L'humanité a besoin rêveurs

Marie Curie

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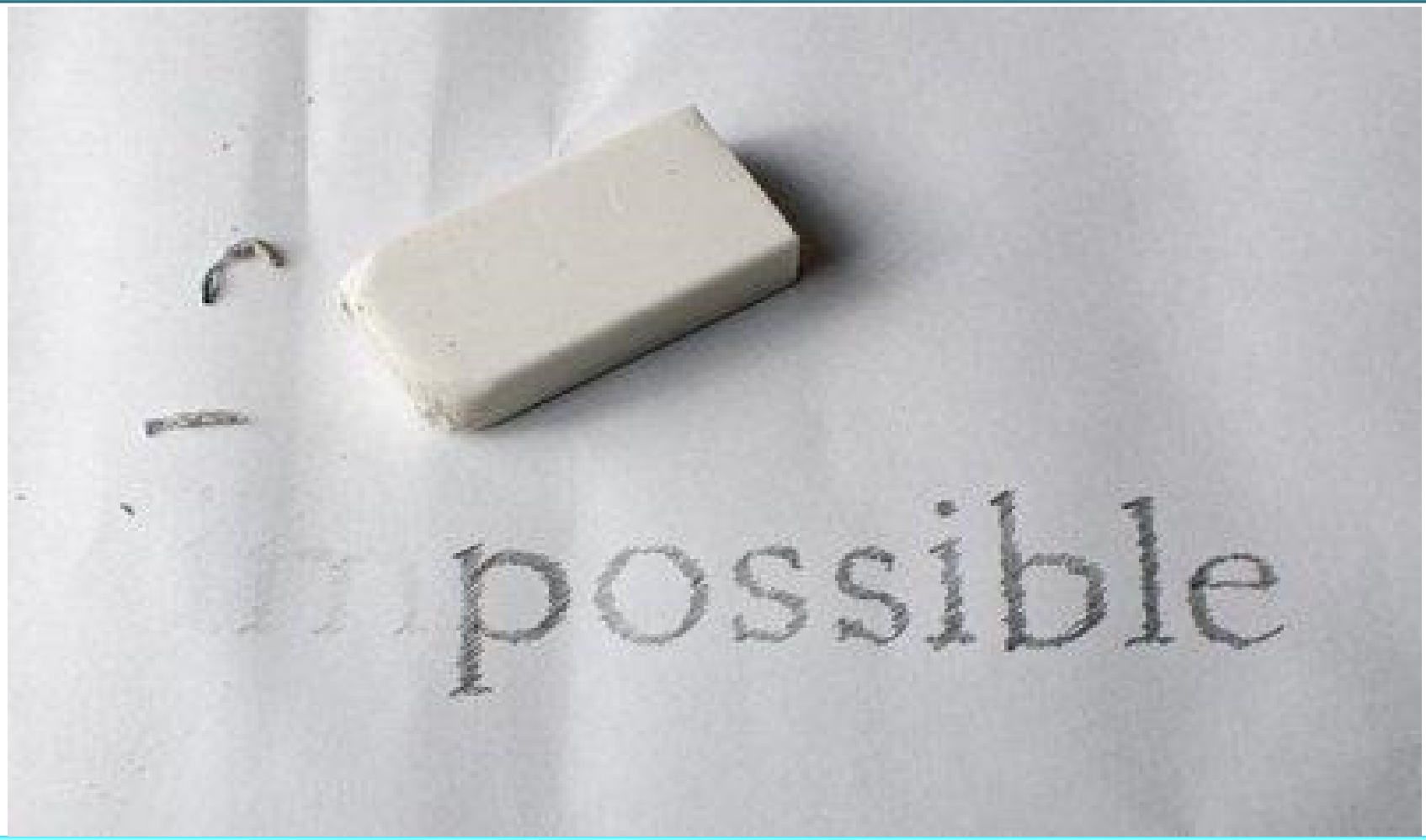
30 9 '96

Humanity needs dreamers

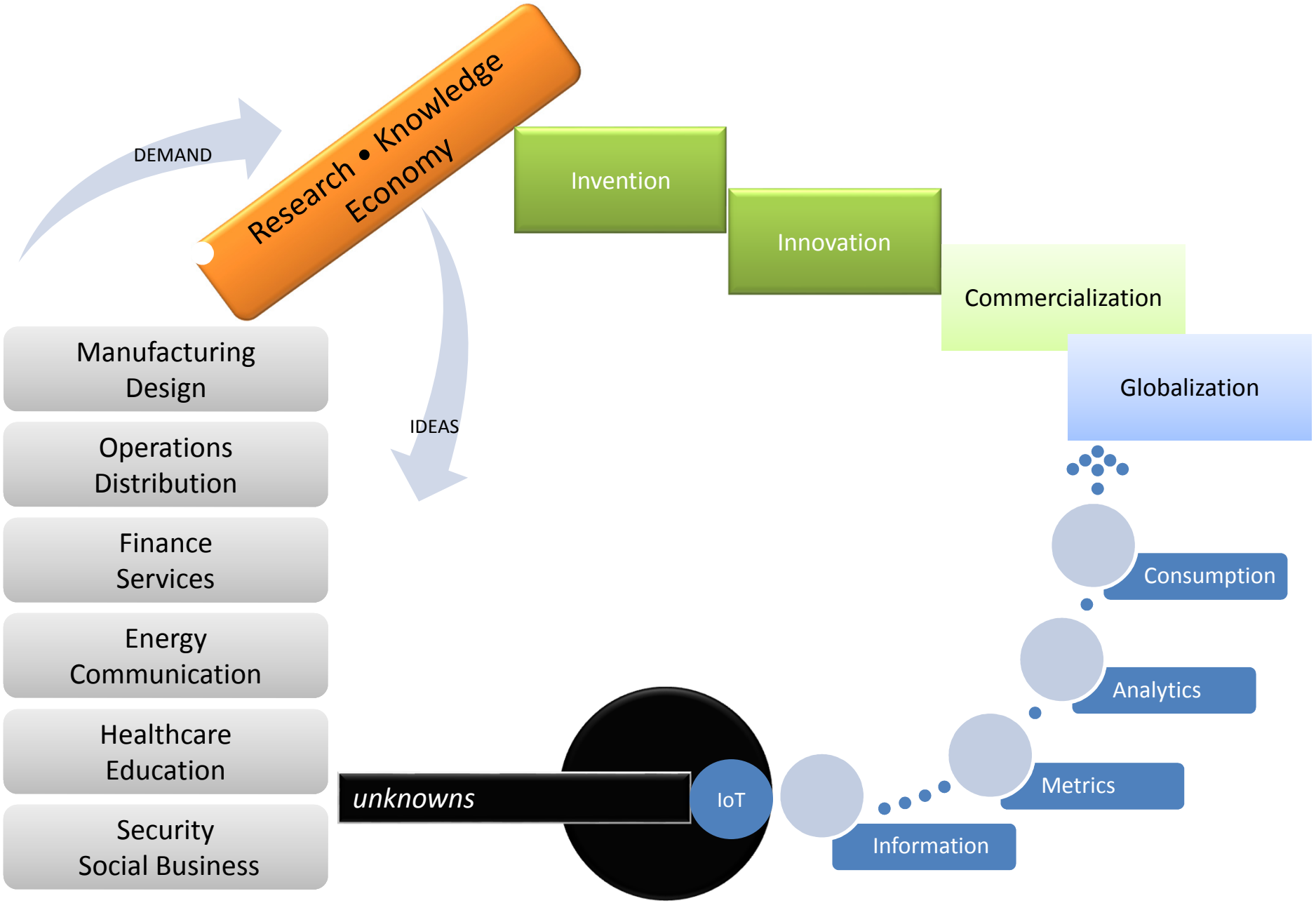
Marie Curie

"So we went to Atari and said, 'Hey, we've got this amazing thing, even built with some of your parts, and what do you think about funding us?
Or we'll give it to you. We just want to do it. Pay our salary, we'll come work for you.' And they said, 'No.' So then we went to Hewlett-Packard, and they said,
'Hey, we don't need you. You haven't got through college yet.'" -- *Steve Jobs on attempts to get Atari and HP interested in his and Steve Wozniak's Apple PC.*



Shoumen Palit Austin Datta

Any Business



New Business

- Market wants
- Market does not know it wants
- Demand signals
- Demand creation

Unknowns Exist

1.2 billion (of the 7 billion global population) connect via Facebook, 2010

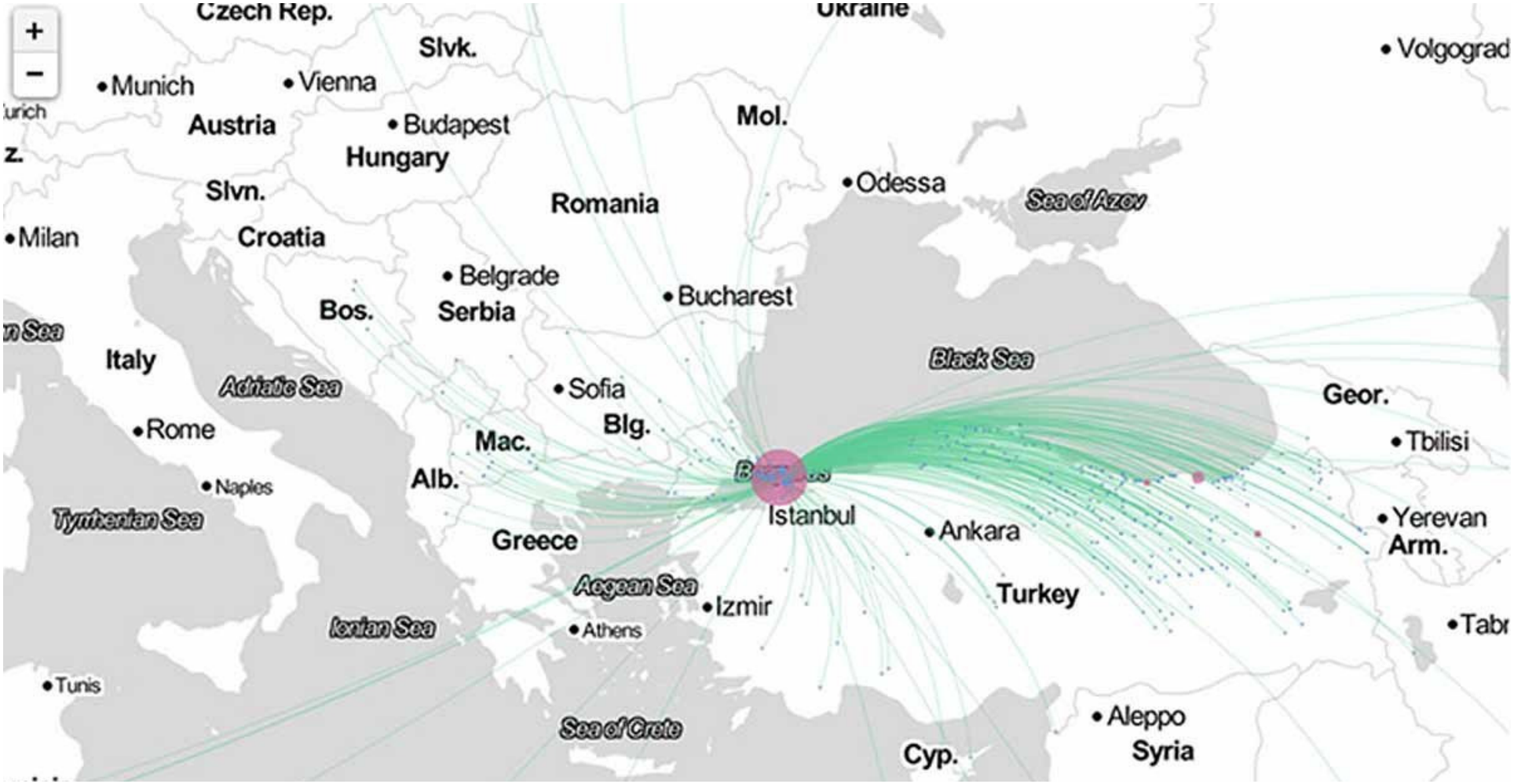
DATA reveals –

- **Internet accessibility**
- **Demographics**
- **Migration trends - where you live vs where you were born**

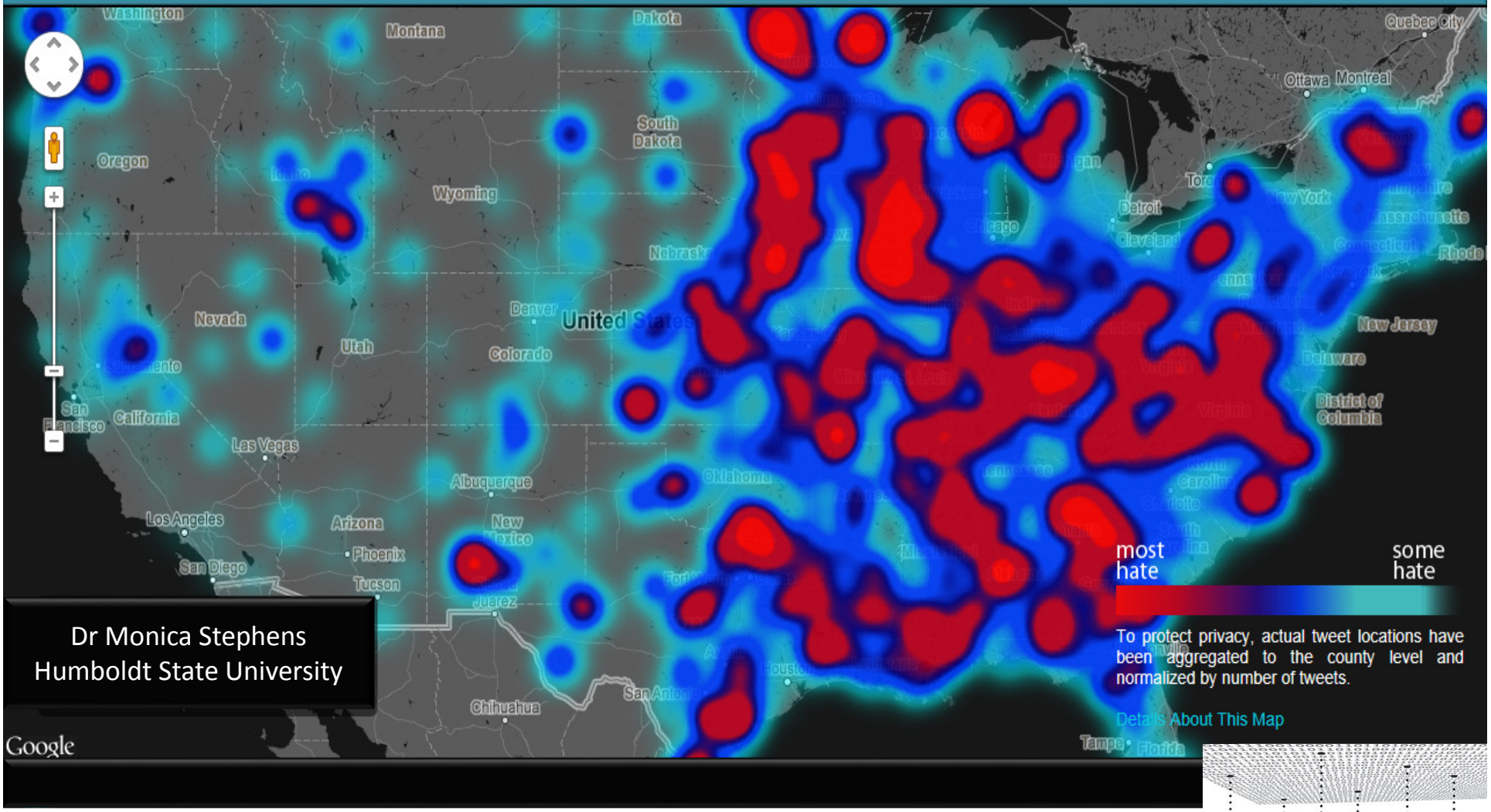
1.2 billion (of the 7 billion global population) connect via Facebook, 2010

