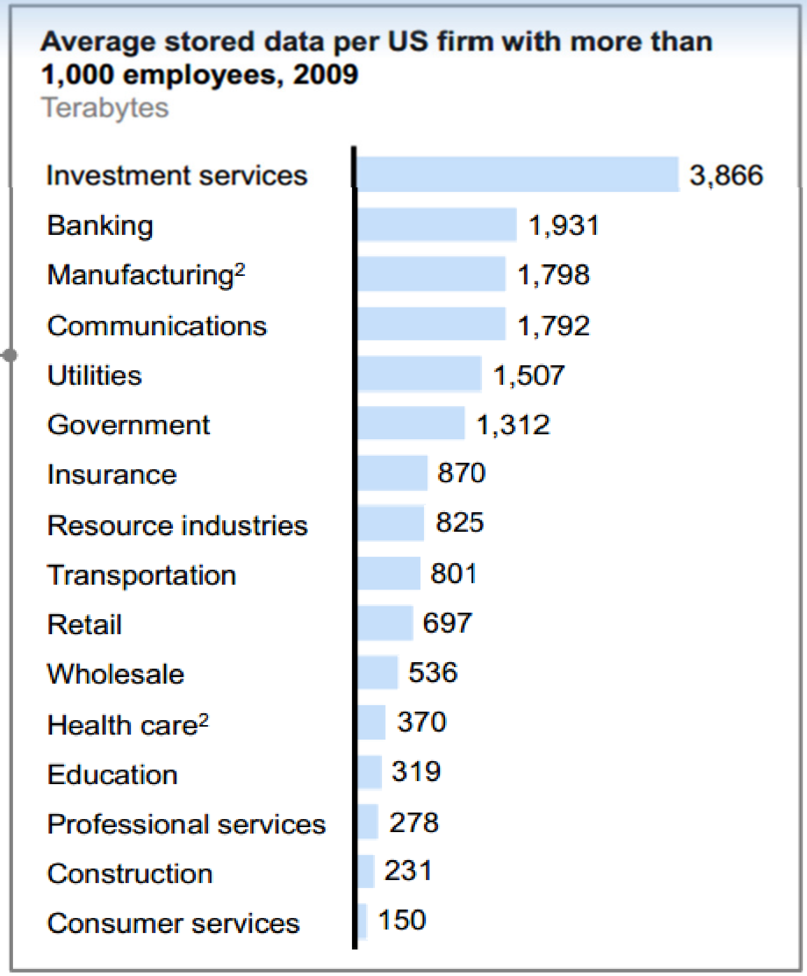


Source: Ericsson

ITU and a number of companies to equip submarine communications cables with sensors to relay data regarding tsunamis or earthquakes.

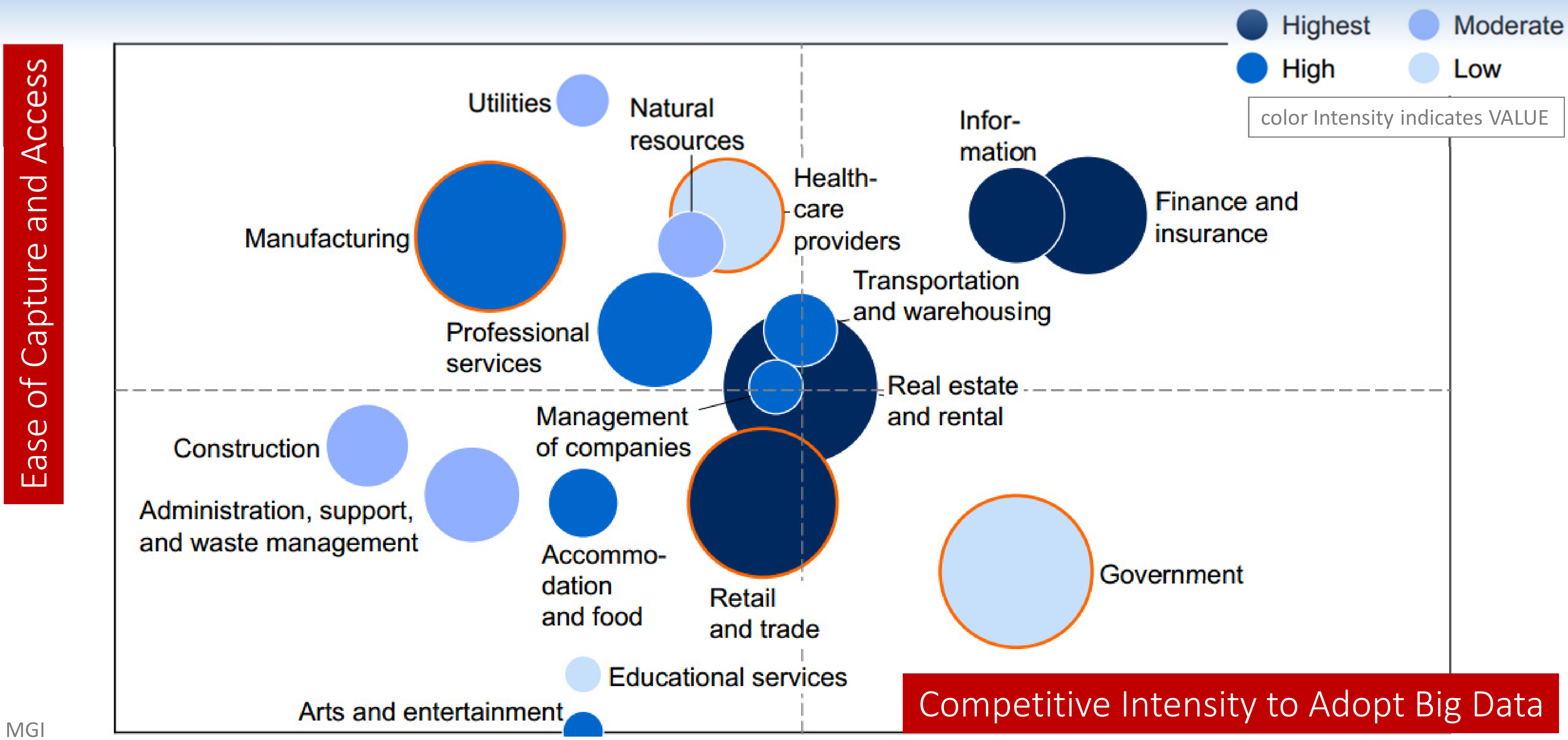
US has about one-third of the world's data …





http://bit.ly/S-Datta

The term "big data" is mired in hype but it has VALUE if analyzed in context



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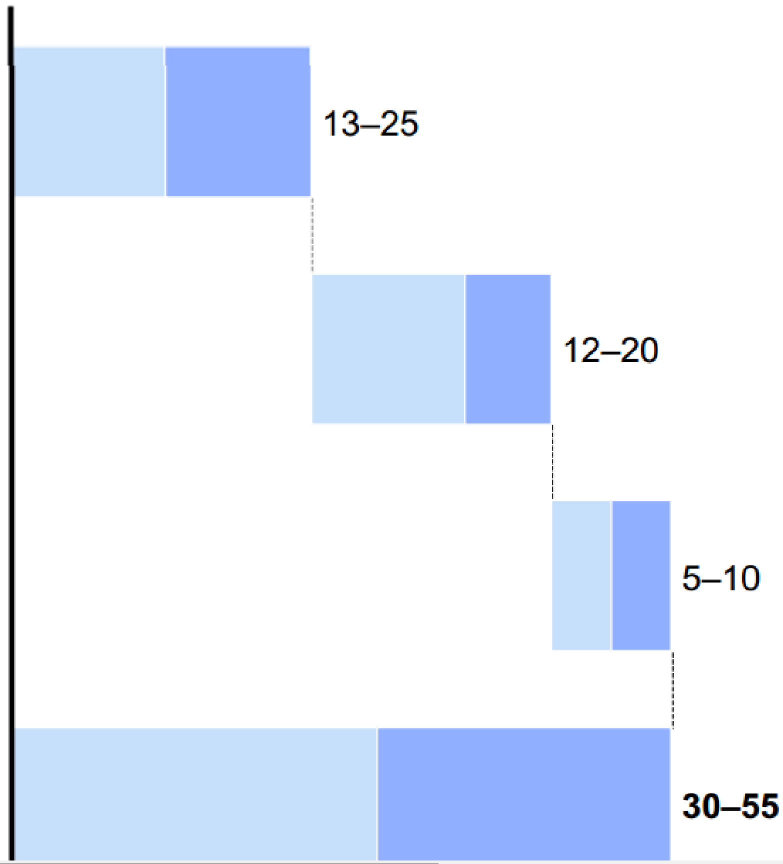
Predicted value of data analytics in the retail supply chain (circa 2020)

Stage of value chain	Area of improvement due to big data analytics
Supply chain	▪ Inventory management ▪ Transport optimization ▪ Returns management
Operations	▪ Performance transparency ▪ Labor resource optimization
Merchandising	▪ Assortment optimization
Total	

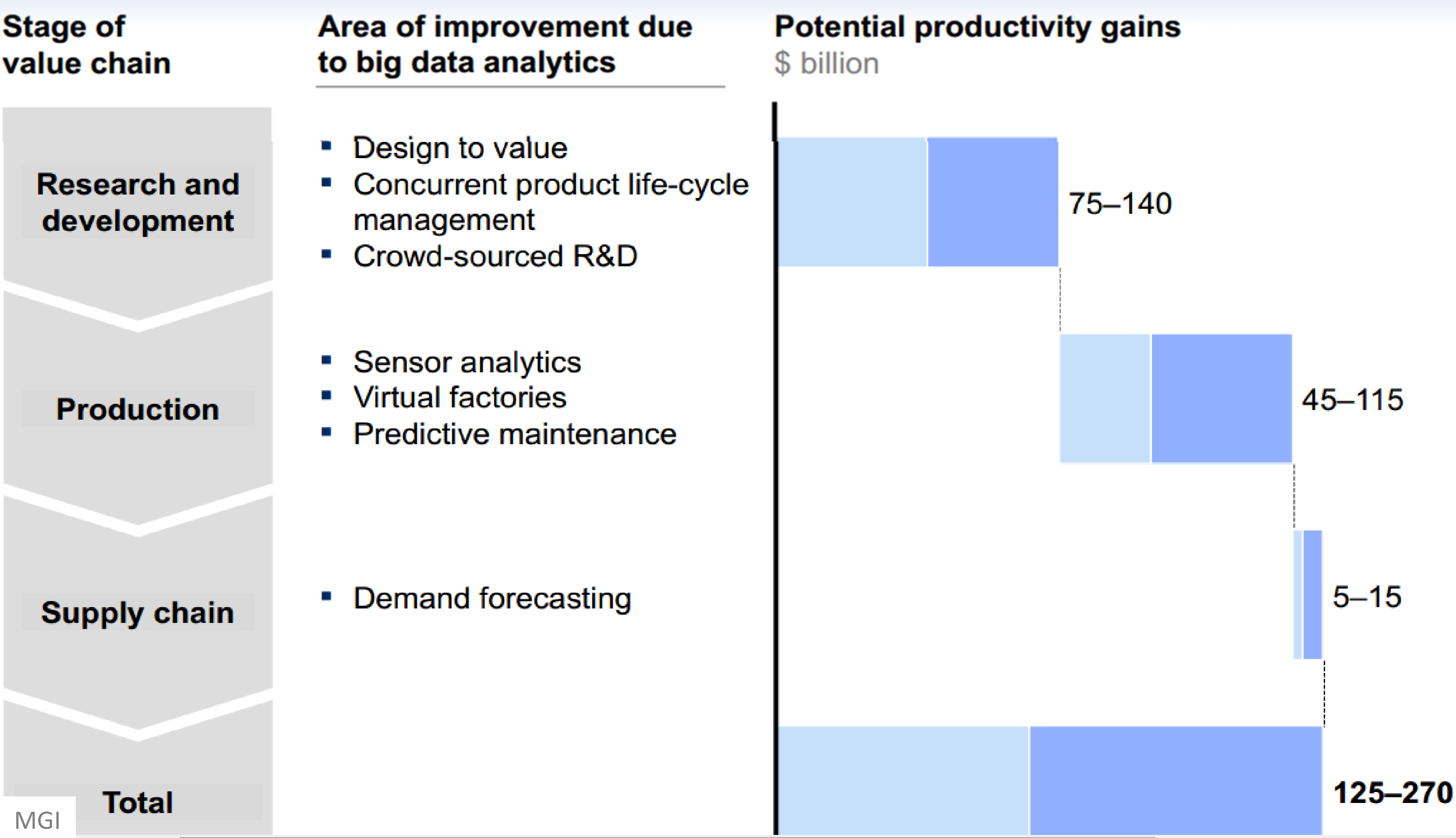
Value of incremental retail GDP
$ billion by 2020



MGI

http://bit.ly/S-Datta

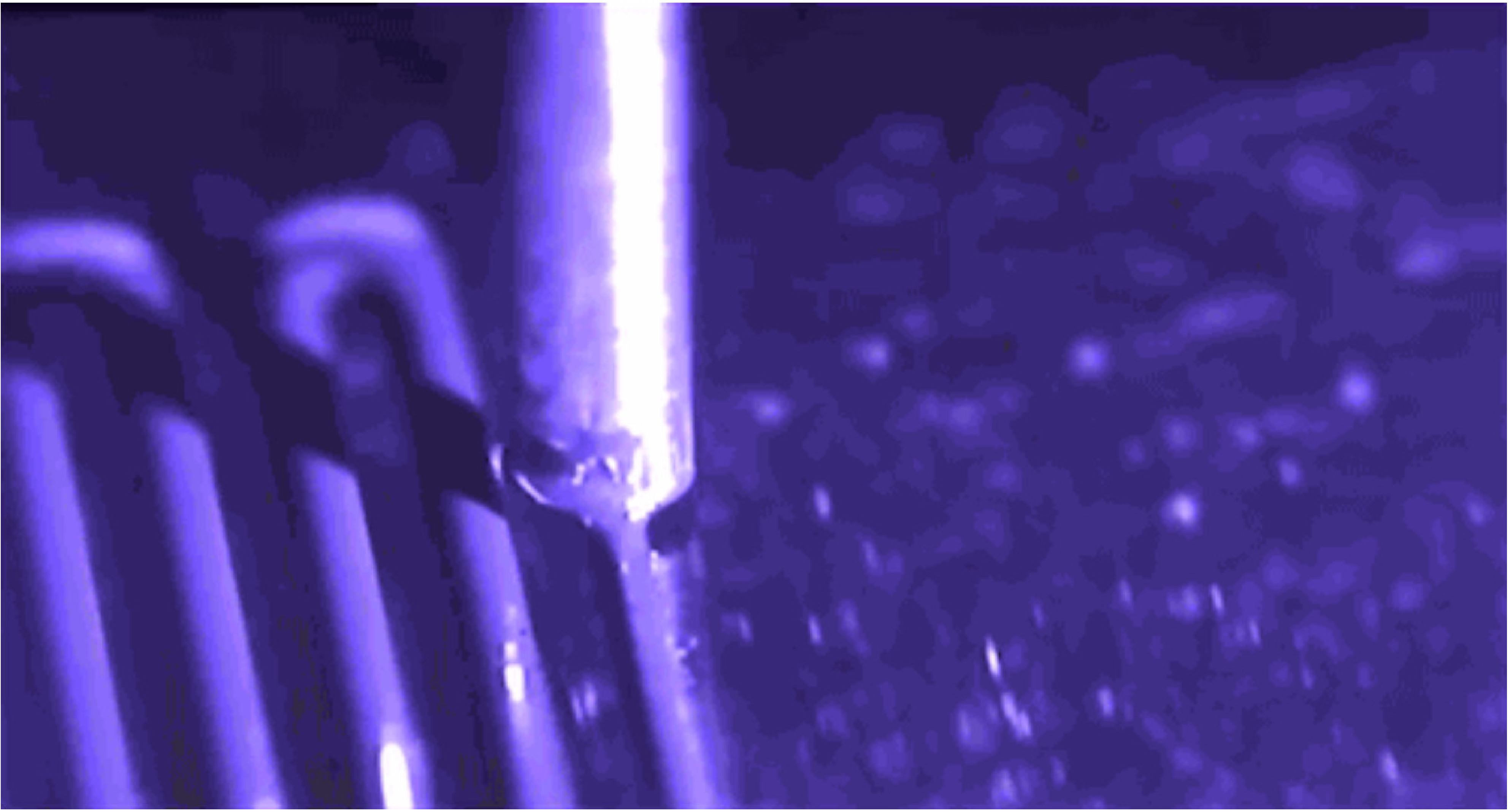
Predicted value of data analytics in manufacturing (circa 2020)



MGI

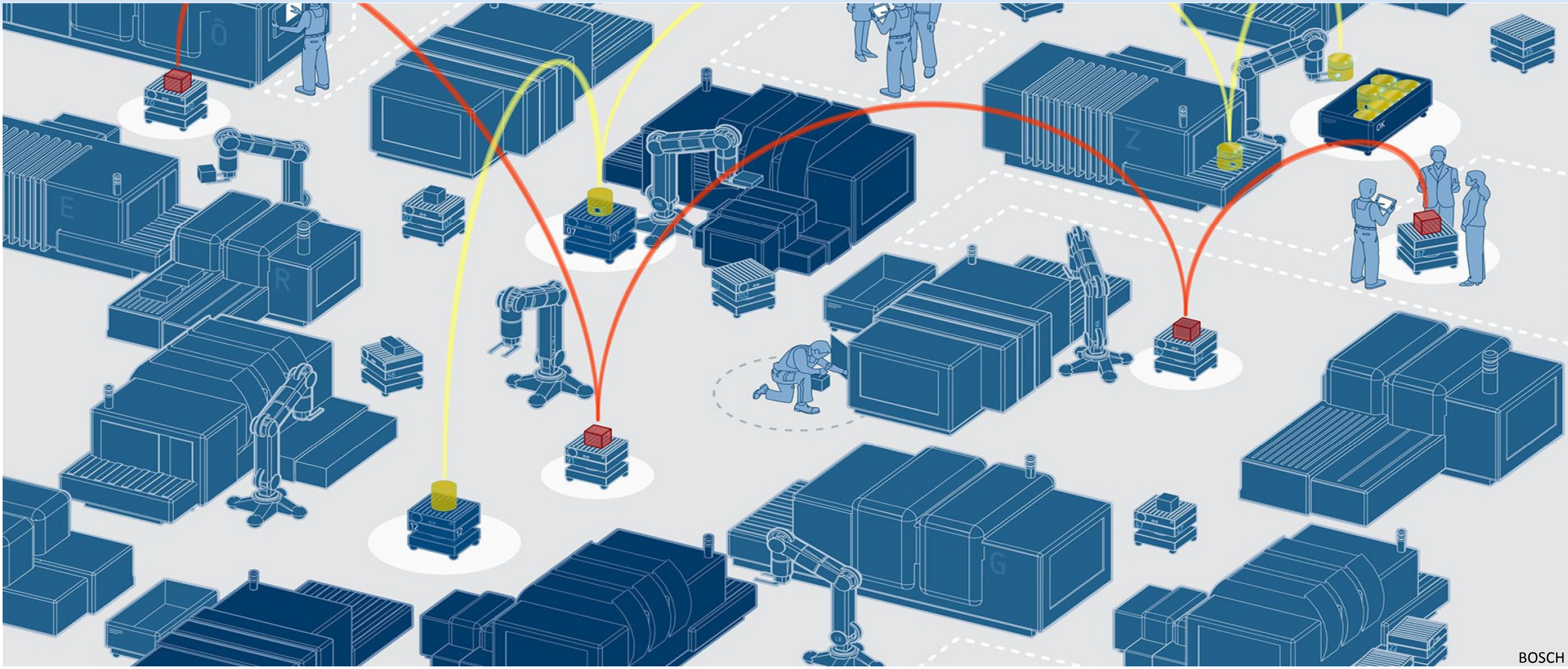
http://bit.ly/S-Datta

Data from inside machines – GE prints sensors deep inside equipment



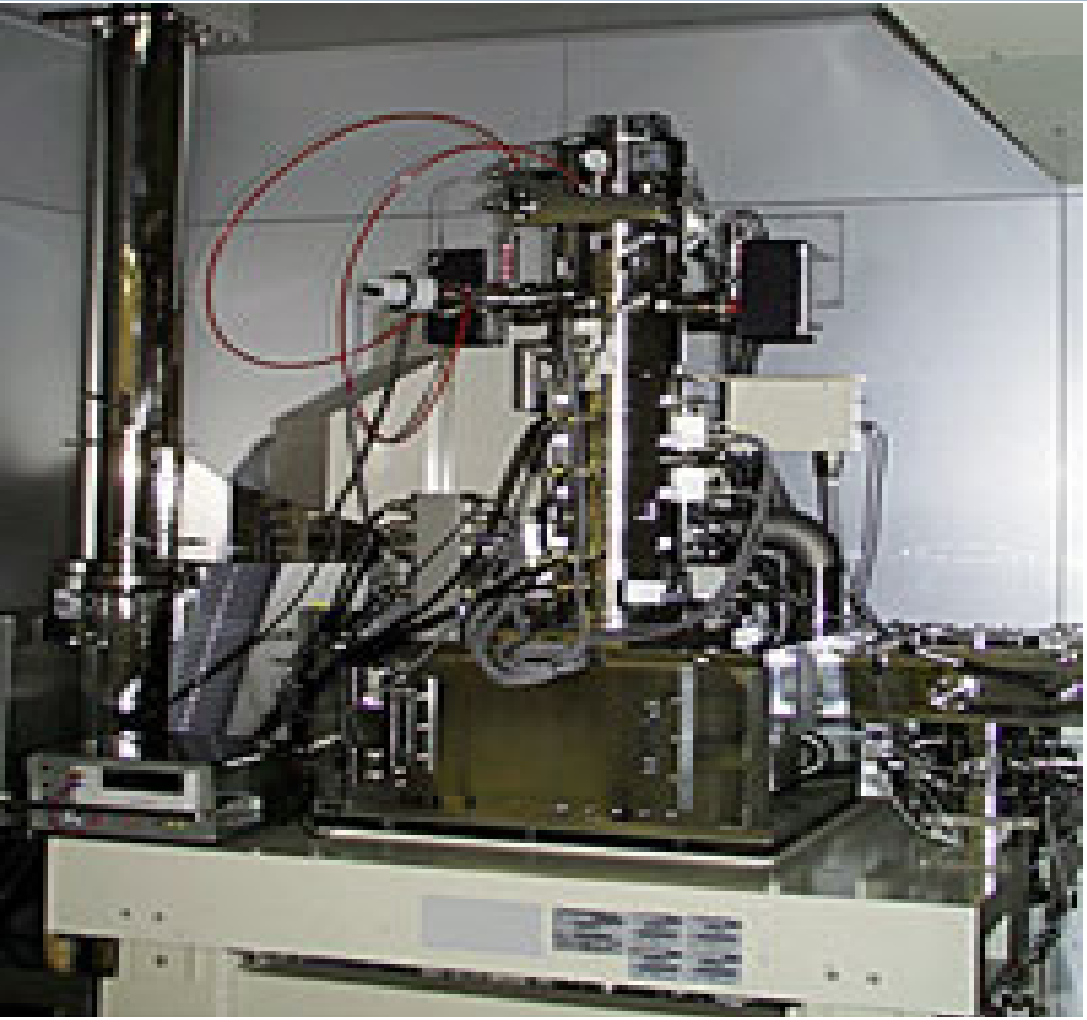
Robotics in manufacturing is nothing new but shop floor data networks?

Data networks improve variant configuration and connects to supply chains



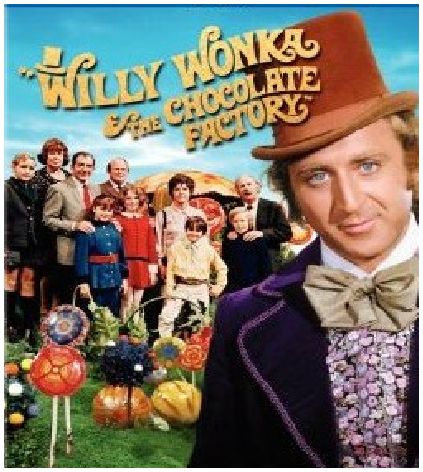
BOSCH

Emma's Omlette Factory – The Kitchen of the Future – i Print on Demand



Move over…Willy Wonka and The Chocolate Factory

Electron Beam Photo Lithograph from the ancient era modified as a domestic food printer connected to commodity pipelines (milk, cheese, eggs)



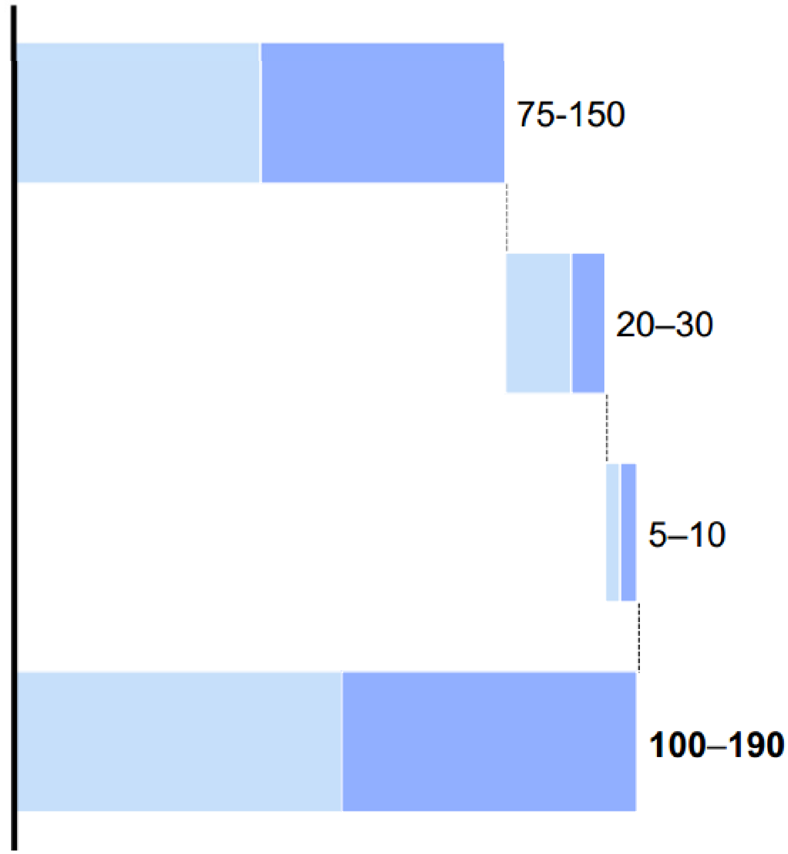
What skills do you need to transform this idea into reality?

For additional information please visit http://bit.ly/MIT-Made-in-Taiwan

Predicted value of data analytics in healthcare (circa 2020)

Stage of value chain	Area of improvement due to big data and analytics
Clinical operations	▪ Comparative effectiveness ▪ Clinical decision support ▪ Remote patient monitoring ▪ Performance transparency
Research and development	▪ R&D optimization ▪ Personalized medicine ▪ Pharmacovigilance[1]
Public health	▪ Surveillance and response
Total	

Potential cost savings
$ billion



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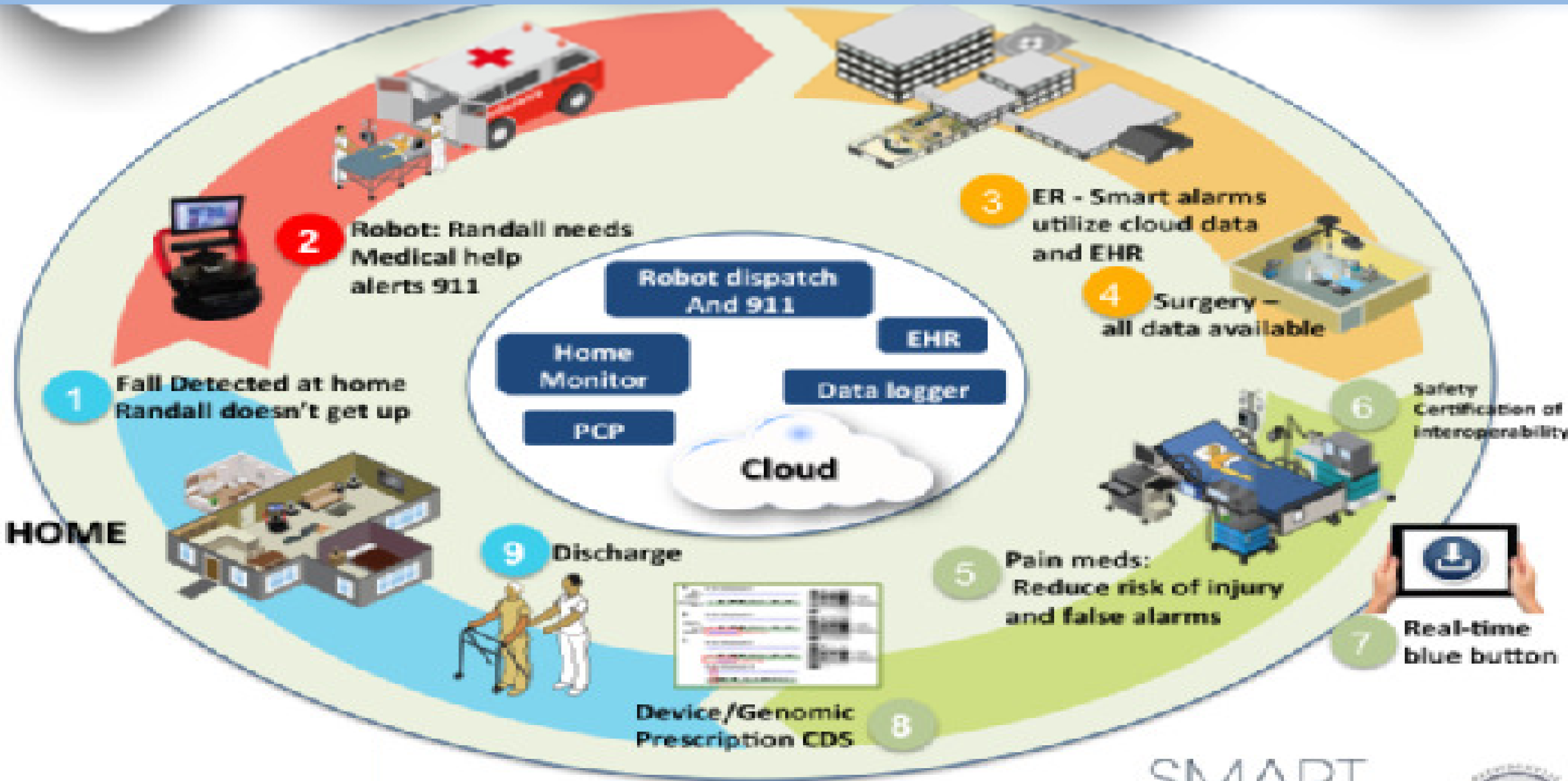
http://bit.ly/S-Datta

Real-time data – acquisition, analytics, decision support, security & privacy

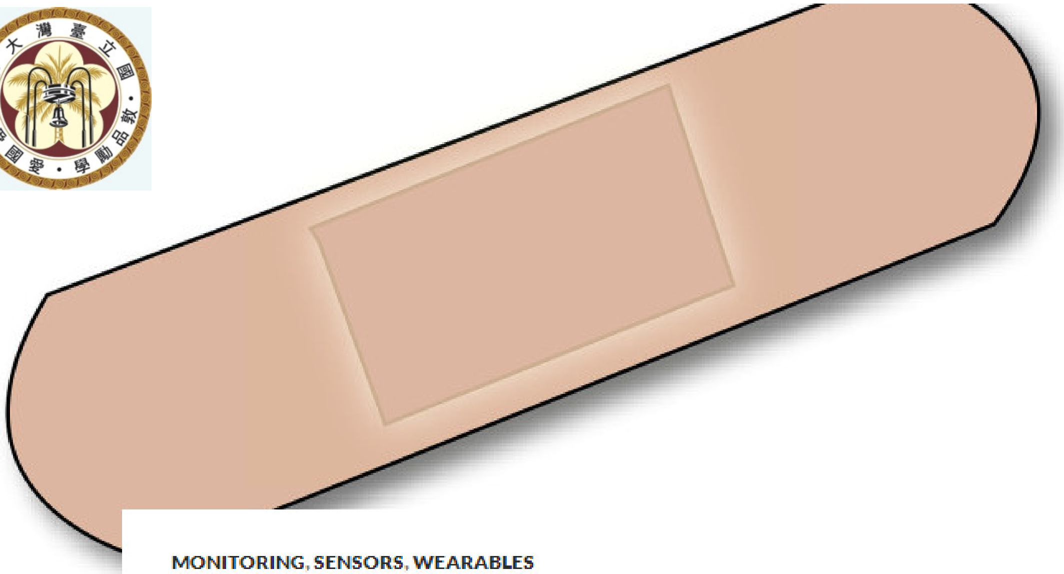


Dr Julian Goldman MD
MDPnP – MGH – HMS

Predictive value of data analytics in healthcare diagnostics and wellness

Pay-Per-Pee Home Healthcare – Wireless Toilet Bowl Connected to Health Informatics System

Weigh-scale, BMI, FOBT, urine sugar & ketone body analysis, blood pressure monitor, pulse oximeter, networked to PC via WiFi and/or Bluetooth with biometric id and face recognition.



MONITORING, SENSORS, WEARABLES

SENSOR / 3D PRINTING / BANDAGE COMBINATION FOR CONTINUOUS MONITORING

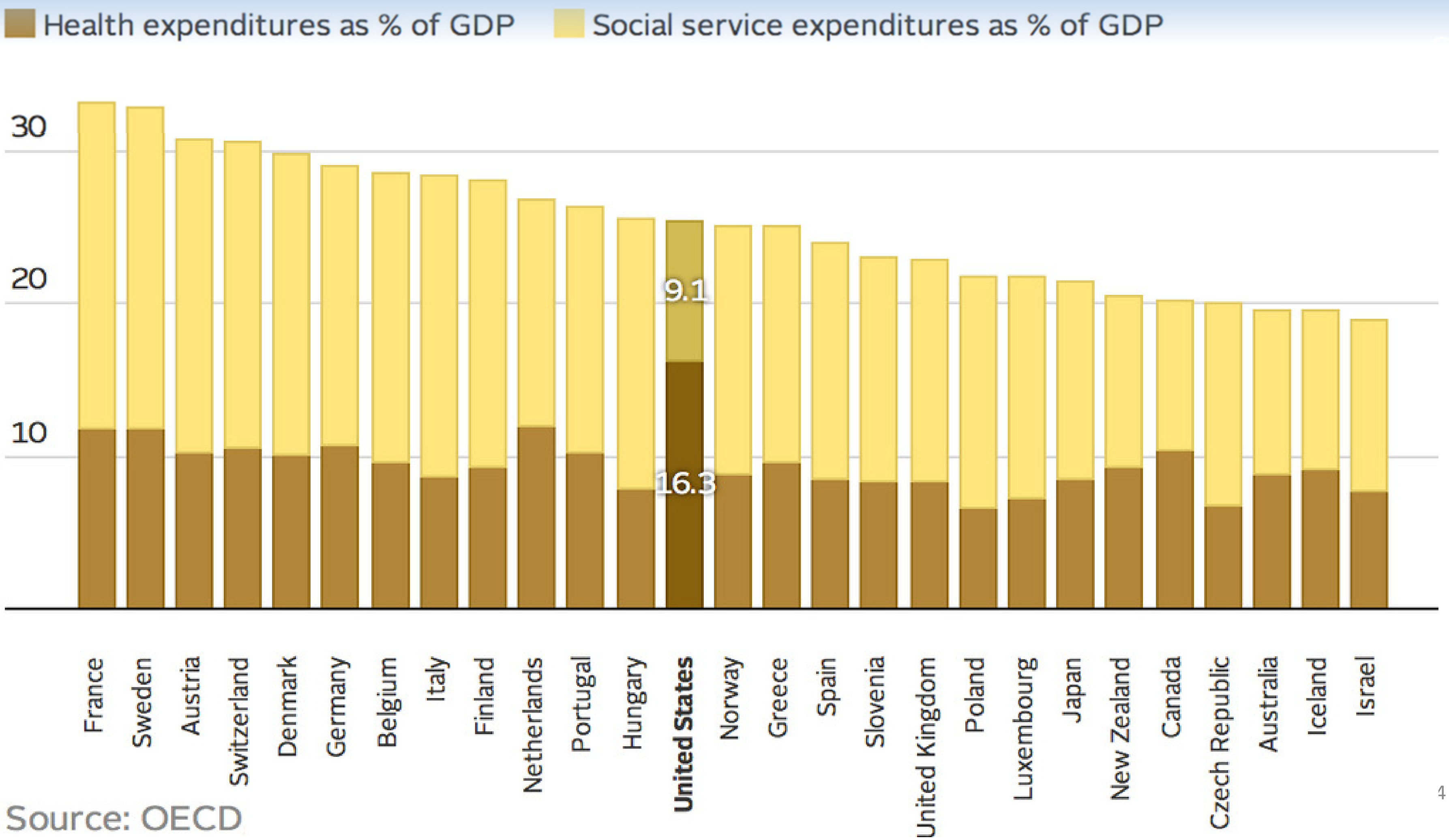
JULY 18, 2014 LISAWEINER

Bioscope bandages, developed at the National Taiwan University, wirelessly transmit temperature, heart rate, movement and vital sign data to doctors to monitor or remotely diagnose.

The bandage comes with an integrated thermometer, accelerometer, and sensors to measure electrical activity. A microphone can track organ sound patterns to detect disease. The area holding the modules is 3D printed for easy sensor additions or changes.

Laughter is the best indicator of this disease but the wireless sensors to detect laughter is not covered by your health insurance

The Paradox of US Healthcare – Global Anomaly ? Is social service a stigma ?



Source: OECD

Proposed value generation ($ billions, due to data) in government by 2020

Productivity gains	**Higher operational efficiency**	**35–95**	▪ Automated submissions/processing ▪ Monitoring of performance variability ▪ Measurement of service outcomes
Reduced expenses	Reduced improper payments	35–85	▪ Systematic, multi-level claim checking ▪ Algorithms for decision support
	Lower procurement costs	90–140	▪ Price and service transparency ▪ Vendor and provider comparisons
Increased revenue	Improved tax collection	155–235	▪ Identification of collection anomalies ▪ Correlation and statistical analyses ▪ Higher accuracy of record-keeping

MGI

Predicted Exponential Increase in Efficiency and Growth of Global GDP

Data in connection with the Internet of Things Industrial Internet

Predicted Exponential Increase in Efficiency and Growth of Global GDP

Global Projected Growth includes the IoT and the Industrial Internet

5 ECONOMIC GROWTH SECTORS + 12 DOMAINS OF RAPID ADVANCES

- Energy
- Trade
- Big data[1]
- Infrastructure
- Talent

FIVE SECTORS + **12 DOMAINS**

Modified and adapted from MGI

Industrial Internet

CONVERGENCE CATALYZED ECONOMIC POTENTIAL ~$15 to $50 TRILLION circa 2025

Mobile Internet	Cloud of Things	Increasingly inexpensive and capable mobile computing devices and Internet connectivity
Automation of knowledge	Predictive Analytics	Intelligent software systems that can perform knowledge work tasks involving unstructured commands and subtle judgments
The Internet of Things	Privacy, Cyber-Security	Networks of low-cost sensors and actuators for data collection, monitoring, decision making, and process optimization
Cloud technology	Data, Decisions, SCM	Use of computer hardware and software resources delivered over a network or the Internet, often as a service
Advanced robotics	Cyber-Physical Systems	Increasingly capable robots with enhanced senses, dexterity, and intelligence used to automate tasks or augment humans
Autonomous and near-autonomous vehicles	Transportation + Disaster & Emergency First Response Systems in Smart Cities	Vehicles that can navigate and operate with reduced or no human intervention
Next-generation genomics	Healthcare	Fast, low-cost gene sequencing, advanced big data analytics, and synthetic biology ("writing" DNA)
Energy storage	EV as storage	Devices or systems that store energy for later use, including batteries
3D printing	Manufacturing	Additive manufacturing techniques to create objects by printing layers of material based on digital models
Advanced materials	Manufacturing	Materials designed to have superior characteristics (e.g., strength, weight, conductivity) or functionality
Advanced oil and gas exploration and recovery	Energy Supply Chain	Exploration and recovery techniques that make extraction of unconventional oil and gas economical
Renewable energy	Smart Grid	Generation of electricity from renewable sources with reduced harmful climate impact
Aerospace Locomotives		Maintenance and fault prevention using in-flight monitoring; reduce down-time by auto-tracking metrics; fuel consumption; supply chain

There is more to the Internet of Things (IoT) than FitBits and smartphone-controlled thermostats. While consumer goods are some of the IoT's most visible applications, they're just one part of the vast and game-changing phenomenon that could soon encompass 200 billion connected devices and add trillions of dollars to the economy.

In fact, experts estimate that the IoT will resonate strongly in the "invisible" industrial sector, capturing and analyzing data generated by drilling rigs, jet engines, locomotives and other heavy-duty machines.

This network is called the Industrial Internet and it's already helping companies shave costs and boost performance. Union Pacific, America's largest railroad company, has improved productivity by wiring its locomotives with sensors that monitor parts and supply data to algorithms that try to predict whether a component might break down and when. "Industrial data is not only big, it's the most critical and complex type of big data," says Jeff Immelt, chairman and CEO of GE. "Observing, predicting and changing performance is how the Industrial Internet will help airlines, railroads and power plants operate at peak efficiency."

GE is betting big on the Industrial Internet. The company believes the network could add $10 and $15 trillion – the size of today's U.S. economy - to global GDP over the next 20 years. Its software arm has developed a software platform called Predix that allows Union Pacific, as well as oil drilling companies, wind farms, hospitals and other customers to perform prognostics, reduce downtime and increase efficiency.

Capturing Big Data and transmitting it to dedicated servers presents its own set of technological and logistical challenges. That's why GE, AT&T, Cisco and IBM teamed up this spring to launch the Industrial Internet Consortium. The goal of this open, not-for-profit group is to break down technology silos, improve machine-to-machine communications and bring the physical and digital worlds closer together.

To do that, member companies will pool their R&D capabilities to develop common server architectures and advanced test beds to standardize key components of the Industrial Internet.

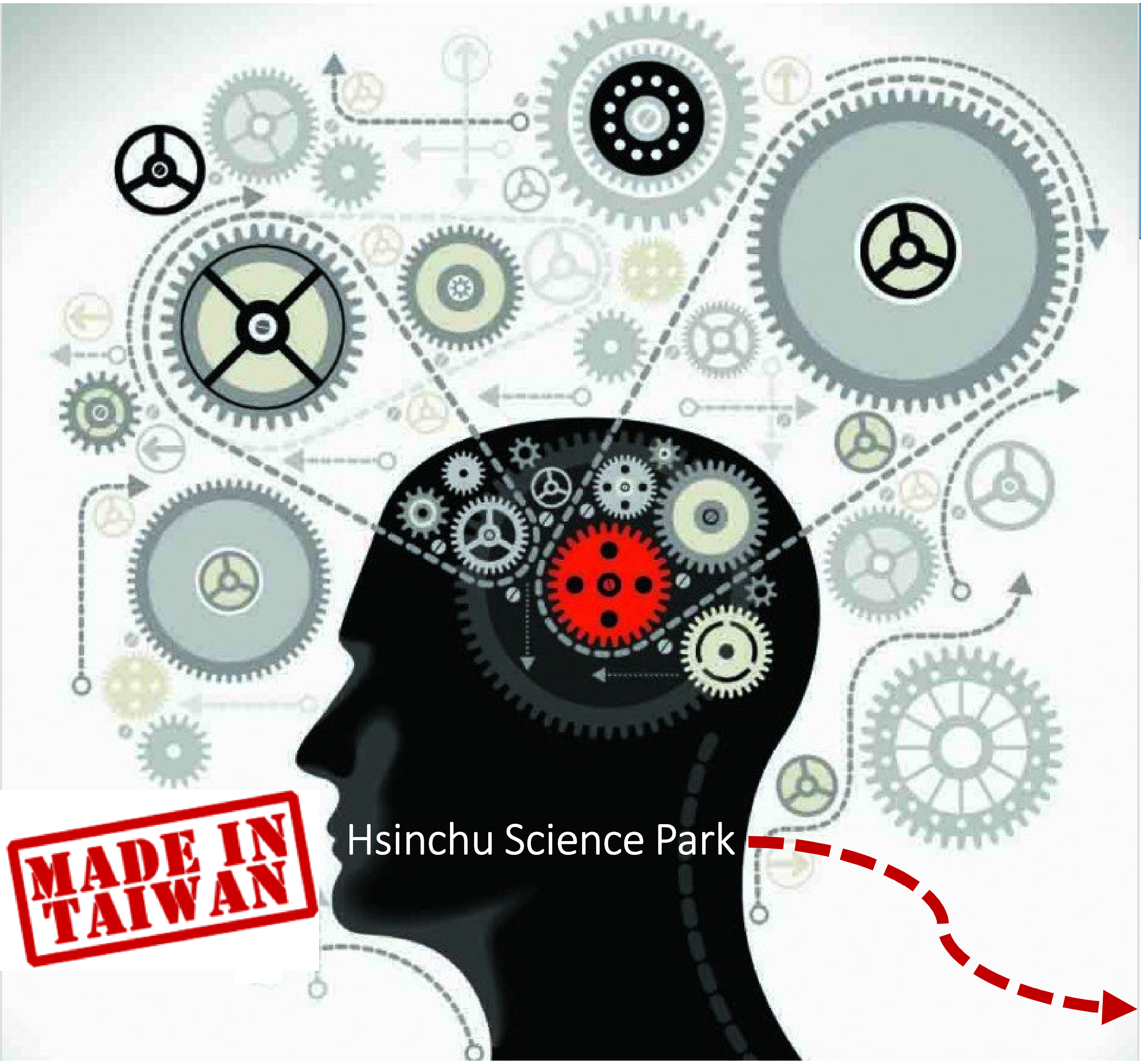
Massive gas turbines are also getting connected to the Industrial Internet.

While the possibilities of the Industrial Internet are just beginning to be harnessed, companies aren't waiting around. In a speech to power company executives, Wall Street analysts and investors at the Electrical Products Group Conference this spring, GE's Immelt said that by the end of the year, he expected GE to launch over 40 "Predictivity" industrial analytical applications, which could generate more than $1 billion in revenue for the company.

The Internet is no longer just about email, e-commerce and Twitter, says Joe Salvo, manager of the Complex Systems Engineering Laboratory at GE Global Research. "We are at an inflection point," he says. "The next wave of productivity will connect brilliant machines and people with actionable insight."

Where is my slice of the pie?

How much of the $10 - $15 trillion may be diverted to my bank?



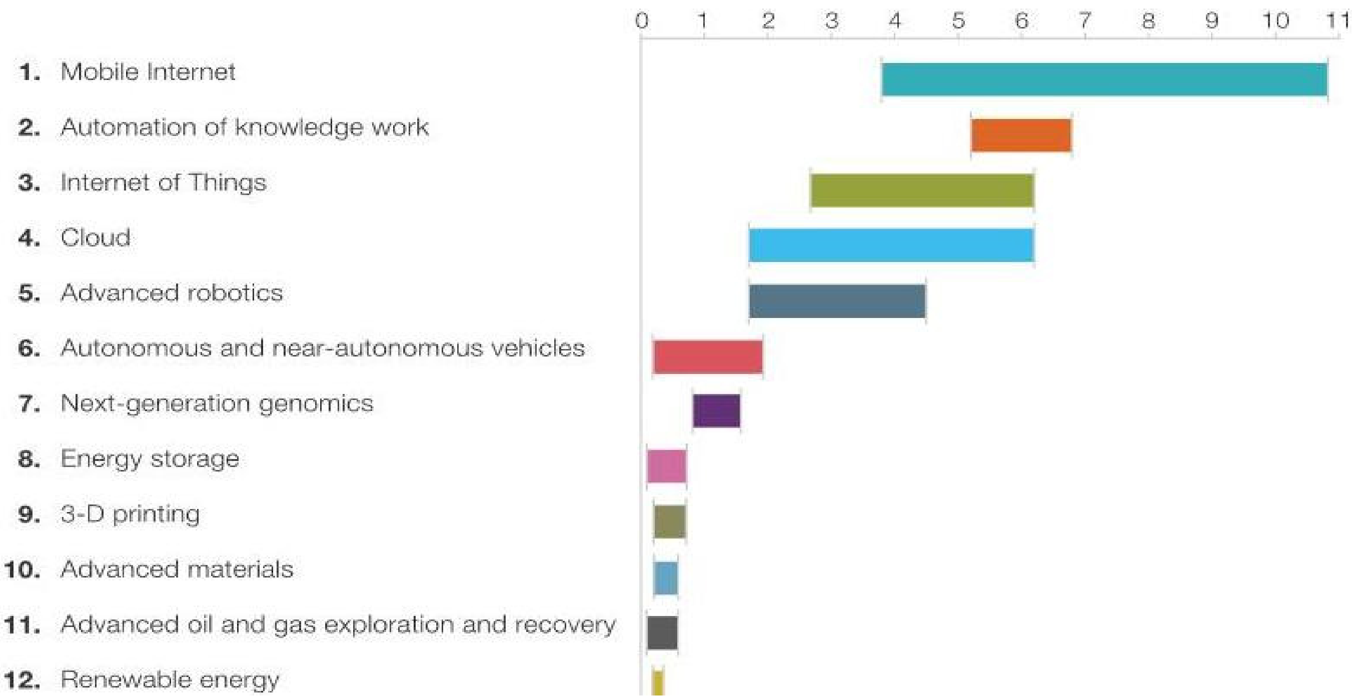
Goldman-Sachs Quick Get Rich Insider Information

COMPANY	TICKER	GS RATING	POSITIONING
ARM Holdings	UK:ARM	Buy	Low-power chip designs
Atmel Corp.	ATML	Neutral	Exposure to microcontroller growth
Broadcom Corp.	BRCM	Neutral	Well-positioned in connectivity/broadband
Cisco Systems Inc.	CSCO	Buy	IoT thought leader (Wi-Fi, "fog" computing)
Freescale Semiconductor	FSL	Buy	Exposure to microcontroller growth
Garmin Ltd.	GRMN	Neutral	Expanding wearables, connected car portfolio
Gemalto NV	NL:GTO	Buy	Digital security expertise to monetize IoT
InvenSense Inc.	INVN	Buy	Early design wins on wearables
Maxim Integrated Products	MXIM	Buy	Exposure to microcontroller growth
Microchip Technology Inc.	MCHP	Neutral	Exposure to microcontroller growth
Murata Manufacturing Co.	JP:6981	Buy	Benefits from Japan upstream supply chain
Qualcomm Inc.	QCOM	Buy	Cellular/connectivity leadership
Ruckus Wireless Inc.	RKUS	Buy	Pure-play Wi-Fi vendor
Samsung Electronics	KR:005930	Buy	Widest hardware reach in IoT
Silver Spring Networks Inc.	SSNI	Buy	Connected city pure play (smart meters, etc)
TE Connectivity Ltd.	TEL	Buy	Increasing focus on sensors
Wistron NeWeb Corp.	TW:6285	Neutral	Expert in wireless solutions

The Logical Analysis of Economic Impact

Economy is the art of making the most of life (GBS)

MGI Estimated Potential Annual Economic Impact in $ Trillion (circa 2025)



In highly successful firms such as McKinsey and Company hundreds of new MBAs join the firm every year and almost as many leave. But the company is able to crank out high-quality work year after year because its core capabilities are rooted in its processes and values rather than in its resources (vision). I sense, however, that these capabilities of McKinsey also constitute its disabilities. The rigorously analytical, data-driven processes that help it create value for its clients in existing, relatively stable markets render it much less capable in technology markets.
Clayton Christensen (Harvard Business School, 2000) also in his book *The Innovators Dilemma*

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#1 Mobile Internet

Increasingly inexpensive and capable mobile computing devices and Internet connectivity

Potential economic impact in 2025 across sized applications of
$3.7 trillion–$10.8 trillion

10–20% potential cost reduction in treatment of chronic diseases through remote health monitoring

How can MOOC help?
What types of courses?
What forms of training?
What are the pre-requisites?
How relevant is this to Taiwan?

Component technologies

- Wireless technologies
- Small, low-cost computing and storage devices
- Advanced display technology, natural user interfaces
- Advanced, low-cost batteries

Key applications

- Service delivery
- Worker productivity
- Additional consumer surplus from use of mobile-Internet services

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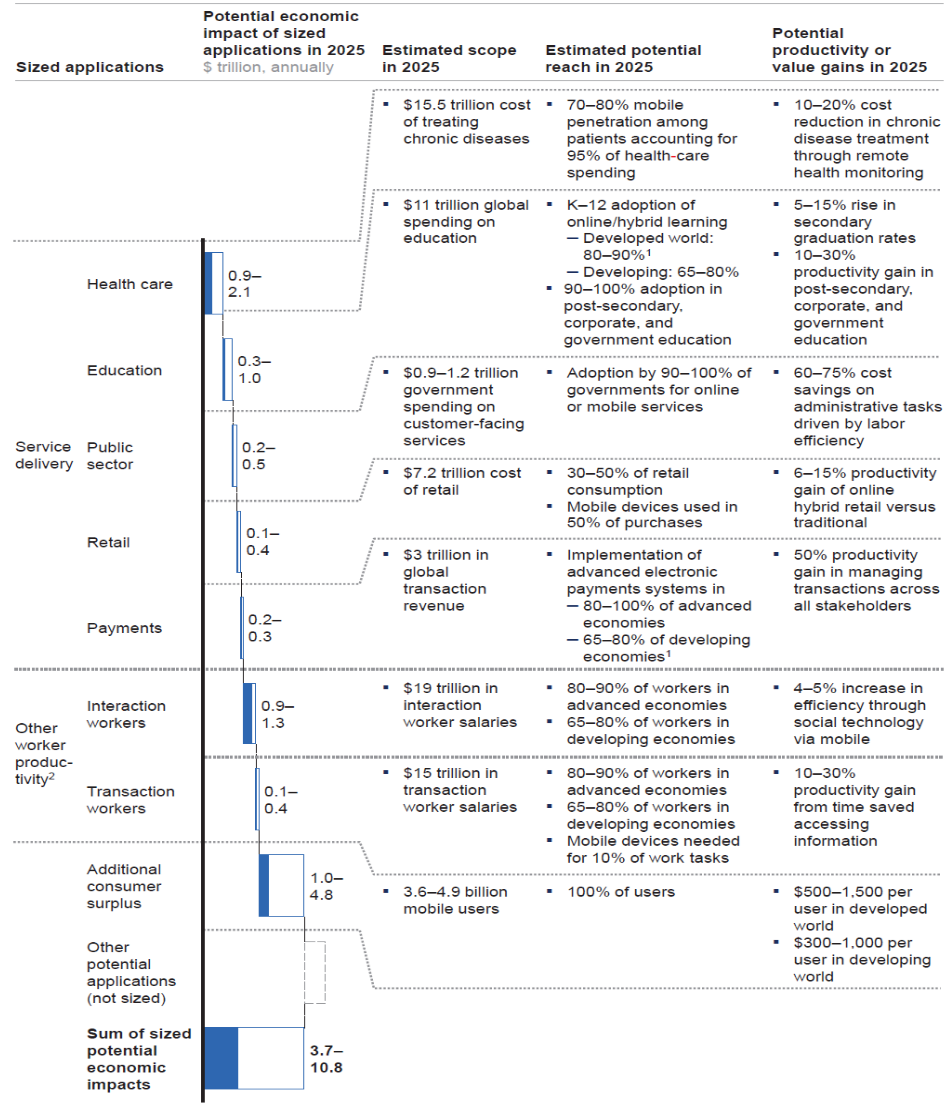
How can MOOC help?
What types of courses?
What forms of training?
What are the pre-requisites?
How relevant is this to Taiwan?

Sized applications of mobile Internet could have direct economic impact of $3.7 trillion to $10.8 trillion per year in 2025



	Sized applications	Potential economic impact of sized applications in 2025 ($ trillion, annually)	Estimated scope in 2025	Estimated potential reach in 2025	Potential productivity or value gains in 2025
Service delivery	Health care	0.9–2.1	▪ $15.5 trillion cost of treating chronic diseases	▪ 70–80% mobile penetration among patients accounting for 95% of health-care spending	▪ 10–20% cost reduction in chronic disease treatment through remote health monitoring
	Education	0.3–1.0	▪ $11 trillion global spending on education	▪ K–12 adoption of online/hybrid learning — Developed world: 80–90%[1] — Developing: 65–80% ▪ 90–100% adoption in post-secondary, corporate, and government education	▪ 5–15% rise in secondary graduation rates ▪ 10–30% productivity gain in post-secondary, corporate, and government education
	Public sector	0.2–0.5	▪ $0.9–1.2 trillion government spending on customer-facing services	▪ Adoption by 90–100% of governments for online or mobile services	▪ 60–75% cost savings on administrative tasks driven by labor efficiency
	Retail	0.1–0.4	▪ $7.2 trillion cost of retail	▪ 30–50% of retail consumption ▪ Mobile devices used in 50% of purchases	▪ 6–15% productivity gain of online hybrid retail versus traditional
	Payments	0.2–0.3	▪ $3 trillion in global transaction revenue	▪ Implementation of advanced electronic payments systems in — 80–100% of advanced economies — 65–80% of developing economies[1]	▪ 50% productivity gain in managing transactions across all stakeholders
Other worker productivity[2]	Interaction workers	0.9–1.3	▪ $19 trillion in interaction worker salaries	▪ 80–90% of workers in advanced economies ▪ 65–80% of workers in developing economies	▪ 4–5% increase in efficiency through social technology via mobile
	Transaction workers	0.1–0.4	▪ $15 trillion in transaction worker salaries	▪ 80–90% of workers in advanced economies ▪ 65–80% of workers in developing economies ▪ Mobile devices needed for 10% of work tasks	▪ 10–30% productivity gain from time saved accessing information
	Additional consumer surplus	1.0–4.8	▪ 3.6–4.9 billion mobile users	▪ 100% of users	▪ $500–1,500 per user in developed world ▪ $300–1,000 per user in developing world
	Other potential applications (not sized)				
	Sum of sized potential economic impacts	3.7–10.8			

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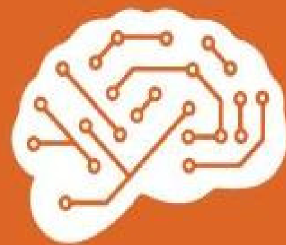

#2 Automation of knowledge work

Intelligent software systems that can perform knowledge-work tasks

Potential economic impact in 2025 across sized applications of **$5.2 trillion–$6.7 trillion**

Additional labor productivity could equal the output of **110 million–140 million** full-time workers

How can MOOC help?
What types of courses?
What forms of training?
What are the pre-requisites?
How relevant is this to Taiwan?

Component technologies

- Artificial intelligence, machine learning
- Natural user interfaces
- Big-data technologies

Key applications

- Smart learning in education
- Diagnostics and drug discovery in health care
- Discovery, contracts/patents in legal sector
- Investments and accounting in finance sector

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Sized applications of automation of knowledge work could have direct economic impact of $5.2 trillion to $6.7 trillion per year in 2025

Sized knowledge worker occupations		Potential economic impact of sized occupations in 2025 $ trillion, annually	Estimated scope in 2025	Estimated potential reach in 2025	Potential productivity or value gains in 2025
Common business functions	Clerical	1.1–1.3	▪ $4.4 trillion in knowledge worker costs ▪ 125 million knowledge workers	▪ 50–65 million full-time equivalents (FTEs) of work potentially automatable	▪ $35,000 value per FTE of additional productivity
	Customer service and sales	0.6–0.9			
Social sector services	Education	0.8–1.0	▪ $2.8 trillion in knowledge worker costs ▪ 55 million knowledge workers	▪ 20–30 million FTEs of work potentially automatable	▪ $50,000 value per FTE of additional productivity
	Health care	0.3–0.4			
Technical professions	Science and engineering	0.6–0.7	▪ $2.2 trillion in knowledge worker costs ▪ 35 million knowledge workers	▪ 15 million FTEs of work potentially automatable	▪ $60,000 value per FTE of additional productivity
	IT	0.4–0.5			
	Managers	0.8–1.1	▪ $2.9 trillion in knowledge worker costs ▪ 50 million knowledge workers	▪ 15–20 million FTEs of work potentially automatable	▪ $60,000 value per FTE of additional productivity
Professional services	Finance	0.4–0.5	▪ $1.5 trillion in knowledge worker costs ▪ 25 million knowledge workers	▪ 10 million FTEs of work potentially automatable	▪ $65,000 value per FTE of additional productivity
	Legal	0.2–0.3			
Other potential applications (not sized)					
Sum of sized potential economic impacts		**5.2–6.7**			

How can MOOC help?
What types of courses?
What forms of training?
What are the pre-requisites?
How relevant is this to Taiwan?

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#3 Internet of Things

Networks of low-cost sensors and actuators for data collection, monitoring, decision making, and process optimization

Potential economic impact in 2025 across sized applications of
$2.7 trillion–$6.2 trillion

Offers potential to drive **productivity across $36 trillion** in operating costs of key affected industries: manufacturing, health care, and mining

How can MOOC help?
What types of courses?
What forms of training?
What are the pre-requisites?
How relevant is this to Taiwan?

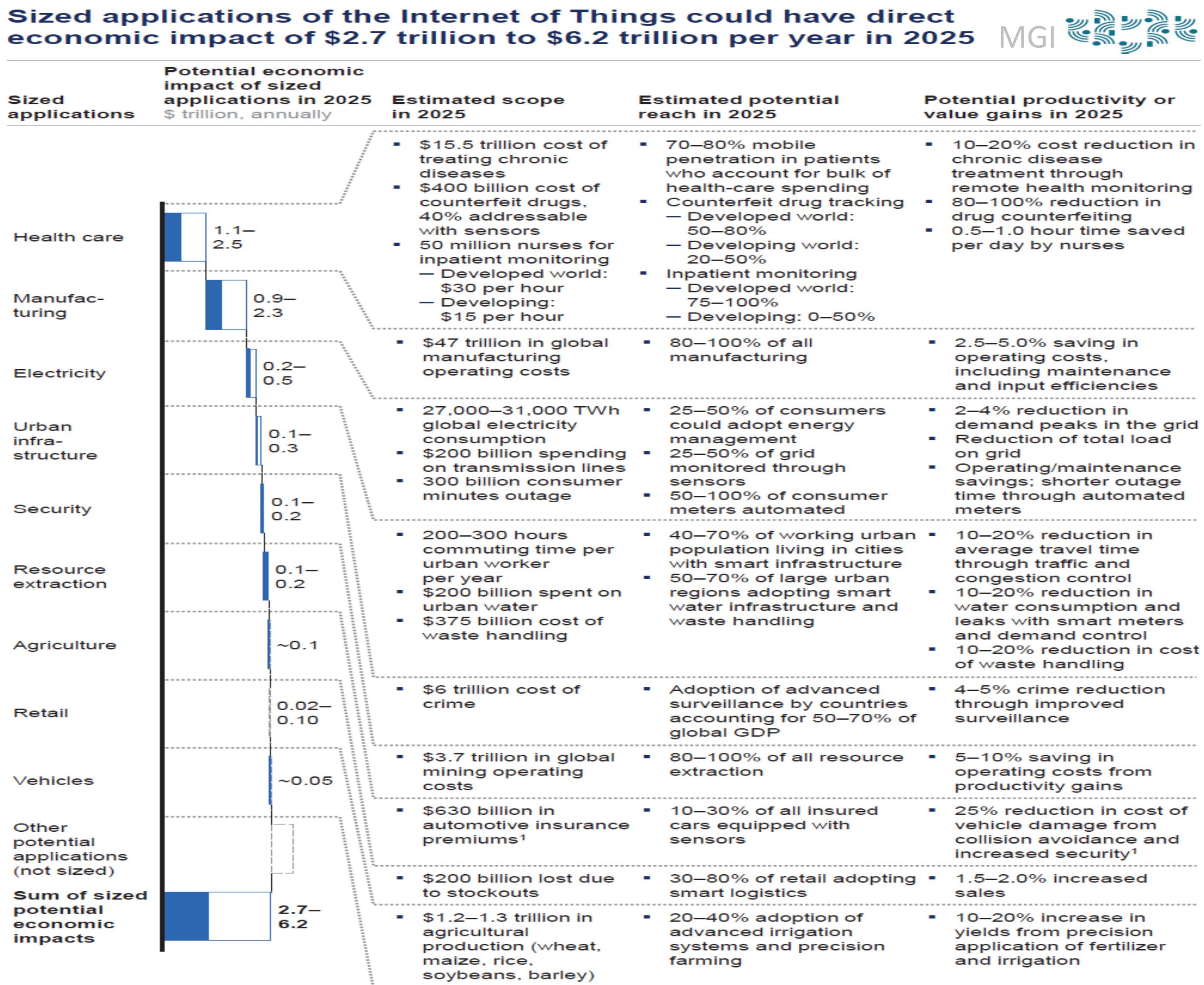
Component technologies

- Advanced, low-cost sensors
- Wireless and near-field communication devices—eg, RFID (radio frequency identification tags)

Key applications

- Process optimization, especially in manufacturing and logistics
- Efficient use of natural resources—eg, smart-meter and smart-grid control of water and electricity
- Remote health-care delivery, sensor-enhanced business models

WORKFORCE DEVELOPMENT



Sized applications of the Internet of Things could have direct economic impact of $2.7 trillion to $6.2 trillion per year in 2025

MGI

Sized applications	Potential economic impact of sized applications in 2025 ($ trillion, annually)	Estimated scope in 2025	Estimated potential reach in 2025	Potential productivity or value gains in 2025
Health care	1.1–2.5	▪ $15.5 trillion cost of treating chronic diseases ▪ $400 billion cost of counterfeit drugs, 40% addressable with sensors ▪ 50 million nurses for inpatient monitoring — Developed world: $30 per hour — Developing: $15 per hour	▪ 70–80% mobile penetration in patients who account for bulk of health-care spending ▪ Counterfeit drug tracking — Developed world: 50–80% — Developing world: 20–50% ▪ Inpatient monitoring — Developed world: 75–100% — Developing: 0–50%	▪ 10–20% cost reduction in chronic disease treatment through remote health monitoring ▪ 80–100% reduction in drug counterfeiting ▪ 0.5–1.0 hour time saved per day by nurses
Manufacturing	0.9–2.3	▪ $47 trillion in global manufacturing operating costs	▪ 80–100% of all manufacturing	▪ 2.5–5.0% saving in operating costs, including maintenance and input efficiencies
Electricity	0.2–0.5	▪ 27,000–31,000 TWh global electricity consumption ▪ $200 billion spending on transmission lines ▪ 300 billion consumer minutes outage	▪ 25–50% of consumers could adopt energy management ▪ 25–50% of grid monitored through sensors ▪ 50–100% of consumer meters automated	▪ 2–4% reduction in demand peaks in the grid ▪ Reduction of total load on grid ▪ Operating/maintenance savings; shorter outage time through automated meters
Urban infrastructure	0.1–0.3	▪ 200–300 hours commuting time per urban worker per year ▪ $200 billion spent on urban water ▪ $375 billion cost of waste handling	▪ 40–70% of working urban population living in cities with smart infrastructure ▪ 50–70% of large urban regions adopting smart water infrastructure and waste handling	▪ 10–20% reduction in average travel time through traffic and congestion control ▪ 10–20% reduction in water consumption and leaks with smart meters and demand control ▪ 10–20% reduction in cost of waste handling
Security	0.1–0.2	▪ $6 trillion cost of crime	▪ Adoption of advanced surveillance by countries accounting for 50–70% of global GDP	▪ 4–5% crime reduction through improved surveillance
Resource extraction	0.1–0.2	▪ $3.7 trillion in global mining operating costs	▪ 80–100% of all resource extraction	▪ 5–10% saving in operating costs from productivity gains
Agriculture	~0.1	▪ $1.2–1.3 trillion in agricultural production (wheat, maize, rice, soybeans, barley)	▪ 20–40% adoption of advanced irrigation systems and precision farming	▪ 10–20% increase in yields from precision application of fertilizer and irrigation
Retail	0.02–0.10	▪ $200 billion lost due to stockouts	▪ 30–80% of retail adopting smart logistics	▪ 1.5–2.0% increased sales
Vehicles	~0.05	▪ $630 billion in automotive insurance premiums[1]	▪ 10–30% of all insured cars equipped with sensors	▪ 25% reduction in cost of vehicle damage from collision avoidance and increased security[1]
Other potential applications (not sized)				
Sum of sized potential economic impacts	2.7–6.2			

How can MOOC help?
What types of courses?
What forms of training?
What are the pre-requisites?
How relevant is this to Taiwan?

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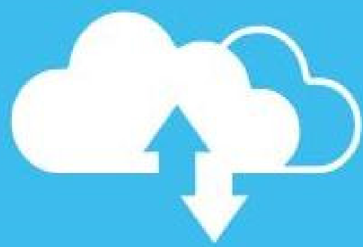

#4 **Cloud**

Use of computer hardware and software resources to deliver services over the Internet or a network

Potential economic impact in 2025 across sized applications of
$1.7 trillion–$6.2 trillion

15–20% potential productivity gains across IT infrastructure, application development, and packaged software

How can MOOC help?
What types of courses?
What forms of training?
What are the pre-requisites?
How relevant is this to Taiwan?

Component technologies

- Cloud-management software—eg, virtualization, metering
- Data-center hardware
- High-speed networks
- Software/platform as a service (SaaS/PaaS)

Key applications

- Cloud-based delivery of Internet services and applications
- Enterprise IT productivity

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Sized applications of cloud technology could have economic impact of $1.7 trillion to $6.2 trillion per year in 2025

Sized applications		Potential economic impact of sized applications in 2025 $ trillion, annually	Estimated scope in 2025	Estimated potential reach in 2025	Potential productivity or value gains in 2025
	Surplus from cloud-based Internet	1.2–5.5	2–3 billion more Internet users, most in developing economies	Nearly all Internet applications use cloud as a core enabler	$25–85 surplus per user per month
Enterprise productivity[1]	Infrastructure and operating expenses	0.3–0.4	$1.26 trillion or 40% of global IT spending in base scenario[2]	Varying levels of cloud adoption across enterprises ▪ All enterprises could have potential to use cloud ▪ Most enterprises may use a hybrid cloud ▪ The share of public cloud usage may increase as cybersecurity improves	20–30% productivity gains ▪ Reduced infrastructure and facilities footprint ▪ Higher task standardization and automation
	Application development and packaged software	0.2–0.3	$1.68 trillion or 60% of global IT spending in base scenario[2]		10–15% productivity gains ▪ Standardization of application environment and packages ▪ Faster experimentation and testing
	Other potential applications (not sized)				
	Sum of sized potential economic impacts	**1.7–6.2**			

How can MOOC help?
What types of courses?
What forms of training?
What are the pre-requisites?
How relevant is this to Taiwan?

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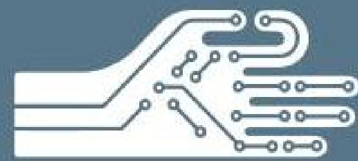

#5 Advanced robotics

Increasingly capable robots with enhanced sensors, dexterity, and intelligence; used to automate many tasks

Potential economic impact in 2025 across sized applications of
$1.7 trillion–$4.5 trillion

Offers potential to **improve the lives** of 50 million amputees and those with impaired mobility

How can MOOC help?
What types of courses?
What forms of training?
What are the pre-requisites?
How relevant is this to Taiwan?

Component technologies

- Artificial intelligence/computer vision
- Advanced robotic dexterity, sensors
- Distributed robotics
- Robotic exoskeletons

Key applications

- Industrial/manufacturing robotics
- Service robots—eg, food preparation, cleaning, and maintenance
- Robotic surgery
- Human augmentation
- Personal and home robots—eg, for cleaning, lawn care

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How can MOOC help?
What types of courses?
What forms of training?
What are the pre-requisites?
How relevant is this to Taiwan?

Sized applications of advanced robotics could have direct economic impact of $1.7 trillion to $4.5 trillion per year in 2025

Sized applications	Potential economic impact of sized applications in 2025 $ trillion, annually	Estimated scope in 2025	Estimated potential reach in 2025	Potential productivity or value gains in 2025
Robotic human augmentation	0.6–2.0	▪ 50 million amputees and people with impaired mobility in advanced economies	▪ 5–10% of amputees and people with impaired mobility in advanced economies	▪ $240,000–390,000 per person for extended/improved quality of life[1]
Industrial robots	0.6–1.2	▪ 355 million applicable industrial workers	▪ 30–60 million FTEs of work potentially automatable across key job types	▪ 75% potential improvement in productivity per unit of work automated
Surgical robots	0.2–0.6	▪ 200 million major surgeries in countries with developed health care	▪ 5–15% of major surgeries in countries with developed health-care systems	▪ 60,000–180,000 lives saved per year ▪ 50% reduction in sick and inpatient days
Personal and home robots	0.2–0.5	▪ 90–115 billion hours spent on tasks such as cleaning and lawn care per year in advanced economies	▪ 25–50% of households in advanced economies	▪ 20–50 billion hours saved per year ▪ $10 value per hour of time saved
Commercial service robots	0.1–0.2	▪ 130 million applicable service workers	▪ 10–15 million FTEs of work potentially automatable across key job types	▪ 35–55% potential improvement in productivity per unit of work automated
Other potential applications (not sized)				
Sum of sized potential economic impacts	**1.7–4.5**			

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#6 **Autonomous or near-autonomous vehicles**

Vehicles that can navigate and operate autonomously or semiautonomously in many situations

Potential economic impact in 2025 across sized applications of

$0.2 trillion–$1.9 trillion

Could save **30,000–150,000 lives** from potentially fatal traffic accidents

How can MOOC help?
What types of courses?
What forms of training?
What are the pre-requisites?
How relevant is this to Taiwan?

Component technologies

- Artificial intelligence, computer vision
- Advanced sensors—eg, radar, Lidar,[1] GPS
- Machine-to-machine communication

Key applications

- Self-driving cars and trucks

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Sized applications of autonomous and near-autonomous vehicles could have direct economic impact of $200 billion to $1.9 trillion per year in 2025

Sized applications	Potential economic impact of sized applications in 2025 ($ trillion, annually)	Estimated scope in 2025	Estimated potential reach in 2025	Potential productivity or value gains in 2025
Autonomous cars	0.1–1.4	▪ 900 million new cars produced in or after 2018 ▪ 500 hours per year spent in car by average owner	▪ 5–20% of all driving autonomous – 20–30% of cars sold from 2017–20 with potential to be autonomous – 50–100% driving time spent under full computer control	▪ $2–8 per hour in value of time saved ▪ 70–90% fewer accidents ▪ 15–20% gain in fuel efficiency
Autonomous trucks	0.1–0.5	▪ 24 million trucks produced in 2018 or later	▪ 10–30% of new trucks with autonomous driving capabilities ▪ 50% driven by human drivers	▪ 70–90% fewer accidents ▪ 10–40% greater fuel efficiency ▪ 1–2 drivers per 10 trucks (for monitoring)
Other potential applications (not sized)		▪ Potential applications not sized include commercial drones, military drones, and/or autonomous and near-autonomous submersible vehicles for applications such as fossil fuels exploration		
Sum of sized potential economic impacts	**0.2–1.9**			

How can MOOC help?
What types of courses?
What forms of training?
What are the pre-requisites?
How relevant is this to Taiwan?

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#7 Next-generation genomics

Fast, low-cost gene sequencing, advanced analytics, and synthetic biology (ie, “writing” DNA)

Potential economic impact in 2025 across sized applications of
$0.7 trillion–$1.6 trillion

Extending and enhancing lives accounts for 75% of potential impact—eg, through faster disease detection, new drugs

How can MOOC help?
What types of courses?
What forms of training?
What are the pre-requisites?
How relevant is this to Taiwan?

Component technologies

- Advanced DNA-sequencing technologies
- DNA-synthesis technologies
- Big data and advanced analytics

Key applications

- Disease treatment
- Agriculture
- Production of high-value substances

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Sized applications of next-generation genomics could have direct economic impact of $700 billion to $1.6 trillion per year in 2025

Sized applications	Potential economic impact of sized applications in 2025 $ trillion, annually	Estimated scope in 2025	Estimated potential reach in 2025	Potential productivity or value gains in 2025
Disease treatment	0.5–1.2	▪ Estimated deaths from relevant diseases – Cancer: 12 million – Cardiovascular: 23 million – Type 2 diabetes: 4 million ▪ 160 million newborns	▪ Patients with access to relevant treatment – Cancer: 20–40% – Cardiovascular: 15–40% – Type 2 diabetes: 20–40% ▪ Access to prenatal genetic screening: – Developed world: 100% – Less-developed: 30–50%[1]	▪ Extended life expectancy – Cancer: 0.5–2 years[2] – Cardiovascular: 1 year – Type 2 diabetes: 1 year[3] ▪ Value of prenatal screening[4] – Developed world: $1,000 – Less-developed: $200
Substance production	0.1–0.2	▪ 60 billion gallons per year of ethanol ▪ 350–500 billion gallons per year of diesel	▪ Ethanol: 20–40% of world production ▪ Diesel: 2–3% of world production	▪ 15–20% cost saving in ethanol production ▪ 150–200% price premium for diesel ▪ 30–70% CO_2 reduction from fuels over life cycle
Agriculture	0.1–0.2	▪ $1.2–1.3 trillion worth of major crops (wheat, maize, rice, soybeans, barley, tomatoes)	▪ 60–80% of agricultural production improved using genomics data ▪ 20–80% of current genetically engineered crops to be further enhanced	▪ 5–10% increase in yields due to process optimization ▪ 5–10% increase in yields from use of advanced genetically engineered crops
Other potential applications (not sized)				
Sum of sized potential economic impacts	0.7–1.6			

How can MOOC help?
What types of courses?
What forms of training?
What are the pre-requisites?
How relevant is this to Taiwan?

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#8 Energy storage

Devices or physical systems that store energy for later use

Potential economic impact in 2025 across sized applications of
~$0.1 trillion–$0.6 trillion

40–100% of new vehicles sold in 2025 could be electric or hybrid

How can MOOC help?
What types of courses?
What forms of training?
What are the pre-requisites?
How relevant is this to Taiwan?

Component technologies

- Battery technologies—eg, lithium-ion and fuel cells
- Mechanical technologies—eg, pumped hydro and pressurized gas
- Advanced materials, nanomaterials

Key applications

- Electric and hybrid vehicles
- Distributed energy (including off-grid)
- Utility-scale grid storage

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How can MOOC help?
What types of courses?
What forms of training?
What are the pre-requisites?
How relevant is this to Taiwan?

Sized applications of energy storage could have economic impact of $90 billion to $635 billion per year in 2025, including consumer surplus

Sized applications		Potential economic impact of sized applications in 2025 ($ billion, annually)	Estimated scope in 2025	Estimated potential reach in 2025	Potential productivity or value gains in 2025
	Electric and hybrid vehicles	20–415	▪ 115 million passenger vehicles sold ▪ Over 1 billion vehicles in the market	▪ 40–100% of vehicles sold in 2025 could be electric or hybrid	▪ Fuel price: $2.80–7.60 per gallon ▪ 0.22 KWh per mile fuel efficiency for EVs
Distri-buted energy	Stabilizing electricity access	25–100	▪ 13,000 TWh electricity consumption in emerging markets ▪ 2–70 hours per month without electricity	▪ 35–55% adoption with solar and battery combination ▪ 35–55% of companies in Africa, Middle East, and South Asia own diesel generators	▪ $0.75–2.10 per KWh value of uninterrupted power supply to an enterprise ▪ $0.20–0.60 per KWh value per household
Distri-buted energy	Electrifying new areas	0–50	▪ 60–65% rural electrification rate ▪ 1.2 billion people without electricity access ▪ 60 KWh monthly electricity requirement of average household	▪ 50–55% adoption based on number of people projected to earn above $2 per day	▪ $0.20–0.60 per KWh value per household for direct lighting, TV, and radio benefits
Utility grid	Frequency regulation	25–35	▪ 27,000–31,000 TWh global electricity consumption ▪ 1.5% electricity production reserved for frequency regulation ▪ 2.5% additional reserved for renewable integration	▪ 100% technology adoption, more efficient, and cost competitive with incumbent solutions	▪ $30 per MWh weighted average frequency-regulation price
Utility grid	Peak load shifting	10–25	▪ 12% of total electricity production possible to shift ▪ 850 million tons additional CO_2 release	▪ 10–20% adoption of energy storage, given costs compared with combined cycle gas turbines	▪ $65–80 per MWh between non-renewable peak and base load ▪ $45–65 per MWh between peak and average wind price ▪ $30–45 per MWh between peak and average solar price
Utility grid	Infra-structure deferral	~10	▪ $295 billion per year investment in infrastructure T&D deferral ▪ 10% spent to reduce congestion	▪ 15% adoption based on share of transmission lines economical for energy storage	▪ Possible deferral of infrastructure investment by 2.5 years
	Other potential applications (not sized)				
	Sum of sized potential economic impacts	90–635			

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#9 3-D printing

Additive-manufacturing techniques that create objects by printing successive layers of material using digital models

Potential economic impact in 2025 across sized applications of **$0.2 trillion–$0.6 trillion**

Consumers' use of 3-D printing could save them **35–60% in costs** per printed product, while enabling a high level of customization

How can MOOC help?
What types of courses?
What forms of training?
What are the pre-requisites?
How relevant is this to Taiwan?

Component technologies

- Selective laser sintering (SLS)
- Fused deposition modeling (FDM)
- Stereolithography (SLA)
- Direct metal laser sintering (DMLS)

Key applications

- Consumer use of 3-D printers
- Direct product manufacturing
- Tool and mold manufacturing
- Bioprinting of tissue and organs

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Sized applications of 3D printing could have direct economic impact of $230 billion to $550 billion per year in 2025

Sized applications	Potential economic impact of sized applications in 2025 $ billion, annually	Estimated scope in 2025	Estimated potential reach in 2025	Potential productivity or value gains in 2025
Consumer use of 3D printing	100–300	▪ $4 trillion in sales of consumer products that might be 3D printed	▪ 5–10% of relevant products (e.g., toys) could be 3D printable, assuming easy consumer access	▪ 60–80% value increase per 3D-printed product – 35–60% cost savings to consumers – 10% added value from customization
Direct product manufacturing[1]	100–200	▪ $300 billion spending on complex, low-volume items such as implants and tools ▪ $470 billion spending on complex, low-volume parts in transportation	▪ 30–50% of products in relevant categories replaceable with 3D printing	▪ 40–55% cost savings to buyers of 3D-printed products
Tool and mold manufacturing	30–50	▪ $360 billion global market for injection-molded plastics	▪ 30–50% of injection-molded plastics produced with 3D-printed molds	▪ 30% production cost reduction using superior 3D-printed molds
Other potential applications (not sized)				
Sum of sized potential economic impacts	**230–550**			

How can MOOC help?
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How relevant is this to Taiwan?

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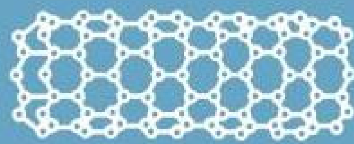

#10 Advanced materials

Materials that have superior characteristics such as better strength and conductivity or enhanced functionality such as memory or self-healing capabilities

Potential economic impact in 2025 across sized applications of
$0.2 trillion–$0.5 trillion

Nanomedicine could be used to **deliver targeted drugs** to 20 million new cancer cases worldwide in 2025

How can MOOC help?
What types of courses?
What forms of training?
What are the pre-requisites?
How relevant is this to Taiwan?

Component technologies

- Graphene
- Carbon nanotubes
- Nanoparticles—eg, nanoscale gold and silver
- Other advanced and smart materials—eg, piezoelectric materials, memory metals, self-healing materials

Key applications

- Nanoelectronics, displays
- Nanomedicine, sensors, catalysts, advanced composites
- Energy storage, solar cells
- Enhanced chemicals and catalysts

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Sized applications of advanced materials could have direct economic impact of $150 billion to $500 billion per year in 2025

Sized applications	Potential economic impact of sized applications in 2025 $ billion, annually	Estimated scope in 2025	Estimated potential reach in 2025	Potential productivity or value gains in 2025
Drug delivery	150–500	20 million new cancer cases worldwide in 2025	5–10% of cancer patients could benefit from nano-based drug delivery treatments	$130,000–230,000 QALY value created per patient[1] ▪ $100,000–200,000 for 1–2 years increased life expectancy ▪ $30,000 from reduced chemotherapy side effects
Other potential applications (not sized)		Example applications not sized include nanomaterials for electronics and composites and applications of other advanced and smart materials, such as self-healing concrete or memory metals		
Sum of sized potential economic impacts	**150–500**			

How can MOOC help?
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How relevant is this to Taiwan?

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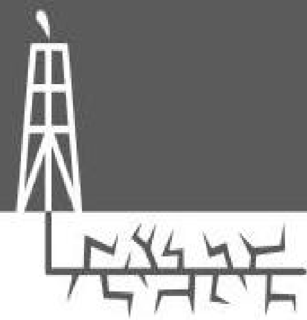

#11 Advanced oil and gas exploration and recovery

Advancements in exploration and recovery techniques that make extraction of additional oil and gas economical

Potential economic impact in 2025 across sized applications of **$0.1 trillion–$0.5 trillion**

Offers potential to supply an **additional 3.6 billion–6.2 billion oil-equivalent barrels** of oil and gas annually by 2025

How can MOOC help?
What types of courses?
What forms of training?
What are the pre-requisites?
How relevant is this to Taiwan?

Component technologies

- Horizontal drilling
- Hydraulic fracturing ("fracking")
- Microseismic monitoring

Key applications

- Energy from fuel extraction; includes shale gas, light tight oil, and coal-based methane
- Coalbed methane and methane clathrate

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How can MOOC help?
What types of courses?
What forms of training?
What are the pre-requisites?
How relevant is this to Taiwan?