DATA reveals Istanbul is the area with highest migration

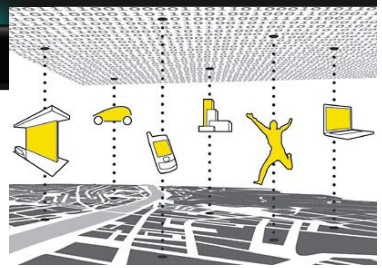
- **Migration trends - where you live vs where you were born**



Twitter Data Analytics from Geo Tagged Social Signals → Killer App for Demand Driver



Dr Monica Stephens
Humboldt State University

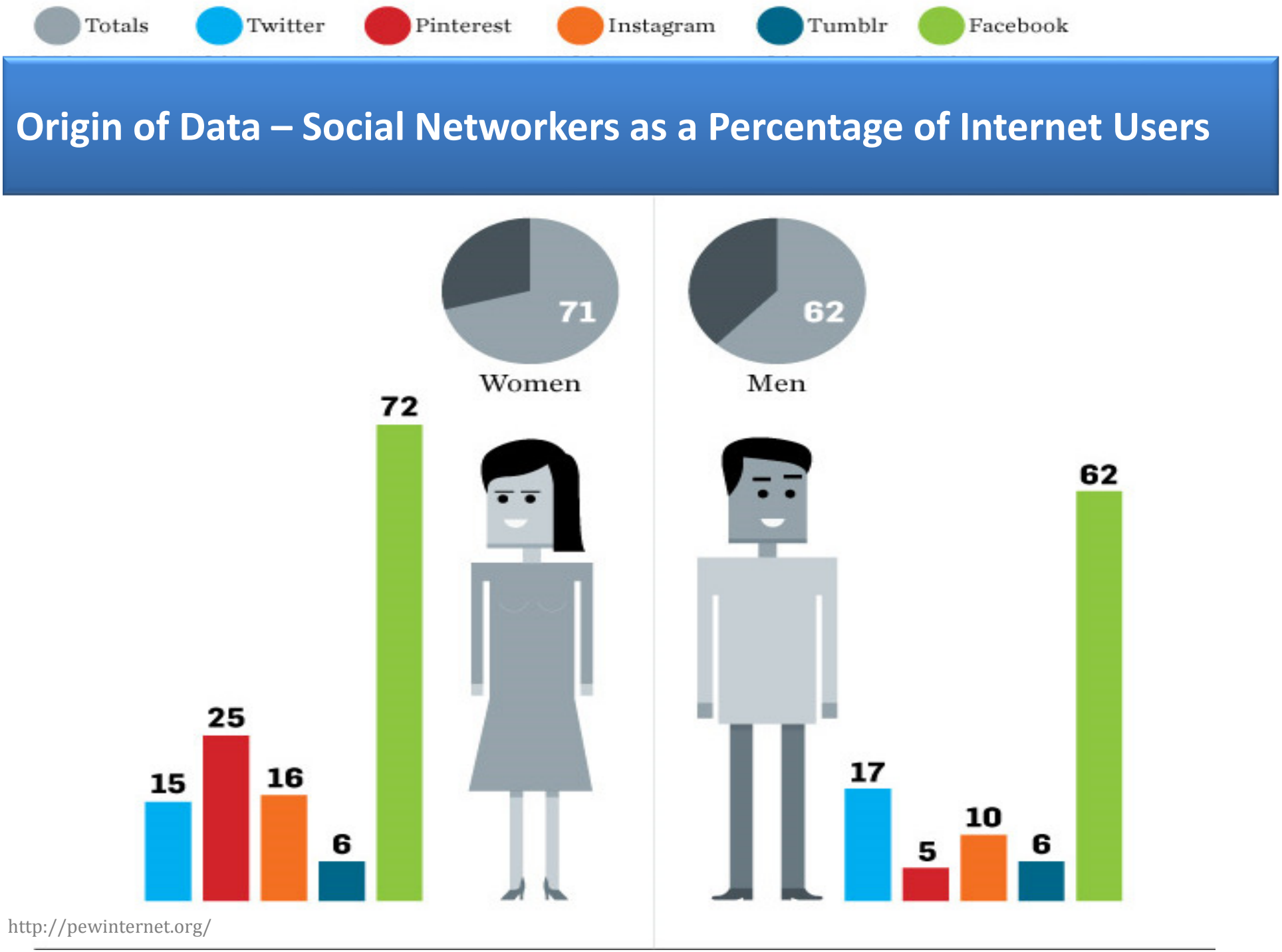


Mapping demand is a variable linked to personality and mobility. Juveniles may tweet each time they pass *Chick-fil-a* but it is unlikely that adults may want to blurb if they are inclined to eat pasta or prawns for dinner • **http://senseable.mit.edu/wikicity/rome/**

Papal Security – Data Analytics from geo-tagged signals helps crowd control in Rome

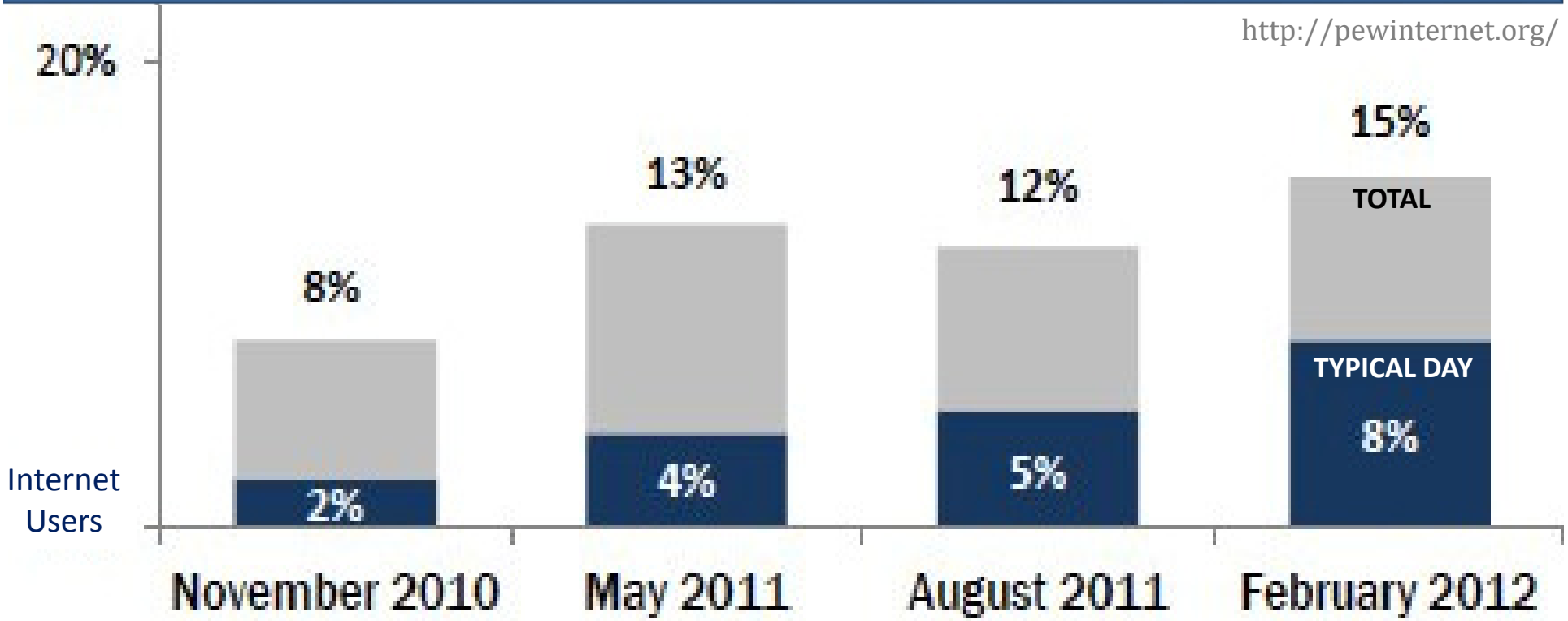
http://senseable.mit.edu/wikicity/rome/

Origin of Data – Social Networkers as a Percentage of Internet Users



http://pewinternet.org/

Origin of Data - Signal vs Noise • Demographics of US Tweeters

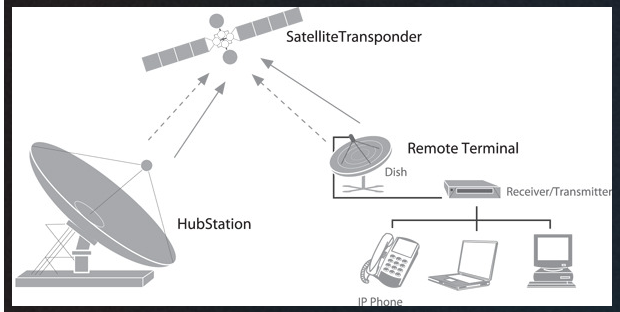


"Typical day" Twitter use by age, 2010-2012

% of internet users in each group who use Twitter on a typical day

	November 2010	May 2011	February 2012
All adults	2%	4%	8%
18-24	4	9	20
25-34	5	5	11
35-44	2	6	9
45-54	2	3	3
55-64	1	2	4

Context of data vs explosion of signal and noise (>25 devices per human)



IoT 2020

200 BILLION MOBILE DEVICES

880m Americas
741m Europe
36m CIS
282m M.E
2,649m Asia and Pacific

Facebook 1.2 billion

280 million

600 million Qzone

364 MILLION Windows Live Hotmail

273 MILLION YAHOO! Mail

200 MILLION twitter

425 million Gmail

115 MILLION friendster

115 MILLION badoo

100 MILLION orkut

100 MILLION LinkedIn

63 MILLION myspace

50 MILLION 50m

yelp

23 mixi

10 Google Latitude

22 OpenTable

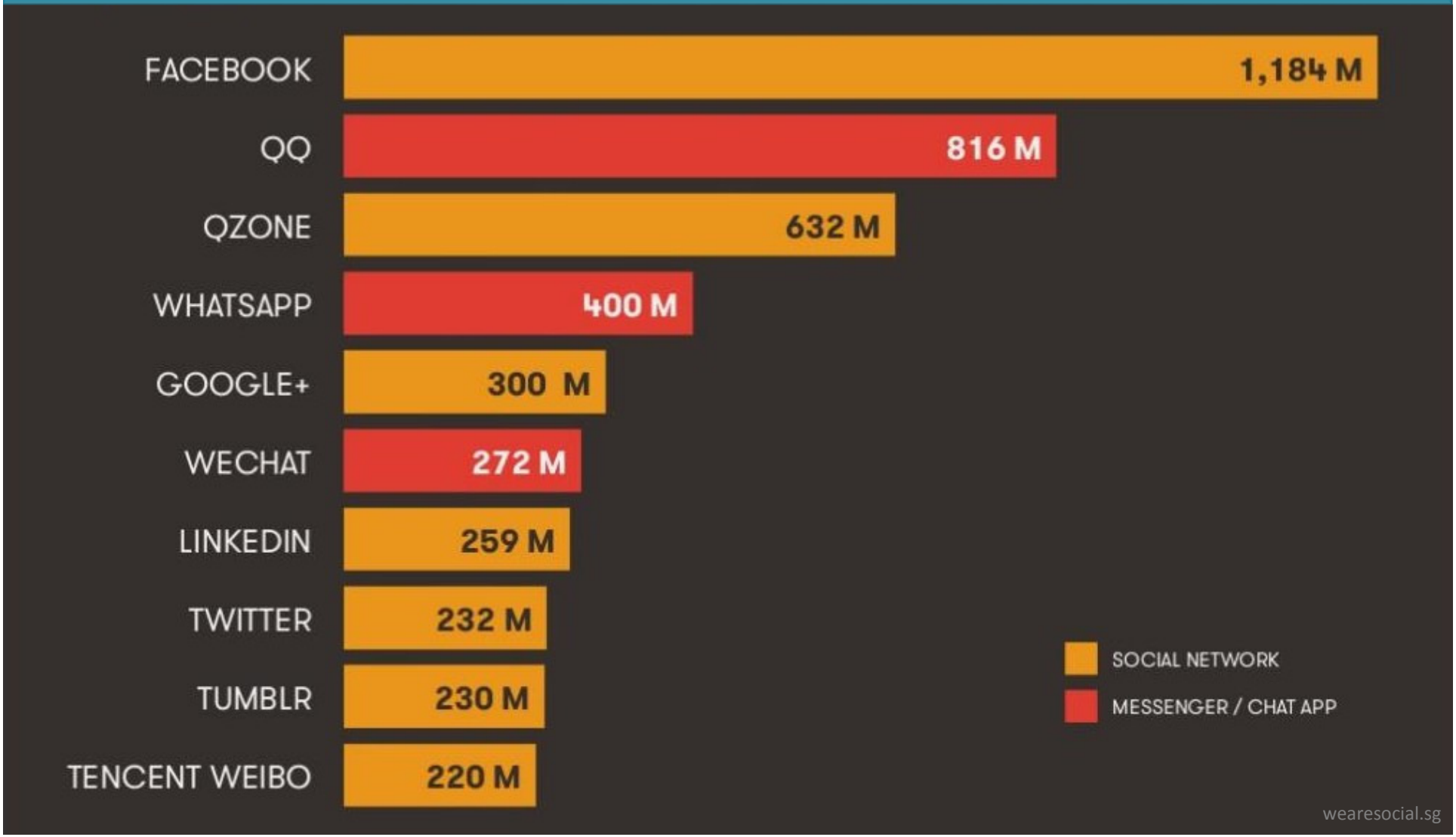
10 foursquare

5 loopt

7 brightkite

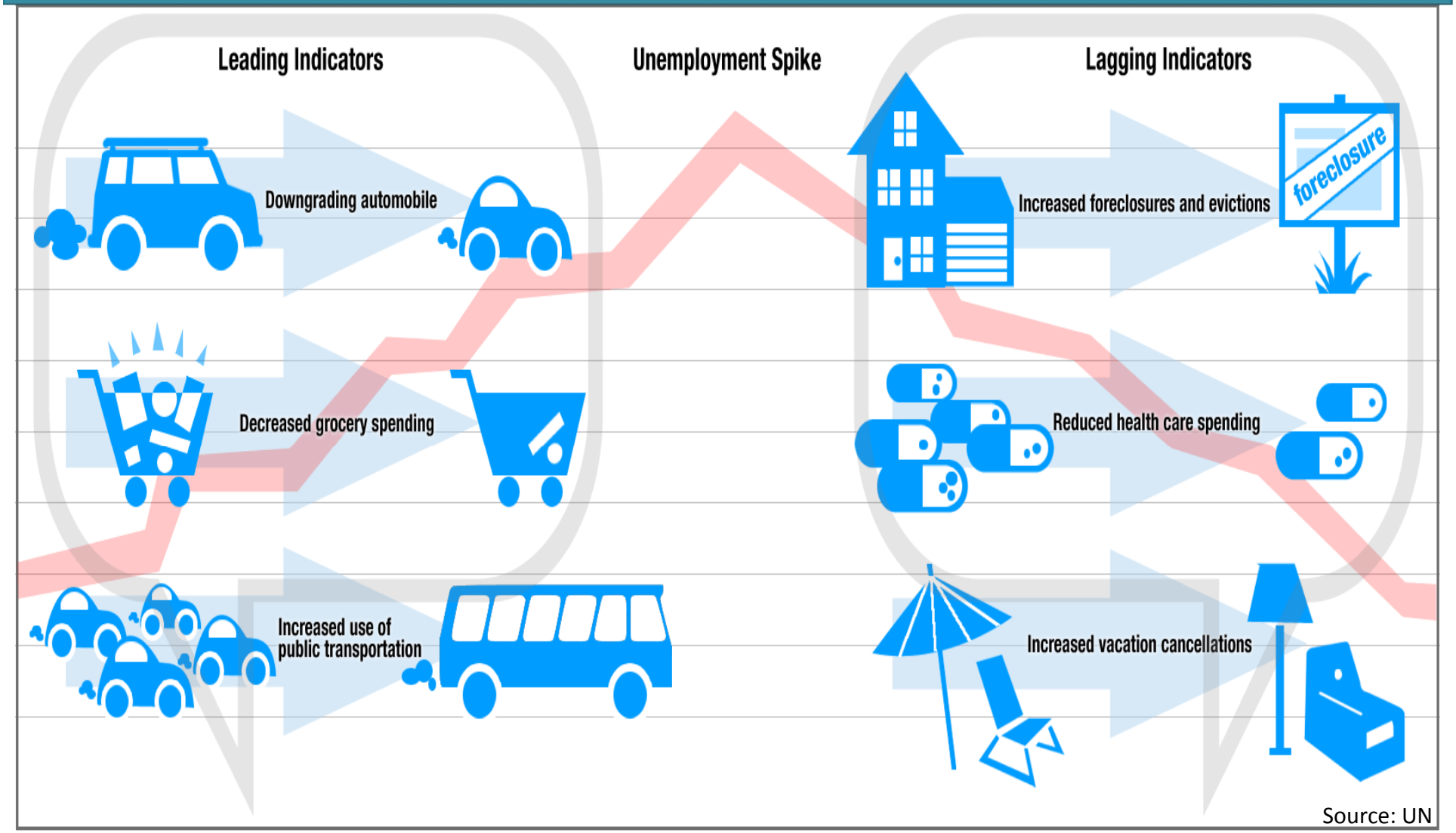
1 Gowalla

Context of BIG DATA - social chatter isn't data, it's mostly mindless drivel



but, as with everything in life, there are exceptions to this gross generalization, too …

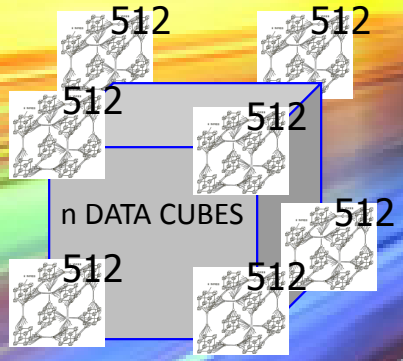
Big Data Analytics - part of the unanticipated changes which may re-equilibrate norms

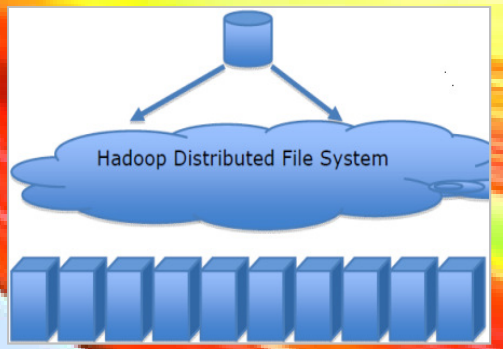


Analysis of social media using SAS shows increases in chatter about certain topics that are leading and lagging indicators of a spike in unemployment.

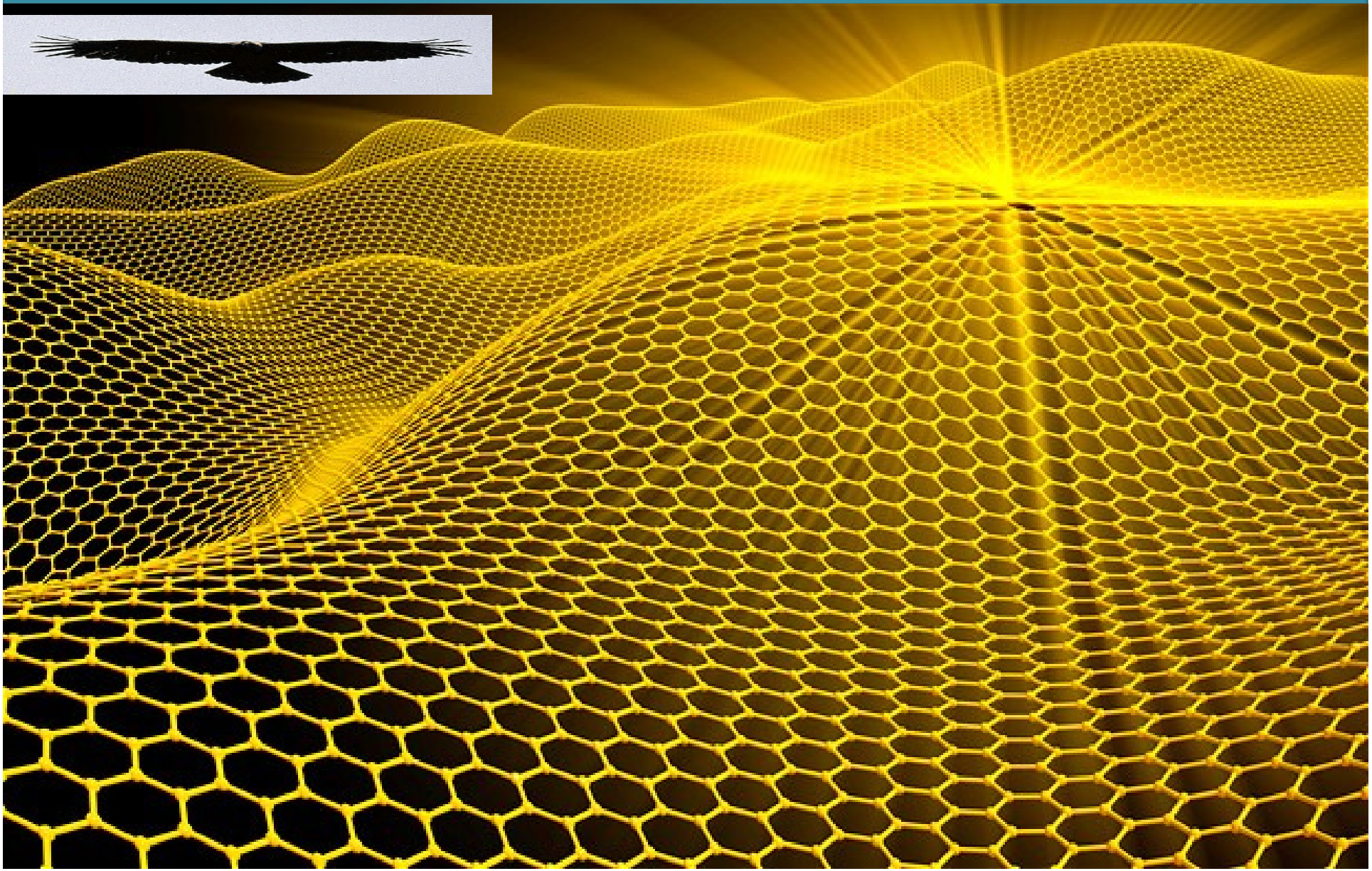
Big Data – Is Social Media for Social Sciences ?

- Volume
- Velocity
- Variety
- Volatility
- Variability
- Vulnerability

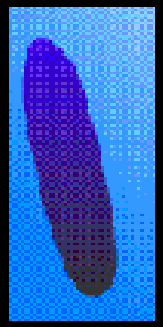




Data Analytics – *What is this?*

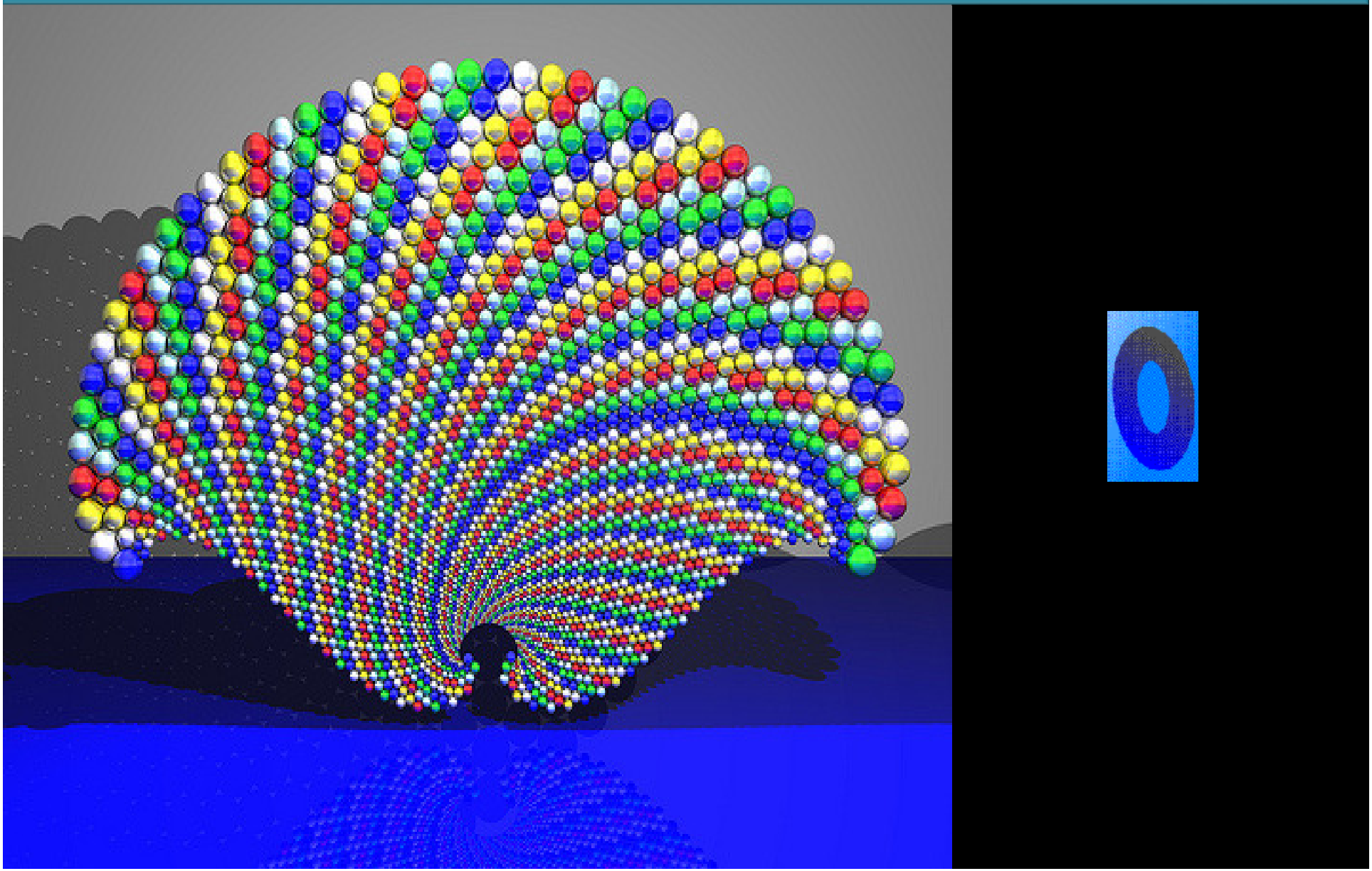


Big Data Analytics – cautionary tale



What is this ?

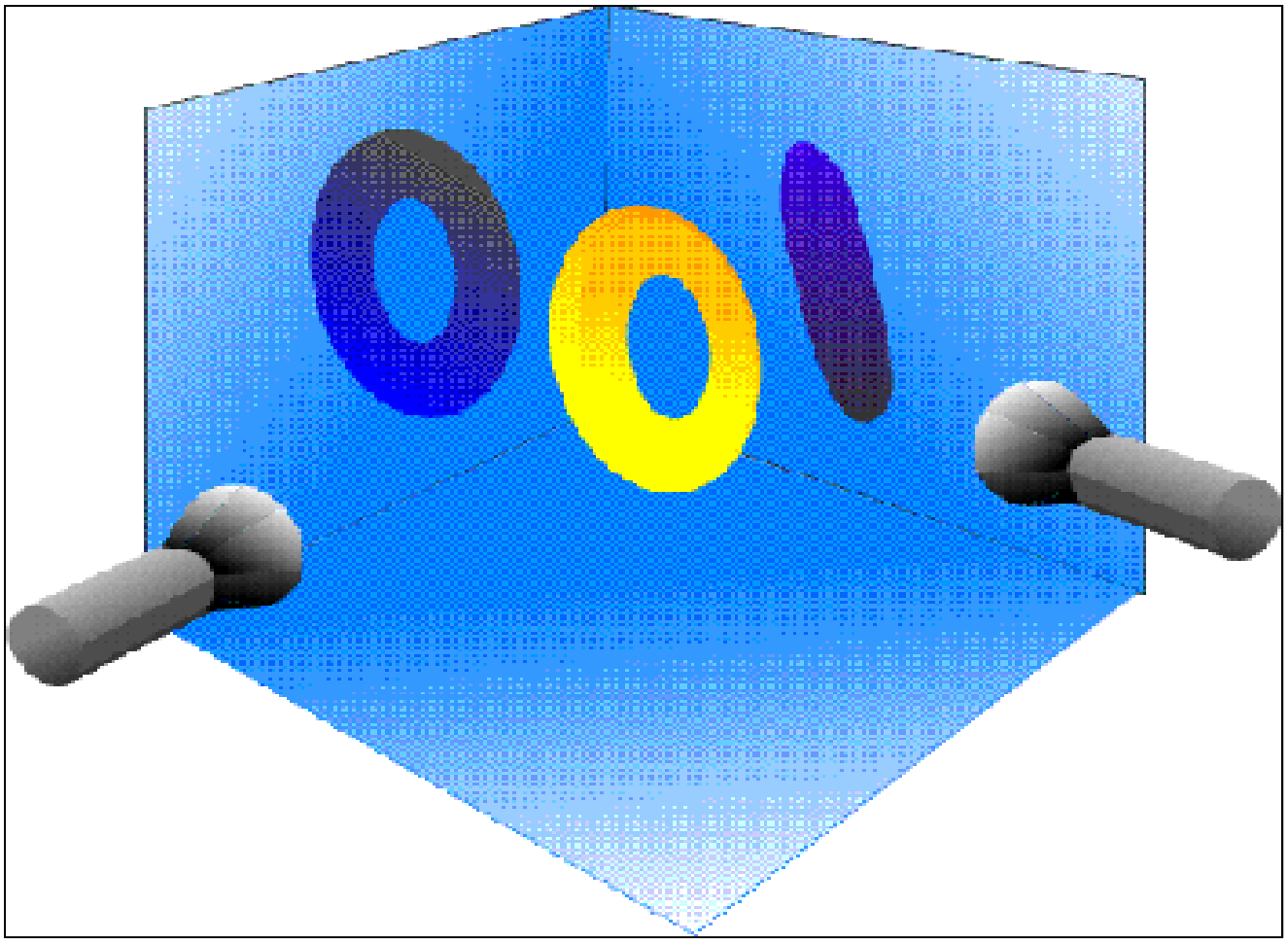
Big Data Analytics – cautionary tale



Big Data Analytics – cautionary tale

What is this ?