Sized applications of advanced oil and gas exploration and recovery could have direct economic impact of $95 billion to $460 billion per year in 2025

Sized regions and applications	Potential economic impact of sized applications in 2025 $ billion, annually	Currently estimated reserves	Estimated potential incremental annual production in 2025	Assumed price in 2025
North America – shale gas[1]	10–35	▪ 71 trillion cubic meters (Tcm) of reserves – 60 Tcm in United States – 11 Tcm in Canada	▪ 145 billion cubic meters (Bcm)	▪ $2–8 per million British thermal unit (MMBtu); nearly $70–280 million per Bcm
North America – light tight oil	60–300	▪ 64 billion barrels of reserves – 57 billion barrels in United States – 7 billion barrels in Canada	▪ 5.4–9.0 million barrels per day	▪ $50–150 per barrel
Rest of the world – shale gas	15–65	▪ More than 150 Tcm of reserves – 36 Tcm in China – 22 Tcm in Argentina	▪ 70–220 Bcm	▪ Regional pricing (per MMBtu) – China, Australia: $8–10 – Argentina: $7–8 – Europe: $6–11
Rest of the world – light tight oil	10–60	▪ More than 130 billion barrels of reserves – 24 billion barrels in Russia – 13 billion barrels in Argentina	▪ 0.5–1.7 million barrels per day	▪ $50–150 per barrel
Other potential applications (not sized)		▪ Potential unsized applications include coalbed methane and methane clathrate		
Sum of sized potential economic impacts[2]	**95–460**			

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#12 **Renewable electricity—solar and wind**

Generation of electricity from renewable sources with reduced harmful climate impact

Potential economic impact in 2025 across sized applications of **$0.2 trillion–$0.3 trillion**

Potential to avoid emissions of **1,000 million–1,200 million tons of CO_2** annually by 2025

How can MOOC help?
What types of courses?
What forms of training?
What are the pre-requisites?
How relevant is this to Taiwan?

Component technologies

- Photovoltaic cells
- Wind turbines
- Concentrated solar power
- Hydroelectric and ocean-wave power
- Geothermal energy

Key applications

- Electricity generation
- Reduction in CO_2 emissions
- Distributed generation

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Sized applications of renewable energy could have economic impact of $165 billion to $275 billion per year in 2025

	Sized renewable energy sources[1]	Potential economic impact of sized renewables in 2025 $ billion, annually	Estimated scope in 2025	Estimated potential reach in 2025	Potential productivity or value gains in 2025
Cost impact	Solar photovoltaics	105–110	▪ 27,000–31,000 TWh global electricity consumption ▪ 8,500–9,500 TWh renewables generation (wind, solar, hydro) ▪ \$4.5–5.5 trillion annual generation cost of global electricity ▪ 2-degree Celsius maximum temperature rise target by 2050 ▪ 450 ppm global greenhouse gas concentration limit by 2050	▪ 1,330–1,570 TWh, or 5% of total electricity generation ▪ 1,100–1,300 TWh incremental generation vs. base scenario	▪ 60–65% drop in the levelized cost of electricity (LCOE) over base scenario
	Wind	40–45		▪ 2,700–3,500 TWh, 10–11% of total ▪ 500–550 TWh incremental generation vs. base scenario	▪ 25–30% drop in LCOE over base scenario – Onshore: 13–15% – Offshore: 50%
	Total cost impact	**145–155**			
Social impact (CO_2 avoided)	Solar photovoltaics	15–90		▪ 700–880 million tons	▪ \$20–100 per ton of CO_2 avoided
	Wind	5–30		▪ 280–300 million tons	▪ \$20–100 per ton of CO_2 avoided
	Other potential applications (not sized)		▪ Potential applications not sized include hydro, biomass, ocean thermal and wave energy, geothermal, next-generation nuclear, and concentrated solar power.		
	Sum of sized potential economic impacts[2]	**165–275**			

How can MOOC help?
What types of courses?
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How relevant is this to Taiwan?

IoE enabled examples

How the medium of the internet is generating value

Internet of Everything (IoE) enabled value predictions in the public sector

1. **Employee productivity ($1.8 trillion):** IoE improves labor effectiveness for new and existing services.
2. **Connected militarized defense ($1.5 trillion):** IoE generates a fourfold force-multiplier effect through improved situational awareness and connected command centers, vehicles, and supplies.
3. **Cost reductions ($740 billion):** IoE improves labor efficiency and capital-expense utilization, leading to reduced operational costs.
4. **Citizen experience ($412 billion):** IoE shortens "search" times, improves the environment, and produces better health outcomes.
5. **Increased revenue ($125 billion):** IoE improves the ability to match supply with demand, while also enhancing monitoring and compliance.

How can MOOC help?
What types of courses?
What forms of training?
What are the pre-requisites?
How relevant is this to Taiwan?

Cisco Systems

IoE enabled value in the public sector – Smart Parking $41 billion

- **New *things* created:** Connected parking spaces, parking meters
- **New *data* flows:** Space availability
- ***Process* innovation:** Pricing/payment; enforcement; finding spaces
- ***People* impact:** Traffic wardens; citizens/drivers; city planners
- **Value impact:** Increases compliance by 30 percent; enables city data sales; reduces traffic congestion/time required to park/fuel usage; dynamic pricing increases revenues

How can MOOC help?
What types of courses?
What forms of training?
What are the pre-requisites?
How relevant is this to Taiwan?

Cisco Systems

IoE enabled value in the public sector – Water Management $39 billion

- **New *things* created:** Connected water meters
- **New *data* flows:** Water meters
- ***Process* innovation:** Water usage
- ***People* impact:** Citizens, city planners
- **Value impact:** Reduces labor and maintenance costs; improves accuracy of readings; decreases water consumption by citizens; lowers meter-reading costs

How can MOOC help?
What types of courses?
What forms of training?
What are the pre-requisites?
How relevant is this to Taiwan?

CISCO SYSTEMS

IoE enabled value in the public sector – Gas Monitoring $69 billion

- **New *things* created:** Connected gas meters
- **New *data* flows:** Gas meters
- ***Process* innovation:** Gas usage
- ***People* impact:** Citizens, city planners
- **Value impact:** Reduces labor and maintenance costs; improves accuracy of readings; decreases gas consumption by citizens; lowers meter-reading costs

How can MOOC help?
What types of courses?
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How relevant is this to Taiwan?

CISCO SYSTEMS

IoE enabled value in the public sector - Disease Management $146 billion

- **New *things* created:** Patient-monitoring systems
- **New *data* flows:** Patient statistics
- ***Process* innovation:** Treatment protocol, admissions, discharge
- ***People* impact:** Patients, clinicians
- **Value impact:** Reduces admissions; enables shorter hospital stays due to home-monitoring systems; promotes usage of standardized treatments that conform to best practices

How can MOOC help?
What types of courses?
What forms of training?
What are the pre-requisites?
How relevant is this to Taiwan?

Cisco Systems

IoE enabled value in the public sector – Road Pricing $18 billion

- **New *things* created:** Vehicle payment system
- **New *data* flows:** Vehicle records, payment prices
- ***Process* innovation:** Pricing, payment
- ***People* impact:** Citizens/drivers; city planners; traffic wardens
- **Value impact:** Increases revenue; reduces traffic congestion, leading to savings in road expansion; reduces CO2 emissions

How can MOOC help?
What types of courses?
What forms of training?
What are the pre-requisites?
How relevant is this to Taiwan?

Cisco Systems

IoE enabled value in the public sector – Telecommuting $125 billion

- New *things (capabilities)* **created:** Traveling employees
- **New** ***data*** **flows:** Information and communication
- ***Process*** **innovation:** Connectivity, collaboration
- ***People*** **impact:** Employees, employers
- **Value impact:** Reduces the real-estate requirement for employers; lowers janitorial and printing costs; improves employee retention and productivity; provides additional employment opportunities

How can MOOC help?
What types of courses?
What forms of training?
What are the pre-requisites?
How relevant is this to Taiwan?

CISCO SYSTEMS

IoE enabled value for DoD - Connected Militarized Defense $1.5 Trillion

- **New *things* created:** Connected command centers, vehicles, supplies
- **New *data* flows:** Location of allied and other forces
- ***Process* innovation:** Situational awareness
- ***People* impact:** Combat personnel
- **Value impact:** Multiplier effect – fourfold increase in combat-mission effectiveness

How can MOOC help?
What types of courses?
What forms of training?
What are the pre-requisites?
How relevant is this to Taiwan?

Cisco Systems

IoE enabled value for for-profit MOOC driven Digital Learning $258 billion

- New *things (capabilities)* **created:** Connected students, teachers, campuses
- **New *data* flows:** Study modules, lectures
- ***Process* innovation:** Instruction, learning techniques
- ***People* impact:** Students, teachers
- **Value impact:** 40 percent improvement in teacher utilization through recorded lessons; 50 percent reduction in instructional supplies

How can MOOC help?
What types of courses?
What forms of training?
What are the pre-requisites?
How relevant is this to Taiwan?

MOOCs may be valuable due to their ability to deliver factual learning outside of face time in the classroom.

Hence, classrooms can serve as project learning or test-bed for activities which transforms theory to practice.

Digital learning helps to flip the classroom from a lecture theater to a project based learning (PBL) environment.

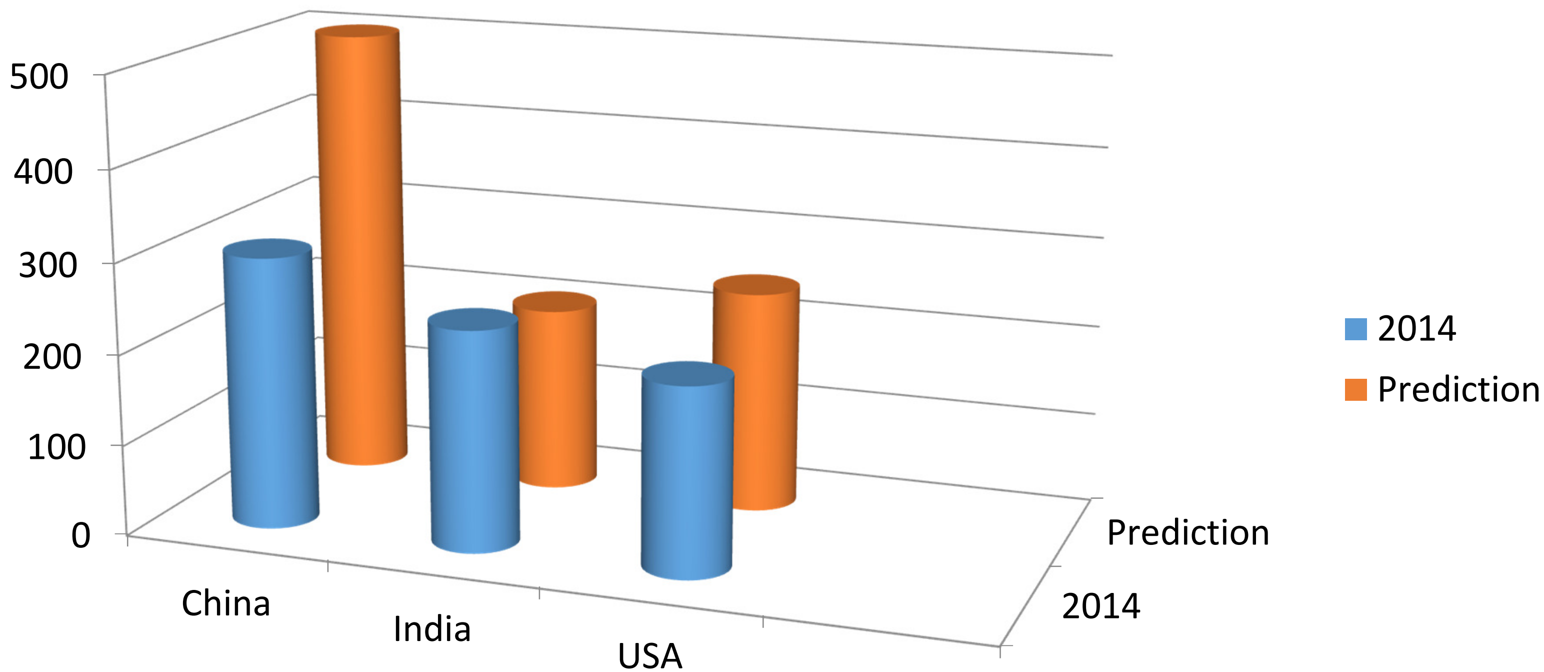
MOOCs may help promote the principles first practiced by Maria Montessori and her education philosophy.

Cisco Systems

Data and Connectivity

How the medium of the IoT is generating value

With 243 million users by 2014, India exceeds US in internet reach. But, India's digital penetration is only 10% and China is 40%. Rising levels of connectivity presents potentially enormous opportunities for business.



November 14, 2013 (TNN)

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How can MOOC help?
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What forms of training?
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How relevant is this to Taiwan?

Demand for Analytical Skills

Boehringer Ingelheim sponsored a competition on Kaggle (platform for data-analysis) to predict if a new drug molecule may cause genetic mutations. The winning team, from among nearly 9,000 competitors, combined experience in insurance, physics and neuroscience. Its analysis beat existing predictive methods by >25%.

FedEx's SenseAware: Customers place a small device the size of a mobile phone inside packages. Device includes GPS, sensors to monitor temperature, light, humidity, barometric pressure and special criteria which may be critical to biomedical products and/or sensitive electronics. Real-time info about product location and if ambient conditions have changed. The data-rich variation of RFID tags helps companies manage complex and perishable supply chains.

Acxiom offers clients, from banks to auto companies, profiles of 500 million customers. Each profile enriched by more than 1,500 data points gleaned from the analysis of up to 50 trillion transactions.

Data from real-time monitoring of blogs, news and Tweets may detect subtle shifts in sentiment that can affect product and pricing strategy. Advanced analytic software allows machines to identify hidden patterns in massive data flow or documents. This machine "intelligence" means that a wider range of knowledge tasks may be automated at lower cost. As companies collect more data from operations, they may gain new revenue streams by selling sanitized information on spending patterns or physical activities to third parties ranging from economic forecasters to health-care companies.

WORKFORCE

DEVELOPMENT

How can MOOC help?
What types of courses?
What forms of training?
What are the pre-requisites?
How relevant is this to Taiwan?

Demand for Analytical Skills

Clearwell Systems (Silicon Valley) analyzes legal documents for pretrial discovery. Machines scanned >0.5 million documents and pinpointed the 0.5% which were relevant. What would have taken a legal team several weeks took 3 days. Machines are becoming adept at structuring basic content for reports, auto-generating marketing and financial materials by scanning documents and data.

Signaling a new quest for AI based decision support system (DSS), IBM's Watson is tackling cancer research by reading >600,000 medical-evidence reports, 1.5 million patient records and 2 million pages of clinical-trial reports and medical-journal articles. Aids decision-support for oncologists at Memorial Sloan-Kettering Cancer Center, NY.

Food retailers Tesco and Delhaize deployed life-size store displays at S. Korean & Belgian subway stations. It allows commuters waiting for trains to use smartphones to order groceries, which are shipped to their homes or available for pickup at a physical store location. Other retailers are using similar displays in physical stores so consumers can also order out-of-stock (OOS) products.

WORKFORCE

DEVELOPMENT

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Demand for Analytical Skills

India has enrolled 380 million citizens in the largest biometric-identity program (Aadhaar). It plans to use the system to make >$50billion in cash transfers to the poor (saves $6billion fraud)

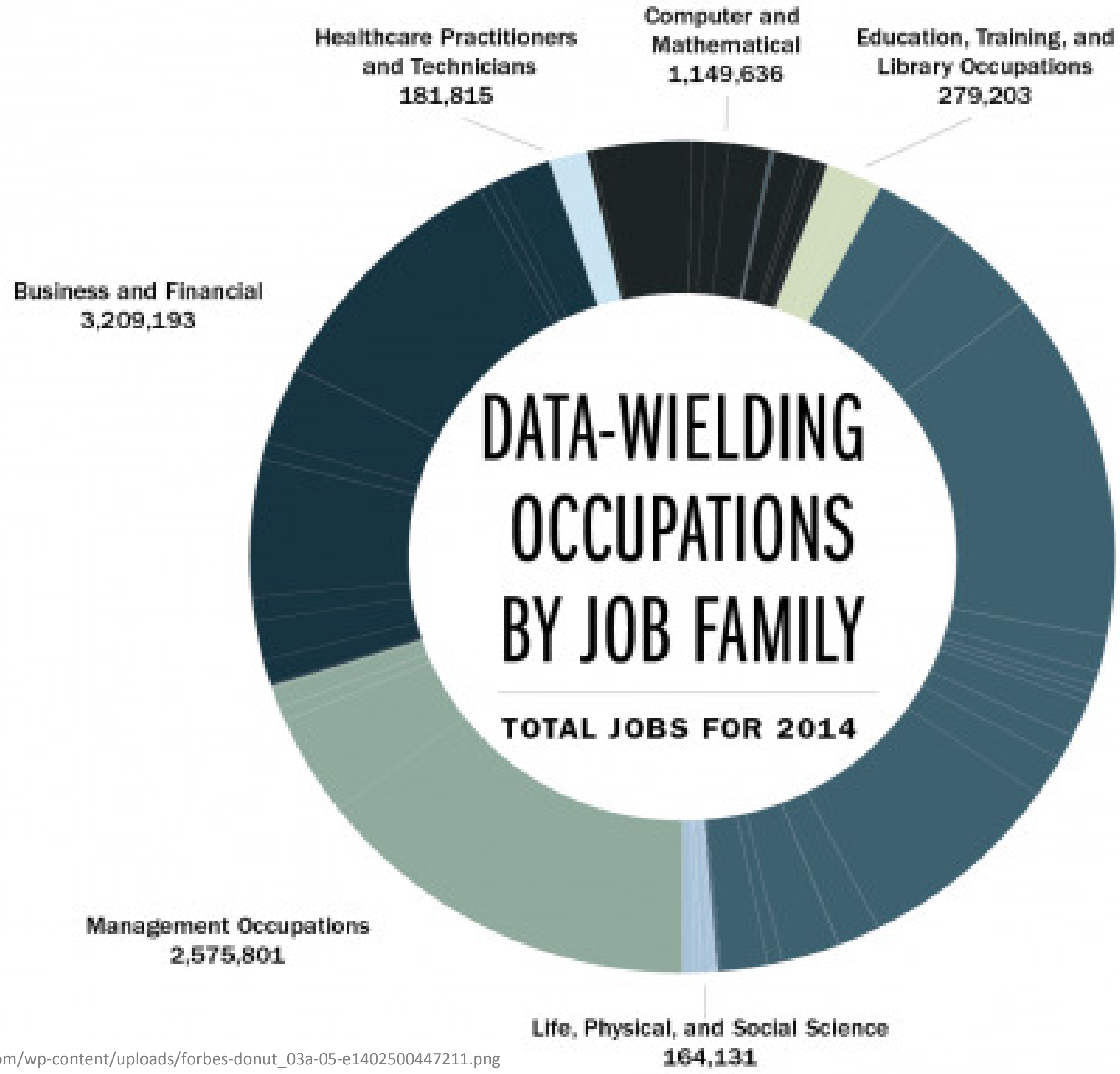
Smartphones and tablets are entering classrooms to deliver personalized MOOC. India is running trials of the sub-$50 Aakash tablet to link more than 25,000 colleges in an e-learning program.

In rural Bangladesh, 90% of births occur outside hospitals. A mobile-notification system alerts clinics to dispatch nurse–midwife teams.

In China, a public–private partnership created a cardiovascular-monitoring system that allows patients to self-administer electrocardiograms and transmit data to specialists in Beijing, who may suggest treatments by phone.

In 2011, US government introduced a Cloud First policy, which laid out a vision to shift a quarter of the $80 billion in annual federal spending to the cloud from in-house data centers. It may save 20-30% on the cost of the shifted work.

Mt Sinai Hospital (NYC) collaborates with GE to use smart tags to track the flow of hundreds of patients, treatments and medical assets in real time. The hospital estimates may treat 10,000 more patients / year and generate $120 million n savings and revenues over several years.

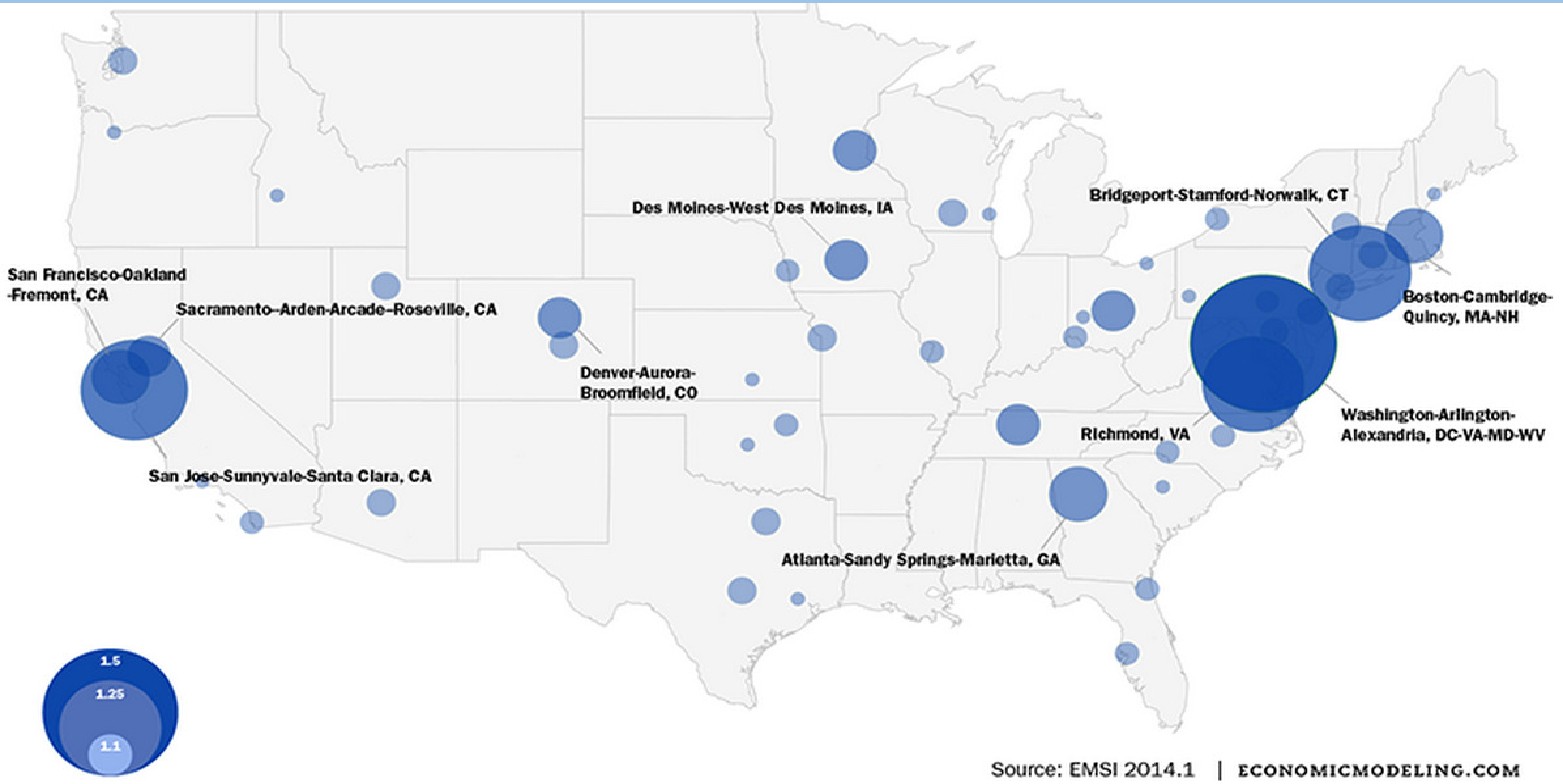


economicmodeling.com/wp-content/uploads/forbes-donut_03a-05-e1402500447211.png

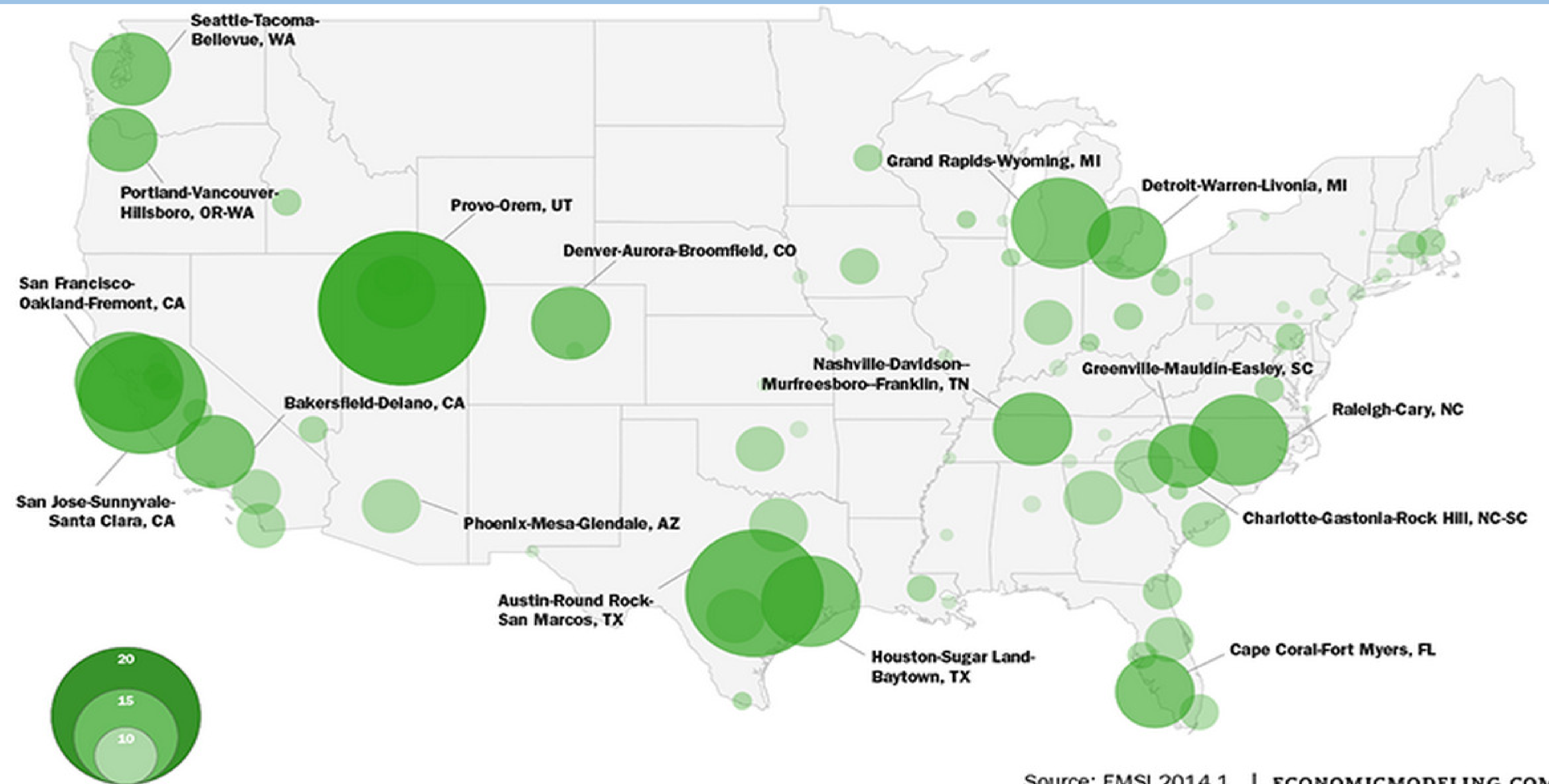
IS TAIWAN
PREPARED FOR THESE
DATA ECONOMY JOBS ?

How can MOOC help?
What types of courses?
What forms of training?
What are the pre-requisites?
How relevant is this to Taiwan?

Current Concentration of Data Jobs in the US

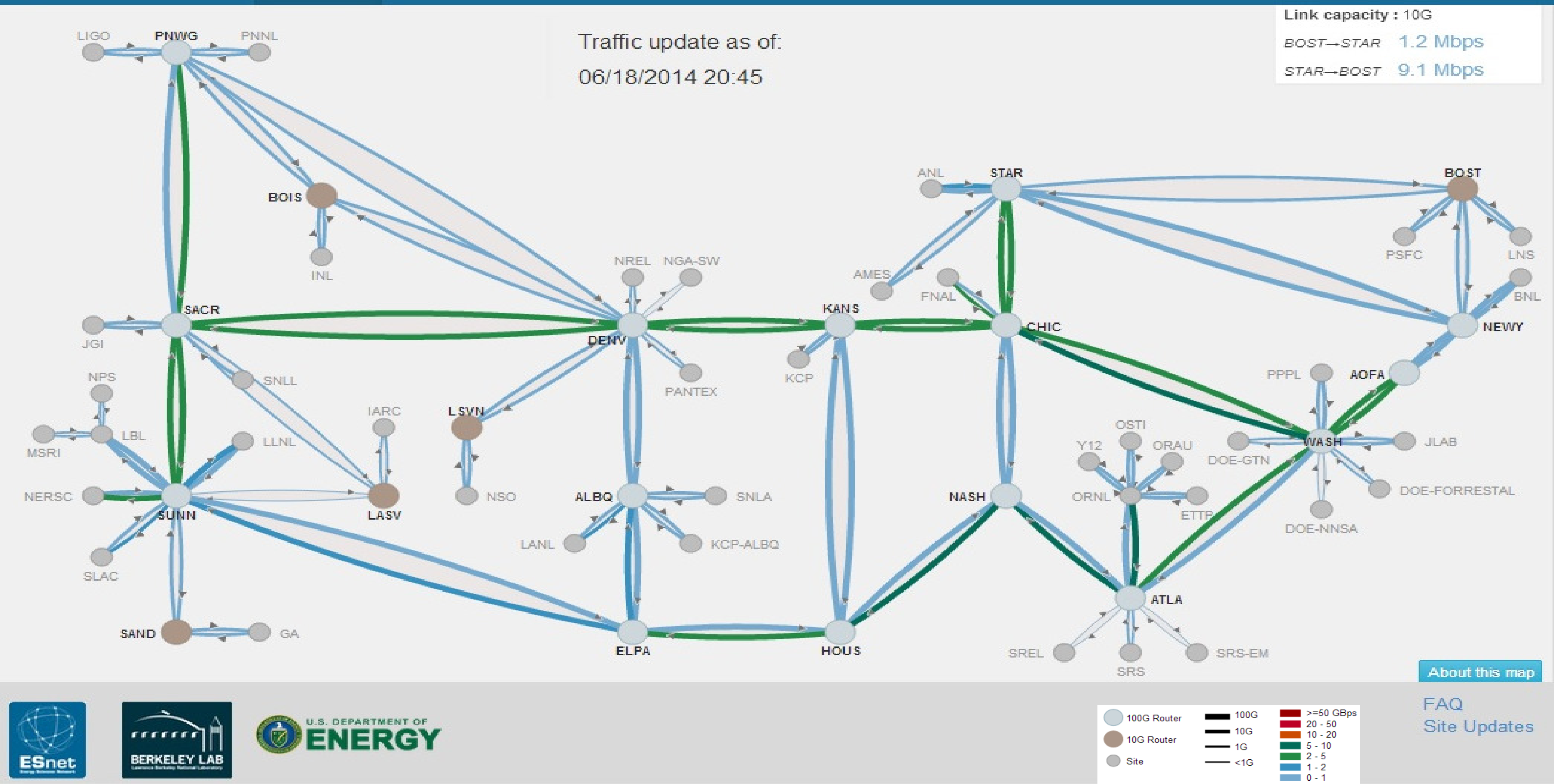


Projected Growth of Data Jobs by Location in the US



Source: EMSI 2014.1 | ECONOMICMODELING.COM

Speed of Data Transmission in the US – now 100 Gbps (proposed 1 Tbps)



Connection Speed

Global Rank	Country/Region	Q1 '14 Avg. Mbps	QoQ Change	YoY Change
1	South Korea	23.6	8.0%	145%
2	Japan	14.6	12%	29%
3	Hong Kong	13.3	8.5%	24%
20	Taiwan	8.9	6.4%	118%
24	Singapore	8.4	6.1%	28%
42	Australia	6.0	2.6%	39%
45	New Zealand	5.6	5.7%	30%
48	Thailand	5.2	6.8%	31%
69	Malaysia	3.5	16%	30%
79	China	3.2	-6.4%	46%
93	Indonesia	2.4	46%	55%
105	Philippines	2.1	5.7%	49%
107	Vietnam	2.0	12%	47%
118	India	1.7	8.4%	34%

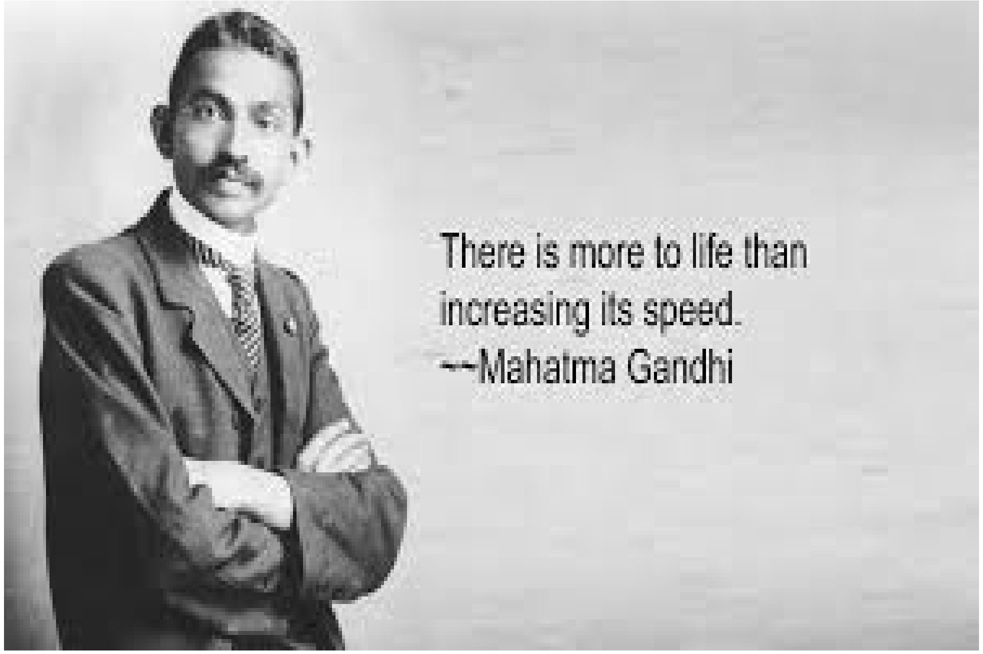
Average Connection Speed
by Asia Pacific Country/Region

Global Rank	Country/Region	Q1 '14 Peak Mbps	QoQ Change	YoY Change
1	South Korea	68.5	6.5%	52%
2	Hong Kong	66.0	-3.3%	0.3%
3	Singapore	57.7	-2.5%	32%
5	Japan	55.6	4.7%	17%
7	Taiwan	52.6	2.1%	61%
30	Thailand	34.4	-11%	14%
41	Australia	31.6	-10%	20%
51	Malaysia	27.9	-6.9%	10%
59	New Zealand	24.3	12%	20%
74	Indonesia	19.4	55%	42%
78	Philippines	18.8	-42%	26%
96	China	13.6	-1.2%	43%
110	Vietnam	12.3	-3.2%	-1.9%
112	India	12.0	-1.5%	7.6%

: Average Peak Connection Speed
by Asia Pacific Country/Region

Source: Akamai Report Q1 2014

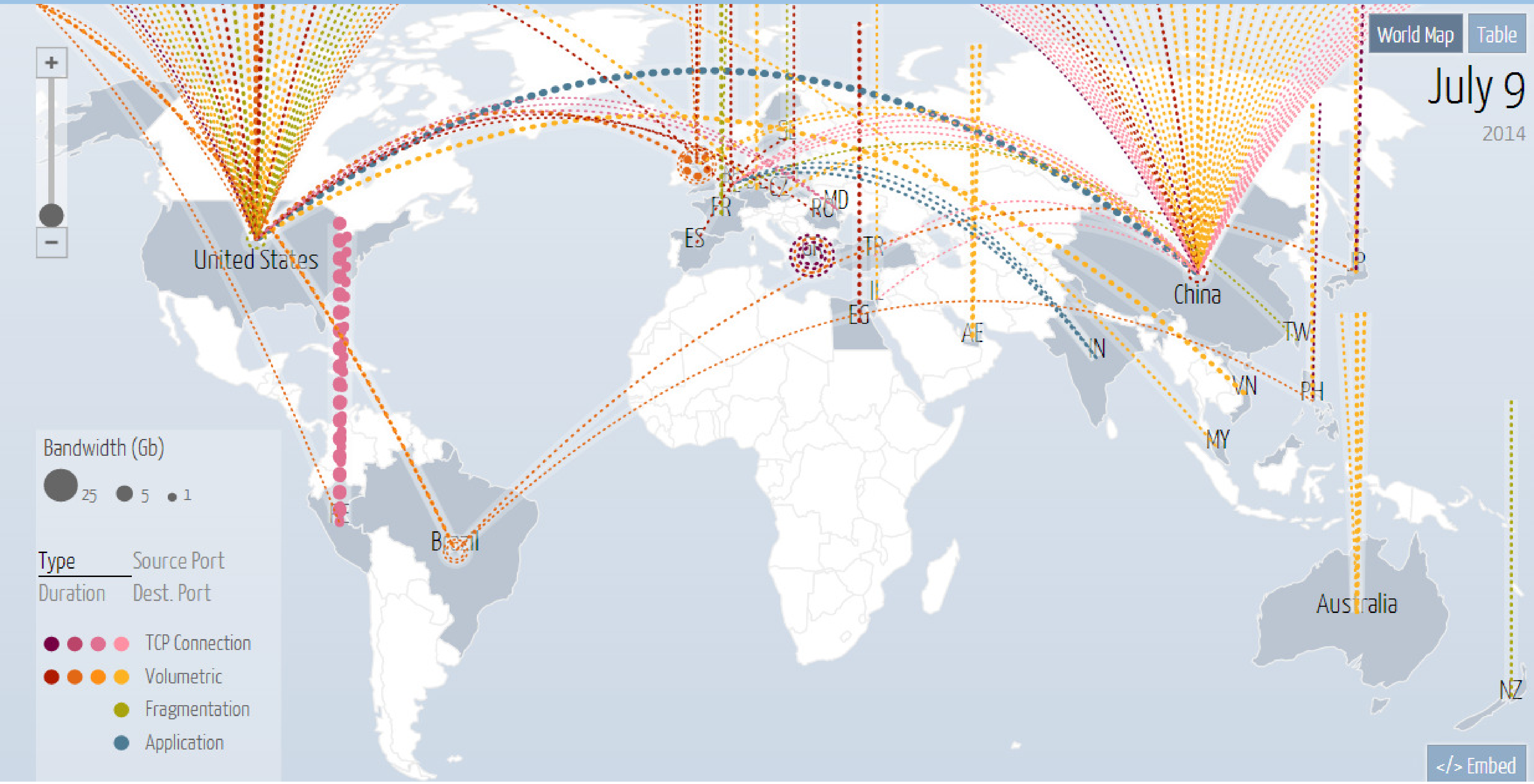
Speed


There is more to life than
increasing its speed.
--Mahatma Gandhi

Is your data secure?