Big Data Analytics – how you look at it – Principal Component Analysis

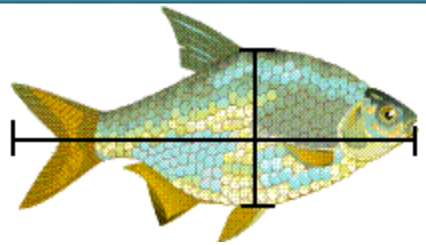


http://obelia.jde.aca.mmu.ac.uk/multivar/pca_graf.htm

Data Analytics – Principal Component Analysis

Low Dimensional Structures from High Dimensional Samples

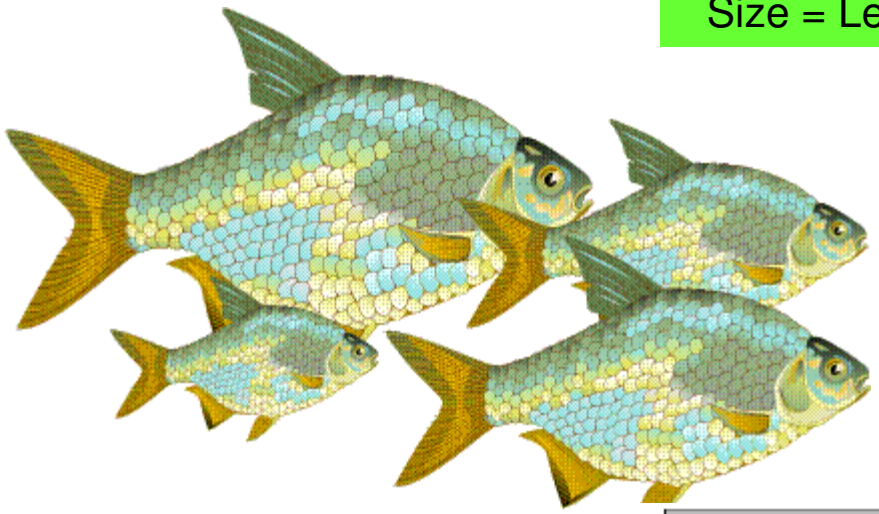
Big Data Analytics – data vs information in the context of process to extract knowledge

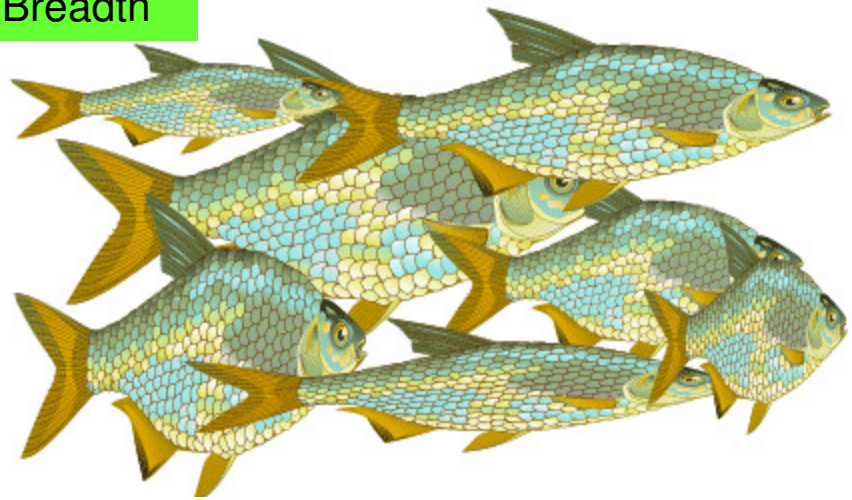


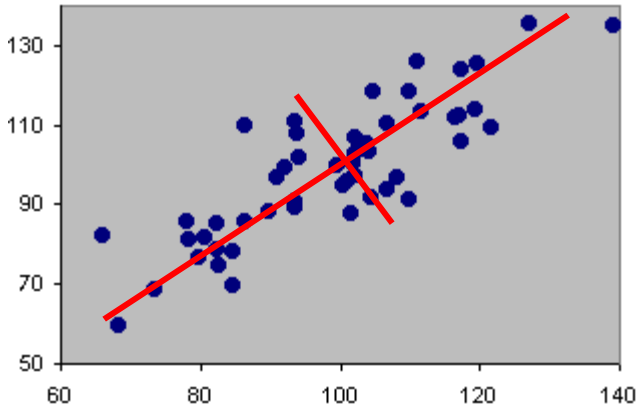
Retains 87.5% of the information

Retains 62.5% of the information

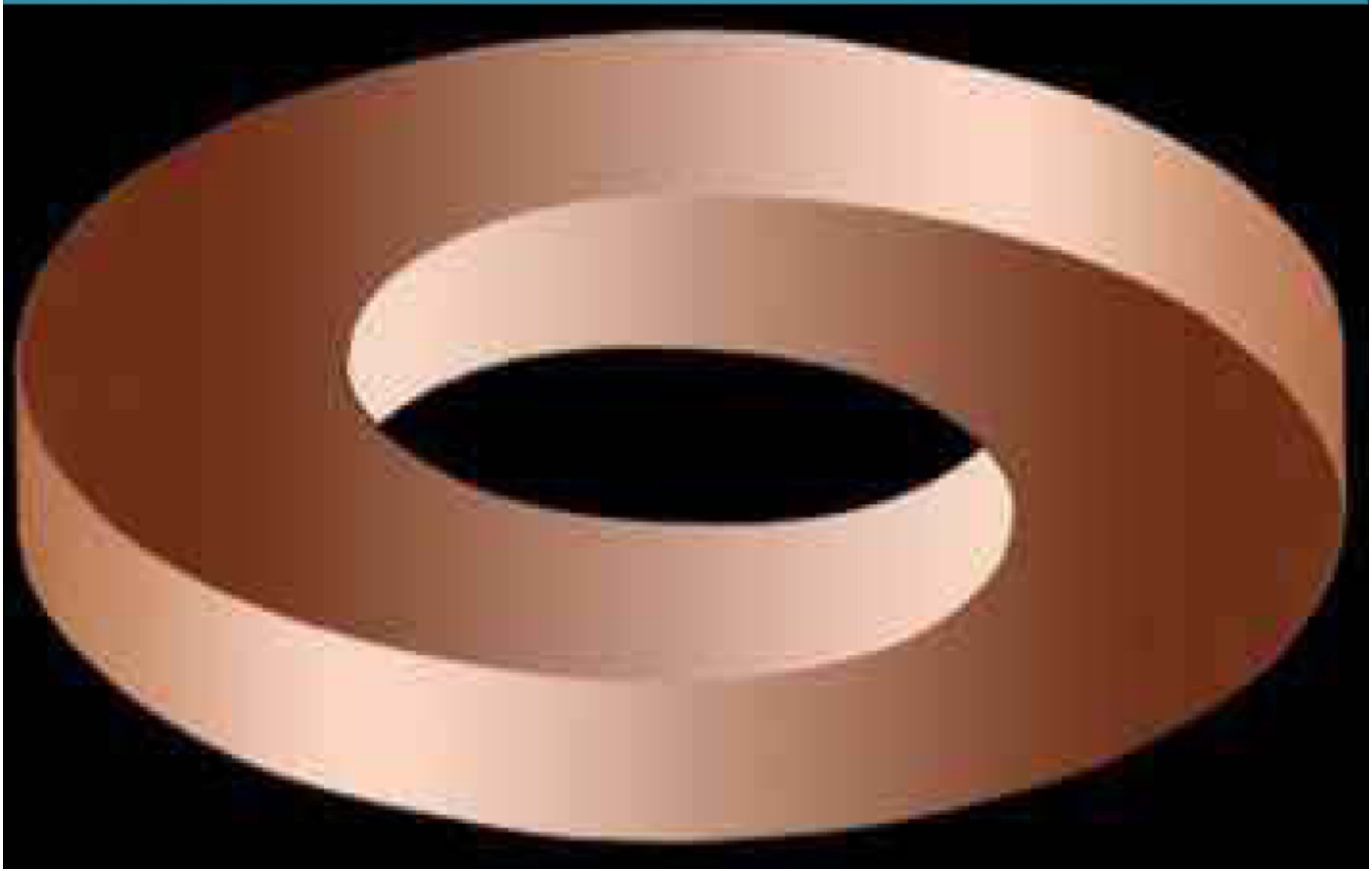
Size = Length + Breadth



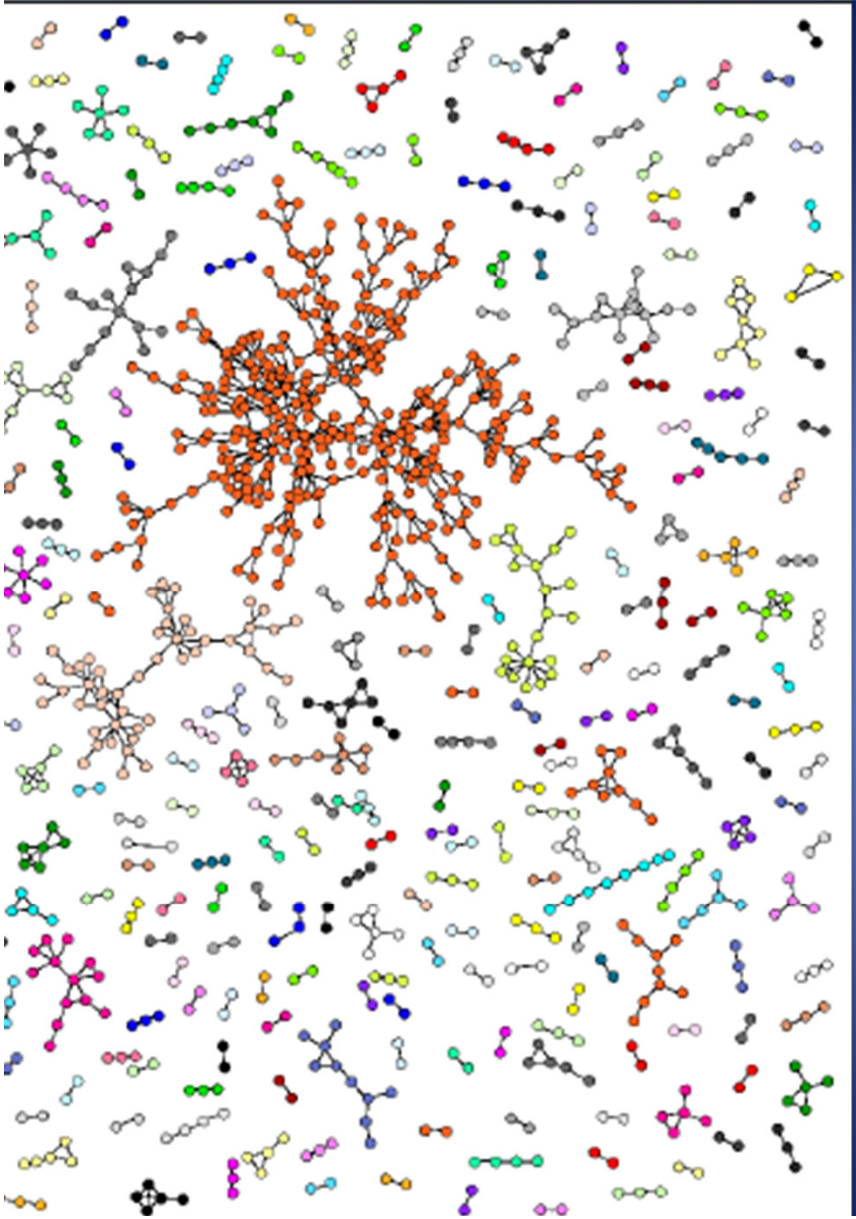


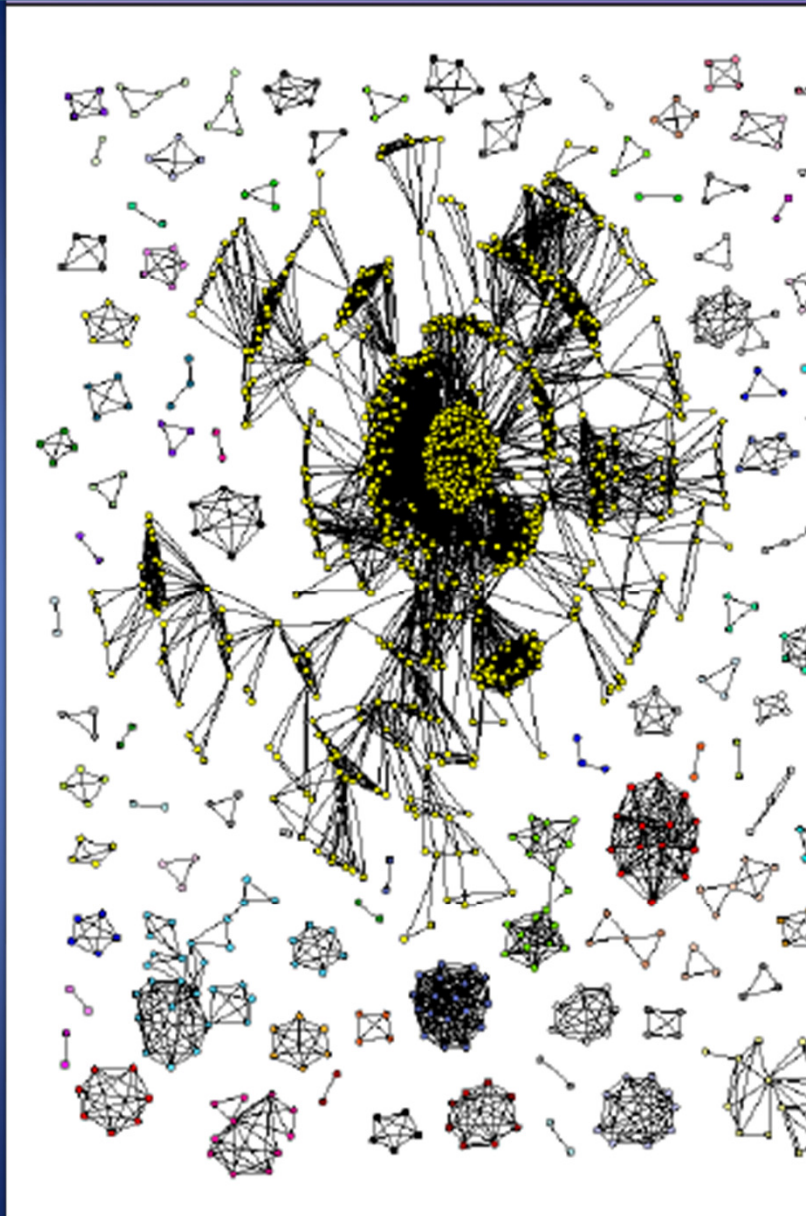


Data – Analytics depend on how you look at it



Data → Context based insight (intuition) ← spread of infection analytics





The Context of Big Data
Who uses Twitter?

All adult internet users (n=1729)	15%
Men (n=804)	14
Women (n=925)	15
Age	
18-29 (n=316)	26**
30-49 (n=532)	14
50-64 (n=521)	9
65+ (n=320)	4
Race/ethnicity	
White, Non-Hispanic (n=1229)	12
Black, Non-Hispanic (n=172)	28**
Hispanic (n=184)	14
Annual household income	
Less than $30,000/yr (n=390)	19
$30,000-$49,999 (n=290)	12
$50,000-$74,999 (n=250)	14
$75,000+ (n=523)	17
Education level	
No high school diploma[2] (n=108)	22
High school grad (n=465)	12
Some College (n=447)	14
College + (n=698)	17
Geographic location	
Urban (n=520)	19**
Suburban (n=842)	14**
Rural (n=280)	8

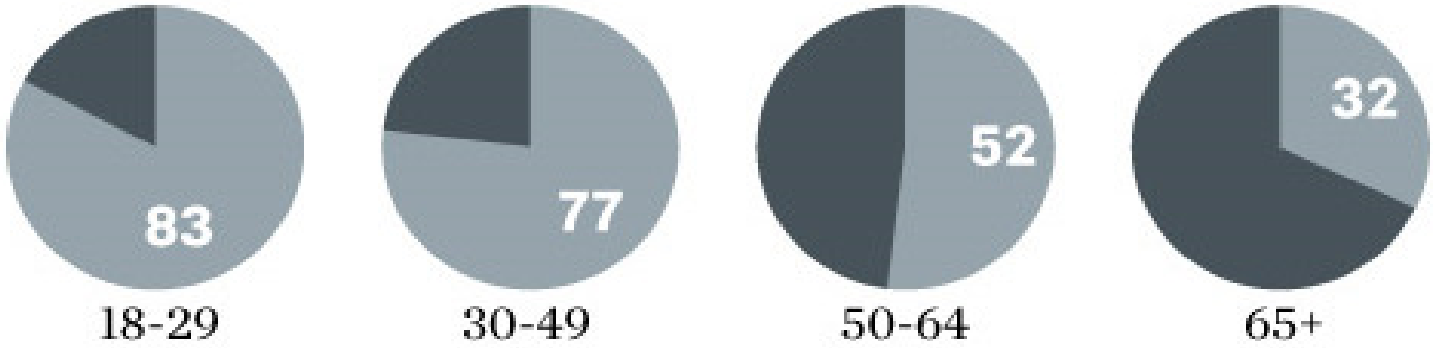
Who uses Twitter on a cell phone? http://pewinternet.org/