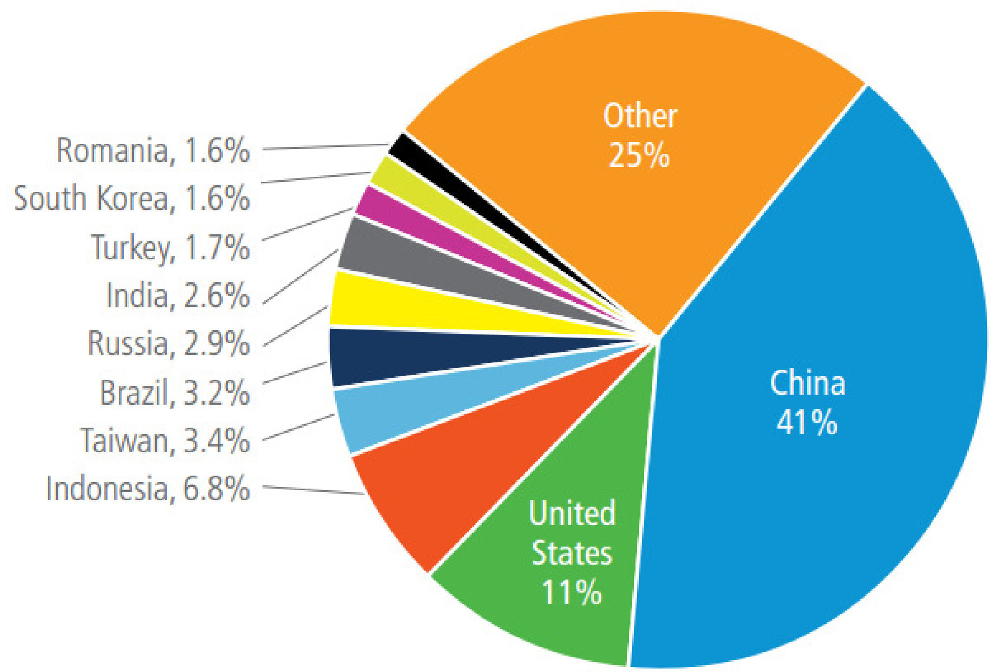
THE RISE OF CYBERSECURITY

Digital Attack Map – The Prelude to Cyber Warfare



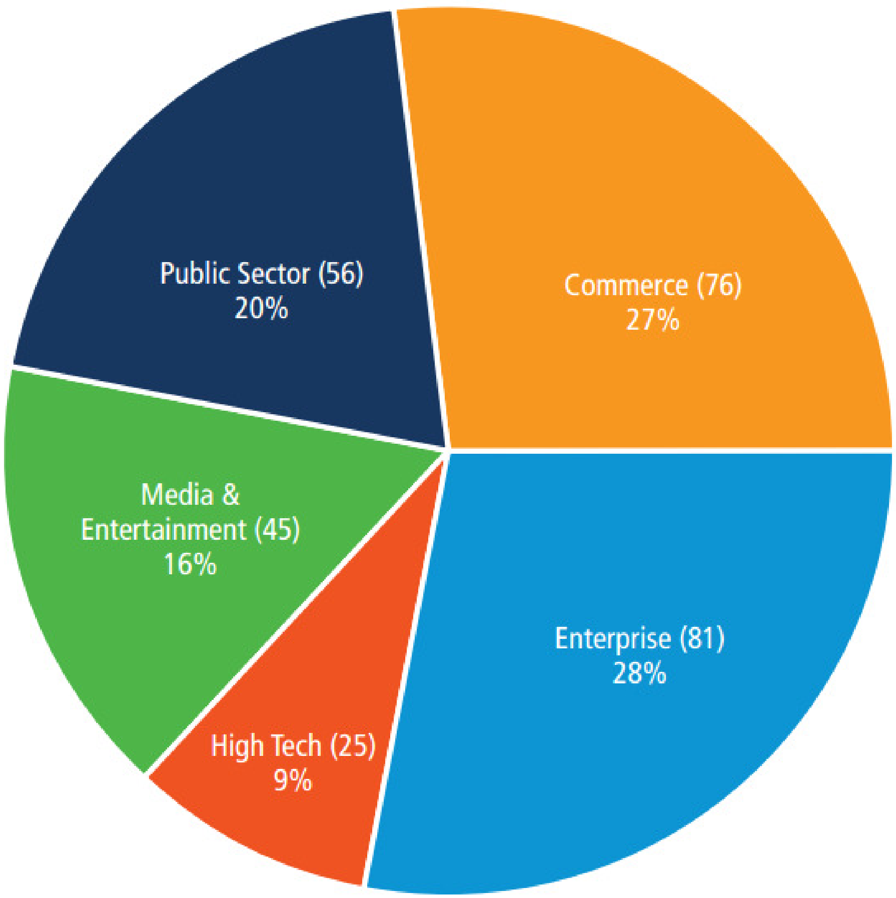
Distributed Denial of Service (DDoS) Attack Traffic (by source IP)

	Country/Region	Q1 '14 Traffic %	Q4 '13 %
1	China	41%	43%
2	United States	11%	19%
3	Indonesia	6.8%	5.7%
4	Taiwan	3.4%	3.4%
5	Brazil	3.2%	1.1%
6	Russia	2.9%	1.5%
7	India	2.6%	0.7%
8	Turkey	1.7%	0.4%
9	South Korea	1.6%	0.6%
10	Romania	1.6%	0.9%
–	Other	25%	12%

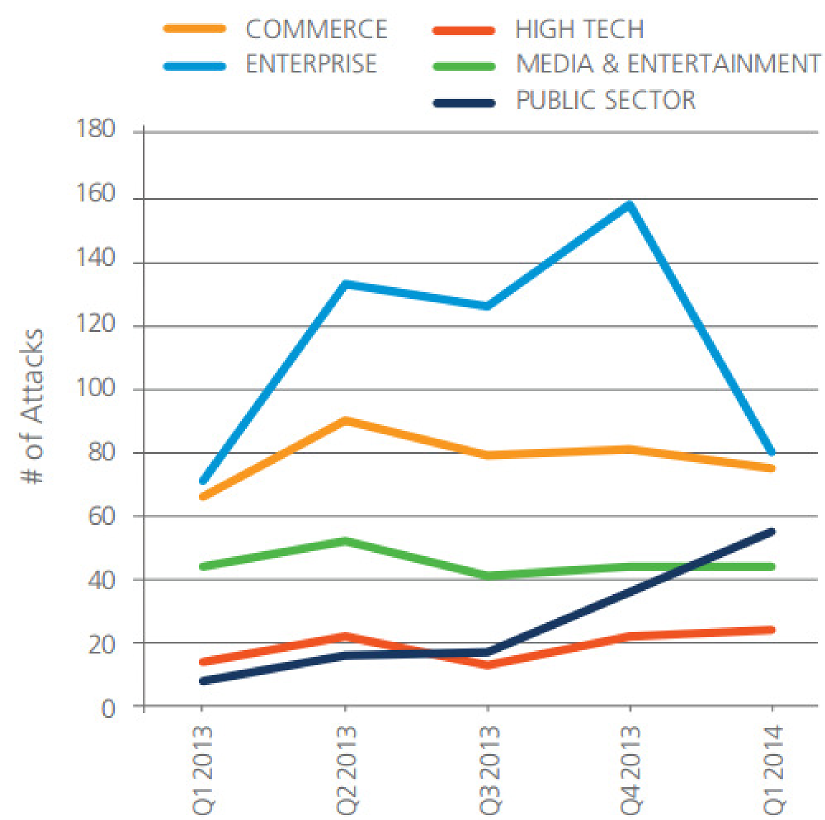


Source: Akamai Report Q1 2014

Distributed Denial of Service (DDoS) Attacks by Sector



Q1 2014 DDoS Attacks by Sector



Attacks by Sector Over Time

Akamai Report Q1 2014

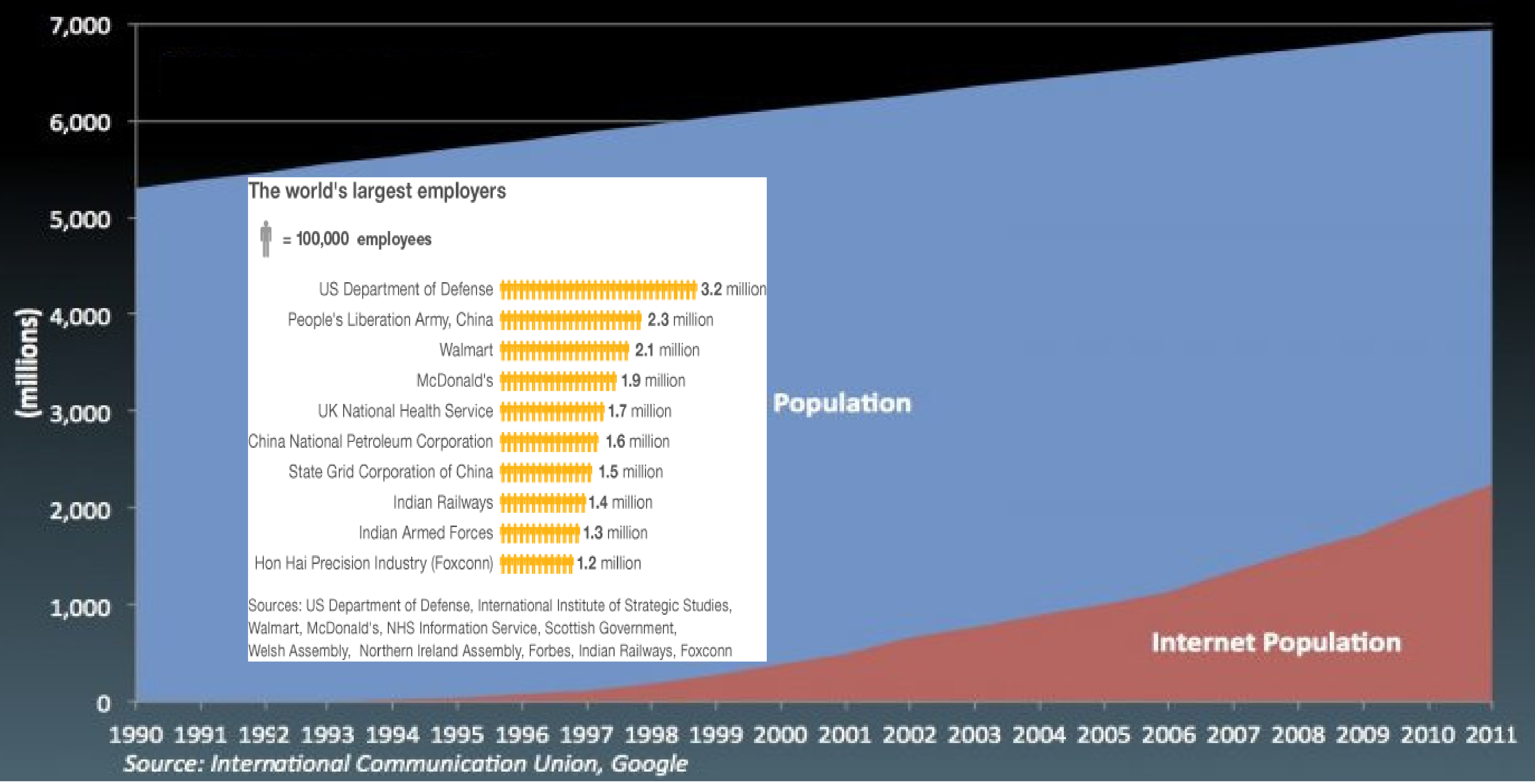
Data Proficiency + Computer Science = Car Hacking (the new car-jacking)

Google Inc. revealed a new operating system for cars, called Android Auto, on Wednesday, laying the groundwork for vehicles to virtually become smartphones on wheels. As more cars become connected to the Internet in some capacity and collect and transmit more data, the question becomes all the more real: Will car-hacking become the new carjacking?

Broad spectrum of data

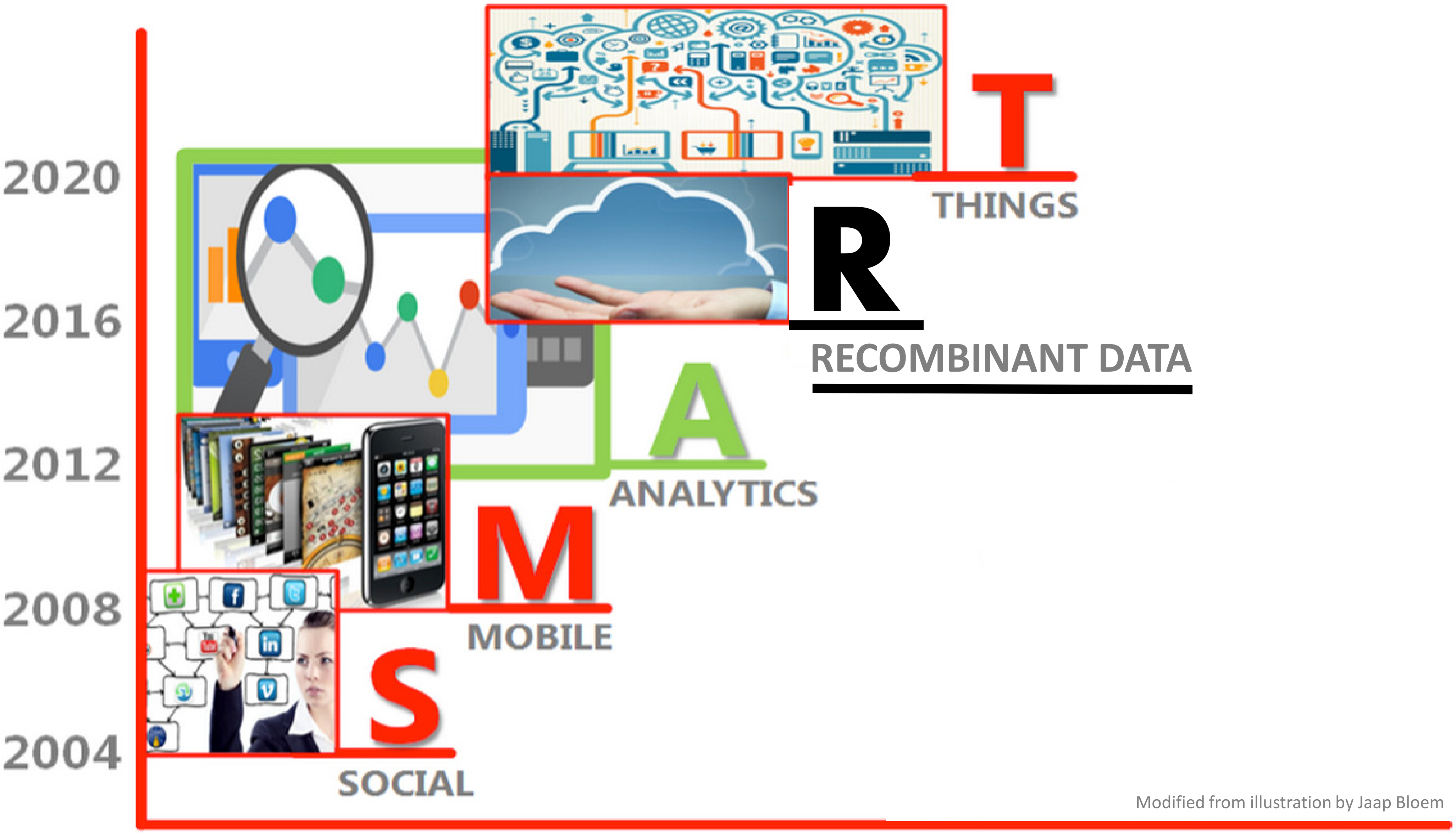
The range of data related applications will stretch our imagination

Data – Imagine what happens if 50% of the population were connected

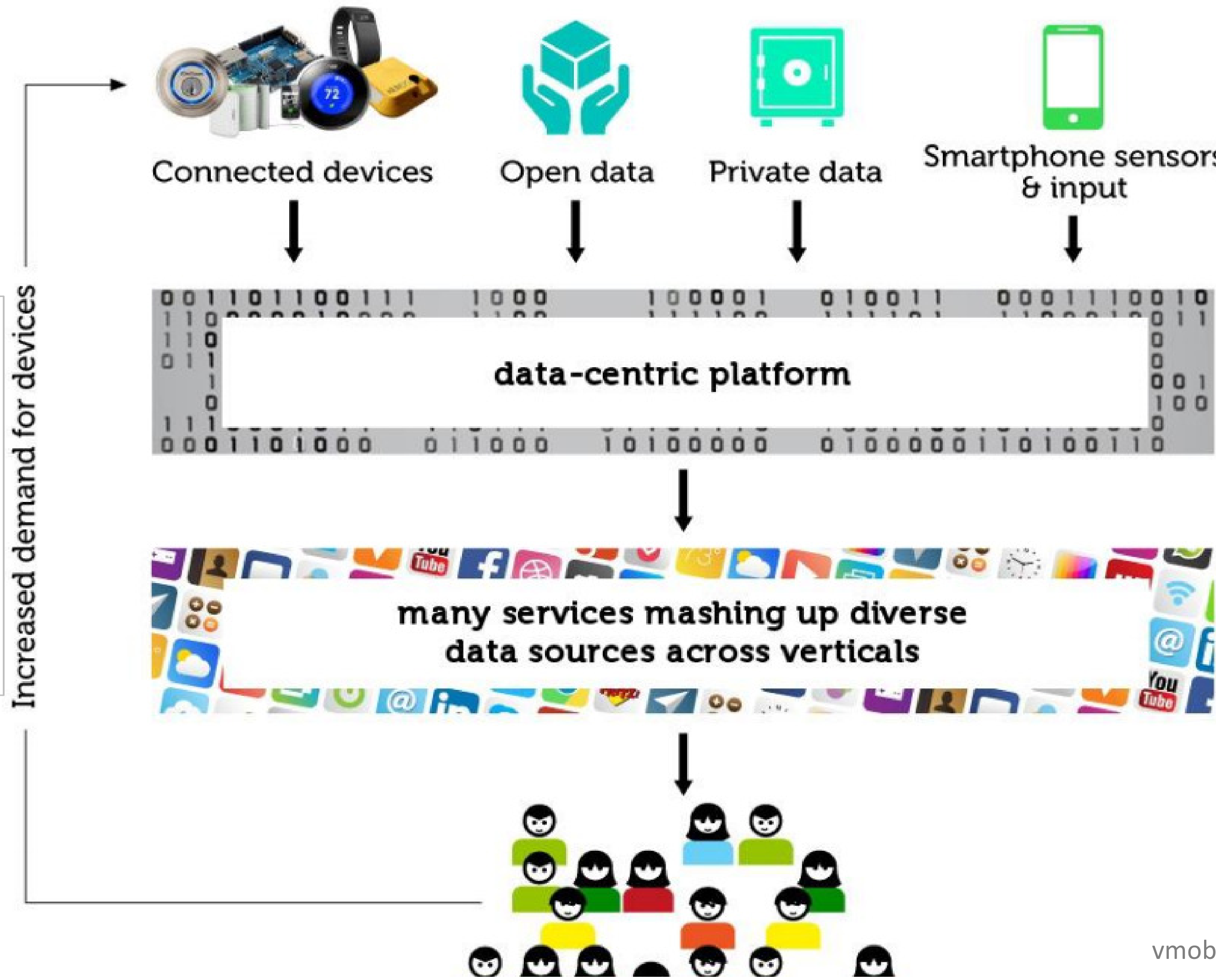


Recombinant Data

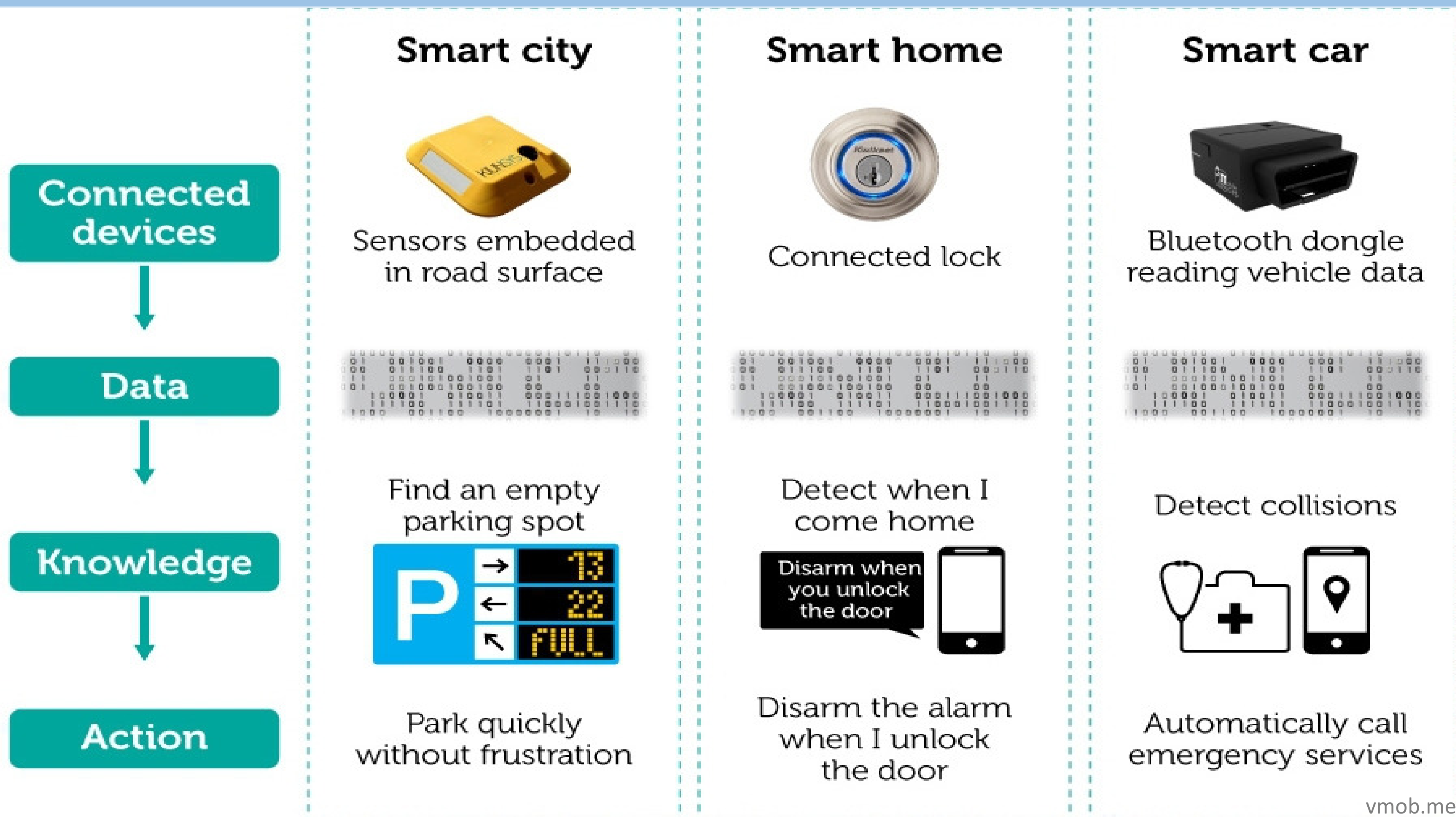
Data (by itself – in one silo) is of limited value unless analyzed in conjunction with other data in context of the application or in context of the problem-question


2020
2016
2012
2008
2004
T
THINGS
R
RECOMBINANT DATA
A
ANALYTICS
M
MOBILE
S
SOCIAL
Modified from illustration by Jaap Bloem

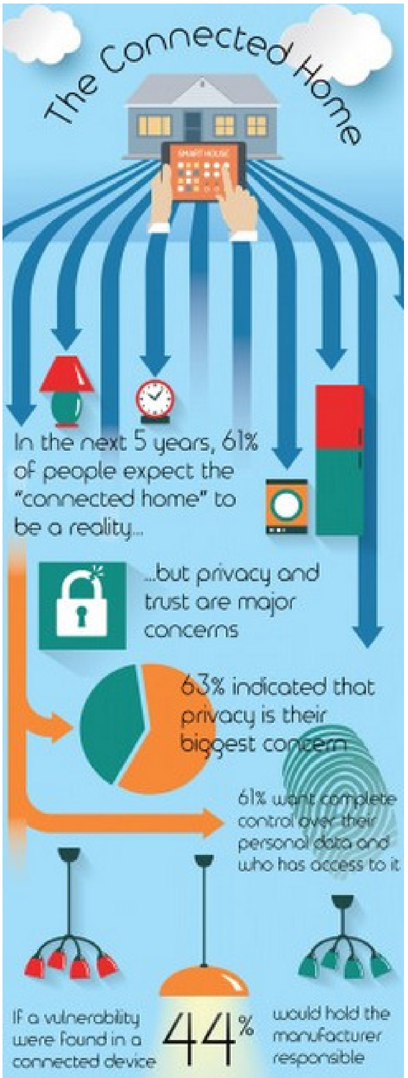
Recombinant DNA is so yesterday … the emergence of Recombinant Data

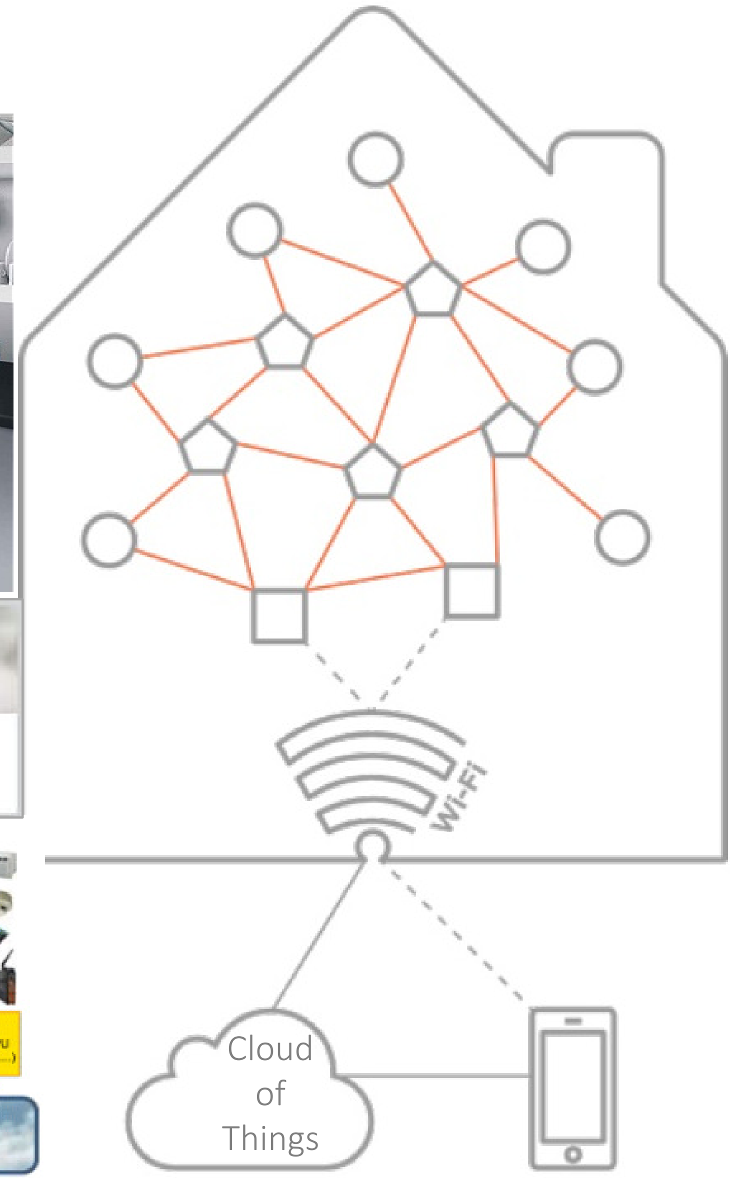


Making Sense of Recombinant Data – unleashing the value cryptic in data

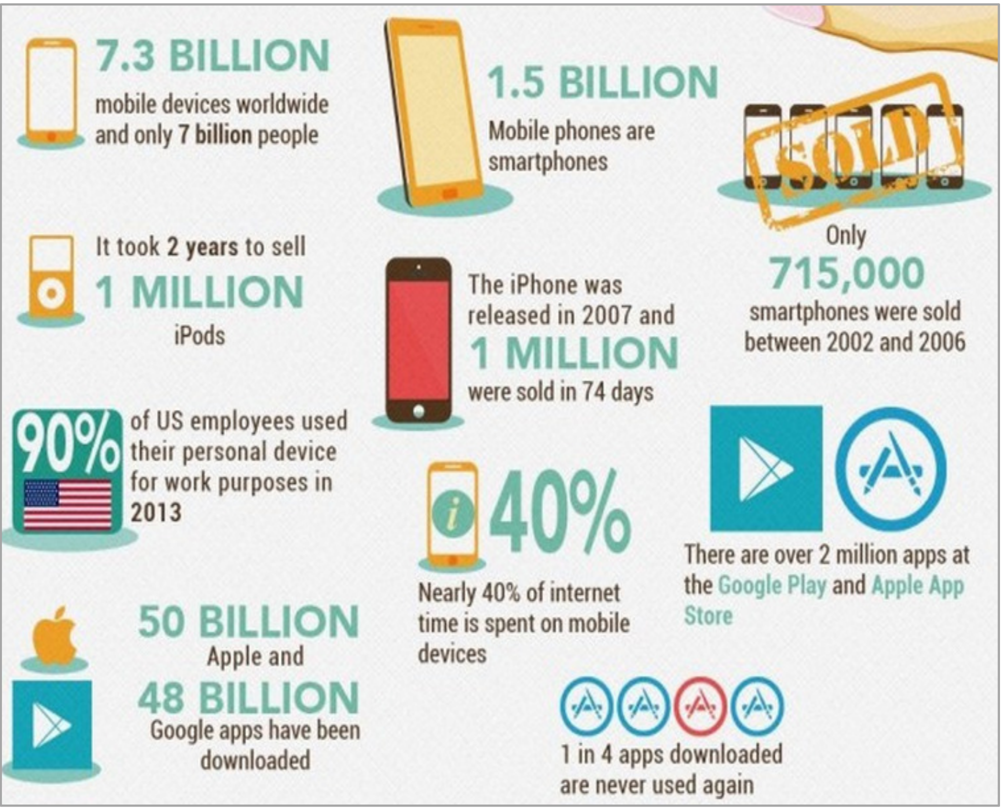


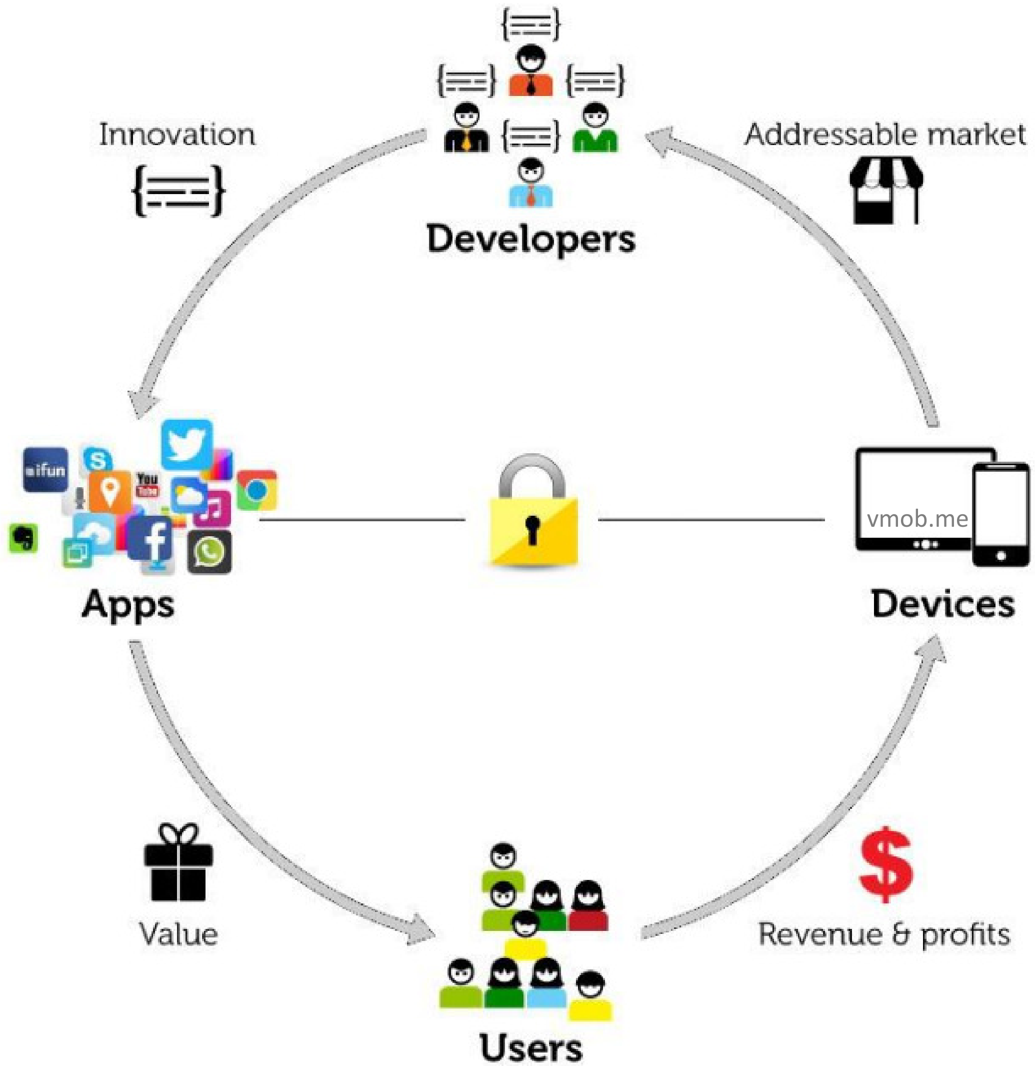
Mesh Network – Is every home a smart home?



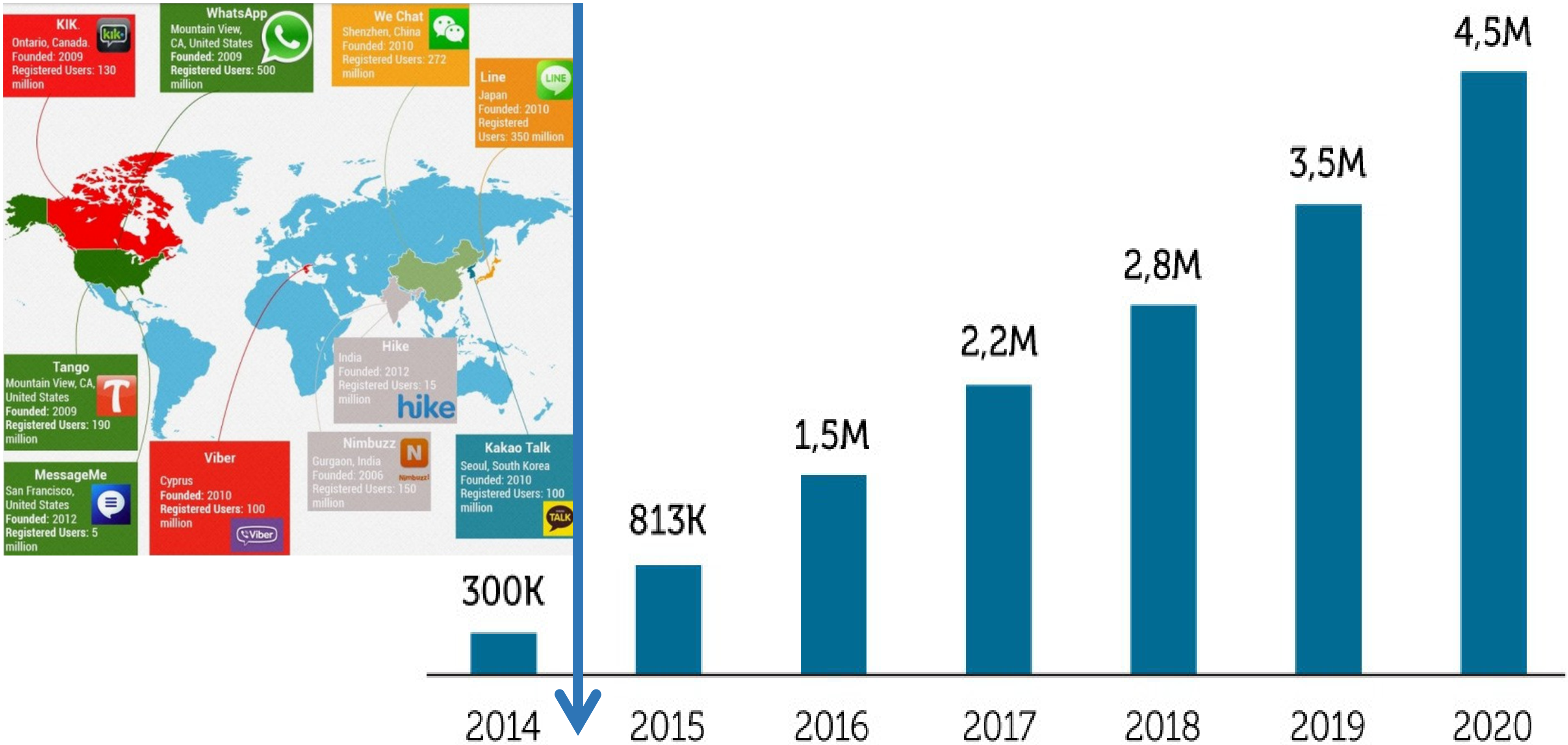


A new business cycle is emerging





Number of developers will exceed the total number of people employed by US DoD

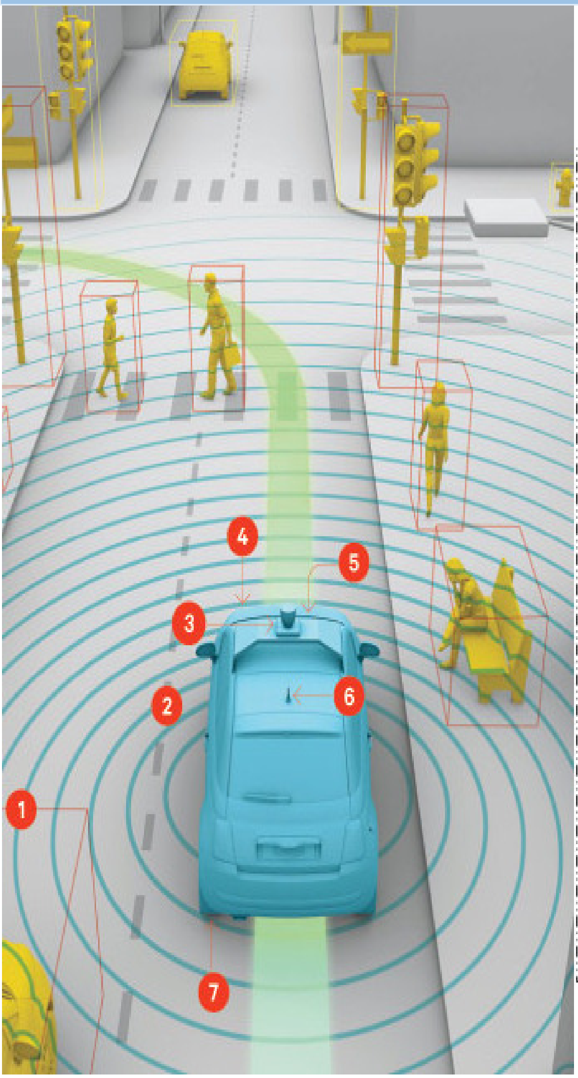


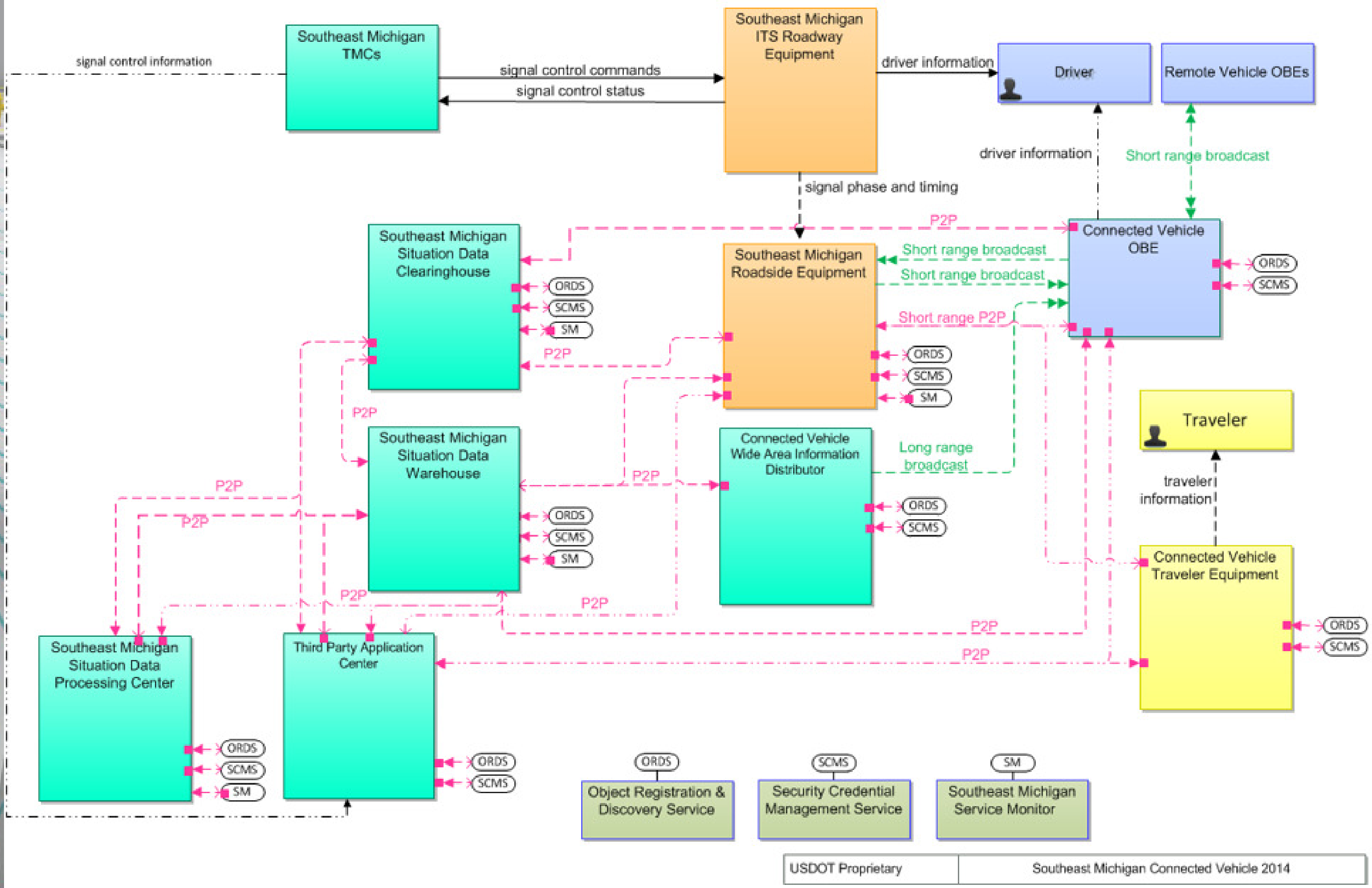
vmob.me

Demand for 4.5 million developers (2020) - jobs in software development


WHY DON'T YOU SAY GOOD MORNING TO YOUR TEACHER?!
I'VE GOT NO IPHONE APP TO DO THAT
DELIGNE

Exabytes of data per second from deployment of autonomous vehicles

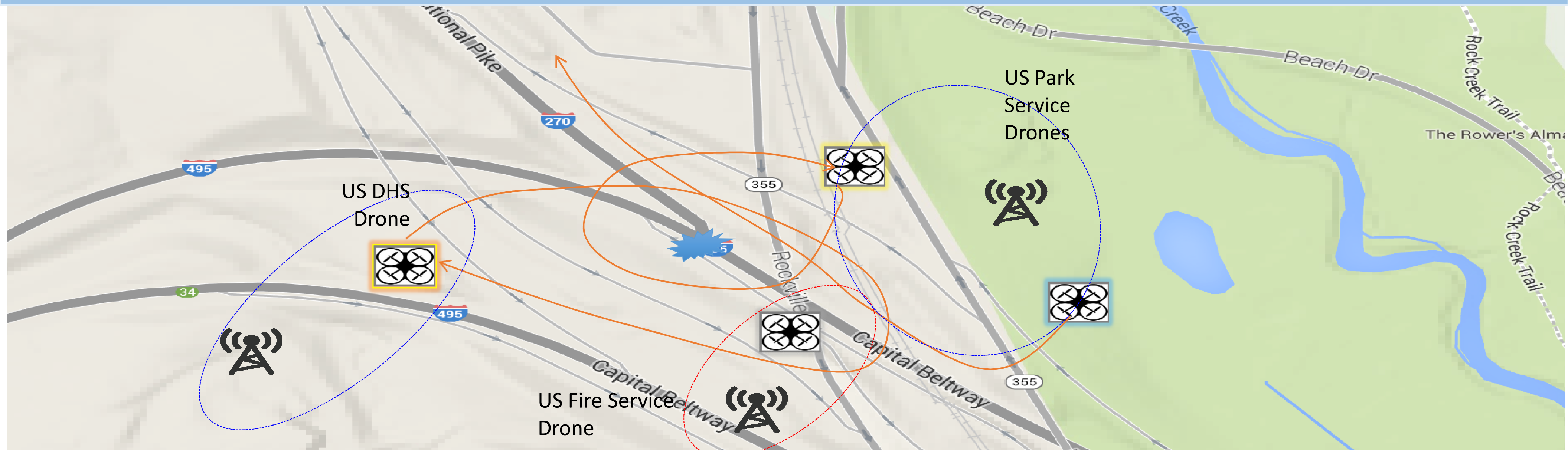


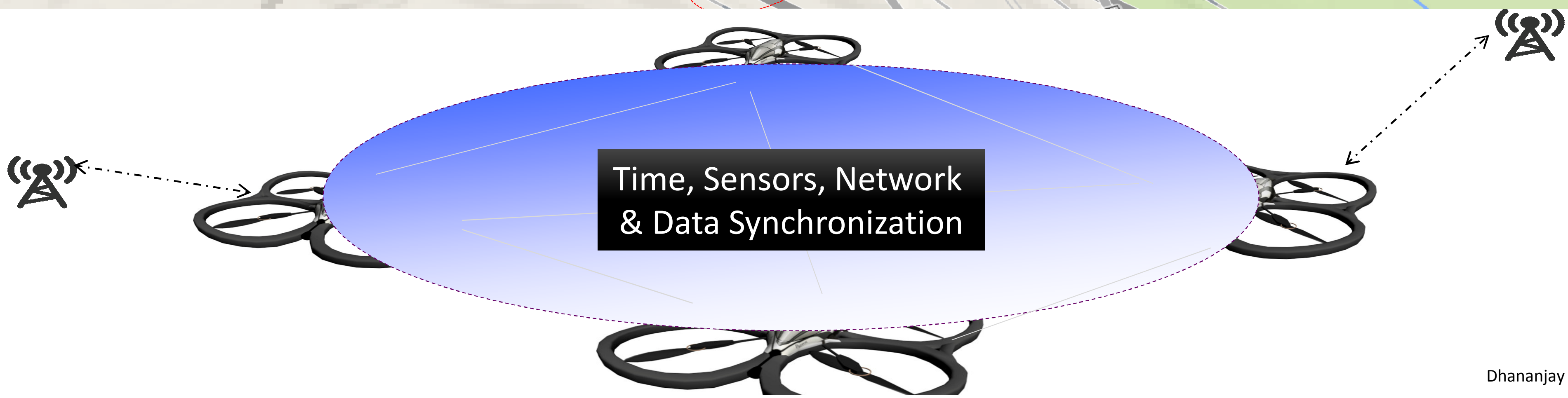





Terrestrial Transportation – Emergency “Crash to Care” Response System

Hellabytes of data from deployment of emergency search & rescue drones





Dhananjay Anand, NIST

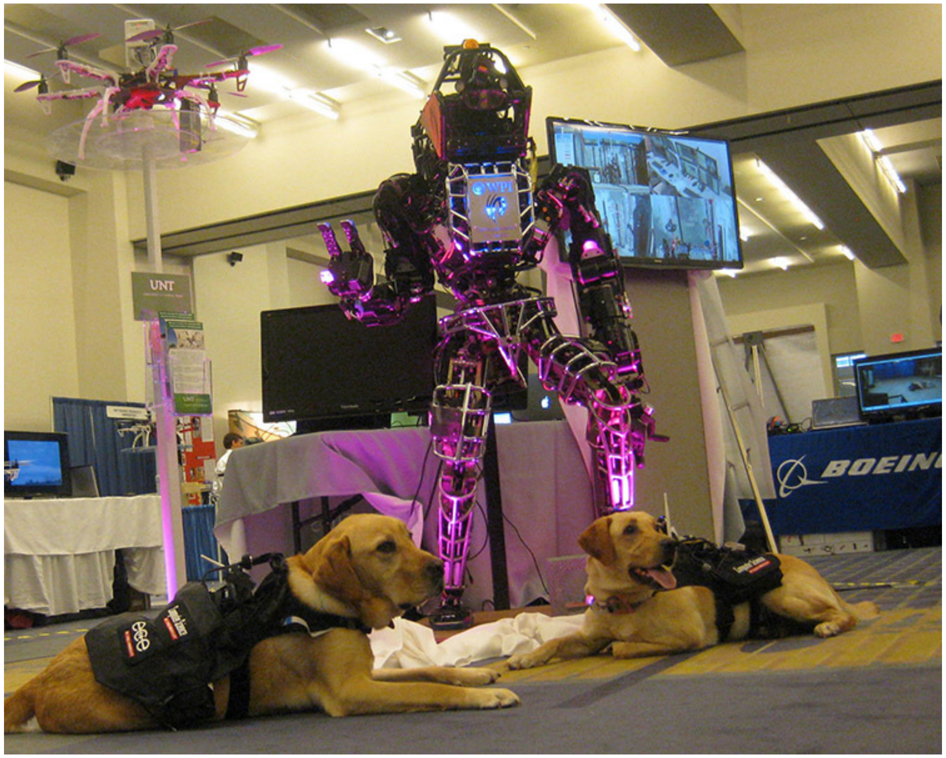
Tectonic Paradigm Shift – Data has gone to the Dogs – Internet of Dogs

Computer Scientists Are Building An Internet Of Dogs For Emergency Rescues

K9 ANALYTICS INC – *We are dogmatic about the future of data*

The Lassie of the future will not bark for the sheriff. Instead, a wireless sensor on her harness will detect gas in an earthquake-shattered building, then text the drones and first responders on the scene. Or at least that's one team's idea behind a design from this year's SmartAmerica Challenge, a project launched by the White House Innovation Fellow program.

The Internet of Dogs is just one part of a larger emergency response system, explains Justyna Zander, the SmartAmerica team lead. Together with computer scientists from a range of academic institutions and industries, they developed a process by which drones, robots, dogs, and human first responders could communicate with one another automatically.



Diesel and Simba resting at the feet of Robo-Cop in the Washington DC Convention Center on June 11, 2014 at the SmartAmerica Challenge organized by Presidential Innovation Fellows Sokwoo Rhee and Geoff Mulligan. Has Boeing receded to the background of US innovation?

Data, People and Cities – Grand Decarbonization Plan for City of Chicago

WHAT WILL YOU DO WITH

FREE DATA STORAGE

FREE COMPUTATION

Monetize data analytics

Google's Big Data

Posted By Paul Tate, June 13, 2014 at

"What if storage and compute power were free? How would that change the way you look at Big Data and the Internet of Things?" asked Tom Howe, Google's senior enterprise consultant for manufacturing during last week's 10th Manufacturing Leadership Summit in Palm Beach, Fla.

Addressing the annual gathering of senior industry executives, Howe suggested that Google is acutely aware of many of the key issues facing manufacturing today as the company has become a significant global producer itself – from the racks it uses in its data centers around the world, to Google Glasses, Nexus smart phones and tablets, the Project Loon high-altitude balloon networks that connect remote regions to the internet, and its newly launched self-driving cars. Not to mention its acquisition of eight or more robotics companies over the last few months.

Howe's focus in his talk, however, was not on Google's own manufacturing activities, but on how the Internet of Things (IoT) and Big Data are rapidly becoming strategic game-changers for all types of manufacturing enterprises. Companies must now actively pursue the collection of multiple types of key data about their operations and their products because, he warned the audience, "if you don't collect this data, someone else will!"

The problem with Big Data, he added, is that 'in our perspective there have been a number of significant blockers to progress in the past." These include the storage costs of massive amounts of information; the cost of crunching the data; the right tools to look at and analyse the data; limitations to network availability and speed; and simply "knowing which questions to even ask", he added.

Google's answer is a 'public cloud' for enterprise IoT. That's where Howe's question to the audience about the potential impact of free storage and compute power comes into play.

He cited different examples of how cloud-based IoT can work in practice - from re-imagining old products such as domestic thermostats that are now connected to the internet, uploading data to the cloud, crunching the results, and sending instructions back down to the device or the owner to create remedial actions; to retrofitting old products like agricultural vehicles that provide real-time location and performance data; to innovative new ideas like smart band aids sending alerts to help to stop the spread of infection in hospitals and medical centers.

How can MOOC help?
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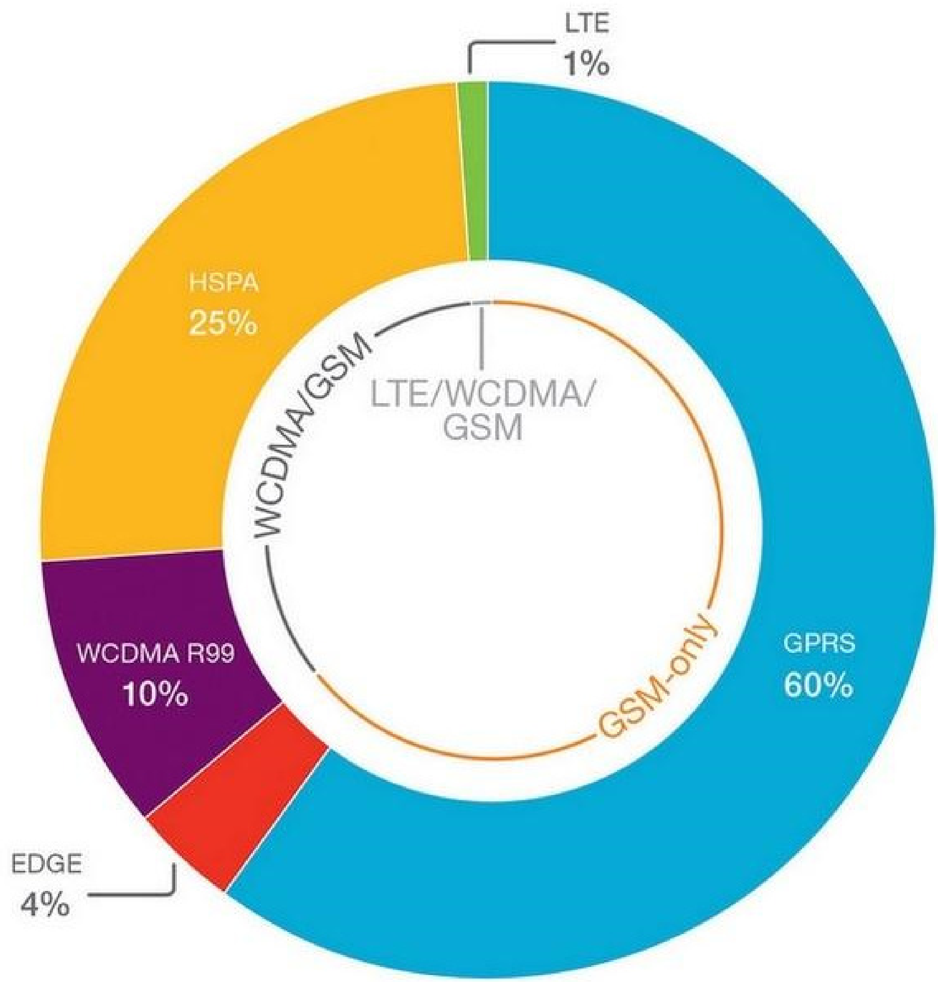
How relevant is this to Taiwan?

Radio capability distribution of M2M devices in measured mobile networks



HELLABYTES

3D

Data Driven Decisionmaking

World Cup star Luminoso scores $6.5M to fund expansion of text analytics business

MIT Media Lab spinoff rolling amidst buzzy World Cup partnership with Sony

By Bob Brown | Follow

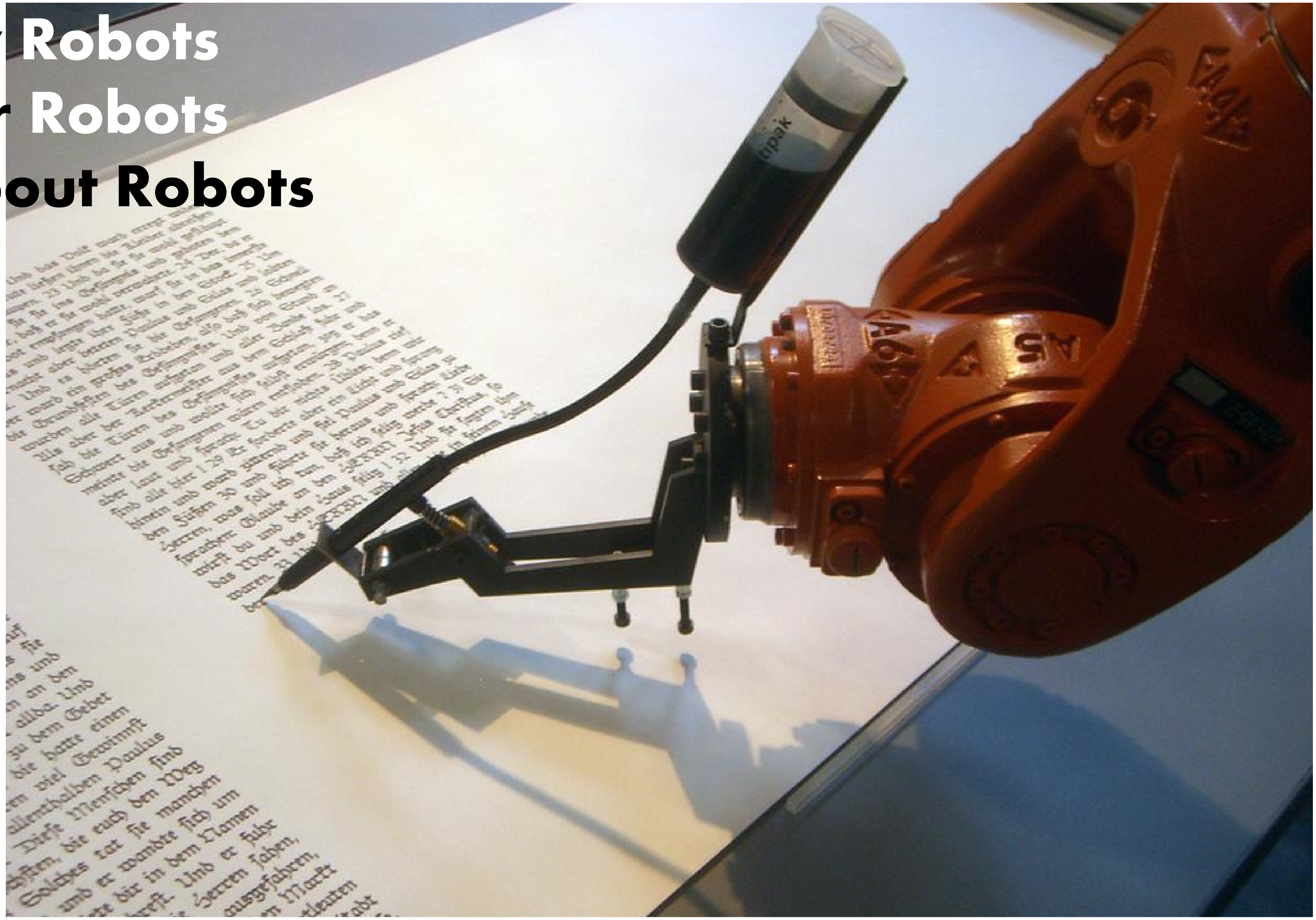
NetworkWorld | Jul 2, 2014 4:30 AM

analytics Startups SaaS

Text analytics company Luminoso, a 2010 MIT Media Lab spinoff that helps its customers make sense out of unstructured data, has raised a $6.5 million Series A round of funding. The 25-person outfit plans to use the funds for new hires in sales, product management and client services as well as to expand its product line.

The fresh funds come via Acadia Woods and Digital Garage, the latter of which is based in Tokyo and was co-founded by MIT Media Lab director Joi Ito. Cambridge, Mass.-based Luminoso, which offers its dashboard service via a software-as-a-service (SaaS) model and also provides APIs that can be incorporated into customers' existing systems, raised $1.5 million in seed funding in 2012.

Articles by Robots
Articles for Robots
Articles about Robots



Associated Press

United States Patent **8,214,314**

***Bonissone* , et al.** **July 3, 2012**

System and process for a fusion classification for insurance underwriting suitable for use by an automated system

Abstract

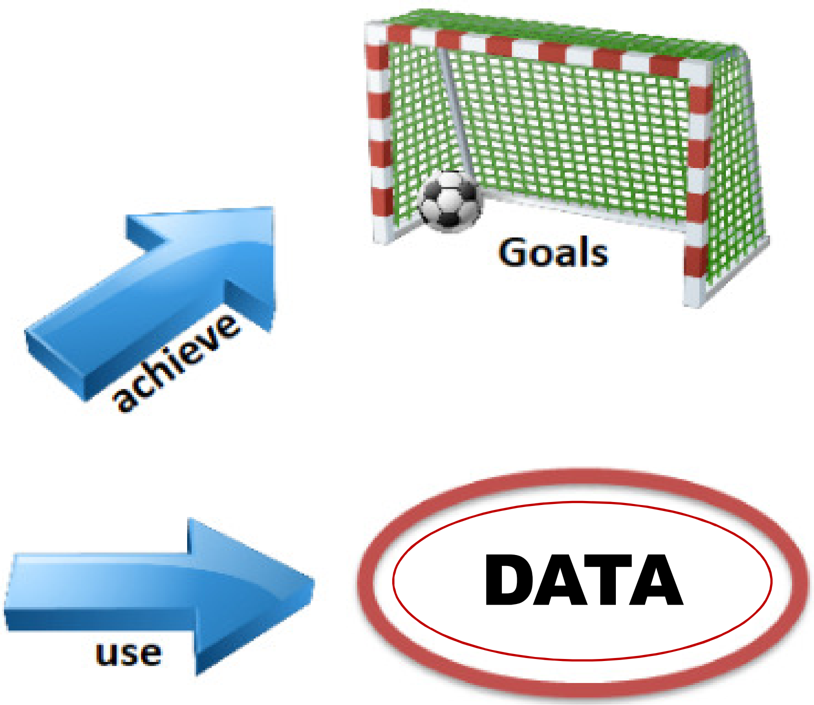
A method and system for fusing a collection of classifiers used for an automated insurance underwriting system and/or its quality assurance is described. Specifically, the outputs of a collection of classifiers are fused. The fusion of the data will typically result in some amount of consensus and some amount of conflict among the classifiers. The consensus will be measured and used to estimate a degree of confidence in the fused decisions. Based on the decision and degree of confidence of the fusion and the decision and degree of confidence of the production decision engine, a comparison module may then be used to identify cases for audit, cases for augmenting the training/test sets for re-tuning production decision engine, cases for review, or may simply trigger a record of its occurrence for tracking purposes. The fusion can compensate for the potential correlation among the classifiers. The reliability of each classifier can be represented by a static or dynamic discounting factor, which will reflect the expected accuracy of the classifier. A static discounting factor is used to represent a prior expectation about the classifier's reliability, e.g., it might be based on the average past accuracy of the model, while a dynamic discounting is used to represent a conditional assessment of the classifier's reliability, e.g., whenever a classifier bases its output on an insufficient number of points it is not reliable.

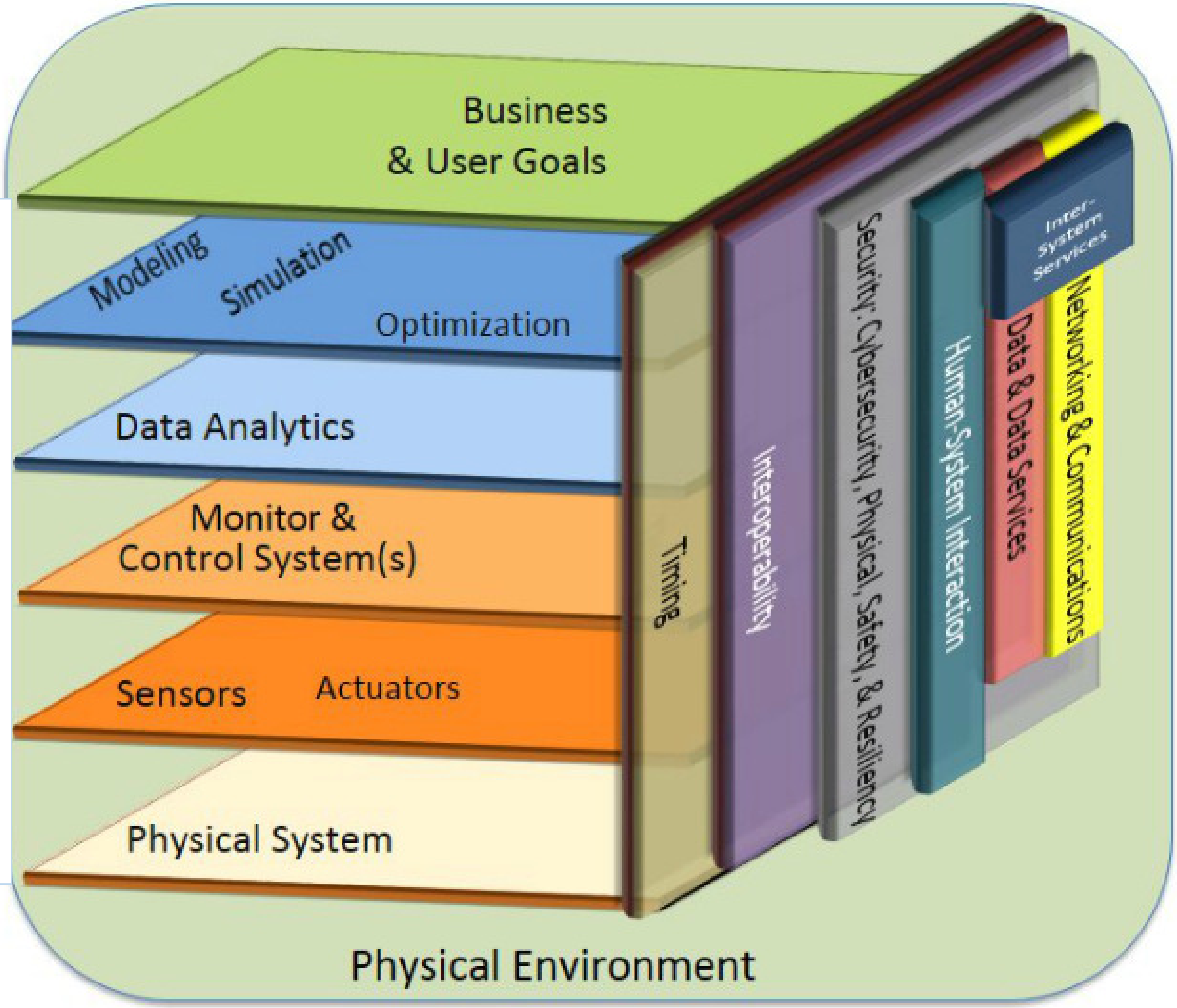
Inventors:	***Bonissone; Piero Patrone*** (Schenectady, NY), **Aggour; Kareem Sherif** (Niskayuna, NY), **Subbu; Rajesh Venkat** (Troy, NY), **Yan; Weizhong** (Clifton Park, NY), **Iyer; Naresh Sundaram** (Clifton Park, NY), **Chakraborty; Anindya** (Schenectady, NY)
Assignee:	**Genworth Financial, Inc.** (Richmond, VA)
Family ID:	**33309734**
Appl. No.:	**12/131,545**
Filed:	**June 2, 2008**

Intelligent Recombinant Data Analytics

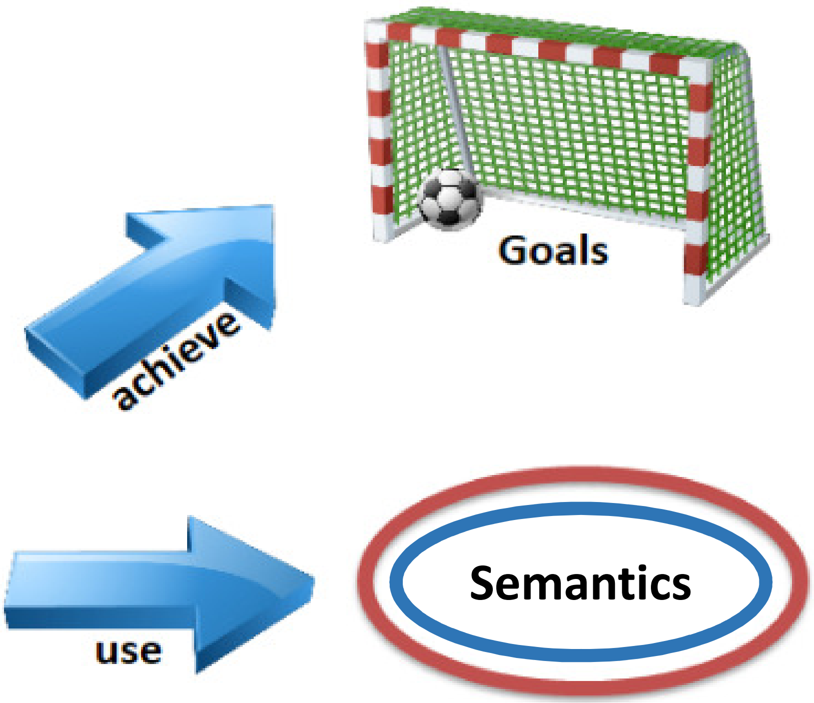
Predictions are very difficult, especially if it is about the future – Niels Bohr (1885-1962)

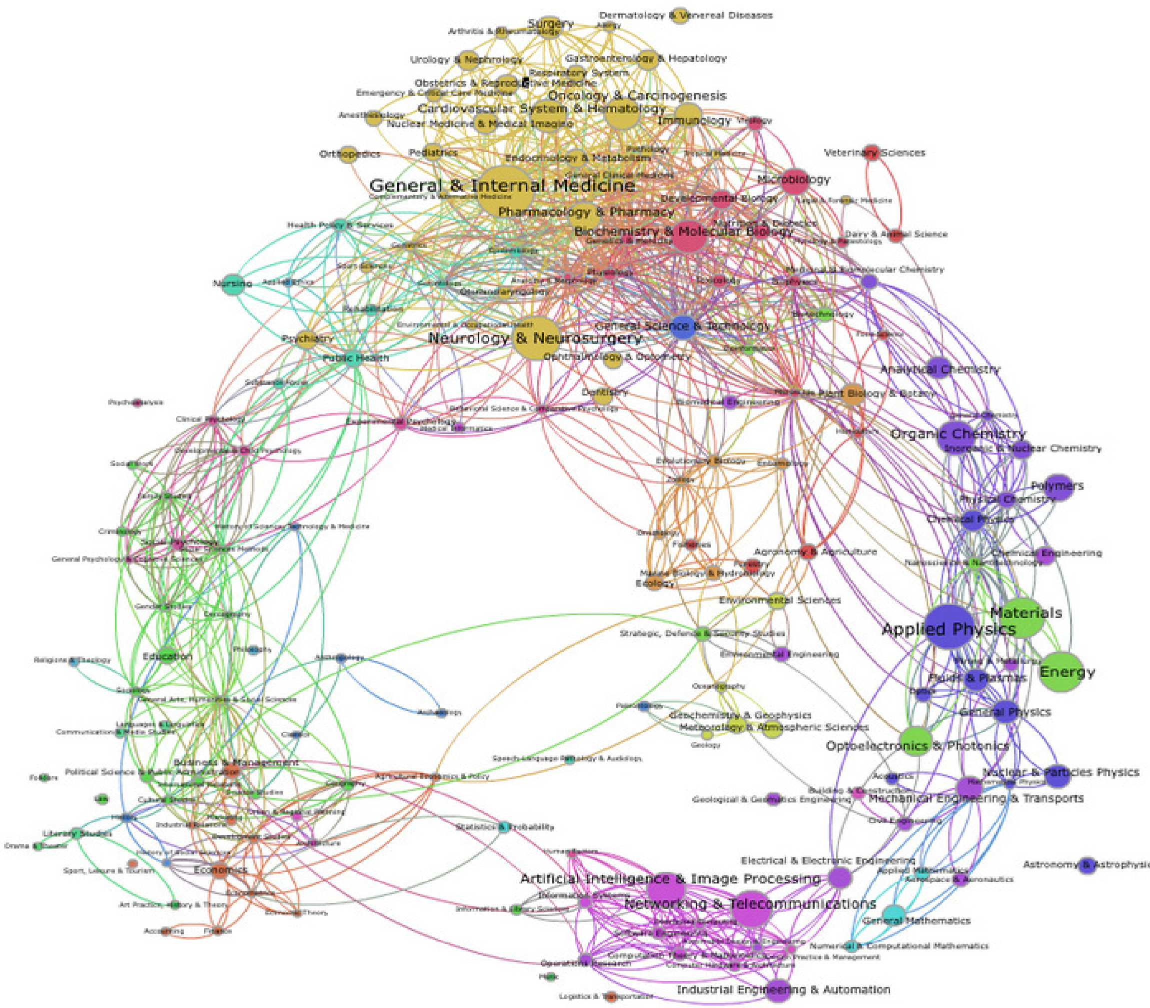
A staple horizontal for any vertical – IRDA & Data Driven Decision-making





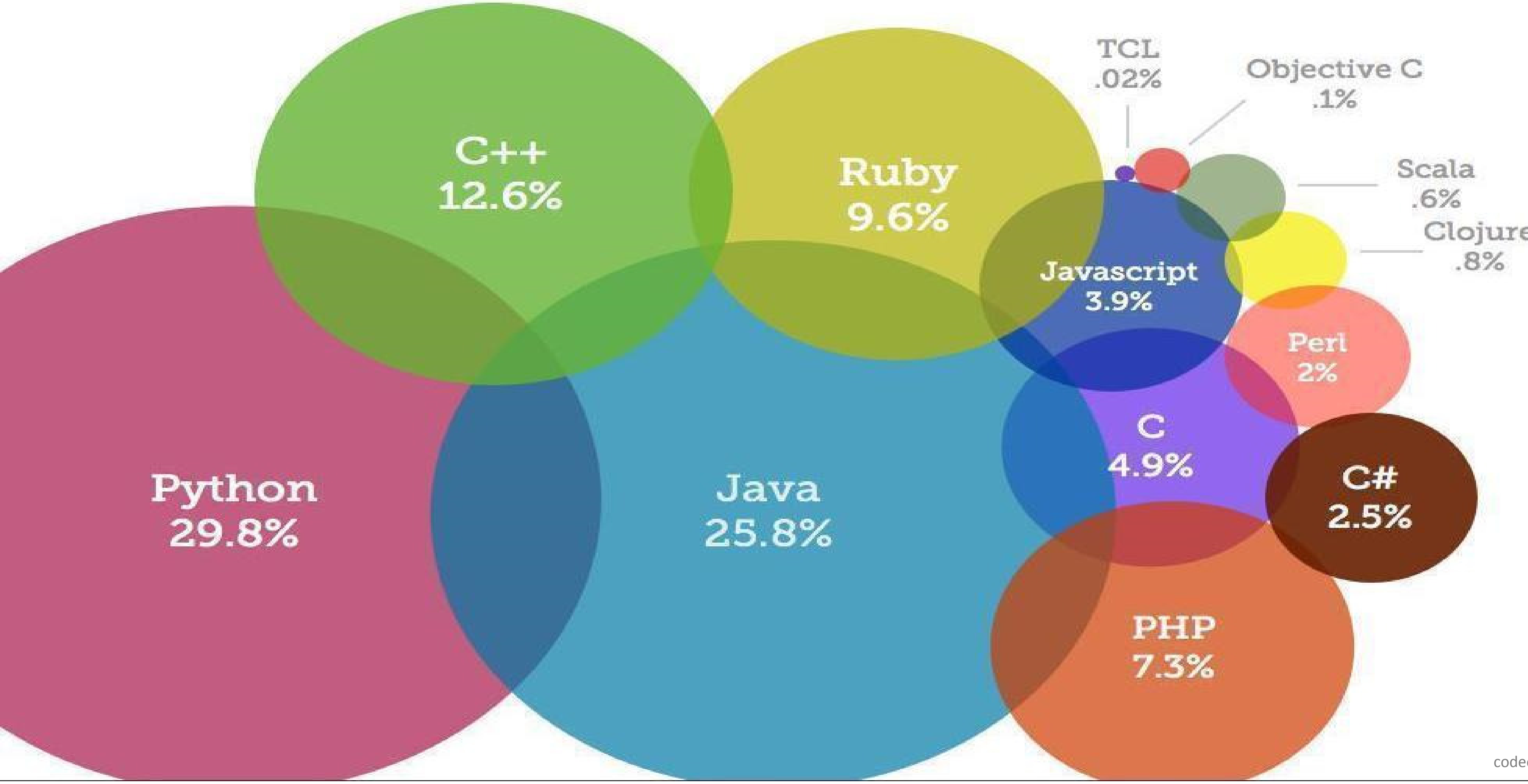
Data without context? Context without semantics? Semantics without ontology?





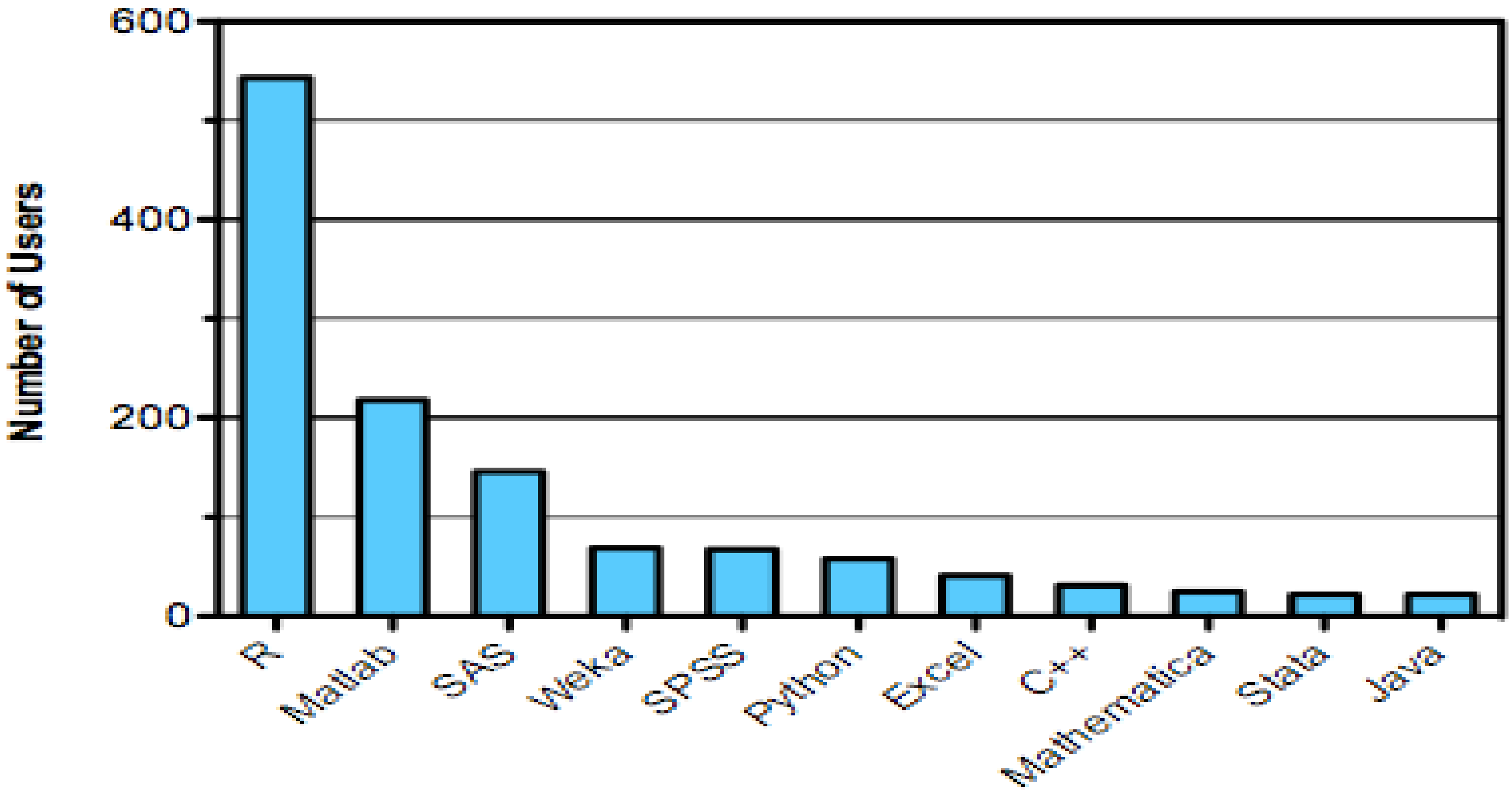
Dr Shoumen Palit Austin Datta ● SVP, Industrial Internet Consortium ● Research Affiliate, School of Engineering, Massachusetts Institute of Technology ● shoumen@mit.edu

Data without software ? Girls Who Code </> Common Coding Languages



codeeval.com

Software used in data analysis competitions – temporary advantage – R



Data from 2011 but still current for 2014.

Data, Connectivity, Context, Value – Gulf between Principles and Practice

Transparent and innovative business models are in dynamic state with real-time information, instant price discovery and quick problem resolution. The latter is now a basic expectation of consumers, citizens and business customers. Taken together, these changes will force many companies to rethink elements of their business models which are not in pace with these progressive practices. Leaders will need to make their companies more transparent and elevate rapid responsiveness as a core competency. Business models built on transparency and responsiveness will satisfy customers and help companies become more agile and credible with their stakeholders as long as privacy and security concerns are adequately addressed. The key rate limiting step is the availability of skilled workforce.

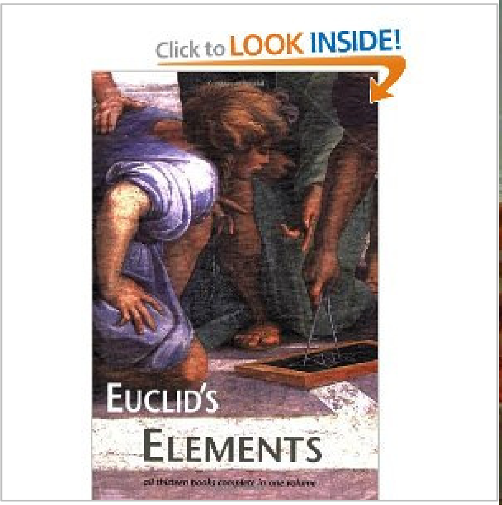
- http://www.ibm.com/analytics/us/en/
- http://hbr.org/2012/10/big-data-the-management-revolution/ar/1
- http://googleblog.blogspot.com/2010/10/what-were-driving-at.html
- http://hbr.org/2012/10/data-scientist-the-sexiest-job-of-the-21st-century
- http://public.dhe.ibm.com/common/ssi/ecm/en/gbe03575usen/GBE03575USEN.PDF
- http://spectrum.ieee.org/automaton/robotics/artificial-intelligence/how-google-self-driving-car-works

How to deliver value from data? Transform the vision of IRDA into reality?

The rising economic and business impact of information technology means that competition will heat up for graduates in science, technology, engineering and mathematics (STEM) where job growth is likely to be several times faster than in other areas. As the automation of knowledge work gains momentum and computers start handling a growing number of tasks now performed by knowledge workers, some mid-level jobs will disappear. People with higher-level skills will become more important. Providing new forms of training to upgrade knowledge workers’ capabilities and rethinking the nature of public education, especially in mathematics, will be critical priorities for businesses to invest in and for government leaders to decrease bureaucracy. Education is our key.

Can MOOC catalyze an educated & IRDA-proficient supply chain of talent ?

Did we arrive at a conclusion we knew almost since the beginning of time?