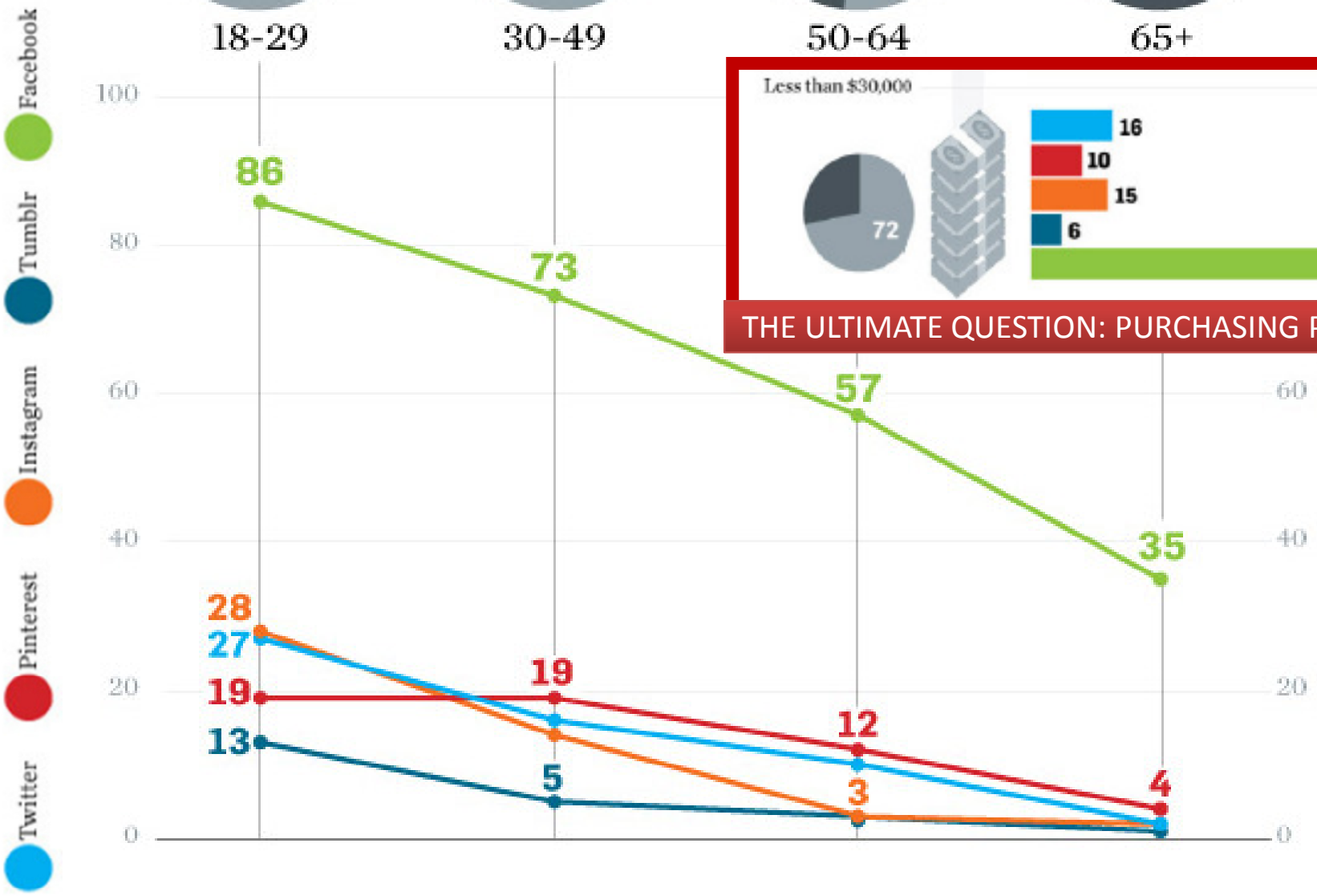
% of adult cell owners in each group who use Twitter on their phones

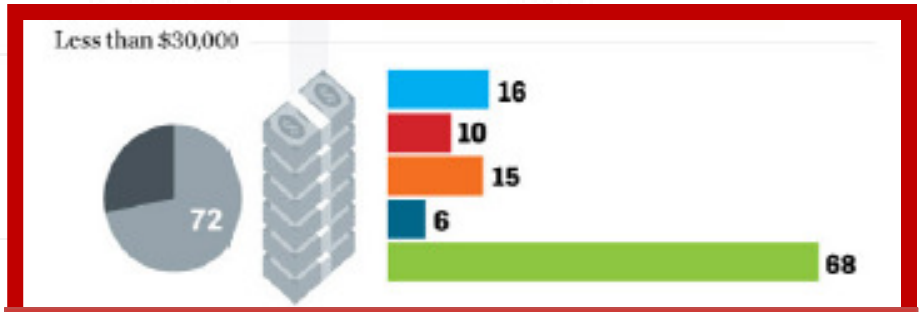
All cell owners (n=1954)	9%
Men (n=895)	9
Women (n=1059)	9
Age	
18-24 (n=225)	22**
25-34 (n=230)	14
35-44 (n=276)	9
45-54 (n=371)	5
55-64 (n=387)	3
65+ (n=429)	<1
Race/ethnicity	
White, Non-Hispanic (n=1404)	7
Black, Non-Hispanic (n=234)	17**
Hispanic (n=180)	12**
Annual household income	
Less than $30,000/yr (n=447)	7
$30,000-$49,999 (n=316)	12
$50,000-$74,999 (n=272)	11
$75,000+ (n=538)	9
Education level	
No high school diploma (n=156)	10
High school grad (n=542)	6
Some College (n=490)	9
College + (n=752)	11
Geographic location	
Urban (n=557)	10
Suburban (n=993)	9
Rural (n=316)	6

http://pewinternet.org/

Age Groups







THE ULTIMATE QUESTION: PURCHASING POWER ?

New Business

- Market wants

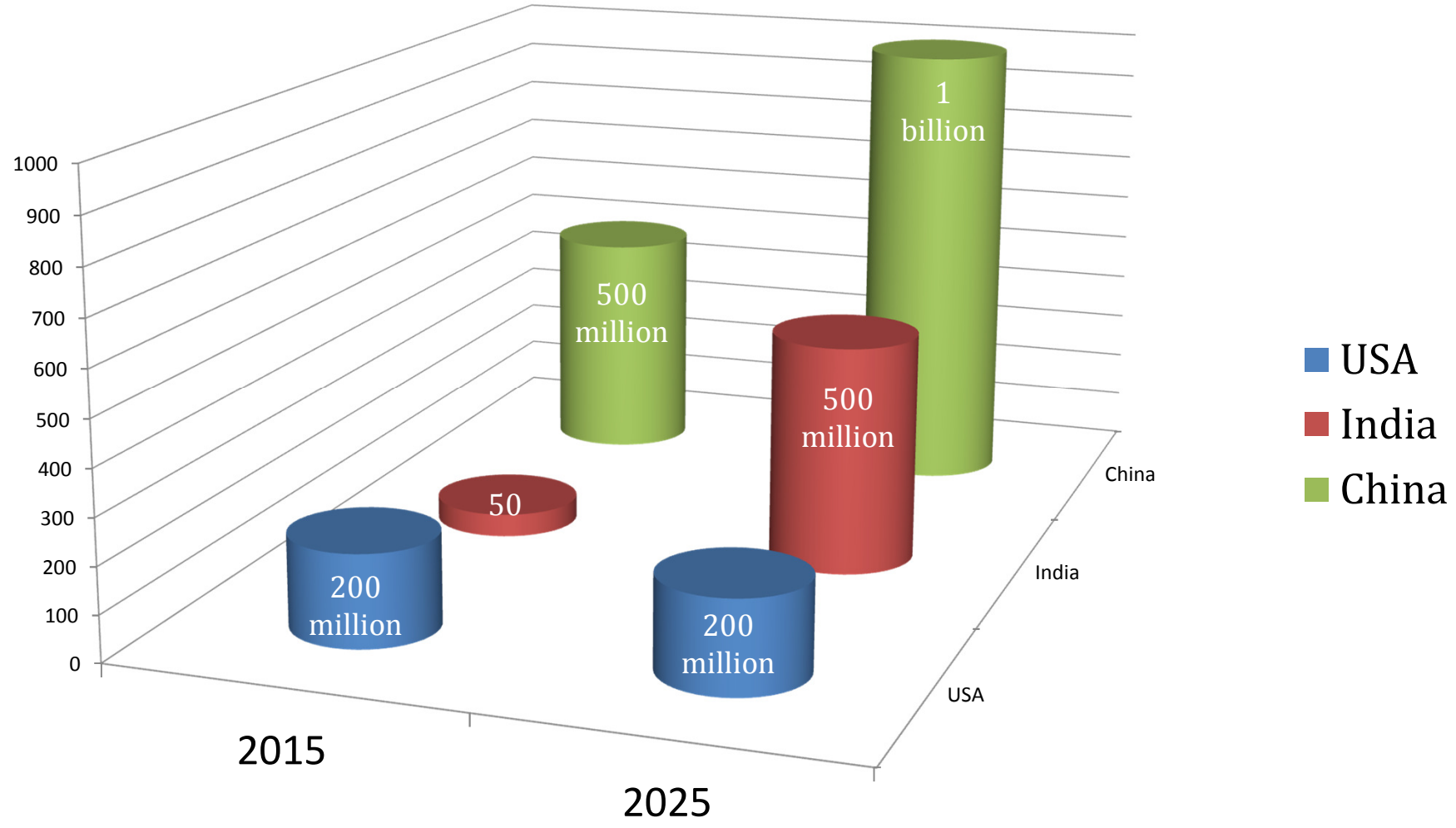
- Market does not know it wants

- Demographics
- Infrastructure
- Purchasing Power Parity

- Innovation
- Value creation
- Catalyze commercialization
- Demographics
- Infrastructure
- Purchasing Power Parity

Unknowns Exist

Growth of the middle-income population segment by purchasing power parity



Prediction for business growth / revenue explosion - Food and Apparel Industries

Energy Infrastructure – Shale Gas – Global Non-Renewable Revolution is a Reality

Continent	Risked Gas In-Place (Tcf)	Risked Technically Recoverable (Tcf)
North America	3,856	1,069
South America	4,569	1,225
Europe	2,587	624
Africa	3,962	1,042
Asia	5,661	1,404
Australia	1,381	396
Total	22,016	5,760

Top Gas Users Rank 1-15	BCF/day
United States	62.4
Russia	38.8
United Kingdom	9.5
Canada	8.6
Iran	8.4
Germany	8.3
Italy	7.1
Japan	7
Ukraine	6.8
Saudi Arabia	6.2
Uzbekistan	4.8
Mexico	4.6
France	4.3
Netherlands	4.2
UAE	3.8
China	3.8

Max energy demand is in Asia → Max gas reserves are in Asia

World consumption of gas per day → 0.25 TCF (in 2013)

Estimated life of global gas → 50 years to 250 years

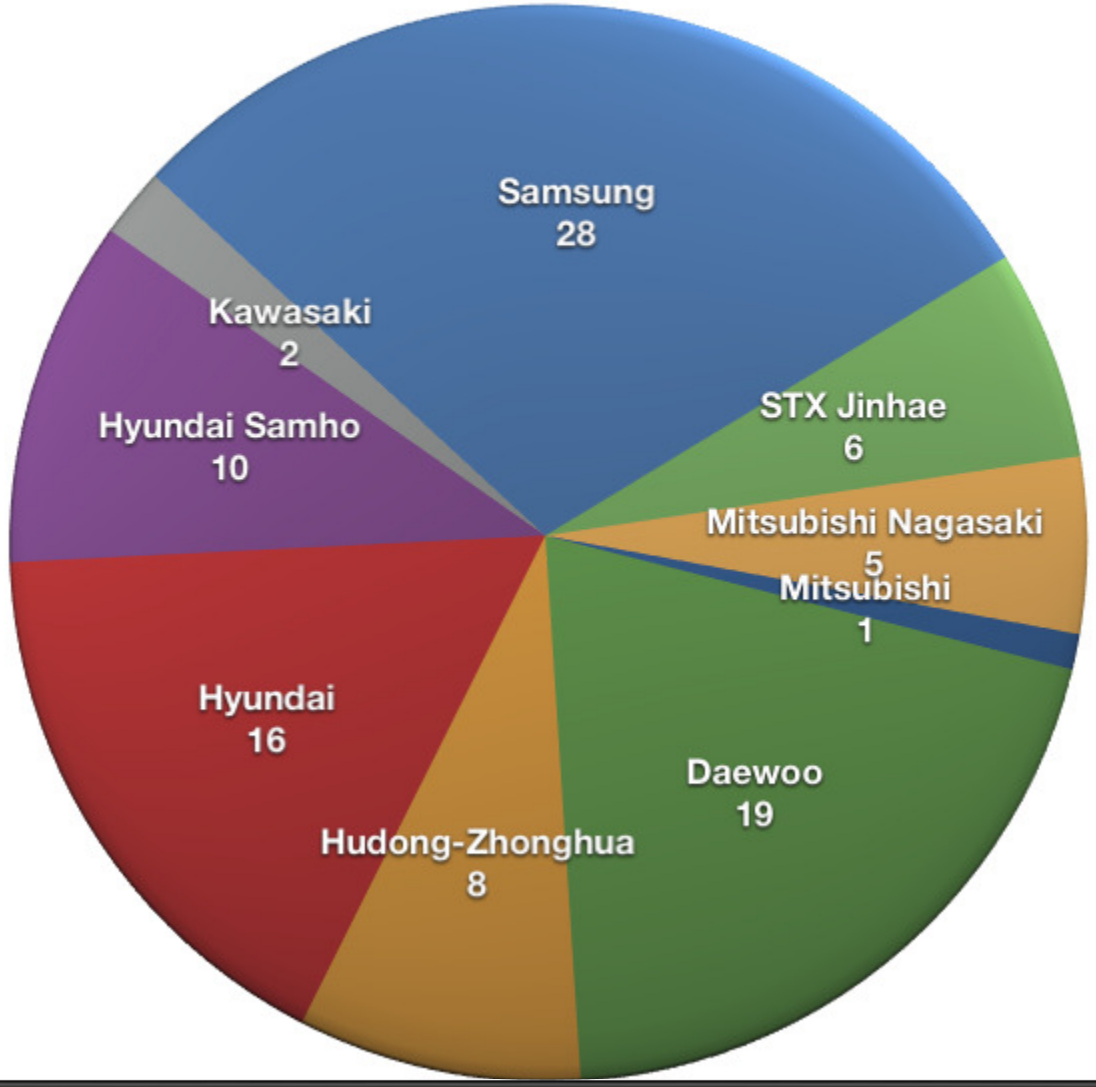
CO_2 released → 53 million metric tonne per TCF gas

Source → www.fas.org/sgp/crs/misc/R42814.pdf

www.netl.doe.gov/technologies/oil-gas/publications/brochures/Shale_Gas_March_2011.pdf