Born Raffaello Sanzio da Urbino in 1483 (Urbino, IT). Died April 6, 1520 (Rome, IT) Raphael - The School of Athens

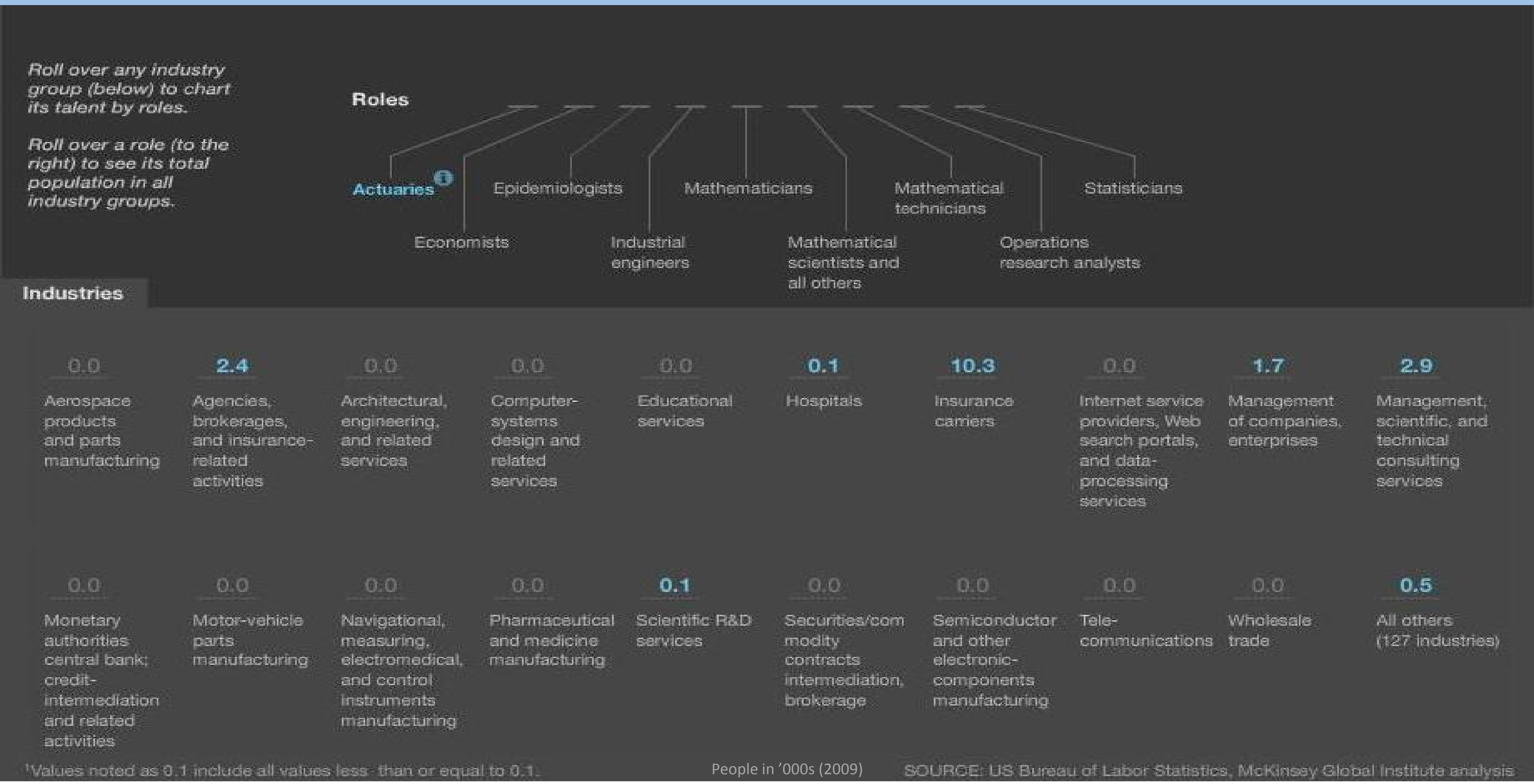
Discussion

- History
- Context
- Purpose
- Economy
- Denominator
- Data
- Conclusion

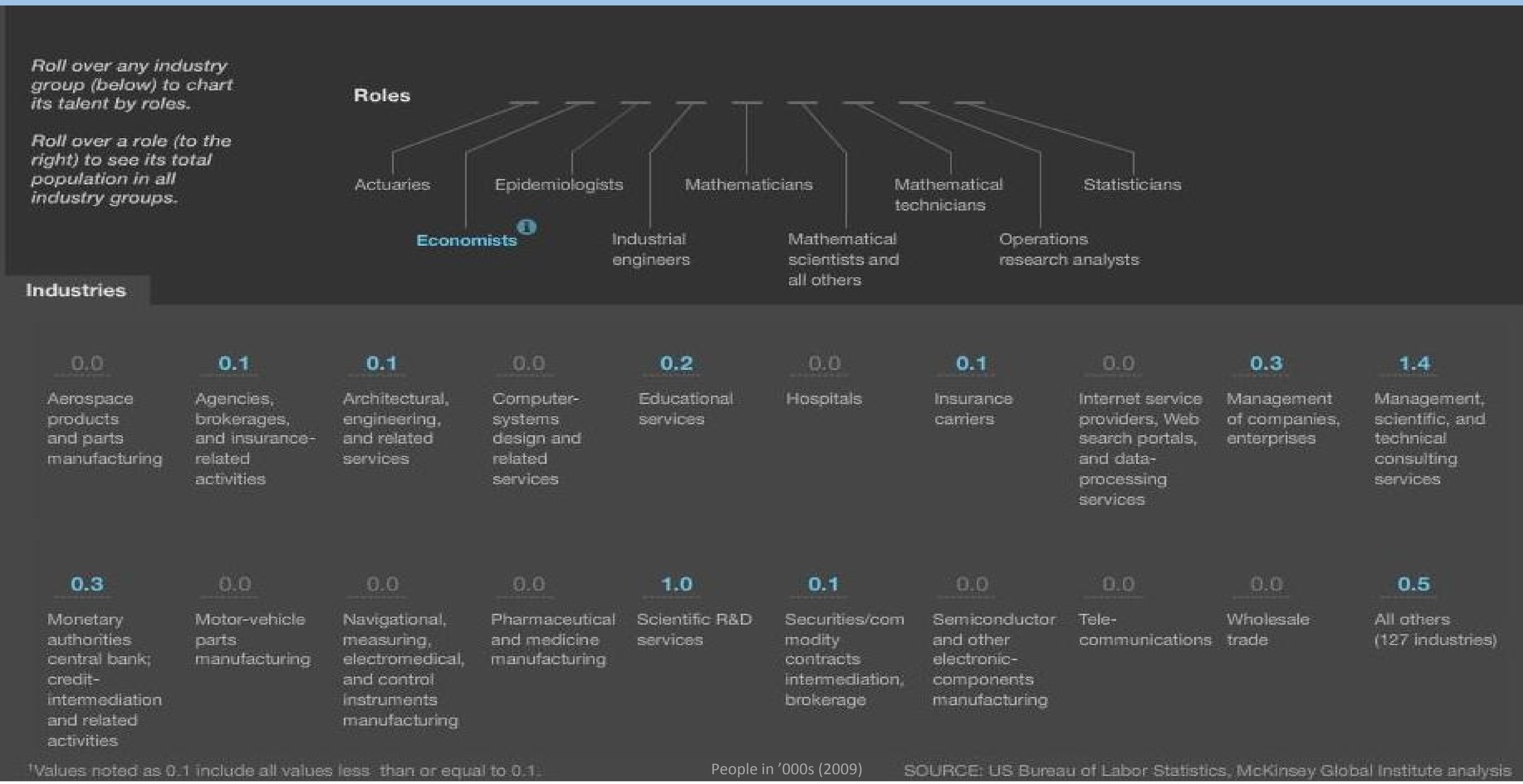
Mathematics

The quintessential denominator

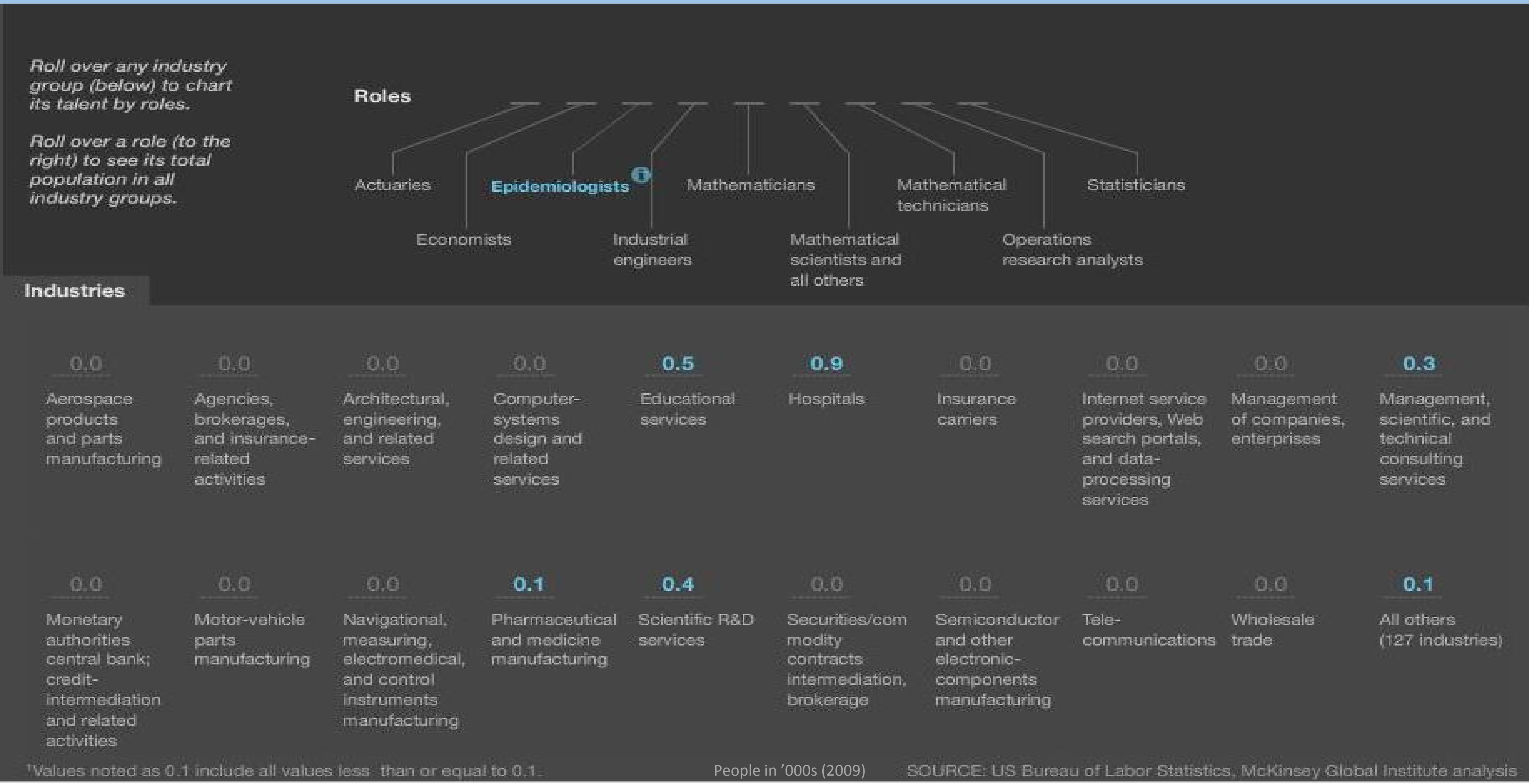
Math-based role: Actuaries



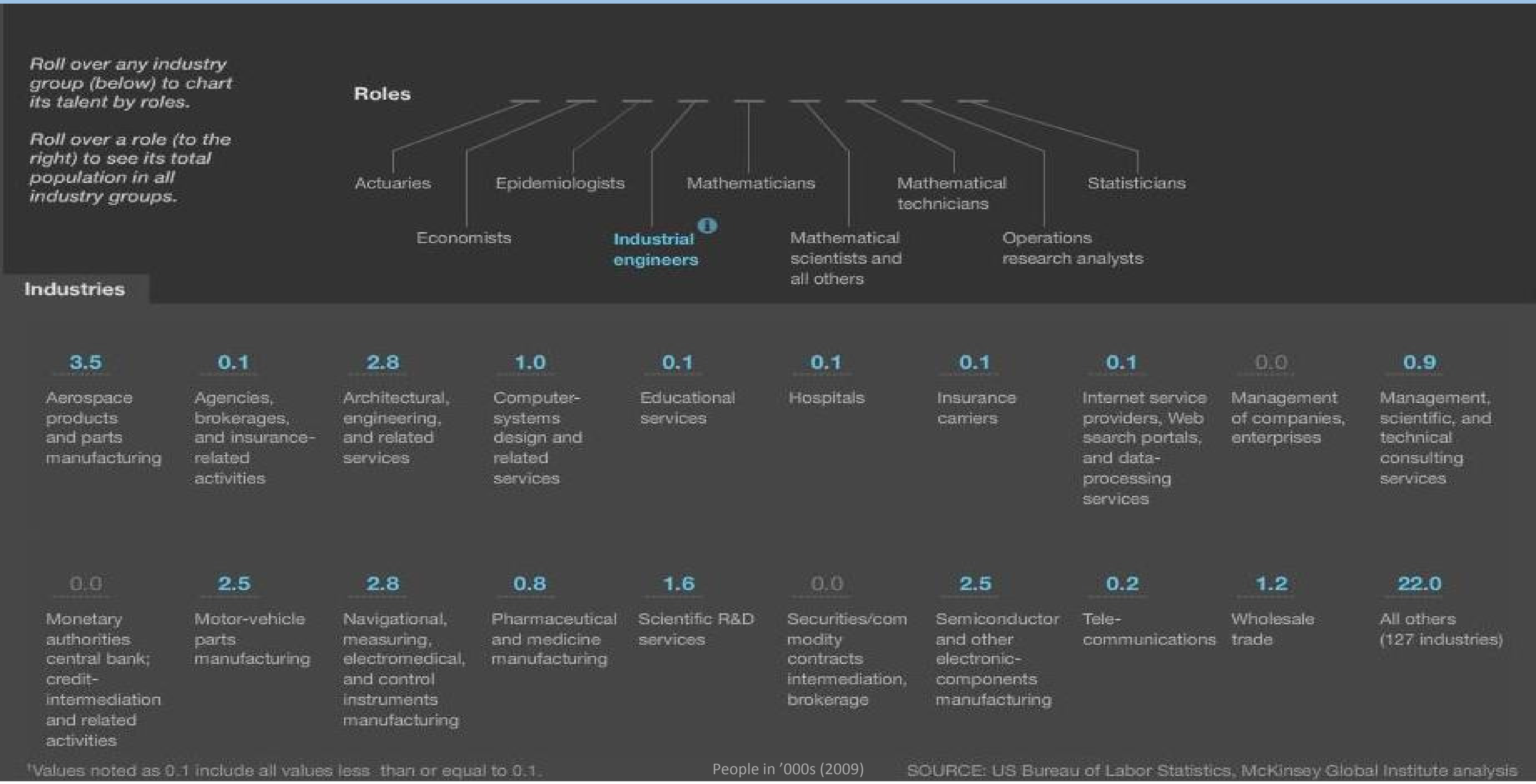
Math-based role: Economists



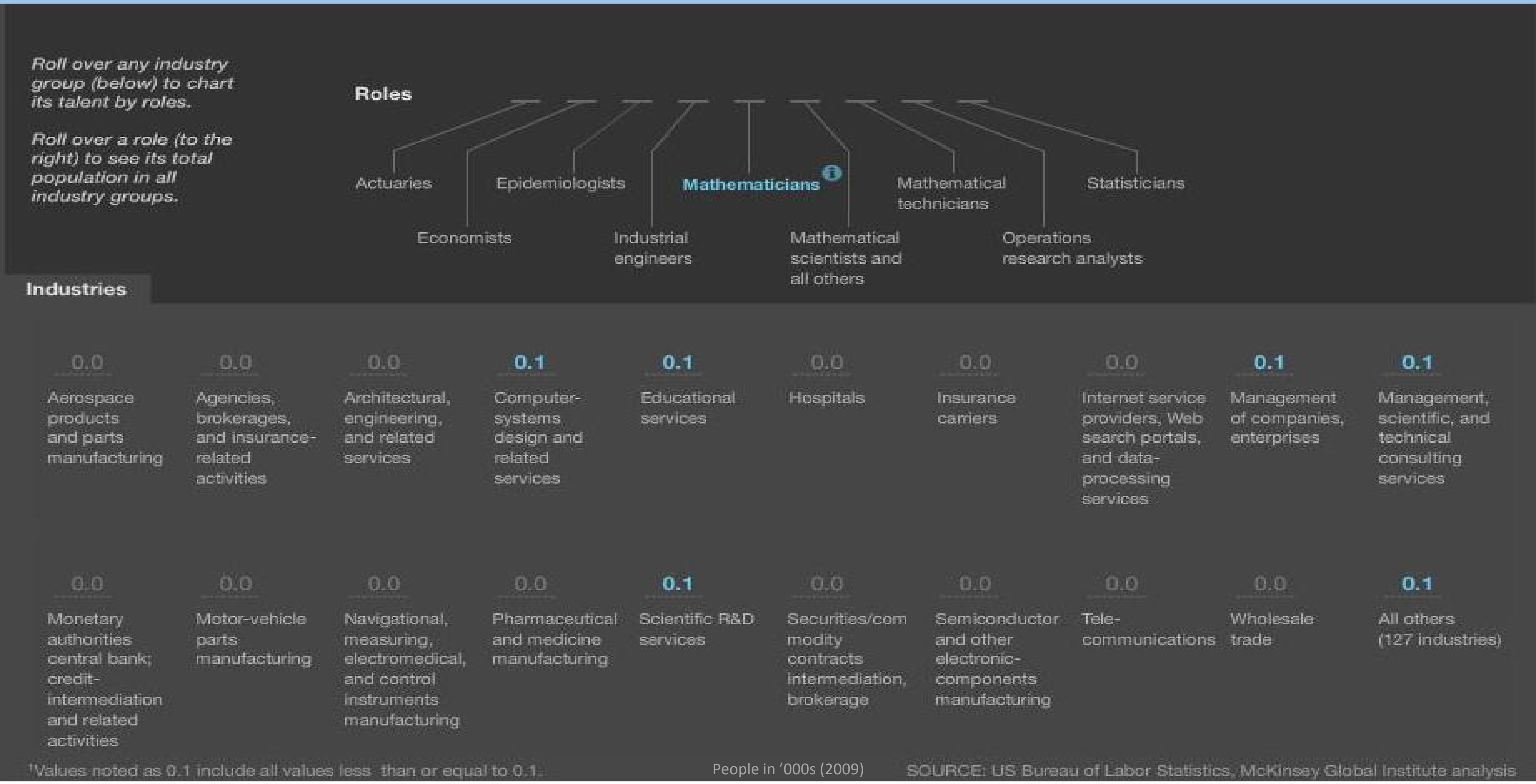
Math-based role: Epidemiologists



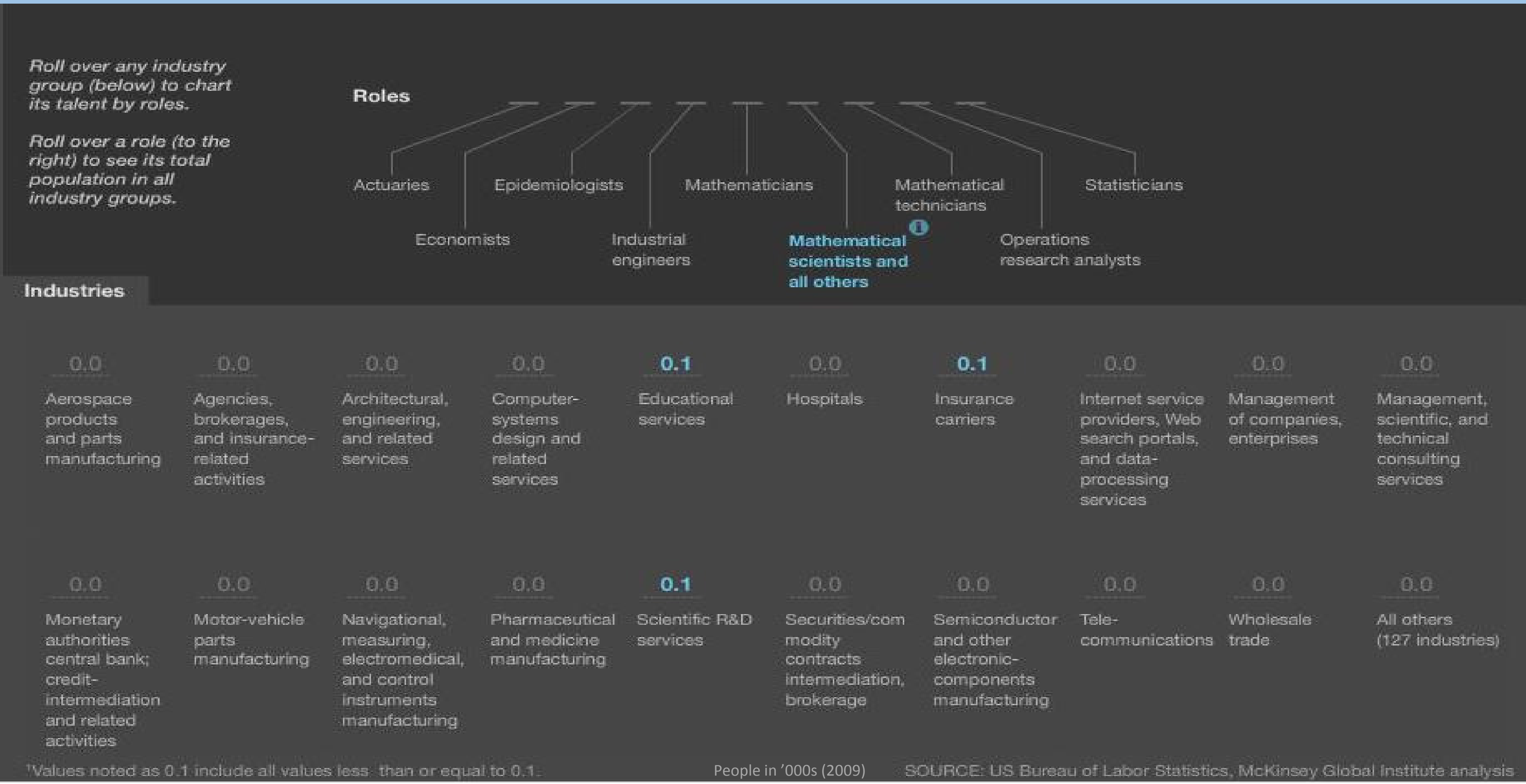
Math-based role: Industrial Engineers



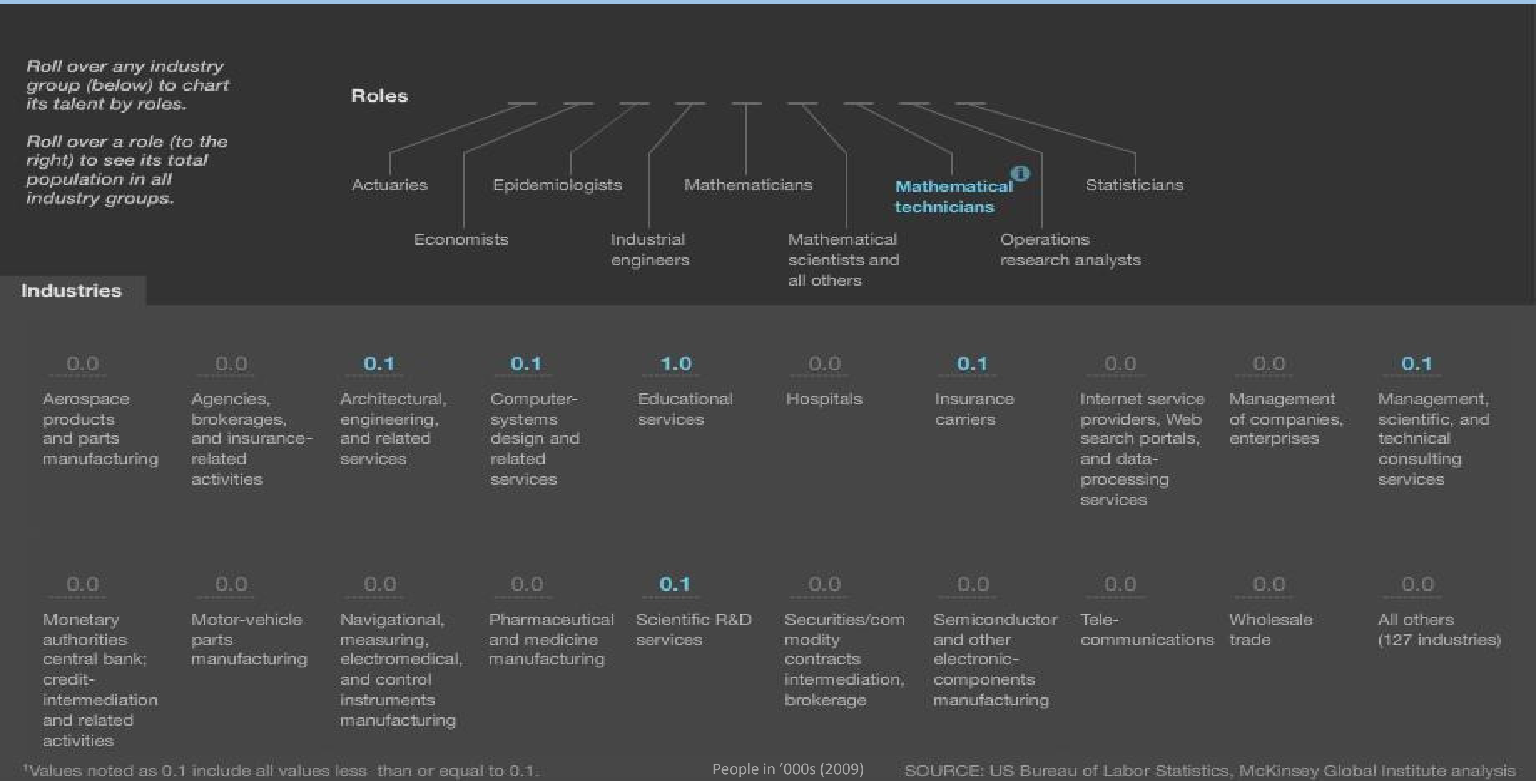
Mathematicians



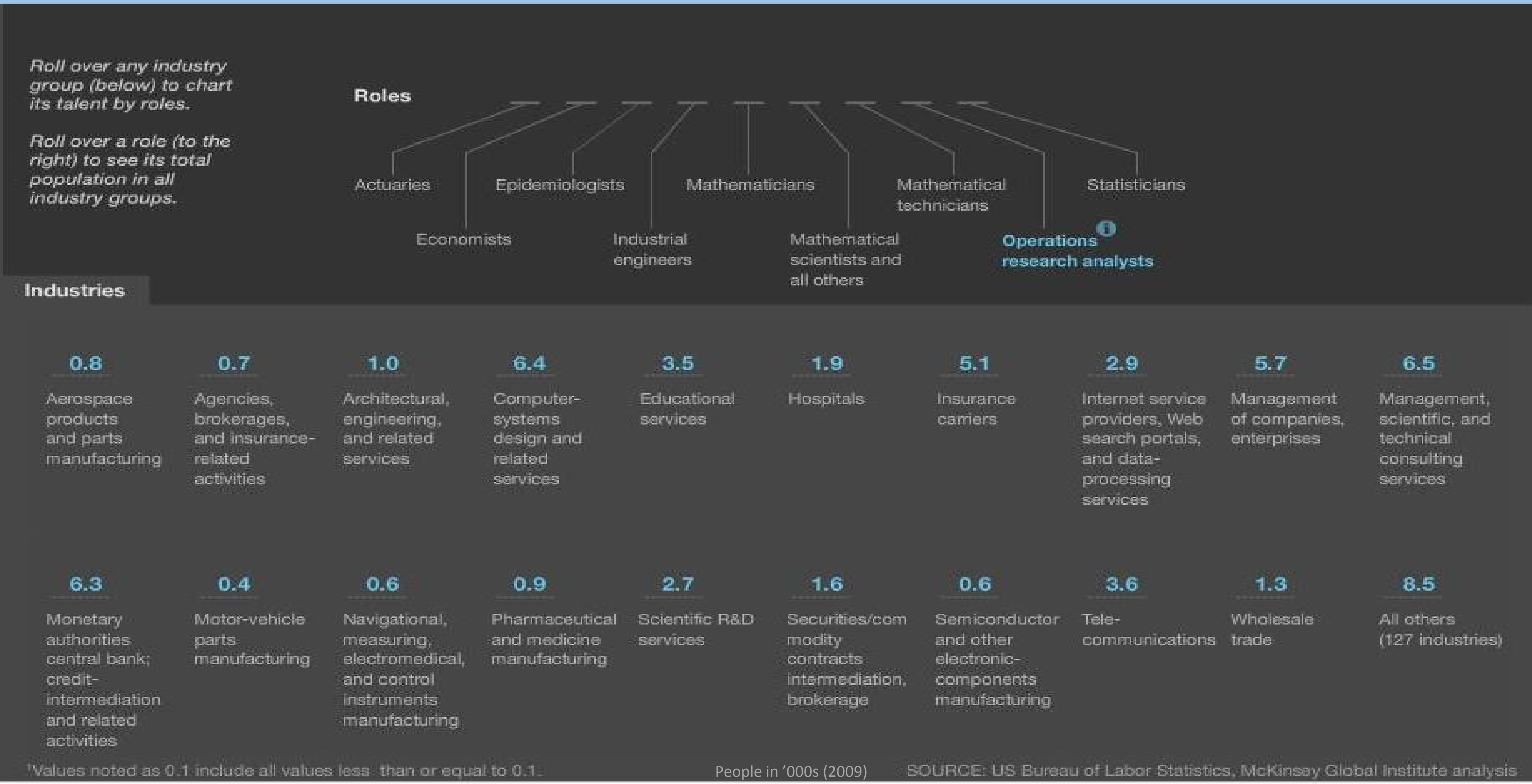
Math-based role: Mathematical Scientists



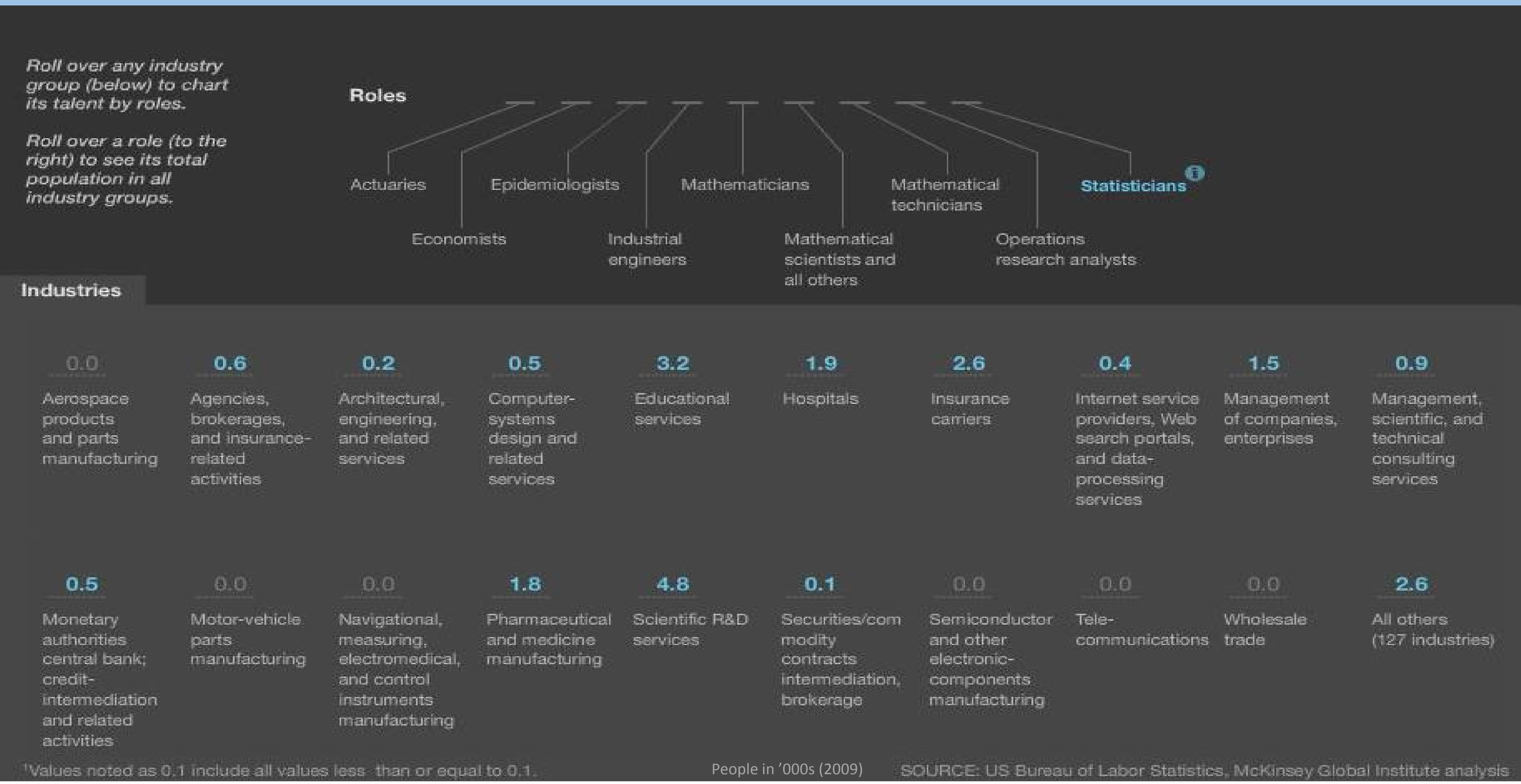
Math-based role: Mathematical Technicians



Math-based role: Operations Research



Math-based role: Statisticians

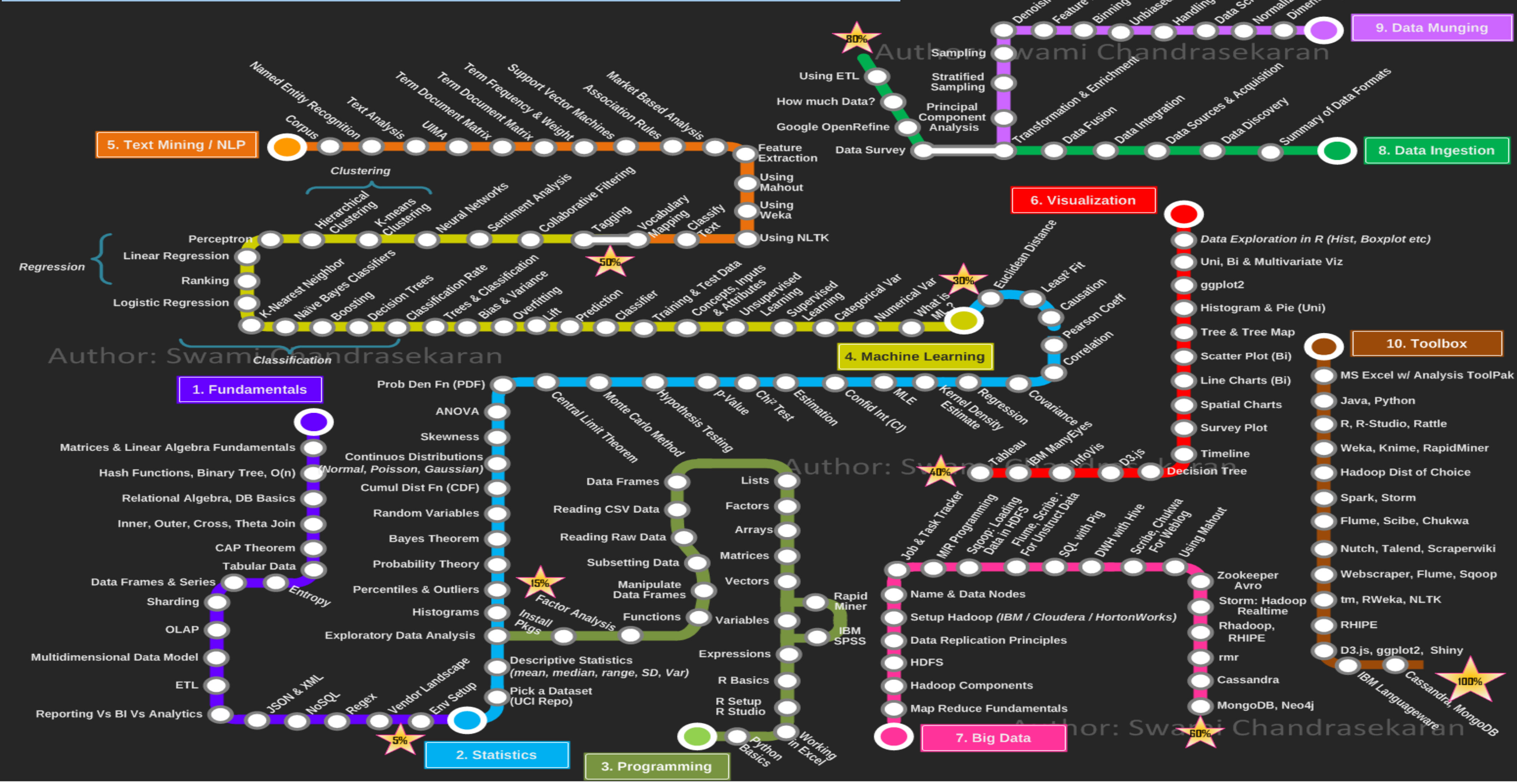


Math-phobia: A grande opportunity disguised as a US skills shortage

By 2018, US will experience a shortage of 190,000 skilled data scientists, and 1.5 million managers and analysts required to reap the actionable insights from the big data deluge. With an estimated 40,000 exabytes of data being collected by 2020 (2,700 exabytes in 2012) the implications of this shortage is a major opportunity. Further driving this explosion in data collection and the demand for skilled practitioners, is the wide range of economic sectors that will leverage big data analytics in the next decade, including retail, manufacturing, healthcare, government & cybersecurity.

http://blog.gopivotal.com/pivotal/news-2/mckinsey-report-highlights-the-impending-data-scientist-shortage#sthash.gBtyRaPg.dpuf

Building blocks on the road to Data Science



Data Science

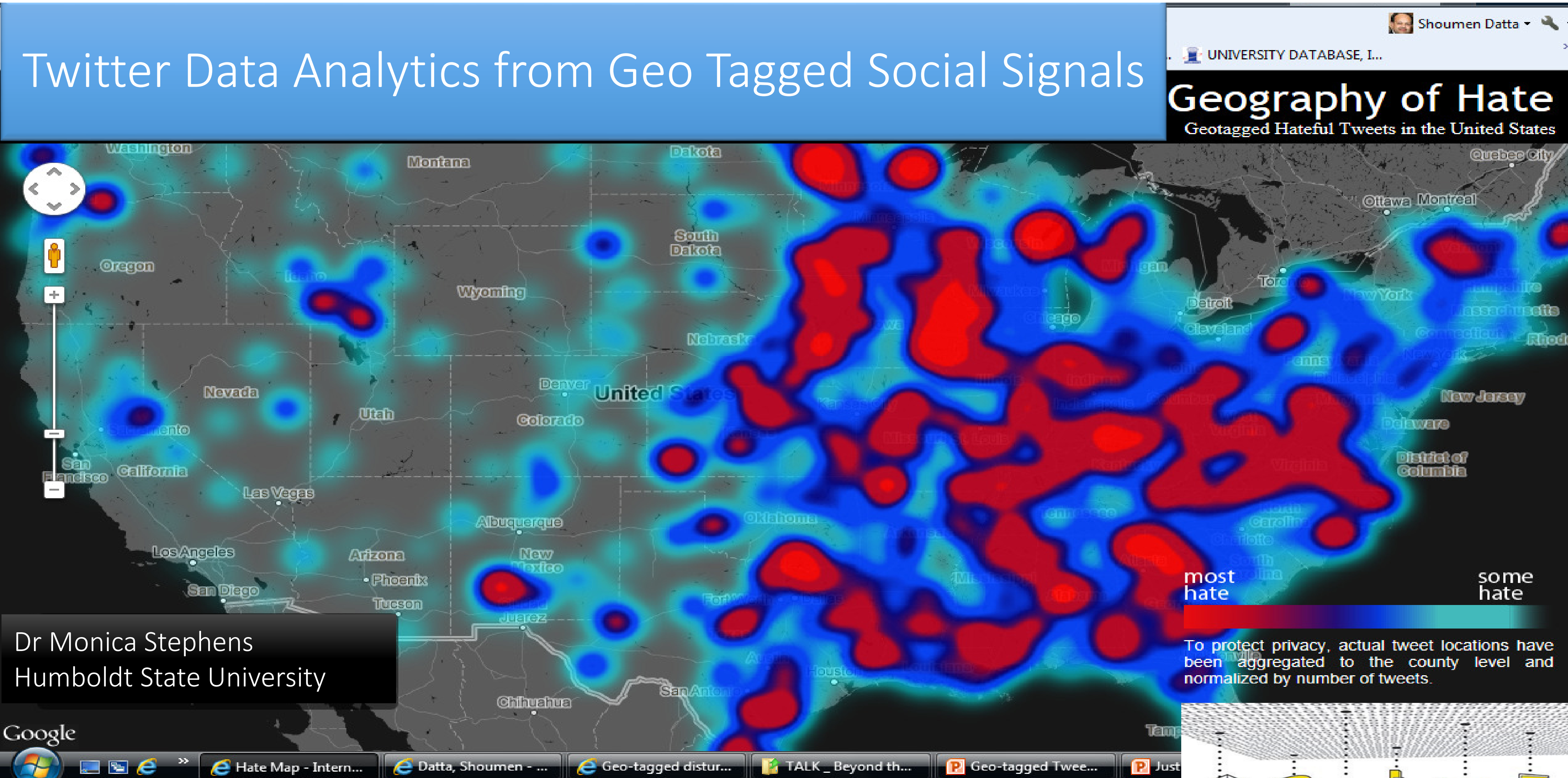
The Emperor's New Clothes (it is the same Emperor inside his new clothes)

1.2 billion (of ~7 billion global population) connects via Facebook (2010)

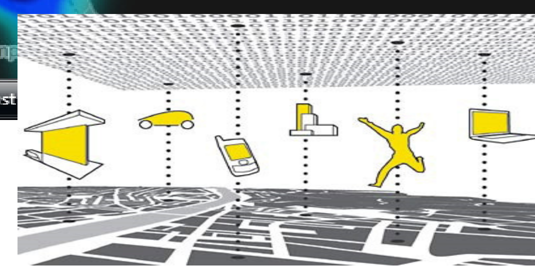
DATA reveals Istanbul is the area with the highest migration

Migration trends – where you live vs where you were born

Twitter Data Analytics from Geo Tagged Social Signals



Dr Monica Stephens
Humboldt State University



Mapping demand is a variable linked to personality and mobility. Juveniles may tweet each time they pass *McDonald's* but it is unlikely that adults may want to tweet if they want to eat pasta or prawns for dinner.
http://senseable.mit.edu/wikicity/rome/

EPIDEMIOLOGY

When Google got flu wrong

US outbreak foxes a leading web-based method for tracking seasonal flu.

BY DECLAN BUTLER

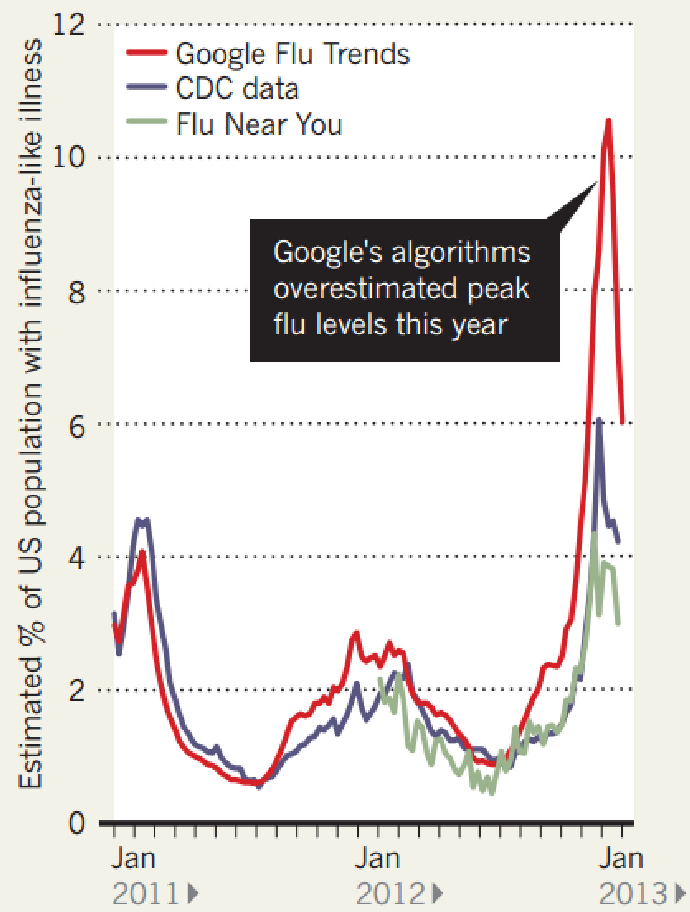
When influenza hit early and hard in the United States this year, it quietly claimed an unacknowledged victim: one of the cutting-edge techniques being used to monitor the outbreak. A comparison with traditional surveillance data showed that Google Flu Trends, which estimates prevalence from flu-related Internet searches, had drastically overestimated peak flu levels. The glitch is no more than a temporary setback for a promising strategy, experts say, and Google is sure to refine its algorithms. But as flu-tracking techniques based on mining of web data and on social media proliferate, the episode is a reminder that they will complement, but not substitute for, traditional epidemiological surveillance networks.

"It is hard to think today that one can provide disease surveillance without existing systems," says Alain-Jacques Valleron, an epidemiologist at the Pierre and Marie Curie University in Paris, and founder of France's Sentinelles monitoring network. "The new systems depend too much on old existing ones to be able to live without them," he adds.

This year's US flu season started around November and seems to have peaked just after Christmas, making it the earliest flu season since 2003. It is also causing more serious illness and deaths than usual, particularly among the elderly, because, just as in 2003, the predominant strain this year is H3N2 — the most

FEVER PEAKS

A comparison of three different methods of measuring the proportion of the US population with an influenza-like illness.

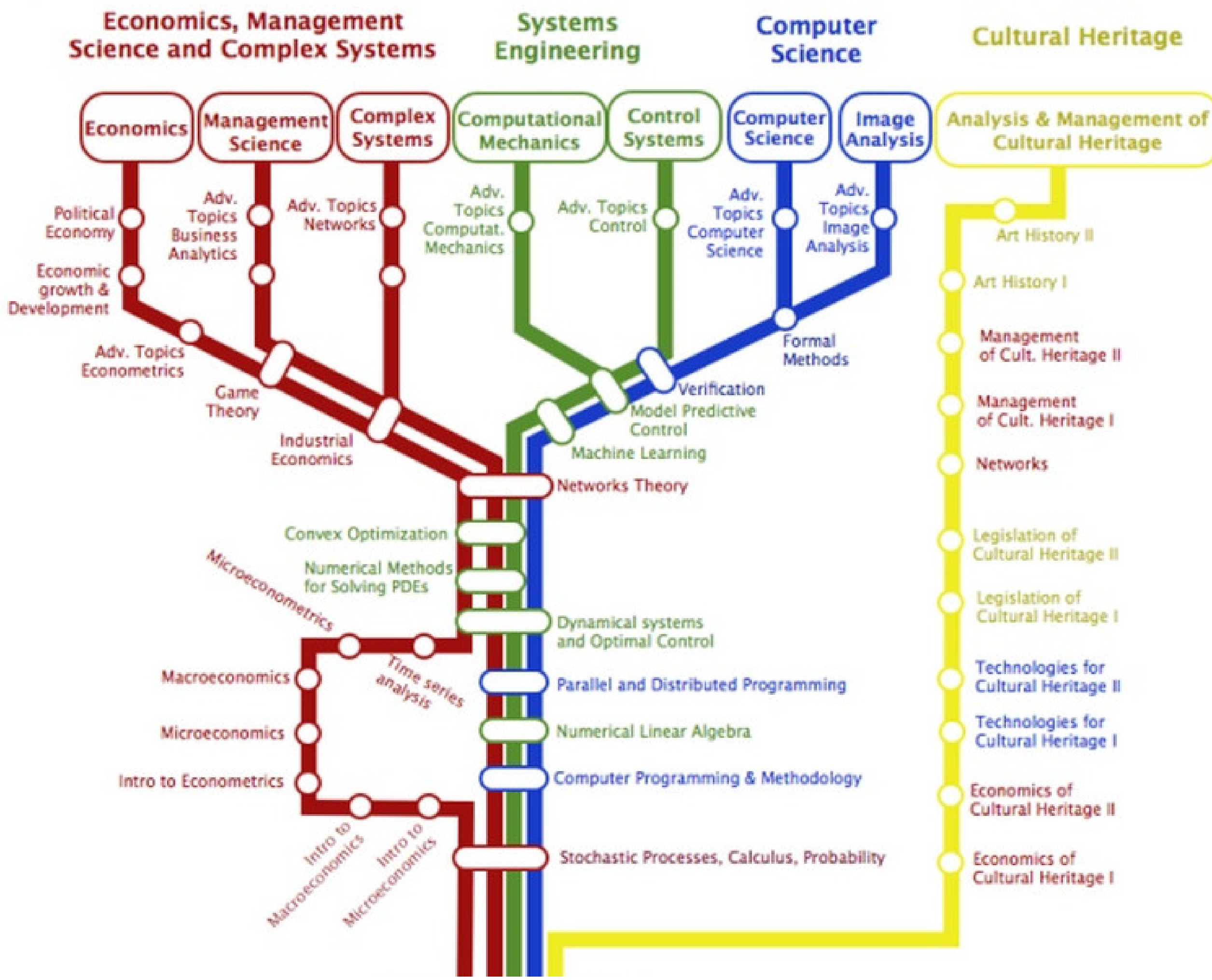


The bottom line – Data must be analyzed in context

Context of Data Analytics – Environment, Dependencies and Ecosystems

Data science without context is noise, context without measurable data is impotent.

Science without religion is lame, religion without science is blind – Albert Einstein



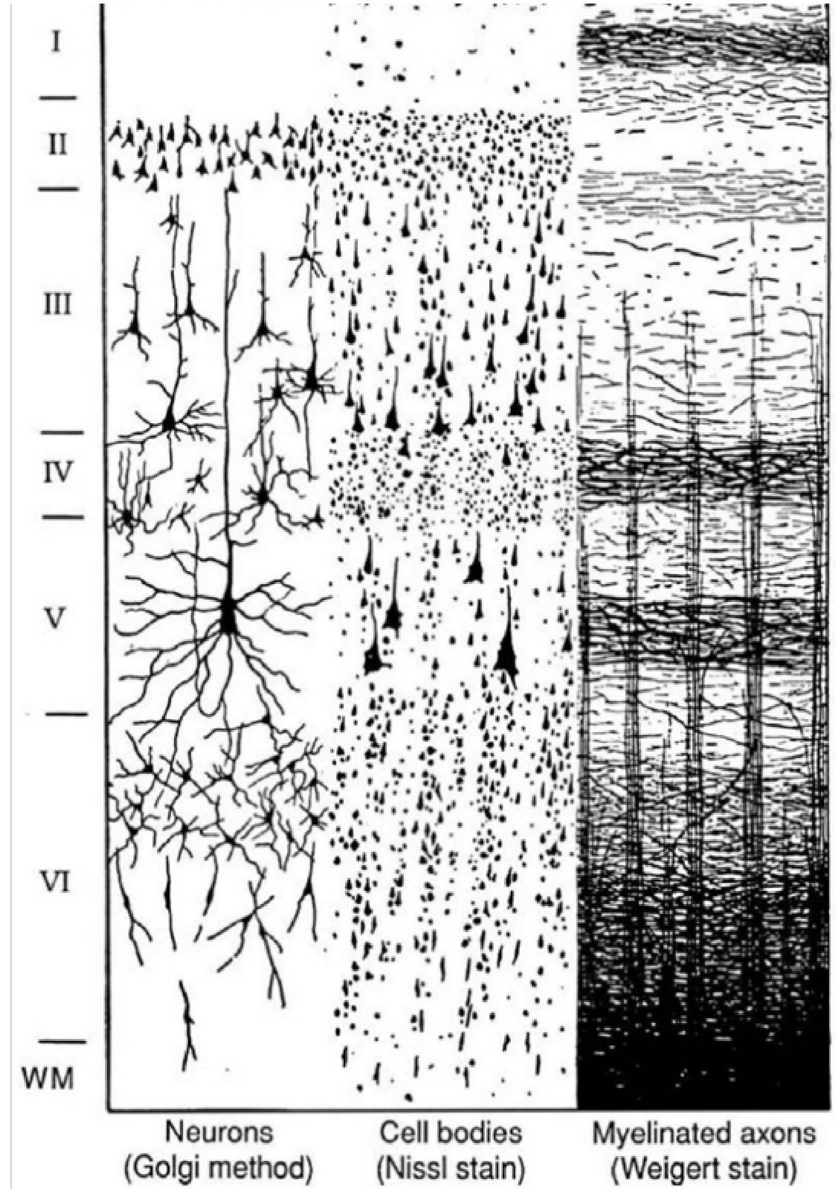
Think and Connect like a Neuron

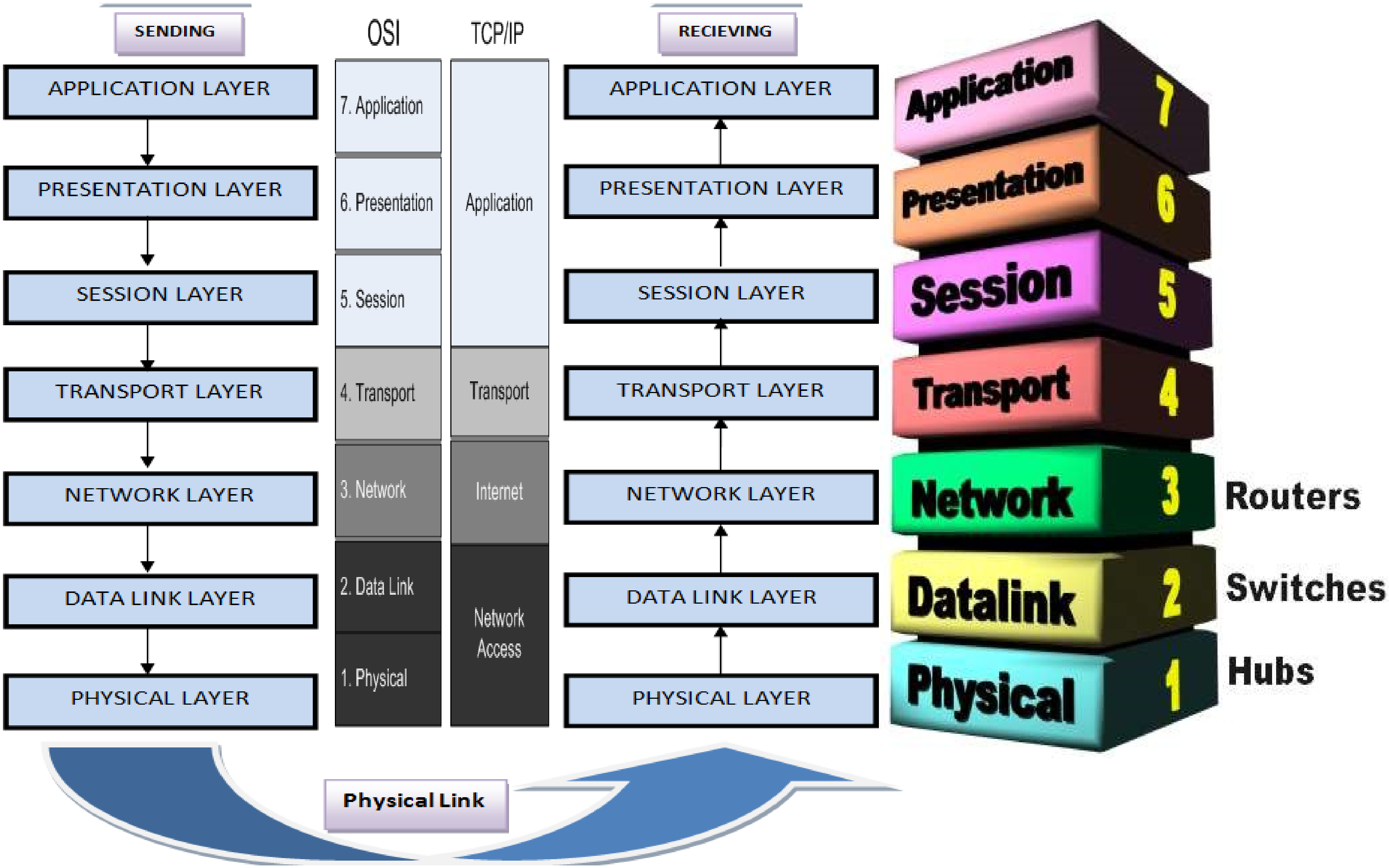
Extracting value from data analytics to generate information

Santiago Ramón y Cajal

Slice of neo-cortex, as identified by Cajal. Every cubic mm contains about 100,000 neurons and 2-4 km of axons and dendrites. Layers I-VII on the right = 2mm vertical distance.

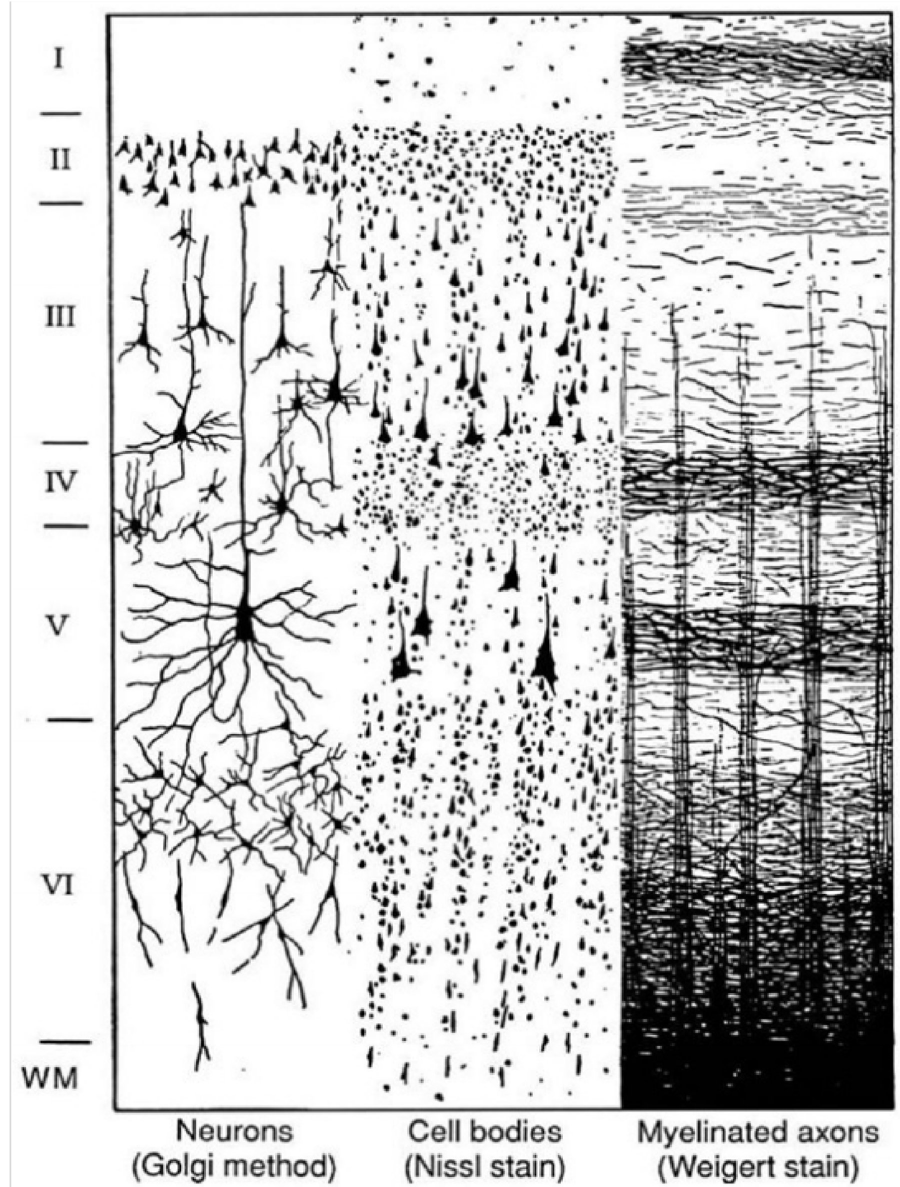
Born	1 May 1852 Petilla de Aragón, Navarre, Spain
Died	18 October 1934 (aged 82) Madrid, Spain

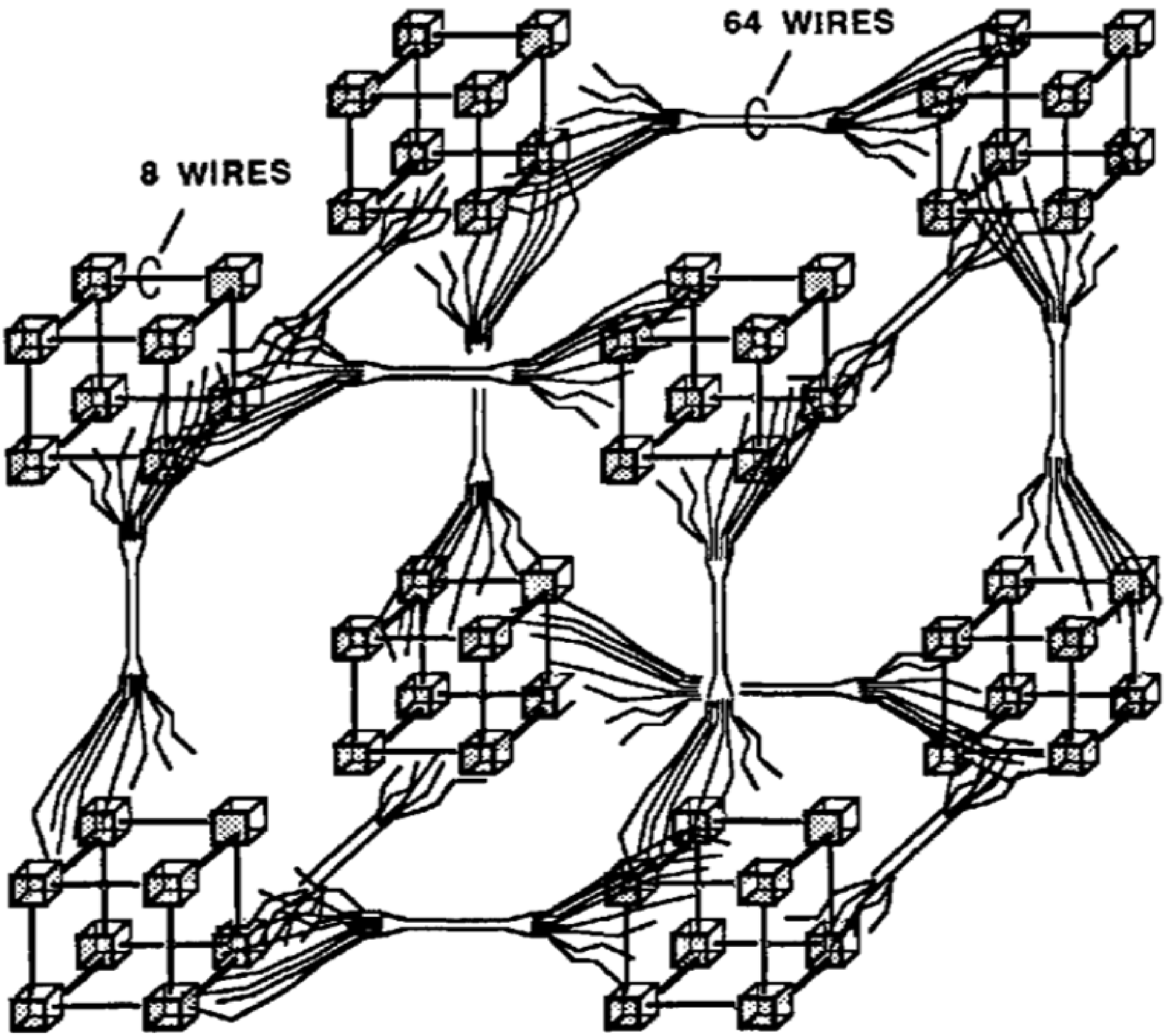



SENDING
OSI
TCP/IP
RECIEVING
APPLICATION LAYER
PRESENTATION LAYER
SESSION LAYER
TRANSPORT LAYER
NETWORK LAYER
DATA LINK LAYER
PHYSICAL LAYER
7. Application
6. Presentation
5. Session
4. Transport
3. Network
2. Data Link
1. Physical
Application
Transport
Internet
Network Access
APPLICATION LAYER
PRESENTATION LAYER
SESSION LAYER
TRANSPORT LAYER
NETWORK LAYER
DATA LINK LAYER
PHYSICAL LAYER
Application 7
Presentation 6
Session 5
Transport 4
Network 3
Datalink 2
Physical 1
Routers
Switches
Hubs
Physical Link

O S I MODEL

Host Layers	data	**application** Network Process to Application
	data	**presentation** Data Representation & Encryption
	data	**session** Interhost Communication
	segments	**transport** End-to-End Connections and Reliability
Media Layers	packets	**network** Path Determination & Logical Addressing (IP)
	frames	**data link** Physical Addressing (MAC & LLC)
	bits	**physical** Media, Signal and Binary Transmission





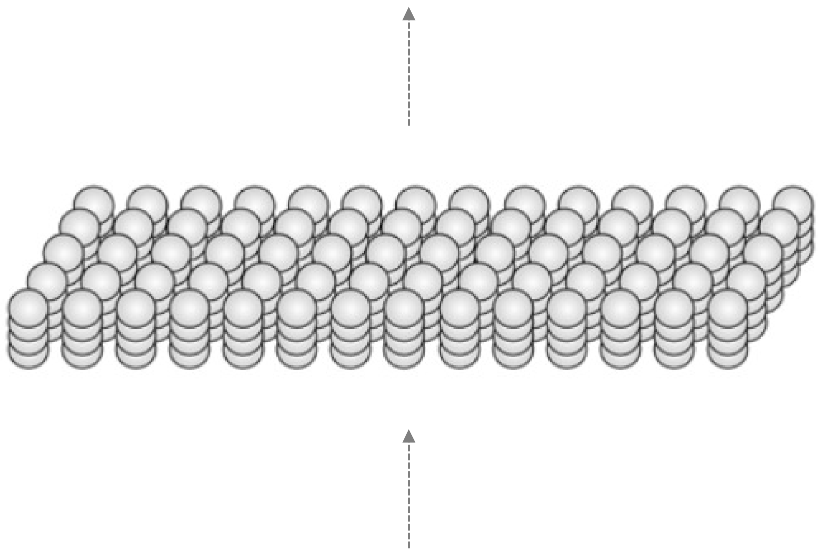
Here, 8 agents make a little cube, and 8 such cubes make a 64-agent supercube.

If we join 8 of these supercubes, we'll have 512 agents. And if we repeat this cube-on-cube pattern ten times, the resulting supercube will contain a billion agents!

But if we link each agent to 30 others instead of only 6, then each agent could communicate with a billion others in only 6 steps.

THE SOCIETY OF MIND
Marvin Minsky (1959)

Hierarchical Temporal Memory (HTM) integrates the semantics of time



Section of a HTM region, equivalent to 1 layer of neurons in the neocortical region (layer 3). Each 4-cell column connects to a subset of the input and each cell connects to other cells in the region (connections are not shown). The principle of this connectivity was abstracted in Minsky's cube-on-cube.

HTM (CLA) attributes include time and context – essential for many CPS (cyberphysical systems) applications and data analytics (context)

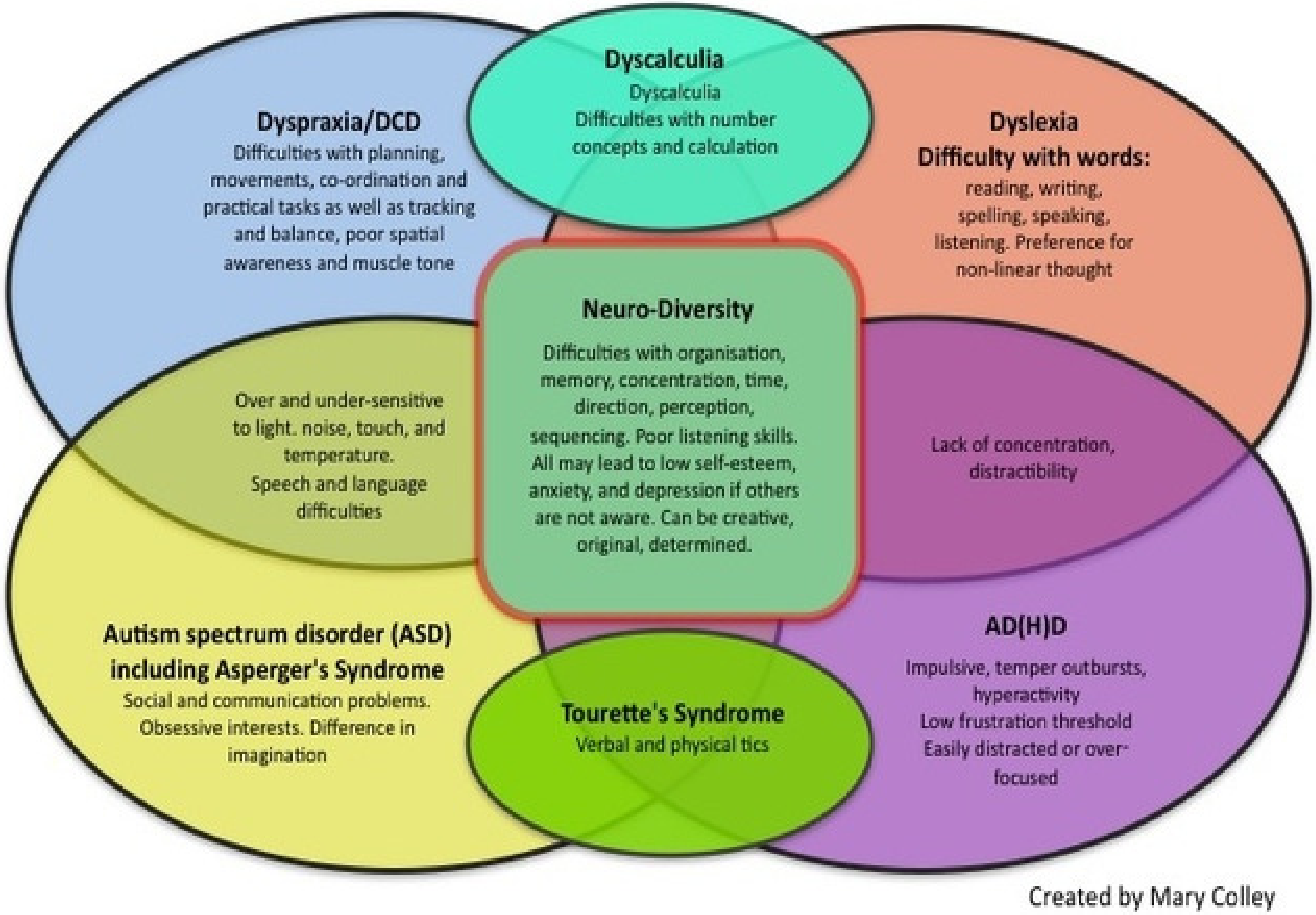
Hierarchical Temporal Memory (HTM) is a machine learning tool to capture the structural and algorithmic properties of the neocortex which is the seat of intelligent thought in the mammalian brain. High level vision, hearing, touch, movement, language and planning are performed by the neocortex. Given such a diverse suite of cognitive functions, the neocortex may be expected to implement an equally diverse suite of specialized neural algorithms. In reality, the neocortex displays a remarkably uniform pattern of neural circuitry. In other words, the neocortex implements a common set of algorithms to perform many different intelligence functions. It may be analogous to an abstraction which is used in a systemic context.

Programming HTM cortical learning algorithms require training through exposure to a stream of sensory data (capabilities are determined largely by exposure). HTM is a memory based ANN system. HTM networks are trained on time varying data and rely on storing a large set of patterns and sequences. A crucial distinction of HTM is embedded in the semantics of time which is an important element in applications relating to cyberphysical systems (CPS). Classic computer memory has a flat organization and does not have an inherent notion of time because the semantics of time are not available in the ISA (instruction set architecture). Therefore, in the classical programming environment, we can implement any kind of data organization and structure on top of the flat computer memory and control how and where information is stored.

HTM memory is more restrictive. HTM memory has a hierarchical organization and is inherently time based. Information is always stored in a distributed fashion. HTM user is expected to specify the size of the hierarchy and what to train the system on but the HTM controls where and how information is stored (data, patterns, text, sequences). Hence, HTMs are learning and prediction machines that can be applied to many types of problems through the inherent abstractions in the system. Although an HTM region is equivalent to only one portion of a neocortical region (layer 3), it can perform inference and prediction on complex data streams. Hence the significance of HTMs in data analytics in multiple domains or verticals.

Although neurons in the neocortex are highly interconnected, inhibitory neurons guarantee that only a small percentage of the neurons are active at one time. Thus, information in the brain is always represented by a small percentage of active neurons within a large population of neurons. This kind of encoding is called a “sparse distributed representation” where a small percentage of neurons are active at one time. “Distributed” refers to the fact that the activation of many neurons are required in order to represent something. A single active neuron conveys some meaning but it must be interpreted within the context of a population of neurons to convey the full or complete meaning relevant to the context.

Understanding the neurological basis of certain anomalies provides clues to information/data processing



Neurons connect to process data and information using the mechanism of pattern recognition

Syntactic Web

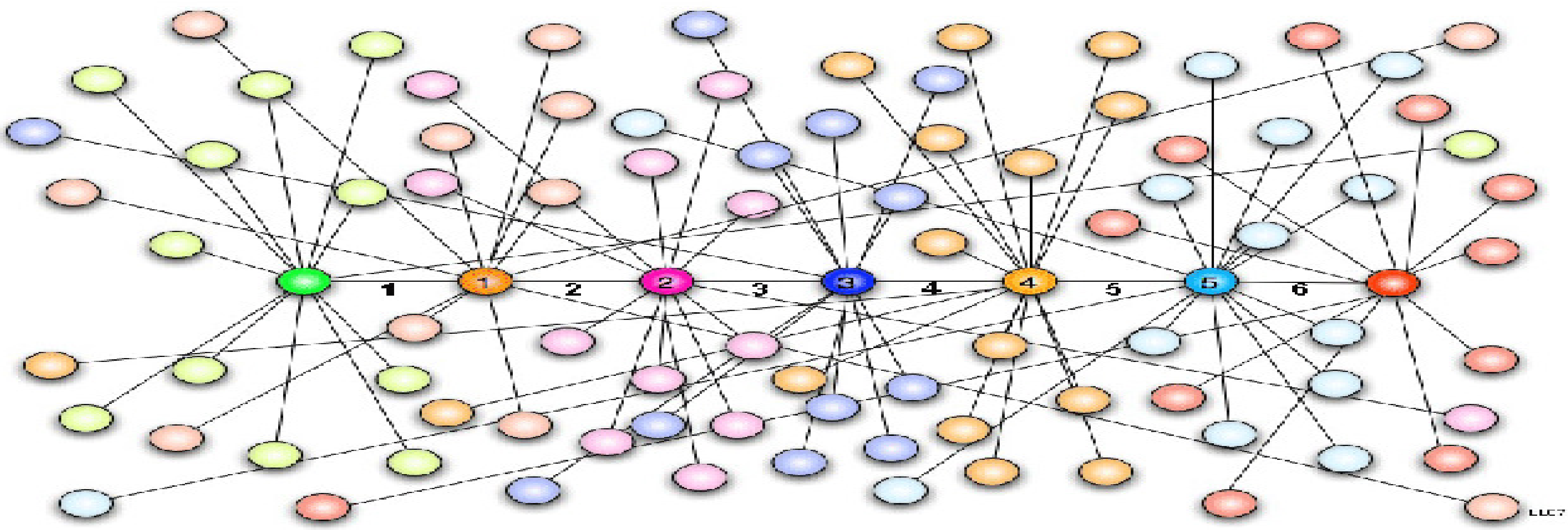
Semantic Web

Synapses can connect, converge and coalesce data from various regions to generate precise response

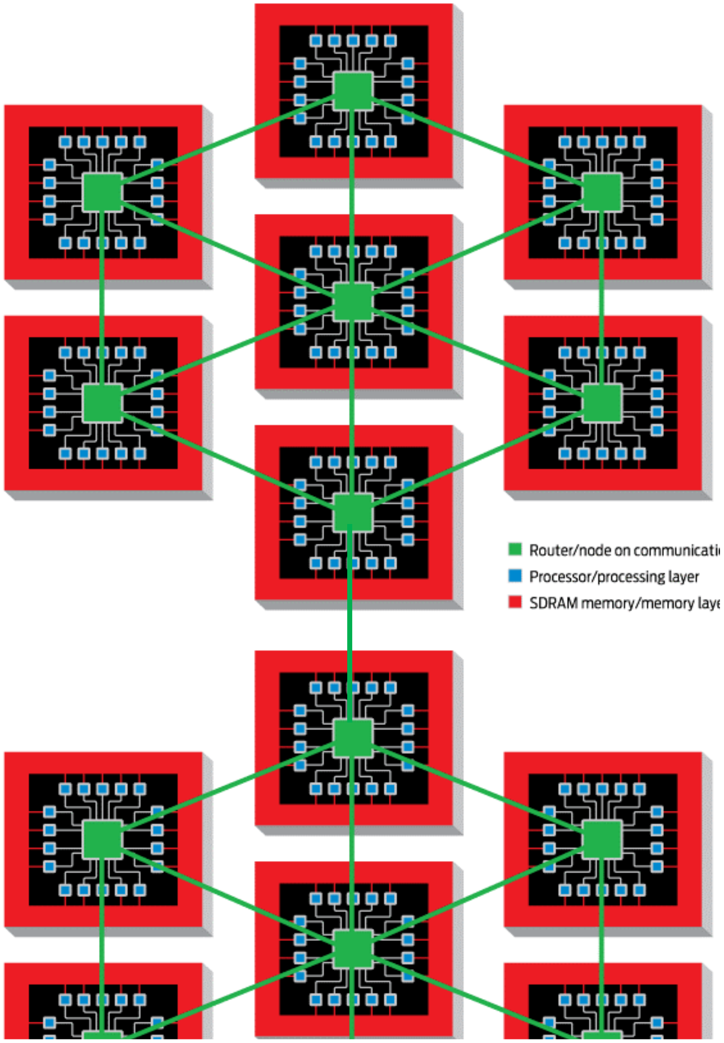
Syntactic Web

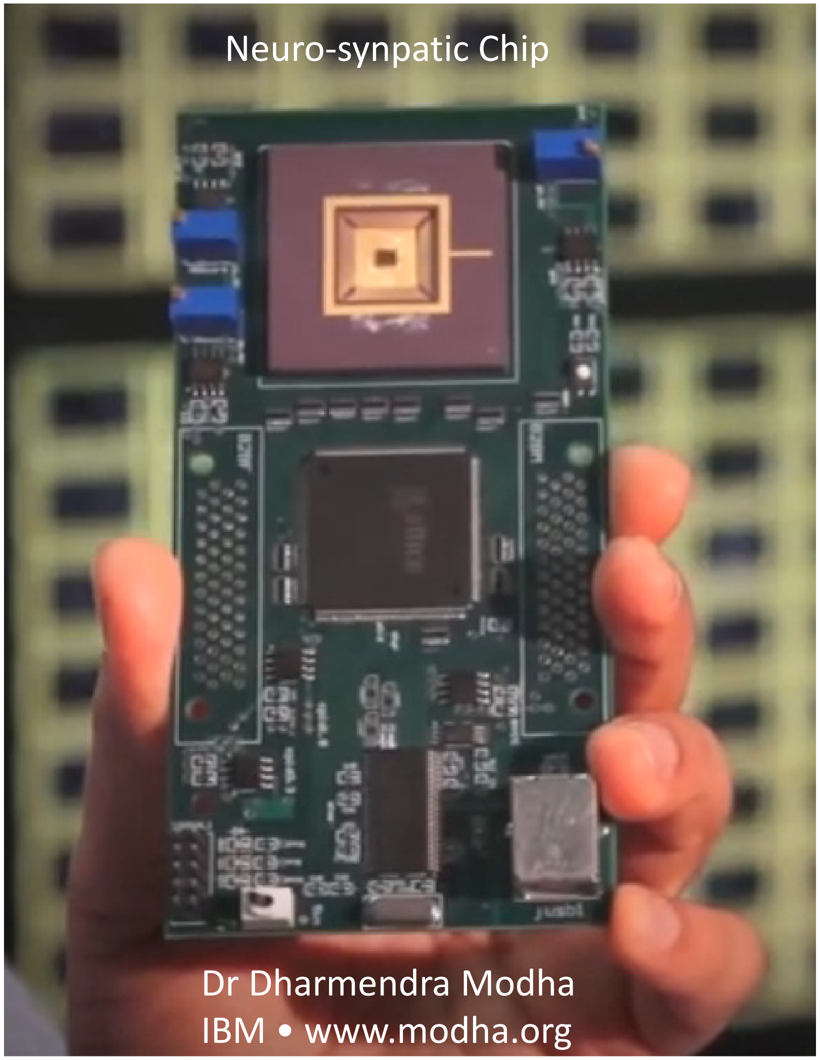
Semantic Web

Synaptic Web



Neuro-Synaptic Chips & Multi-core platforms for parallel processing of noisy, multi-modal, unstructured data



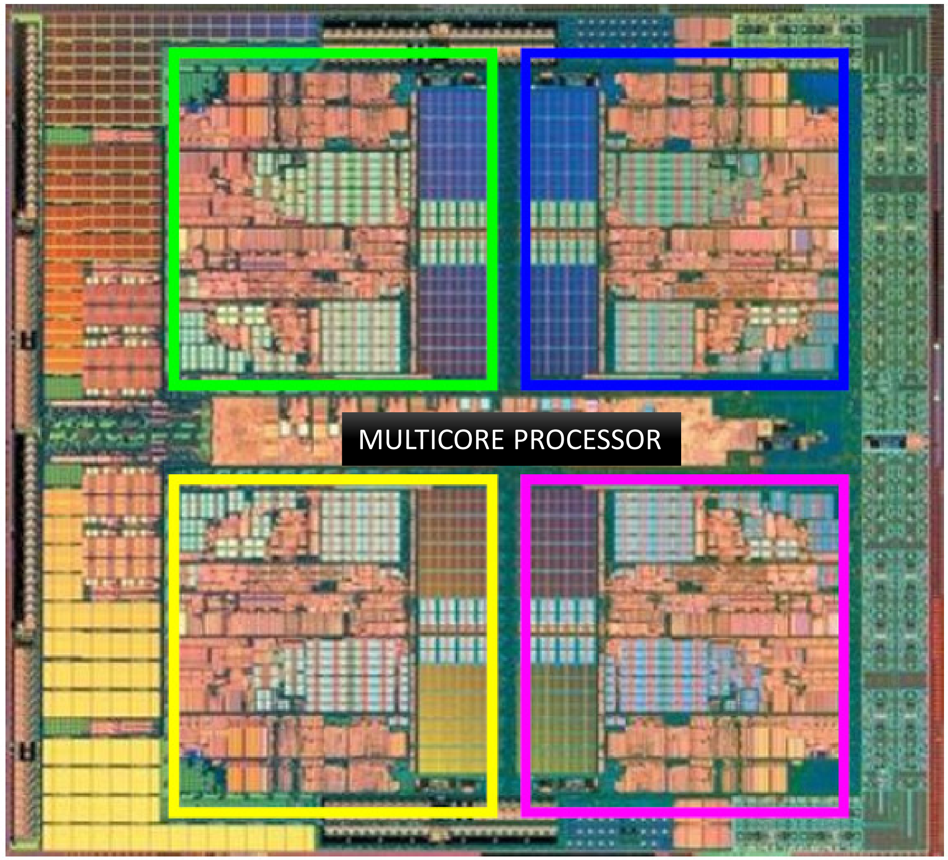


Industrial Internet applications of multi-core platforms: Embedded Fault Detection for Safety-Critical Systems

without reliance on the need for physical redundancy

Data Driven
Anomaly Detection

Model Based
Fault Detection



Software Monitors
FDI Supervisor

Control Algorithms
Signal Processing

Aviation Industry • in-flight monitoring data and aircraft maintenance based on data analytics

Design MOOC to offer ANN – HTM Training ?

Lets the MOOCs begin

Workforce Preparation

The Open Source Data Science Masters

Curriculum

Download ZIP

Download TAR

View On GitHub

This project is maintained by datasciencemasters

Ready?

The Open Source Data Science Curriculum

Start here. **Intro to Data Science** UW / Coursera

- *Topics:* Python NLP on Twitter API, Distributed Computing Paradigm, MapReduce/Hadoop & Pig Script, SQL/NoSQL, Relational Algebra, Experiment design, Statistics, Graphs, Amazon EC2, Visualization.

Data Science / Harvard Video Archive & Course

- *Topics:* Data wrangling, data management, exploratory data analysis to generate hypotheses and intuition, prediction based on statistical methods such as regression and classification, communication of results through visualization, stories, and summaries.

Data Science with Open Source Tools Book

- *Topics:* Visualizing Data, Estimation, Models from Scaling Arguments, Arguments from Probability Models, What you Really Need to Know about Classical Statistics, Data Mining, Clustering, PCA, Map/Reduce, Predictive Analytics
- *Example Code in:* R, Python, Sage, C, Gnu Scientific Library

Math

- **Linear Algebra & Programming**
  - Linear Algebra / Levandosky Stanford / Book $10
  - Linear Programming (Math 407) University of Washington / Course
- **Statistics**
  - Statistics I Princeton / Coursera
  - Stats in a Nutshell Book $29
  - Think Stats: Probability and Statistics for Programmers Digital & Book $25
  - Think Bayes Digital & Book $25
- **Differential Equations & Calculus**
  - Differential Equations in Data Science Python Tutorial
- **Problem Solving**
  - Problem-Solving Heuristics "How To Solve It" Polya / Book $10

Capstone Project

- Capstone Analysis of Your Own Design; Quora's Idea Compendium
- Healthcare Twitter Analysis Coursolve & UW Data Science

Resources

- DataTau - The "Hacker News" of Data Science
- Metacademy - Search for a concept you want to learn
- Coursera - Online university courses
- Wolfram Alpha - The smart number and info cruncher
- Khan Academy - High quality, free learning videos
- Wikipedia - The free encyclopedia
- The Signal and The Noise - Nate Silver Pop-Sci Data Analysis $15
- Zipfian Academy's List of Resources
- A Software Engineer's Guide to Getting Started with Data Science
- Data Scientist Interviews Metamarkets
- /r/MachineLearning Reddit

- **Algorithms**
  - Algorithms Design & Analysis I Stanford / Coursera
  - Algorithm Design, Kleinberg & Tardos Book $125
- **Distributed Computing Paradigms**
  - *See Intro to Data Science UW / Lectures on MapReduce
  - Intro to Hadoop and MapReduce Cloudera / Udacity Course *includes select free excerpts of Hadoop: The Definitive Guide Book $29
- **Databases**
  - SQL Tutorial w3schools / Tutorials
  - SQL Tutorial SQLZOO / Tutorials
  - Introduction to Databases Stanford / Online Course
- **Data Mining**
  - Mining Massive Data Sets Stanford / Digital & Book $58
  - Mining The Social Web Book $30
  - Introduction to Information Retrieval / Stanford Digital & Book $56

OSDSM Specialization: Web Scraping & Crawling

- **Machine Learning**
  - Machine Learning Ng Stanford / Coursera
  - A Course in Machine Learning UMD / Digital Book
  - Programming Collective Intelligence Book $27
  - The Elements of Statistical Learning / Stanford Digital^ & Book $80
  - Machine Learning Caltech / Edx
  - Neural Networks U Toronto / Coursera
- **Statistical Network Analysis & Modeling**
  - Probabilistic Programming and Bayesian Methods for Hackers Github / Tutorials
  - Probabalistic Graphical Models Stanford / Coursera
- **Natural Language Processing**
  - NLP with Python (NLTK library) Digital, Book $36
- **Analysis**
  - Python for Data Analysis Paper Book $24
  - Big Data Analysis with Twitter UC Berkeley / Lectures
  - Social and Economic Networks: Models and Analysis / Stanford / Coursera
- **Visualization**
  - Envisioning Information Tufte / Book $36
  - The Visual Display of Quantitative Information Tufte / Book $27
  - Data Visualization, CS 171 Harvard / Lectures
  - Data Visualization, CSE512 University of Washington / Slides
  - Scott Murray's Tutorial on D3 Blog / Tutorials
  - Berkely's Viz Class UC Berkeley / Course Docs
  - Rice University's Data Viz class Rice University

Python (Learning)

- Learn Python the Hard Way Digital & Book $23
- Python Class / Google
- Think Python Digital & Book $34
- Introduction to Computer Science and Programming MIT OpenCourseWare / Lectures

Python (Libraries)

Installing Basic Packages Python, virtualenv, NumPy, SciPy, matplotlib and IPython & Using Python Scientifically

More Libraries can be found in related specialiaztions

- **Data Structures & Analysis Packages**
  - Flexible and powerful data analysis / manipulation library with labeled data structures objects, statistical functions, etc pandas & Tutorials Python for Data Analysis / Book
- **Machine Learning Packages**
  - scikit-learn - Tools for Data Mining & Analysis
- **Networks Packages**
  - networkx - Network Modeling & Viz
- **Statistical Packages**
  - PyMC - Bayesian Inference & Markov Chain Monte Carlo sampling toolkit
  - Statsmodels - Python module that allows users to explore data, estimate statistical models, and perform statistical tests
  - PyMVPA - Multivariate Pattern Analysis in Python
- **Natural Language Processing & Understanding**
  - NLTK - Natural Language Toolkit
  - Gensim - Python library for topic modelling, document indexing and similarity retrieval with large corpora. Target audience is the natural language processing (NLP) and information retrieval (IR) community.
- **Live Data Packages**
  - twython - Python wrapper for the Twitter API
- **Visualization Packages**
  - Orange - Open source data visualization and analysis for novice and experts. Data mining through visual programming or Python scripting. Components for machine learning. Add-ons for bioinformatics and text mining
- **iPython Data Science Notebooks**
  - Data Science in IPython Notebooks (Linear Regression, Logistic Regression, Random Forests, K-Means Clustering)

Big Data has become big business

Professionals with strong analytical skills are in high demand.

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Business Analytics
Curriculum
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Finance
Financial Planning
Human Factors in Information

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Master of Business Analytics

Data analytics, often referred to as "Big Data," is an emerging and immensely powerful resource for businesses and other organizations, especially because of its predictive capabilities.

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Develop the quantitative sophistication that can lead to leadership within multiple industries waking up to the power of big data.

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Predictive Analytics

- Program Overview
- Curriculum
- Course Schedule
- Faculty
- Admission
- Tuition and Financial Aid
- Registration Information
- Career Options
- Program Overview
- Change Program

Graduate Options

- Featured Faculty

Program Overview:

Master of Science in Predictive Analytics Online

"Big Data." You can find the term everywhere in the media tied to growth and innovation across the public and private sectors in nearly every major industry. But what does "Big Data" really mean? More importantly, how can organizations benefit from it? With new data acquisition technologies come vast new sources of data that can be analyzed to enhance organizational effectiveness, customer service, returns on investment, and a myriad of other business goals.

The Master of Science in Predictive Analytics (MSPA) program, established in 2011, is a fully online part-time graduate program, one of the first to offer dedicated training in data science. Fully accredited graduate-level courses cover business management and communications, information technology, and modeling. Small class sizes promote extensive online interaction among students and our elite faculty, who possess extensive education and business experience. Students gain critical skills for succeeding in today's data-intensive world, including business case study, data analysis, and making recommendations to management. They learn how to utilize database systems (SQL and NoSQL) and analytics software built upon R, Python, and SAS. They learn how to make trustworthy predictions using traditional statistics and machine learning methods. With a wide range of elective courses to choose from, students can customize their studies across a variety of data science disciplines, including marketing analytics, risk analytics, text analytics, and web and network data science. Special topic electives are offered each term, providing additional study opportunities, including decision analytics, financial market models and time series forecasting, sports analytics, geographical information systems, operations management, mathematical programming, simulation methods, and analytics for total quality management. All courses are available in an asynchronous online format, with recorded lectures and tutorials. Find out more about online learning at SCS.