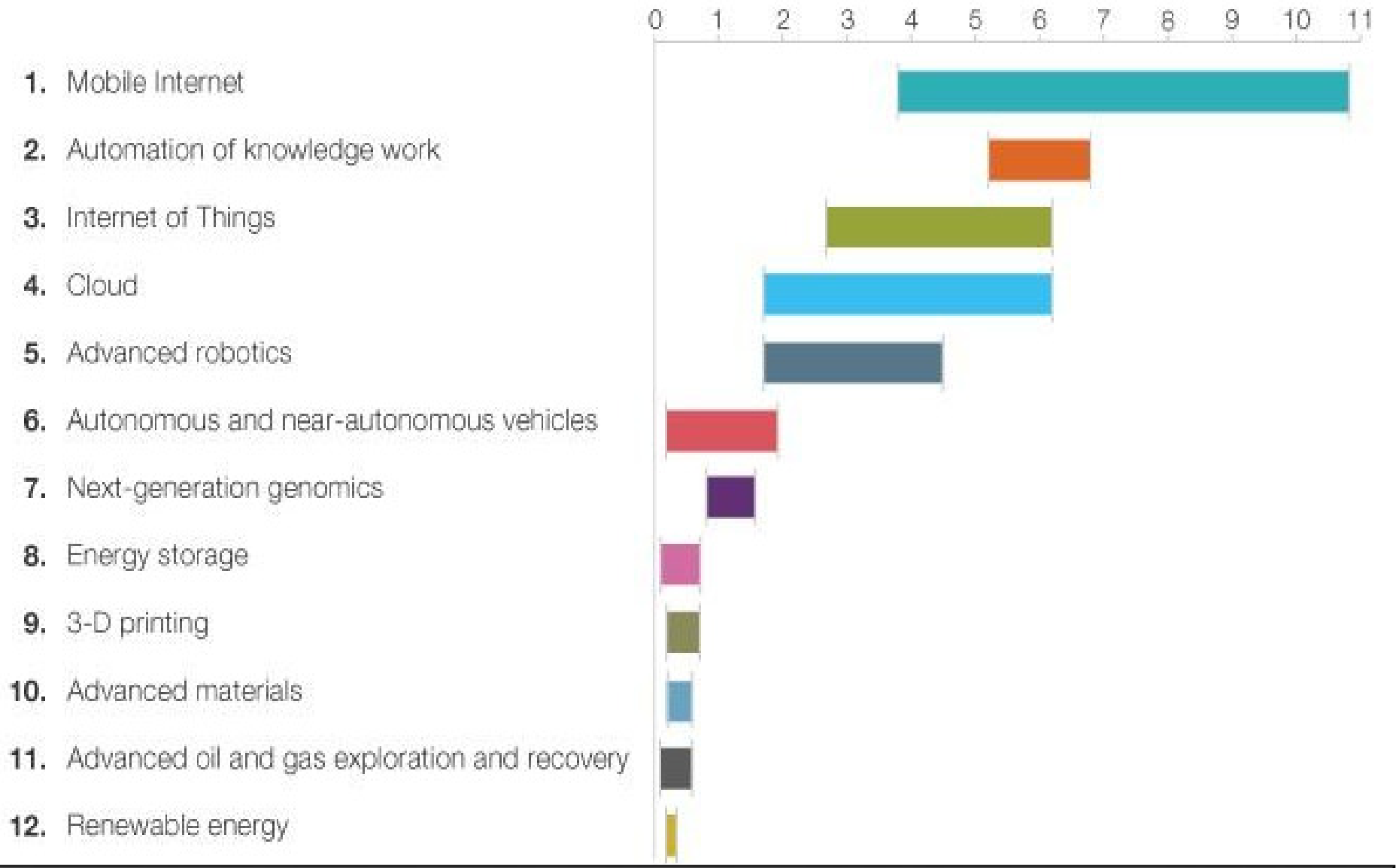
Prediction for energy business growth – ultra high efficiency gas turbine electricity

Energy Demand – Liquid Natural Gas (LNG) Carrier New Build Orders by Shipyard



Circumstantial evidence may support prediction for high efficiency gas turbines

Renewable Energy 2025 - Estimated Impact in US$ Trillion → Negligible?

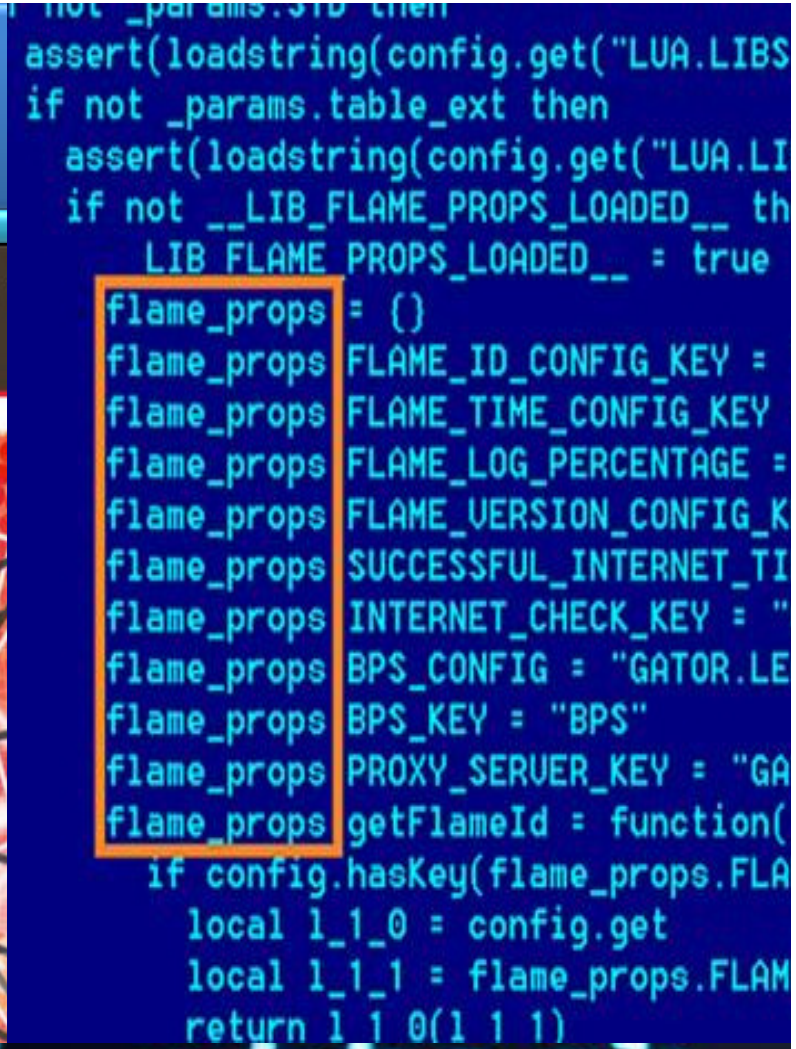


Source → McKinsey ← Old School Bean Counters → Lack of a sense of the future

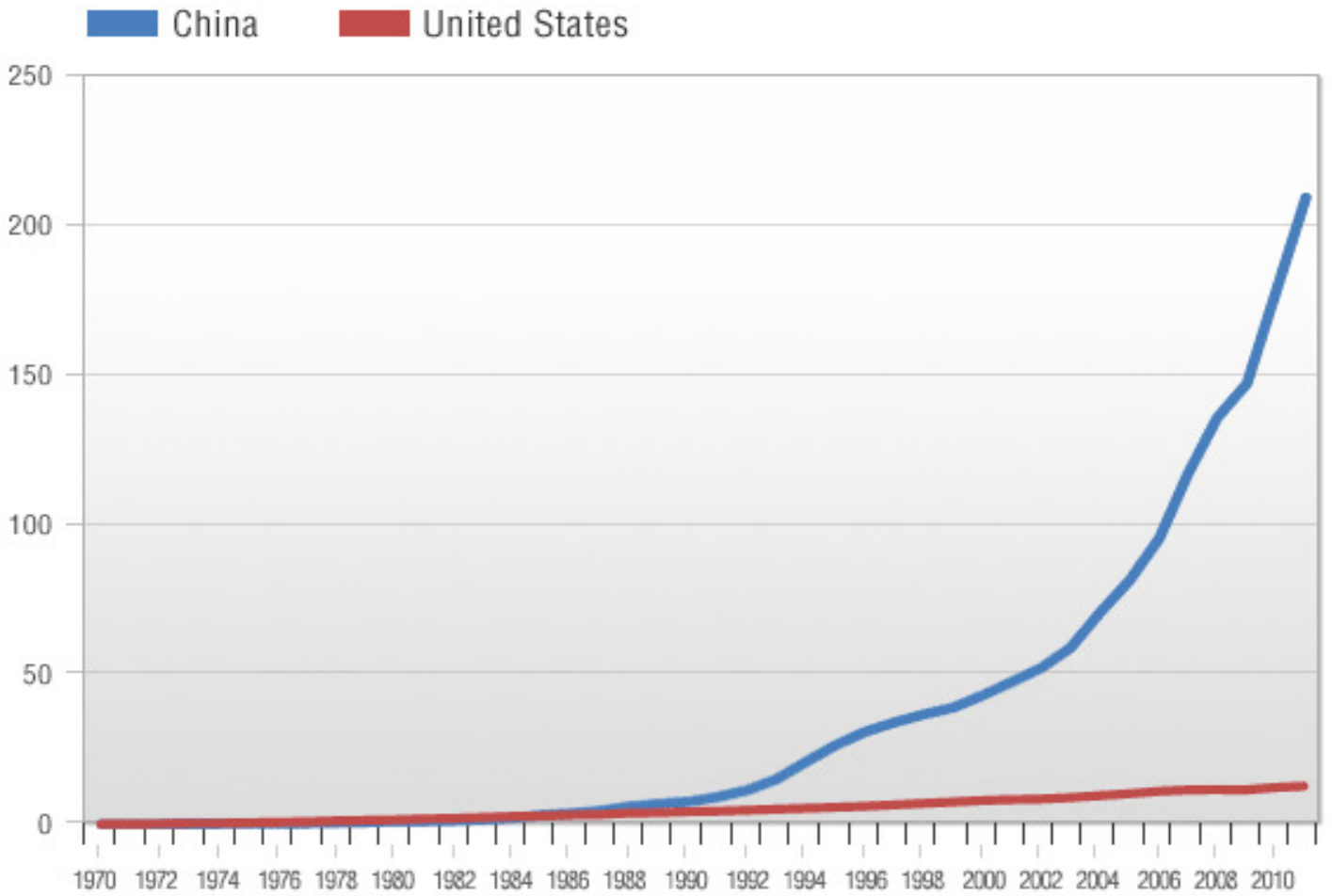
The Innovator's Dilemma by Clayton Christensen → About McKinsey

" In contrast, at 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." (Christensen, 2000).

Rogue State Sponsored Death by Digital Annihilation?

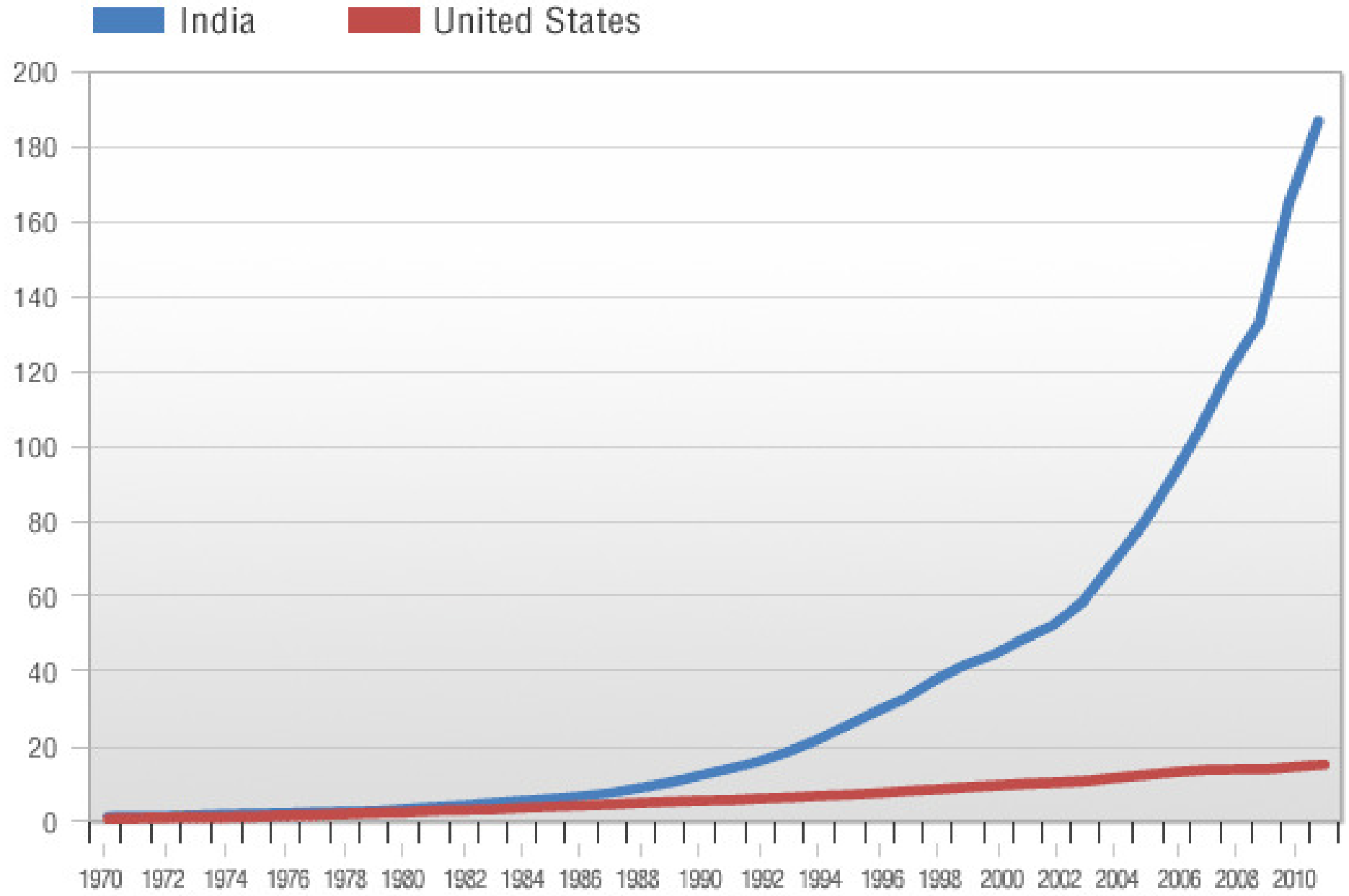


From 1970 through 2011 China's economy (GDP) grew 208 times (US grew 15 times)



2001 to 2011 • China's GDP soared at an average rate of 15.8% annually (measured in its own currency) versus 14.4% for India and 4.2% for US.

India • 2001 through 2011 GDP growth 14.4% (188 times)