Core Courses:

- LEADERS 481-DL Leadership
- PREDICT 400-DL Math for Modelers
- PREDICT 401-DL Statistical Analysis
- PREDICT 402-DL Analytics and Data Collection
- PREDICT 410-DL Predictive Modeling I
- PREDICT 411-DL Predictive Modeling II
- PREDICT 413-DL Time Series and Forecasting
- PREDICT 420-DL Database Systems
- PREDICT 422-DL Practical Machine Learning
- PREDICT 475-DL Project Management
- PREDICT 498-DL Capstone Project
- PREDICT 590-DL Thesis Research

Elective Courses:

- PREDICT 412-DL Advanced Modeling Techniques
- PREDICT 450-DL Marketing Analytics
- PREDICT 451-DL Risk Analytics
- PREDICT 452-DL Web Analytics
- PREDICT 453-DL Text Analytics
- PREDICT 455-DL Data Visualization
- PREDICT 490-DL Special Topics

Berkeley School of Information | ABOUT | ADMISSIONS | ACADEMICS

datascience@berkeley

FOUNDATION COURSES (15 UNITS)	UNITS
Research Design and Application for Data and Analysis	3
Exploring and Analyzing Data	3
Storing and Retrieving Data	3
Introduction to Machine Learning	3
Visualizing and Communicating Data	3
ADVANCED COURSES WILL INCLUDE (9 UNITS)	
Really Big Data: Scaling up and Parallelism	3
Experiments and Experimentation with Data	3
Privacy, Security, and Ethics of Data	3
CAPSTONE COURSE (3 UNITS)	
Synthetic Capstone Course	3

Beyond Data

Science and Engineering MOOC

IRA A. FULTON SCHOOLS OF engineering
ARIZONA STATE UNIVERSITY

Core Courses:
Students must select seven (7) core courses

- IEE 556 Introduction to Systems Engineering
- IEE 505 Information Systems Engineering
- IEE 512 Introduction to Financial Engineering
- IEE 530 Enterprise Modeling
- IEE 541 Engineering Administration
- IEE 545 Simulating Stochastic Systems
- IEE 552 Strategic Technologic Planning (management course meeting MEng requirements)
- IEE 572 Design of Experiments (math course meeting MEng requirements)
- IEE 574 Applied Deterministic Operations Research

Elective Courses:
Select two electives from one area:

Software:

- CSE 563 Software Requirements and Specifications
- CSE 566 Software Project, Process and Quality Management
- CSE 561 Modeling and Simulation Theory and Application
- CSE 598 Software Analysis and Design

Hardware:

- EEE 581 Filtering of Stochastic Processes
- EEE 582 Linear System Theory
- EEE 585 Digital Control Systems
- EEE 586 Nonlinear Control Systems
- EEE 587 Optimal Control Systems

Capstone:
- IEE 593 Applied Project - Systems Engineering

Distance Learning

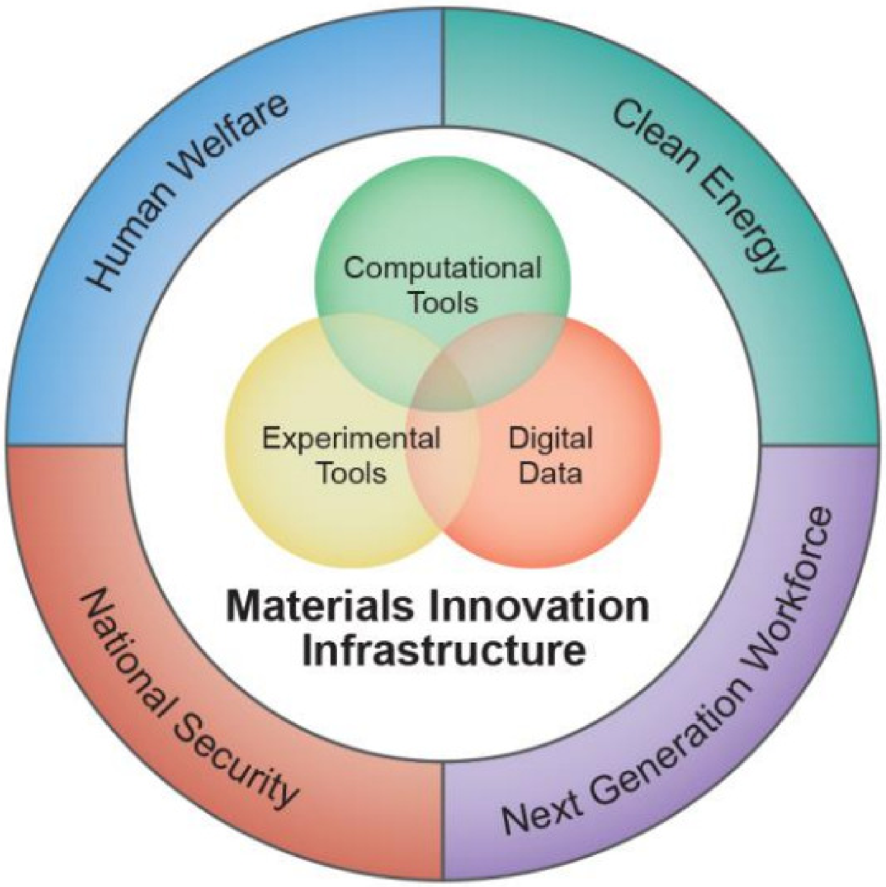
The medical physics degree program is available to distance-learning students at Georgia Tech. All of the required courses and some of the elective courses are offered via distance learning. For most classes video cameras record faculty lectures and student-faculty interaction during regular, semester-long graduate classes. The videotapes and supporting course materials are sent to off-campus students for viewing at their convenience. For classes involving a laboratory component (e.g. MP 6757, MP 6203, MP 6204), distance learning students are expected to travel to Georgia Tech on select weekends to complete the laboratories.

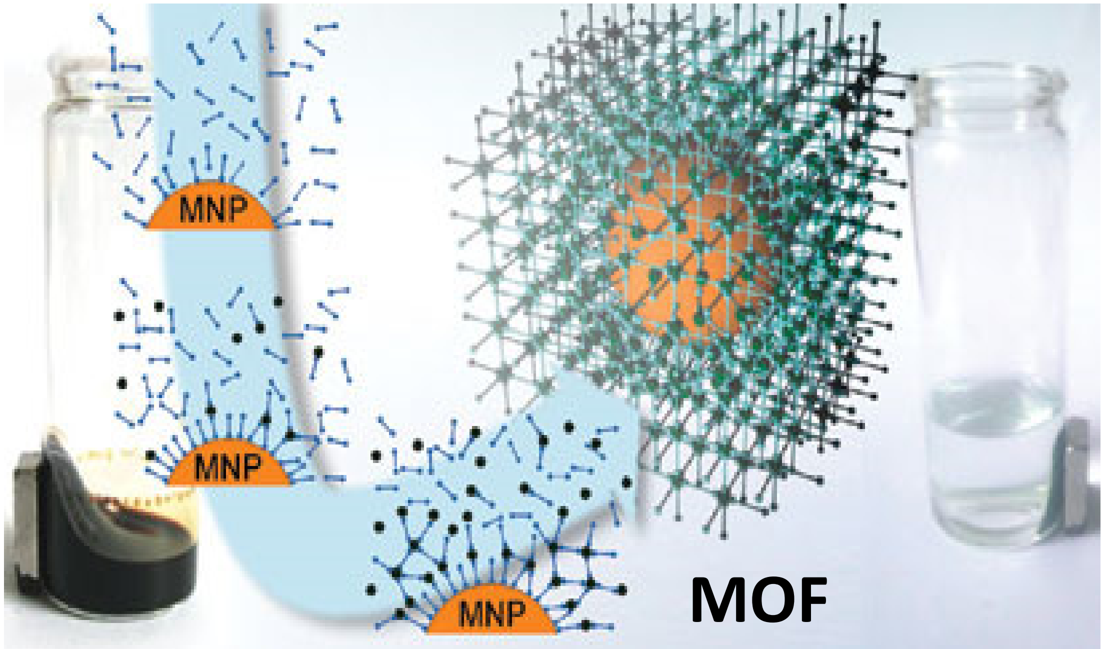
The admission criteria and degree requirements for distance-learning students are the same as those for on-campus students with the exception of the clinical rotation, which is to be fulfilled at a hospital or clinic close to the student's place of residence and as approved by the Georgia Institute of Technology. The internship policy for the distance learning students is detailed on the Clinical Rotation Page.

Procedures and Forms

- Student Evaluation From (Form A)
- Laboratory/task Substitution Form (Form B)
- Distance Learning Facility Information Form (Form C)
- Distance Learning Form of Intent (Form D)
- Distance Learning Authorization Form (Form E)
- Distance Learning Supervisor Agreement Form (Form F)
- Task Completion Form (Form G)
- Task List Approval Form (Form H)
- DL facility MOU

We live in a material world – think graphene, think metal-organic frameworks





Material Genome Initiative (White House, June 2014)

Chemistry is the Central Science – The US Material Genome Initiative

WORKFORCE DEVELOPMENT

	National Security	Human Health and Welfare	Clean Energy Systems	Infrastructure and Consumer Goods
Biomaterials	○	•	○	•
Catalysts	○	•	•	•
Polymer Composites	•	•	○	•
Correlated Materials	•	○	•	•
Electronic and Photonic Materials	•	○	•	•
Energy Storage Systems	•	•	•	•
Lightweight and Structural Materials	•	•	•	•
Organic Electronic Materials	○	•	○	•
Polymers	○	•	○	•

• Primary ○ Secondary www.nist.gov/mgi/upload/MGI-StrategicPlan-2014.pdf

How can MOOC help?
What types of courses?
What forms of training?
What are the pre-requisites?
How relevant is this to Taiwan?

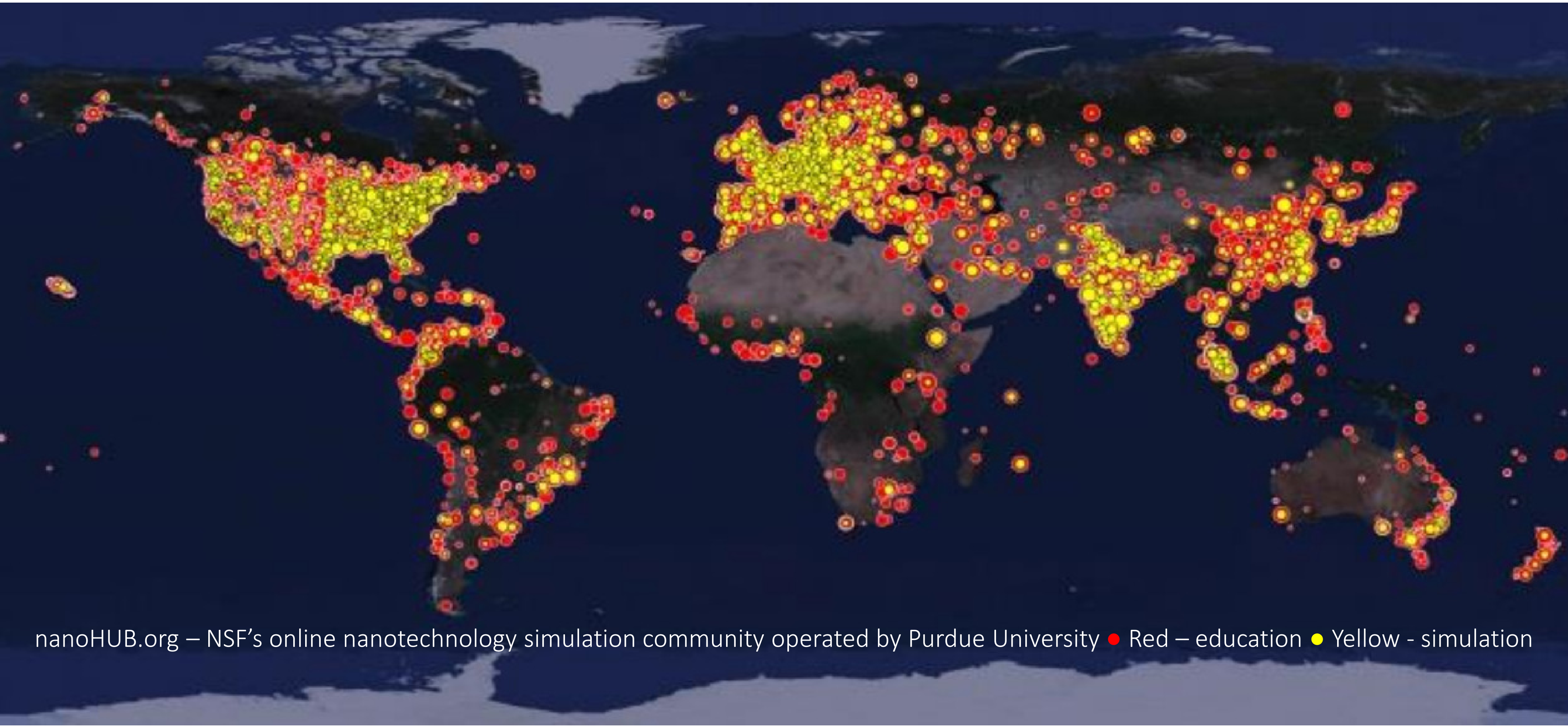
Material Genome Initiative (MGI) may mimic nanoHUB Software Network

The development and distribution of software tools by the Materials Genome Initiative could emulate the nanoHUB.org, an online nanotechnology simulation community developed and operated by the US NSF's Network for Computational Nanotechnology at Purdue University.

NanoHUB empowers a worldwide community cloud-based scientific computing and educational resources, providing a library of over 3,300 seminars, tutorials and teaching materials to a global community of 257,000.

NanoHUB's impact on research is demonstrated by more than 1,030 citations in the scientific literature and over 6,000 secondary citations. Furthermore, nanoHUB makes more than 270 constantly evolving simulation and modeling tools universally accessible and useful via fully interactive sessions in the cloud. Some 12,500 users run more than 430,000 simulations annually without any software installation, by using a web browser. Additionally, nanoHUB simulations are used at more than 180 institutions in formal classroom training that has reached 19,000 students to date. The image (next) depicts the 250,000 users participating in nanoHUB as of 02/2013.

Material Genome Initiative (MGI) may mimic nanoHUB Software Network



nanoHUB.org – NSF's online nanotechnology simulation community operated by Purdue University ● Red – education ● Yellow - simulation

Pharmaceutical Chemistry Online

Enroll in a Master's of Science Degree in Pharmaceutical Chemistry from the University of Florida, College of Pharmacy! Join a growing number of scientists who are receiving their graduate science degrees from the University of Florida's prestigious online programs.

Pharmaceutical Chemistry - Educated Inspiration

- Master a challenging field of science
- Prepare for or enhance a career in pharmaceutical innovation and regulation
- Contribute to life saving remedies and enhance the speed of delivery of new medications
- Translate your personal experiences to benefit others

Course #	Course Title	Credits
PHA 6432	Fundamentals of Pharmaceutical Chemistry	1
PHA 6535	Principles of Nucleotide Activity	2
PHA 6417 PHA 6935	Pharmaceutical Analysis 2 **OR** Organic Structure Elucidation	3
VME 6766	Laboratory QA/QC	3
PHA 6444	Pharmaceutical Chemistry 1	3
PHA 6543	Pharmaceutical Chemistry 2	3
PHA 6935	Metabolic Biochemistry	3
PHA 6425	Drug Biotransformation & Molecular Mechanisms of Toxicity	3
VME 6650	Mammalian Pharmacology	4
PHA 6471 PHA 6935	Synthetic Medicinal Chemistry **OR** Introduction to Medical Bioethics	3
PHA 6354 PHA 6357	Natural Medicinal Products **OR** Herbal and Dietary Supplements	3
PHA 6936	Special Topics in Pharmaceutical Chemistry	1

WORKFORCE DEVELOPMENT

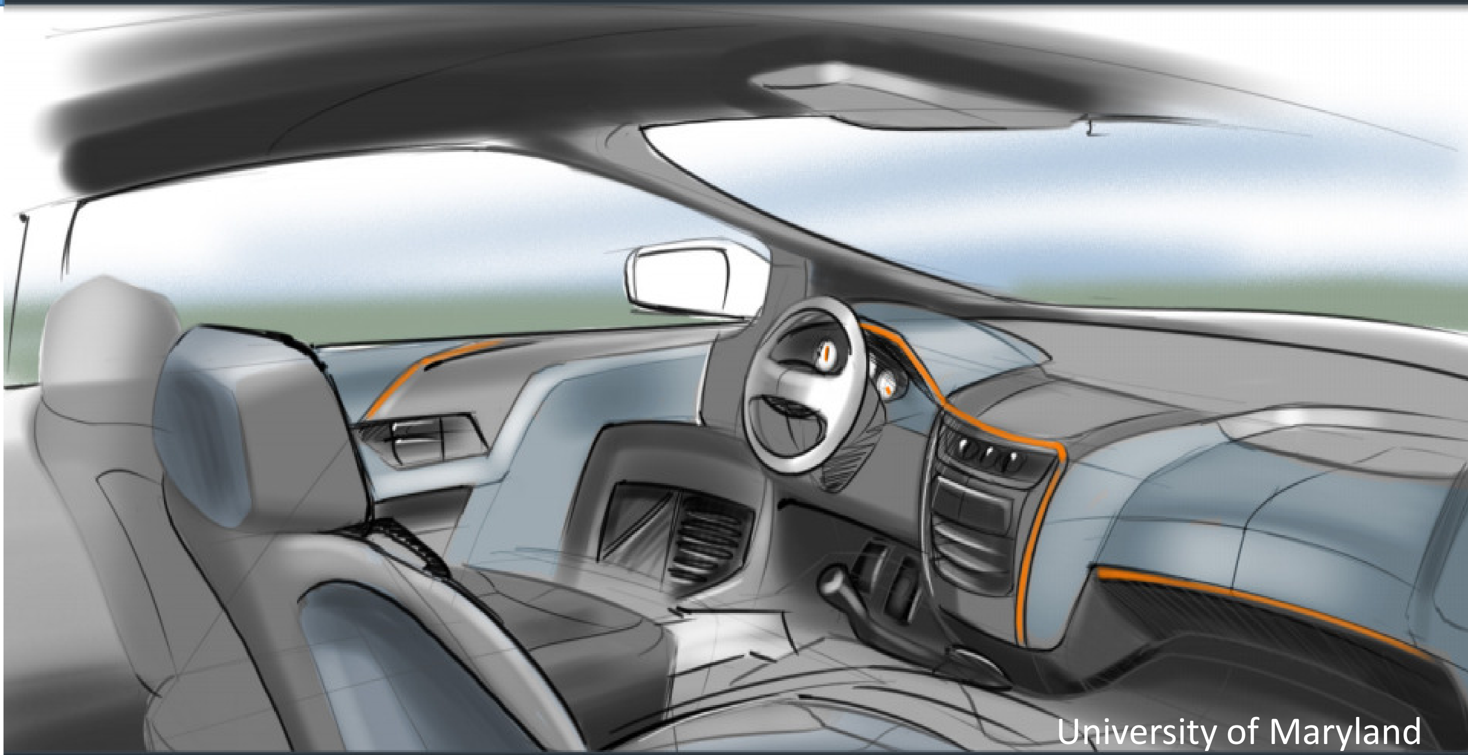
How can MOOC help?
What types of courses?
What forms of training?
What are the pre-requisites?
How relevant is this to Taiwan?

Can MOOC fast track imagination, invention and innovation?

Learn the basics on your own time, all classes are creative labs, evolve as an entrepreneur

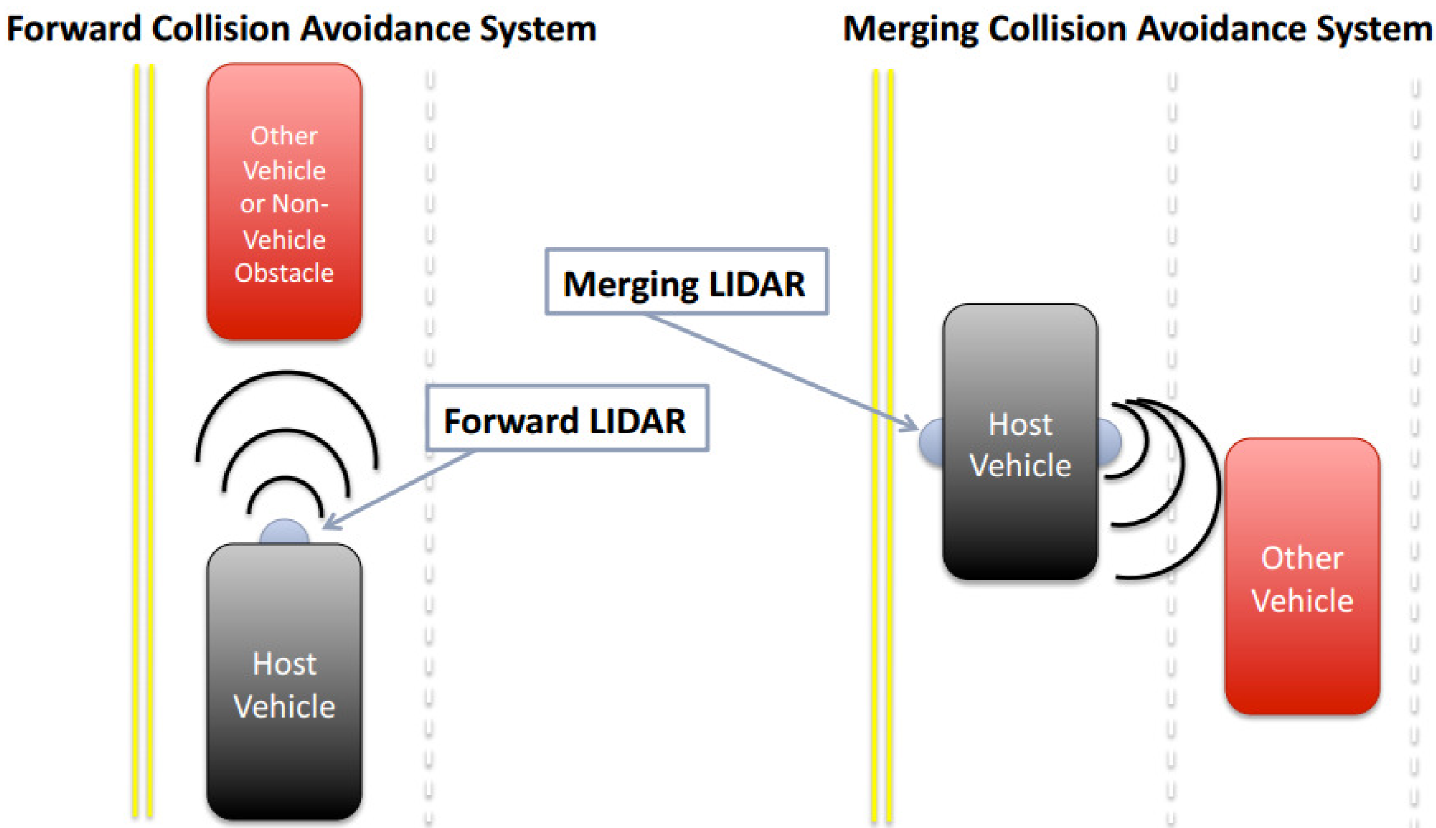
Not a class but a hands-on class project at UMD

Automobile Collision Avoidance System (ACAS)

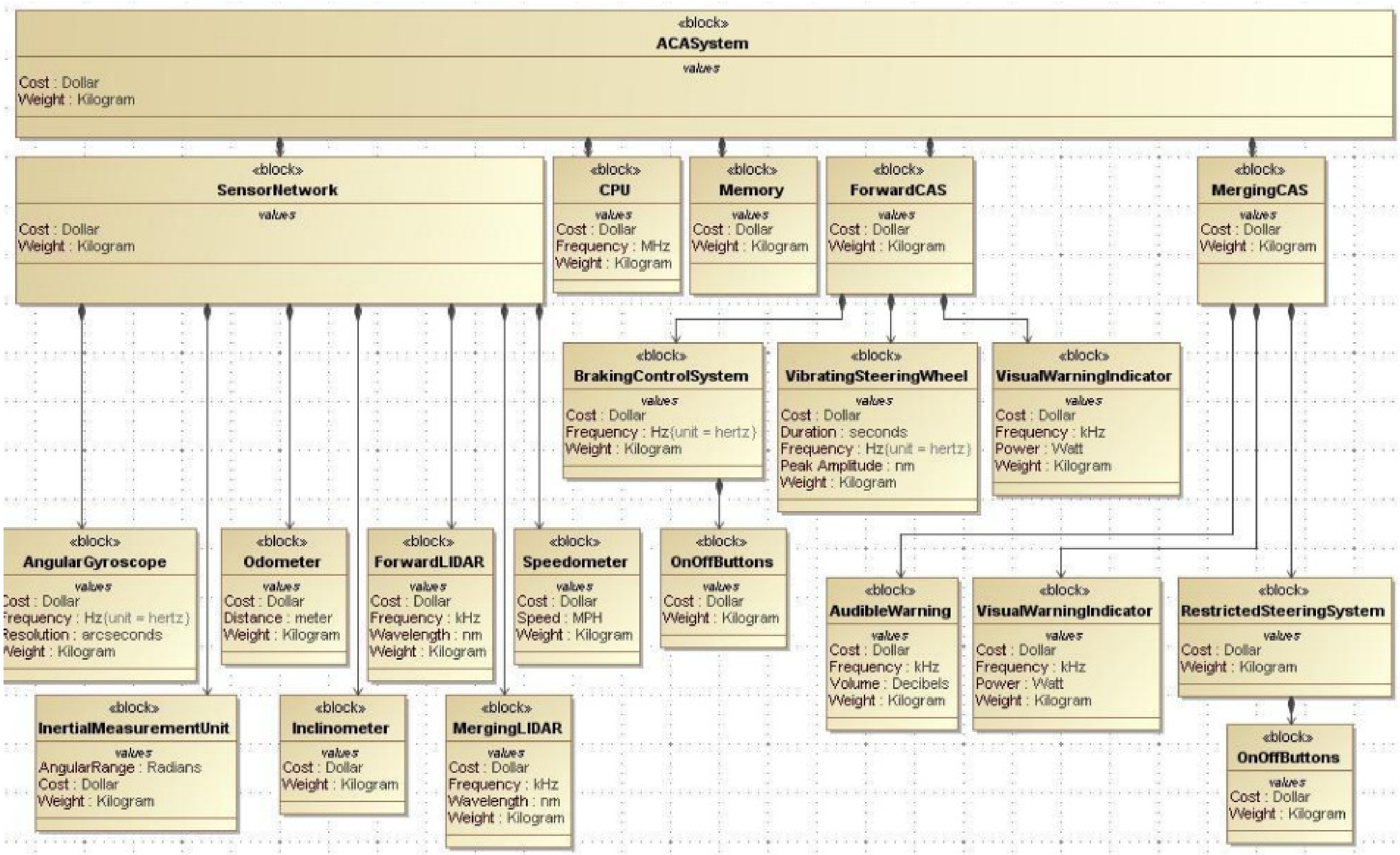


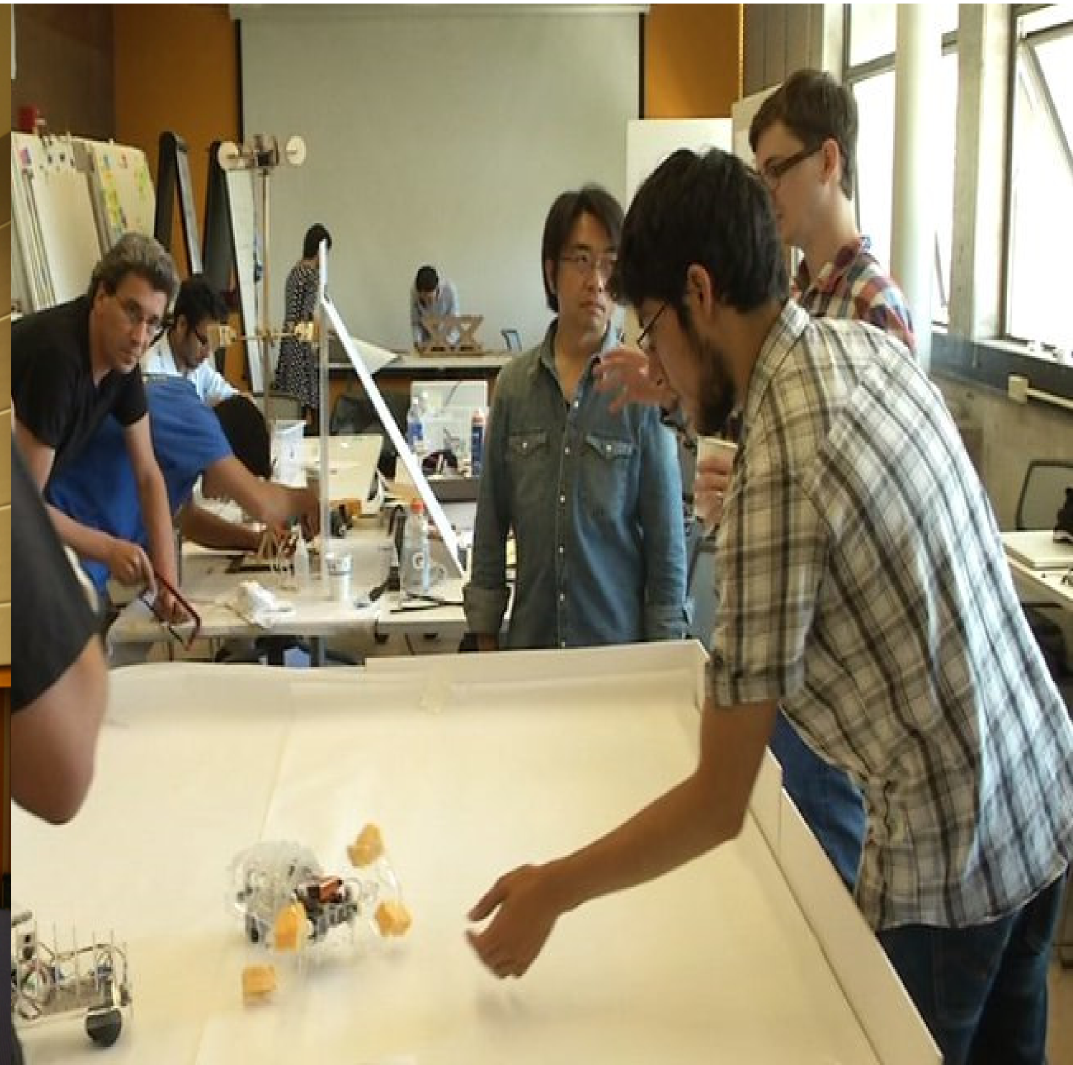
Adi Lang, Deepa Jonnagadla, Alex Atahua & Andy Hammond

UMD Mid Term Project – According to the US NHTSA ~40,000 are killed due to automobile collision. We will design a system to avoid collision.



UMD Mid Term Project – According to the US NHTSA ~40,000 are killed due to automobile collision. We will design a system to avoid collision.





POST-MOOC panacea or post-modern optimism? Little bit of both ?

Agriculture Classroom

Agriculture Laboratory

Discussion

- History
- Context
- Purpose
- Economy
- Denominator
- Data
- Conclusion

Analysis – The Value of MOOCs depends on context and purpose

Dikran W. Kassabian Published on Monday, June 16, 2014

MOOCs may not yet (and may not ever) be the "game changers" for higher education that some predicted. The chance to pursue university mission goals through a high-profile development in higher education that promotes university image, gives some members of the faculty a much larger audience and is perceived positively by a public seeking increased connection with an otherwise exclusive university, is an opportunity too good to pass up.

The exuberance of 2012 has faded, replaced by the skepticism of 2014, but at the early adopter universities, MOOCs appear poised to play an important role in the higher education picture for at least the next few years, perhaps beyond, with a strong value proposition: supporting the goal of improving on-campus teaching and learning while also promoting the university and its faculty. At the same time, the elite universities connect with the public through educational outreach, demonstrating leadership in an emerging higher education learning technology related to jobs.

Followers of MOOC may find it prudent to discard the penchant for best practices. If you have or if you can create a game-changing potential, then, past development challenges are a poor guide to your future development pathway.

Your Focus – What, Where, How, When vs MOOC, GDP, Jobs, Education

Dr Shoumen Palit Austin Datta ● SVP, Industrial Internet Consortium (www.iiconsortium.org) ● Research Affiliate, School of Engineering, Massachusetts Institute of Technology ● http://bit.ly/S-Datta ● shoumen@mit.edu

Watch and avoid stupidity → *example*

Watch: a viral economics course that can be completed in one sitting

Image Credit: Flickr User LendingMemo

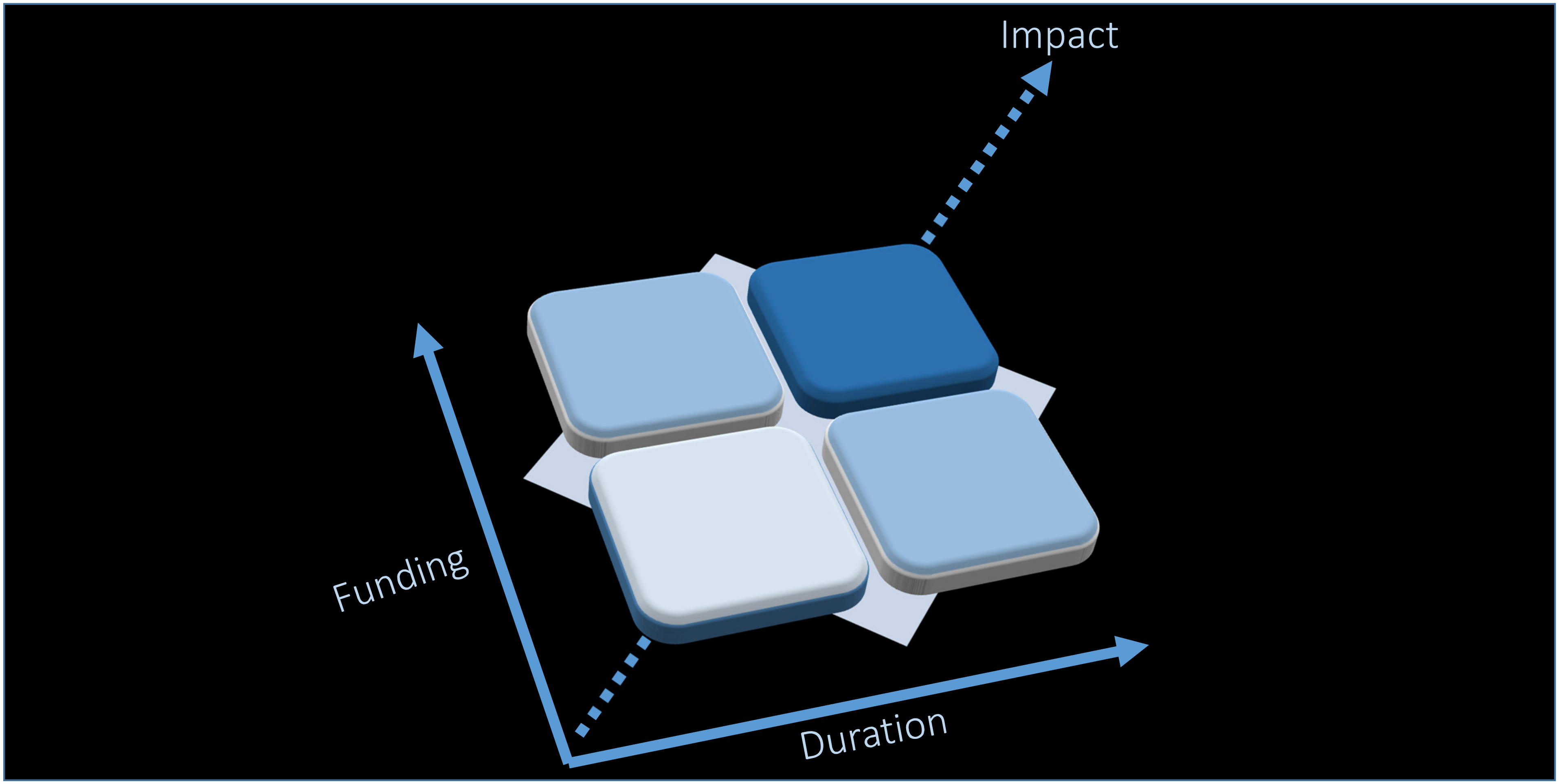
June 26, 2014 11:30 AM
Gregory Ferenstein

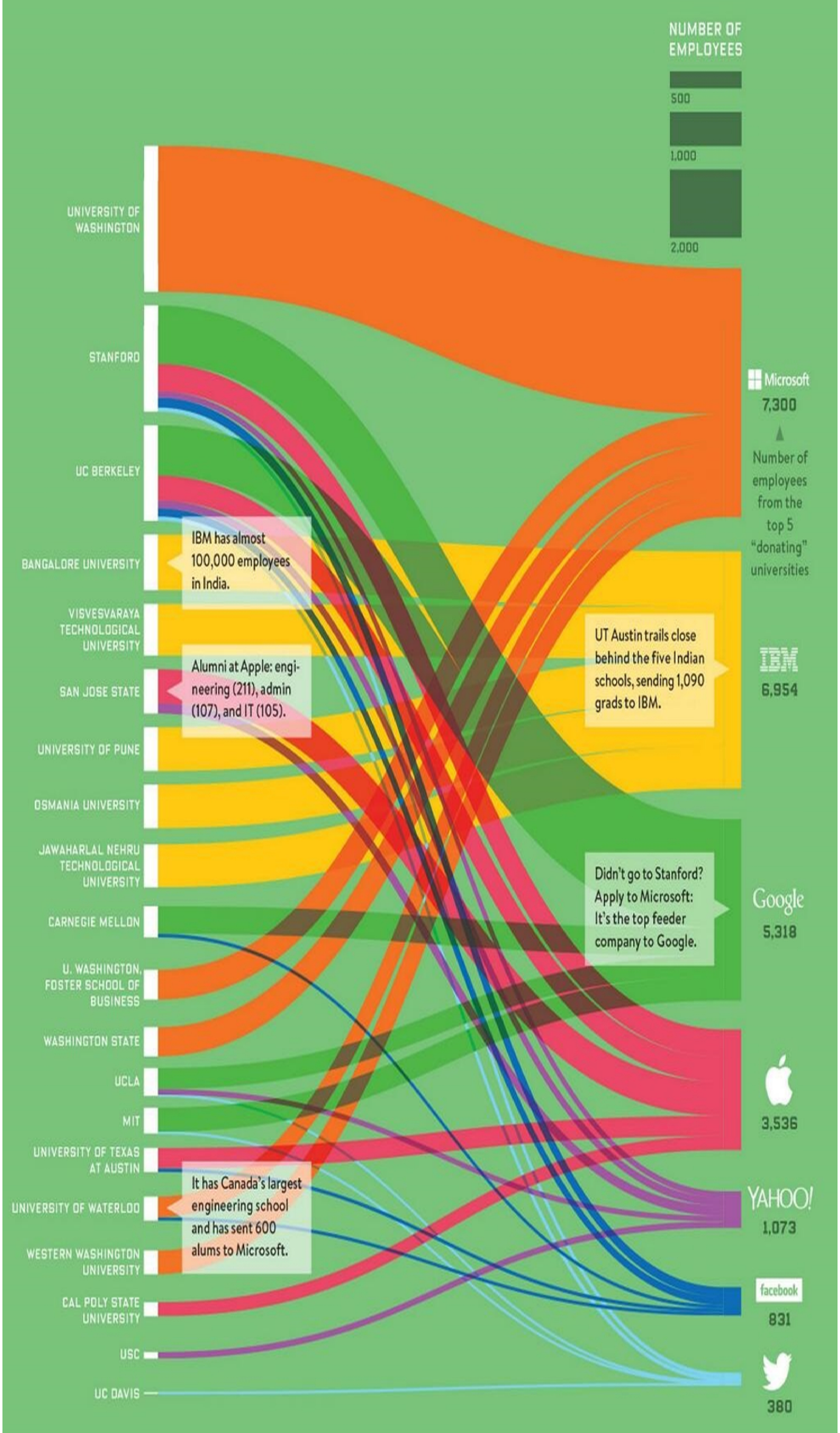
83 125 2 26 1 0

The next frontier in higher education may be viral courses that can be completed in a single day. One of my favorite economists, Tyler Cowen of Marginal Revolution, is out with a new course on “Everyday Economics”, complete with short quizzes and eye-candy visual lectures.

Dr Shoumen Palit Austin Datta
Senior Vice President, Industrial Internet Consortium
Research Affiliate, School of Engineering, Massachusetts Institute of Technology

Are you asking the correct questions? There are no quick fixes, there are no rapid returns but there are costly band-aids.





NUMBER OF EMPLOYEES
500
1,000
2,000
UNIVERSITY OF WASHINGTON
STANFORD
UC BERKELEY
BANGALORE UNIVERSITY
VISVESVARAYA TECHNOLOGICAL UNIVERSITY
SAN JOSE STATE
UNIVERSITY OF PUNE
OSMANIA UNIVERSITY
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY
CARNEGIE MELLON
U. WASHINGTON, FOSTER SCHOOL OF BUSINESS
WASHINGTON STATE
UCLA
MIT
UNIVERSITY OF TEXAS AT AUSTIN
UNIVERSITY OF WATERLOO
WESTERN WASHINGTON UNIVERSITY
CAL POLY STATE UNIVERSITY
USC
UC DAVIS
IBM has almost 100,000 employees in India.
Alumni at Apple: engineering (211), admin (107), and IT (105).
It has Canada's largest engineering school and has sent 600 alums to Microsoft.
UT Austin trails close behind the five Indian schools, sending 1,090 grads to IBM.
Didn't go to Stanford? Apply to Microsoft: It's the top feeder company to Google.
Microsoft
7,300
Number of employees from the top 5 "donating" universities
IBM
6,954
Google
5,318
3,536
YAHOO!
1,073
facebook
831
380

Future-Ready Fiction

Please download this book from
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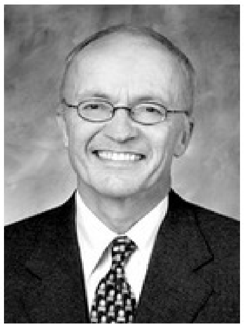
THANK YOU

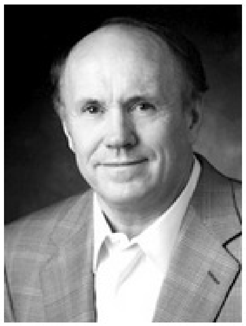
CONSCIENCE AND COMMON SENSE

Far Reaching Changes in the Near Future

Shoumen Palit Austin Datta

Prize in Economic Sciences in Memory of Alfred Nobel 2004





Professor Finn Kydland, Mrs Tanya Kydland, Professor JrJung Lyu and Mr Max Webber on 11 October 2006 in Helsinki, Finland edit

For additional information please visit http://bit.ly/MIT-Made-in-Taiwan

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