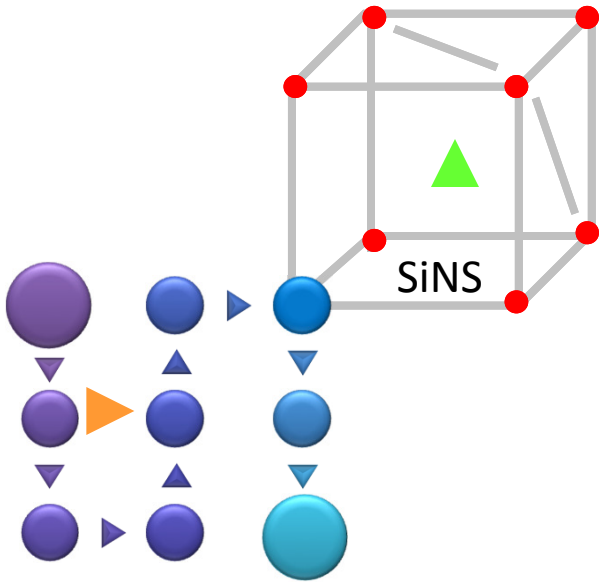


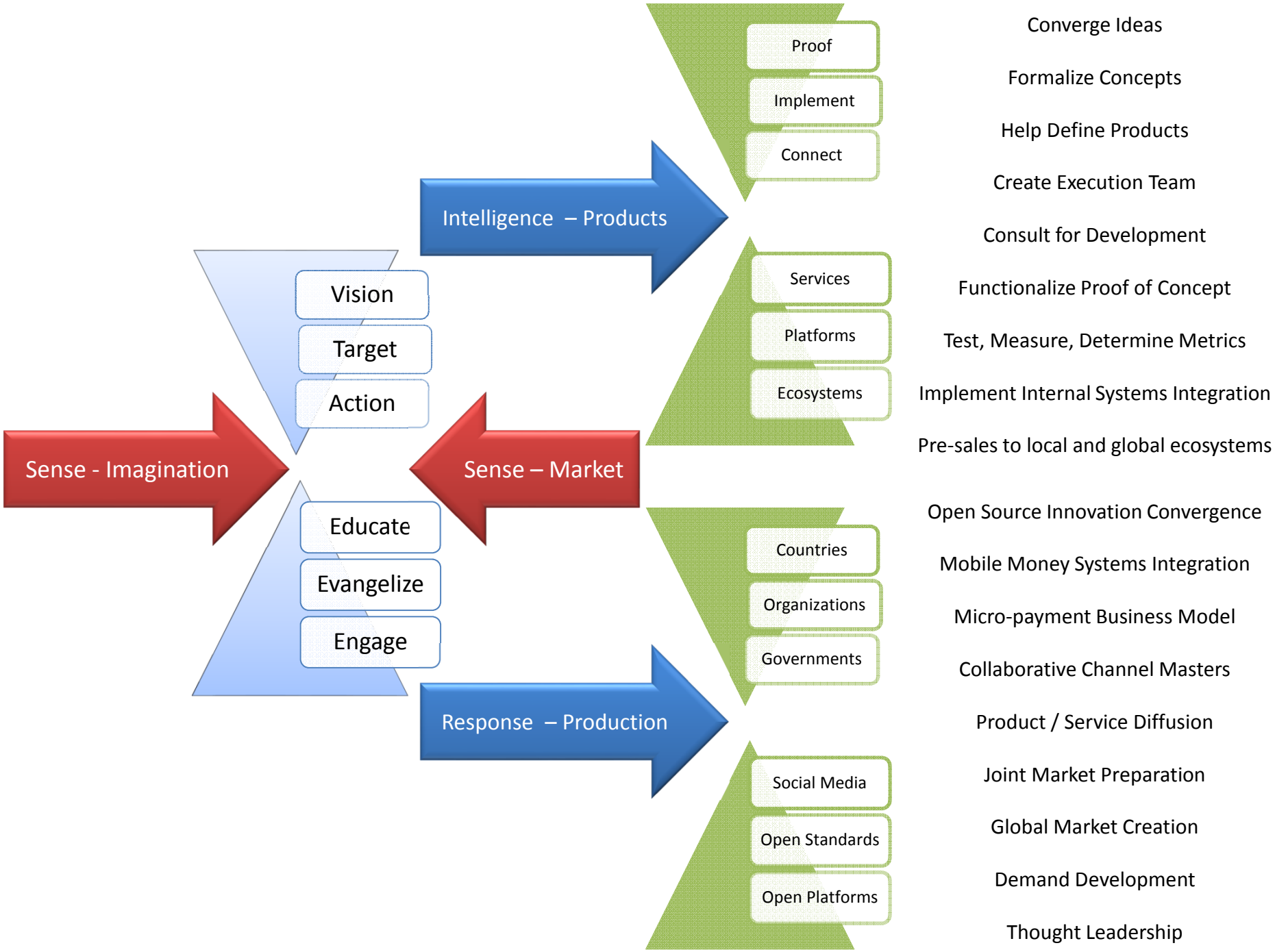
SE Asia Market Opportunity > 4 Billion → Sense Everything

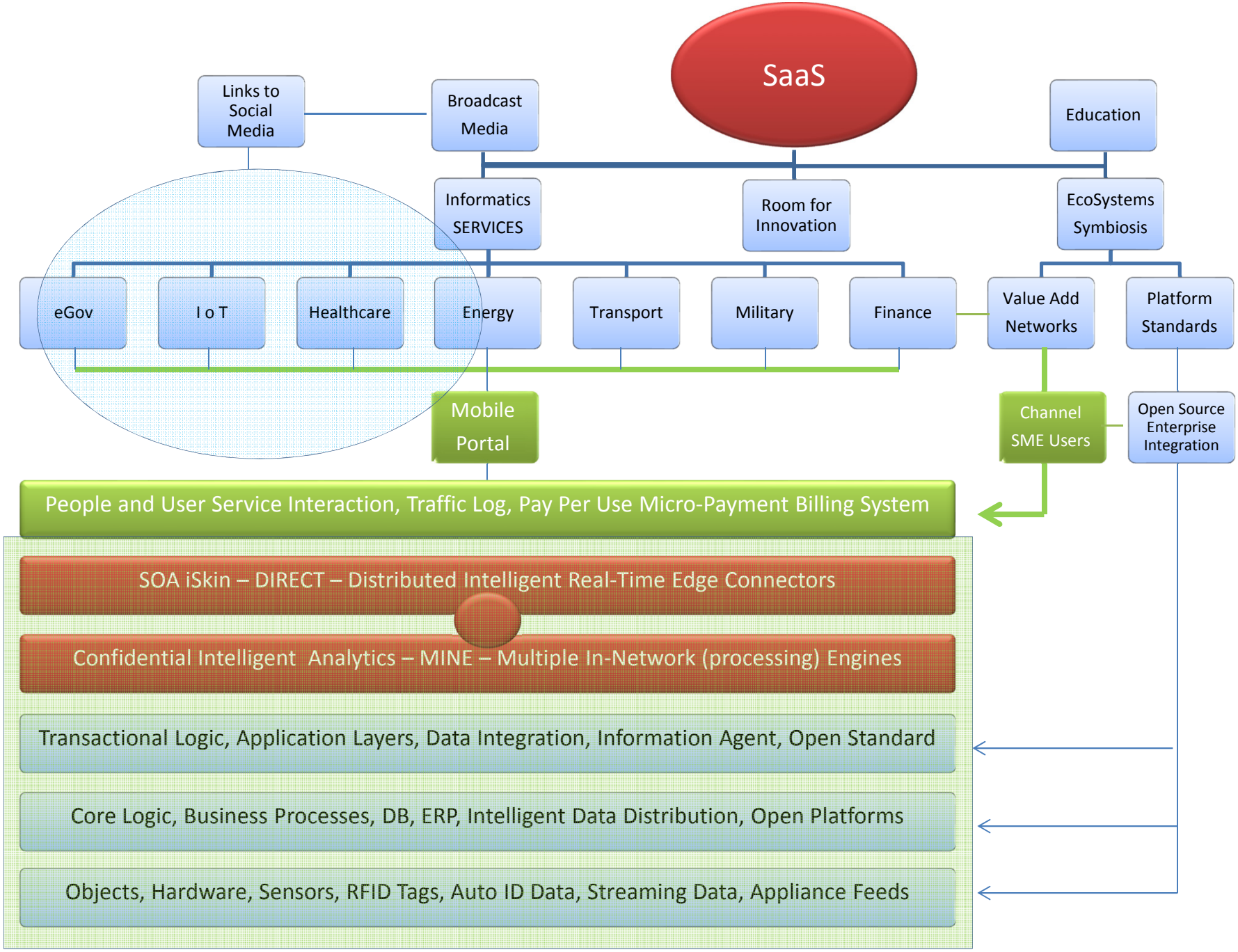
Sense. Intelligence. Response.

Economies of Scale in Systems Approach

Emerging New Lines of Business




Proof
Implement
Connect
Intelligence – Products
Services
Platforms
Ecosystems
Vision
Target
Action
Sense - Imagination
Sense – Market
Educate
Evangelize
Engage
Countries
Organizations
Governments
Response – Production
Social Media
Open Standards
Open Platforms
Converge Ideas
Formalize Concepts
Help Define Products
Create Execution Team
Consult for Development
Functionalize Proof of Concept
Test, Measure, Determine Metrics
Implement Internal Systems Integration
Pre-sales to local and global ecosystems
Open Source Innovation Convergence
Mobile Money Systems Integration
Micro-payment Business Model
Collaborative Channel Masters
Product / Service Diffusion
Joint Market Preparation
Global Market Creation
Demand Development
Thought Leadership



Market Cap of Software Services (2001-2011)

2001

2001	Name	HQ	Industry	Market Cap USD million
1	GE	US	Various	477,406
2	Cisco	US	Network	304,699
3	Exxon Mobil	US	Oil & Gas	286,367
4	Pfizer	US	Pharma	263,996
5	Microsoft	US	Software	258,436
6	Wal-Mart	US	Retail	250,955
7	Citigroup	US	Banking	250,143
8	Vodafone	UK	Telco	227,175
9	Intel	US	Computer	227,048
10	Royal Dutch Shell	NL/UK	Oil & Gas	206,340

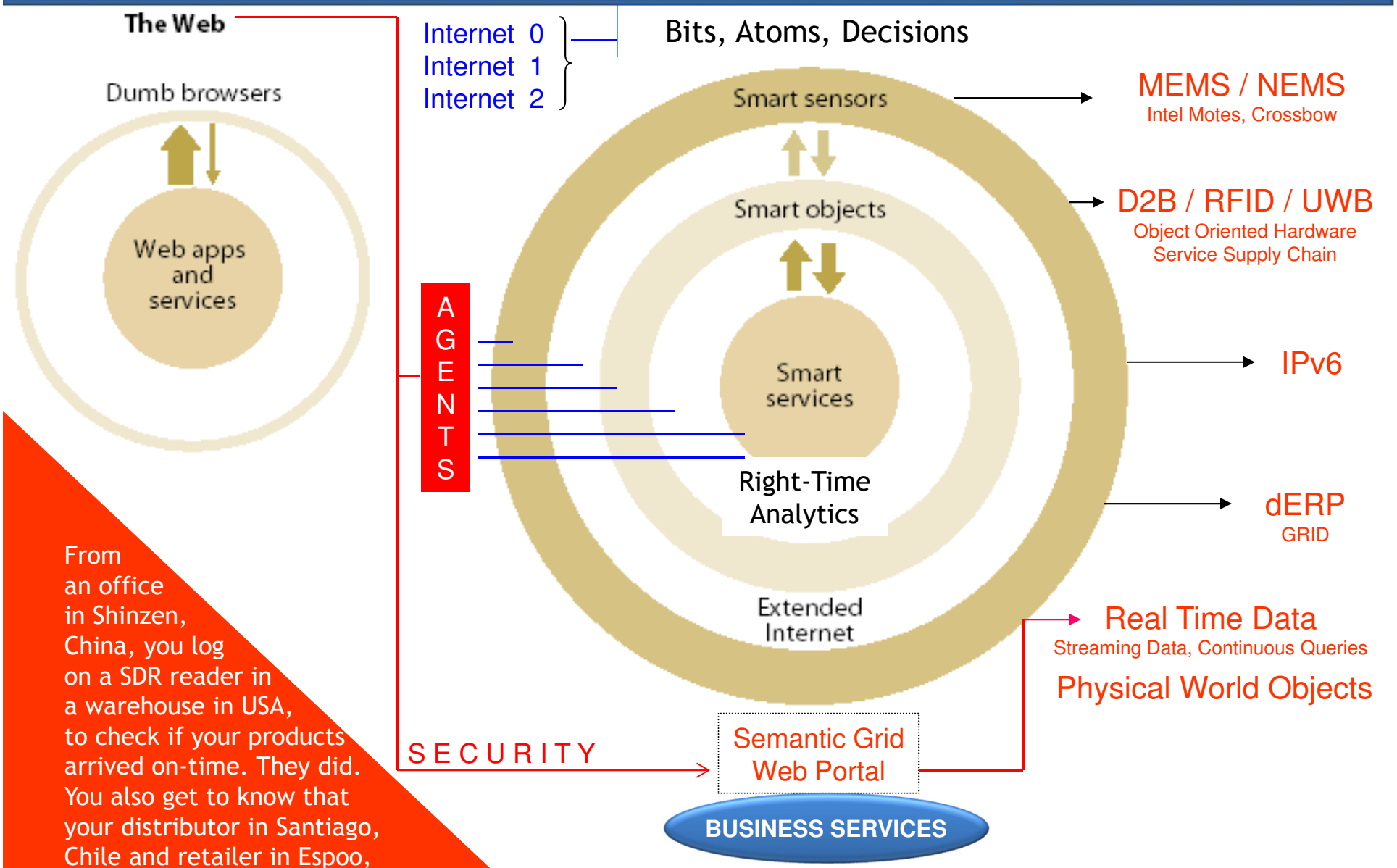
2008

2008 [3]	Name	HQ	Industry	Market Cap USD m
1	Exxon Mobil	US	Oil and gas	403,366
2	Petrochina	China	Oil and gas	325,320
3	GE	US	Various	253,674
4	Microsoft	US	Software	243,687
5	Wal-Mart	US	Retail	235,605
6	P&G	US	Retail	211,460
7	Industrial Commercial Bank of China	China	Banking	208,397
8	Berkshire Hathaway	US	Insurance	202,901
9	China Mobile	China	Telco	198,558
10	J & J	US	Health care	193,602

2011

	2011 [1]
1	Exxon Mobil 417,166.7
2	PetroChina 326,199.2
3	Apple Inc. 321,072.1
4	Industrial and Commercial Bank of China 251,078.1
5	Petrobras 247,417.6
6	BHP Billiton 247,079.5
7	China Construction Bank 232,608.6
8	Royal Dutch Shell 226,128.7
9	Chevron Corporation 215,780.6
10	Microsoft 213,336.4

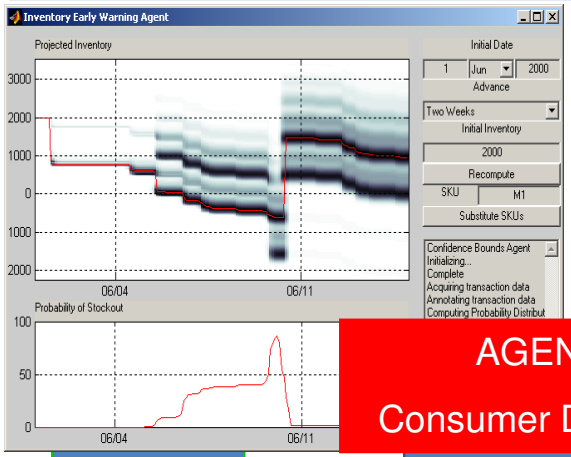
Integrating Ubiquitous Analytics in Real-Time with Data, Information, Application



From an office in Shinzen, China, you log on a SDR reader in a warehouse in USA, to check if your products arrived on-time. They did. You also get to know that your distributor in Santiago, Chile and retailer in Espoo, Finland also checked the delivery status, moments before you logged on.

SDR Data Interrogators as Ubiquitous Internet Appliances in IoT (2003)

Intelligent Object Integration for Business Services – Pay Per Transaction



ACTION

REPLENISHMENT

X instances ?

AGENT
Consumer Demand

Plant
ERP
RDBMS

2 days

Analytics

Real-Time

Virtualization
Dynamic UI

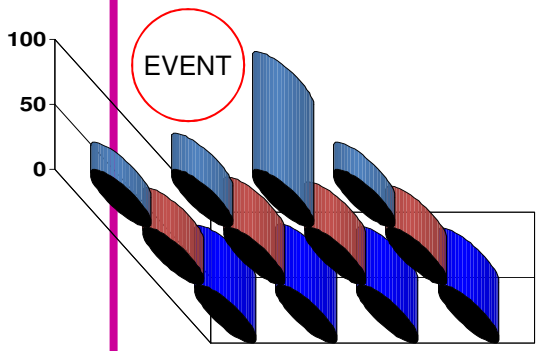
Energy
Defense

Logistics
Transport

Home
Appliance

Social Media

Y days ?



Telematics
Information Agent

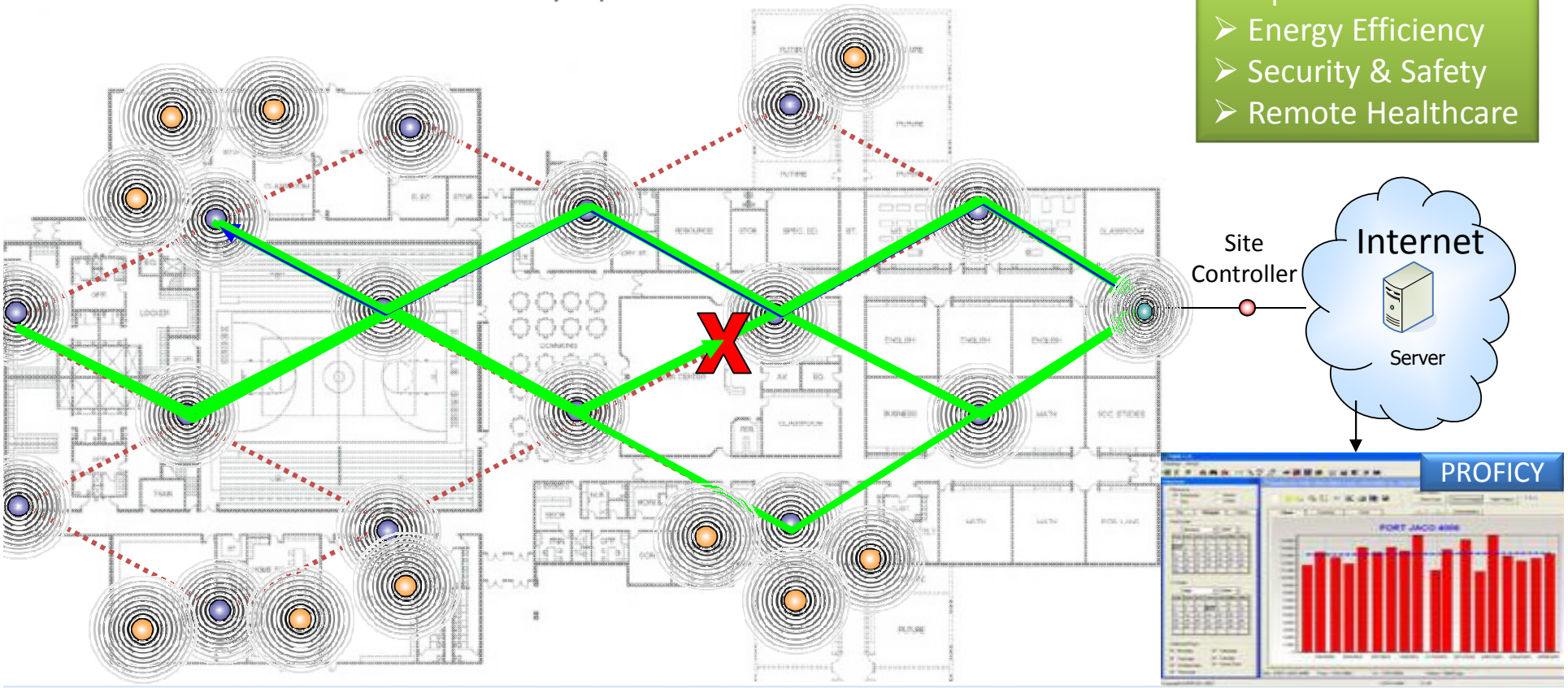
Data
Inventory
Consumption

Dr Shoumen Datta, MIT (2002)

Killer App • Wireless Sensor Networks - Mesh Networks → Energy Efficiency

- Sensors distributed over range > 100 meters
- Multiple dynamics and penetration of barriers
- No single point of failure (self-healing ad hoc mesh)
- Grid power not necessary (battery life 1 to 10 years)
- Bi-directional data (monitoring, reset, reconfiguration)
- Wireless sensors directly upload data to internet via IPv6

Ubiquitous WSN for
- Energy Efficiency
- Security & Safety
- Remote Healthcare



http://dspace.mit.edu/handle/1721.1/62251

Idea

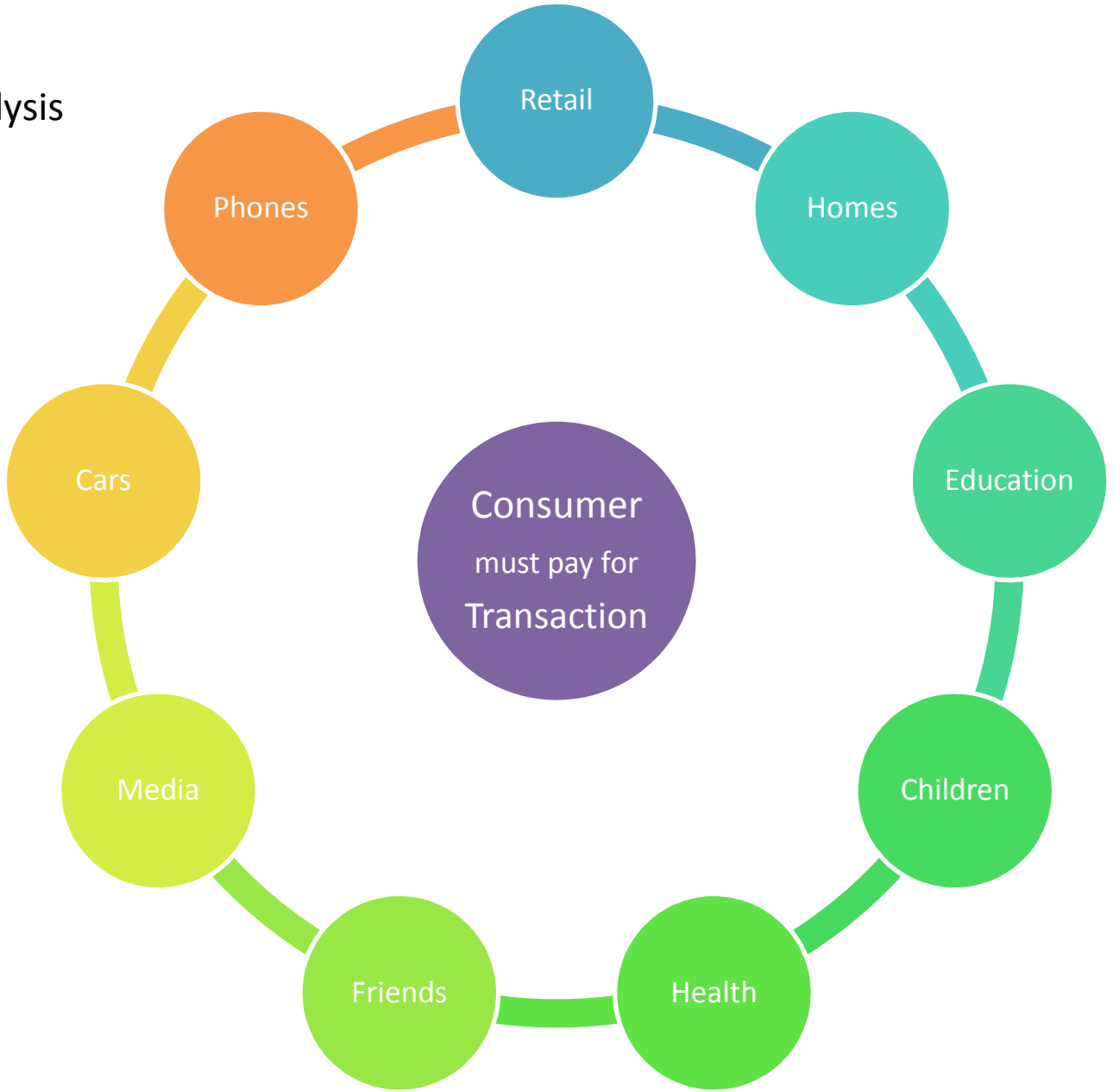
Lifestyle related points of transaction ☑ SAAS-SaaS integrated transactional interface

Value

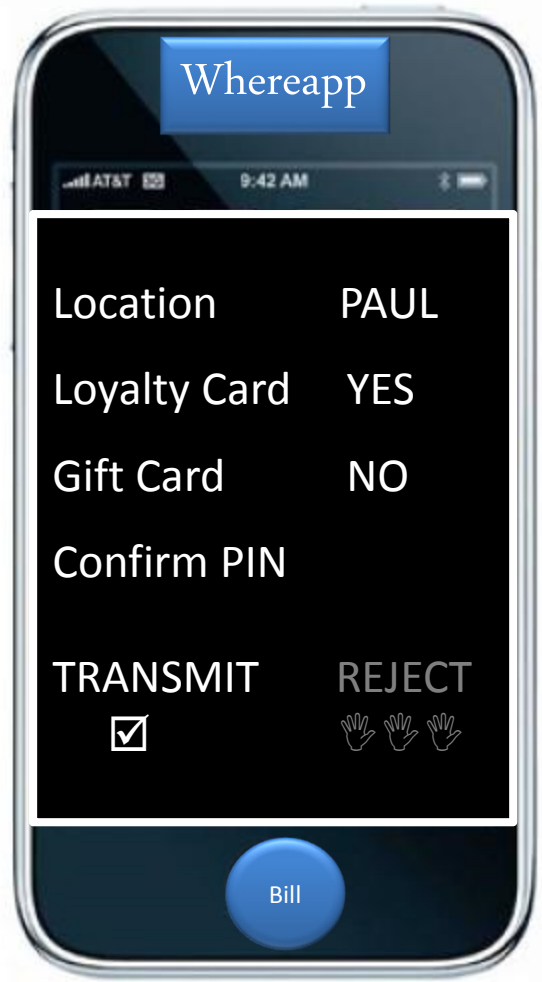
Transaction Cost Analysis

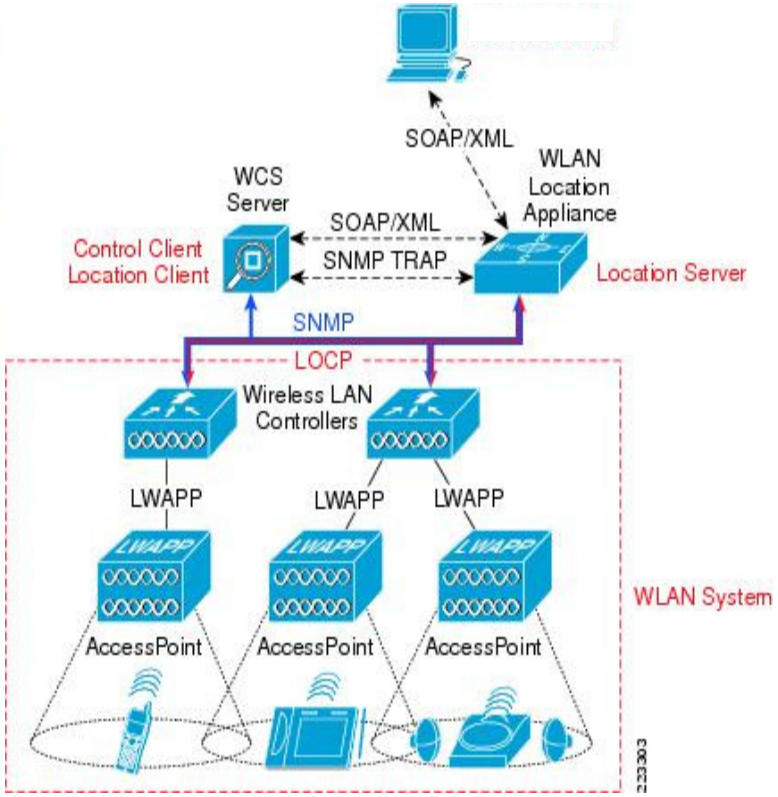
Revenue

Micro-payments



IPv6 Location Aware Services – mobile wallet, healthcare





Location Aware Retail Store

Location Aware Healthcare

Growth potential from mobile finance SaaS platform

Assume **189.9 billion instances** of electronic payments pa global *

Charge 1 cent per instance (transaction) with 10% market share

Earn **$190 million** pa from pay per transaction micro-payments

Based on the assumption that US constitutes one-third of global non-cash payments.*
www.frbservices.org/files/communications/pdf/research/2007_payments_study.pdf

Number of noncash payments in US was 93.3 billion in 2006 (value of $75.8 trillion).

	2003	2006	CAGR*
Total (billions)	81.4	93.3	4.6%
Checks (paid)	37.3	30.6	-6.4%
Debit card	15.6	25.3	17.5%
Signature	10.3	16.0	15.8%
PIN	5.3	9.4	20.6%
Credit card	19.0	21.7	4.6%
ACH	8.8	14.6	18.6%
EBT	0.8	1.1	10.0%

SaaS ECOSYSTEM

Anti-Vandalism
SAAS
SAFETY PIN
Security System

Connect (mobile software) with OPM (other peoples money) at every POT (point of transaction)

Growth potential from pay per mile car insurance

Estimated number of personal automobiles in India and China 30 million

Estimated average distance 6000 miles or 180 billion car-miles per year

Charge (average) 2 cents per mile (age adjusted) for car insurance *

Connect (telematics software) with personal automobile id (IPv6) to bill distance data.

Revenue pa with 10% share **$360 million**

Pay Per Mile insurance reduces barrier to entry and harvests economies of scale

* US average for low risk, low cost insurance for middle-age individuals approximates 5 cents per mile based on 12,000 miles per year.

Revenue from security - pay per hour home insurance

Estimated number of personal homes in India and China 250 million

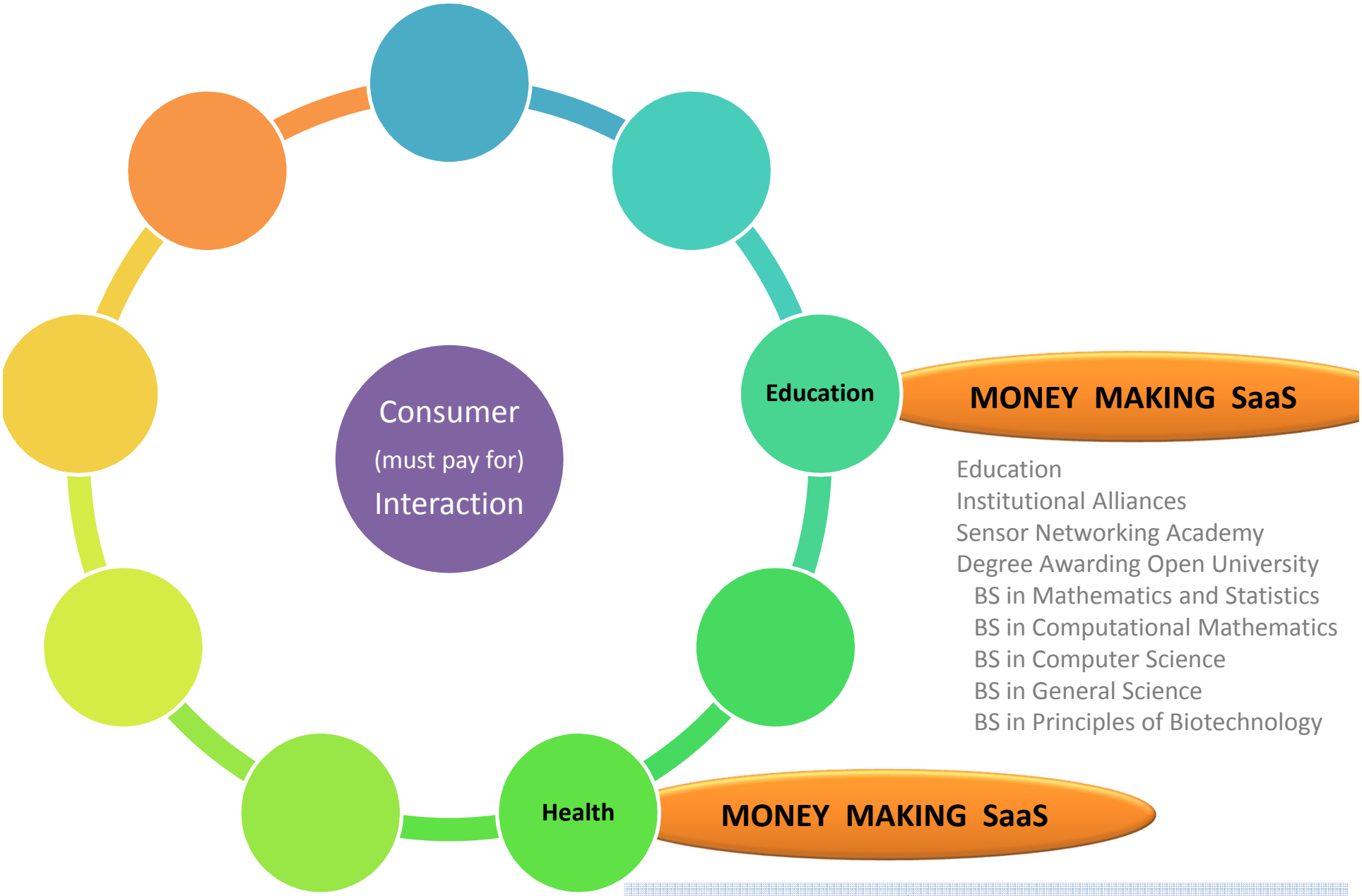
Estimated average 4 hours unoccupied or 365 billion home-hours pa

Charge (average) 1 cent per hour

Revenue pa with 10% share **$365 million**

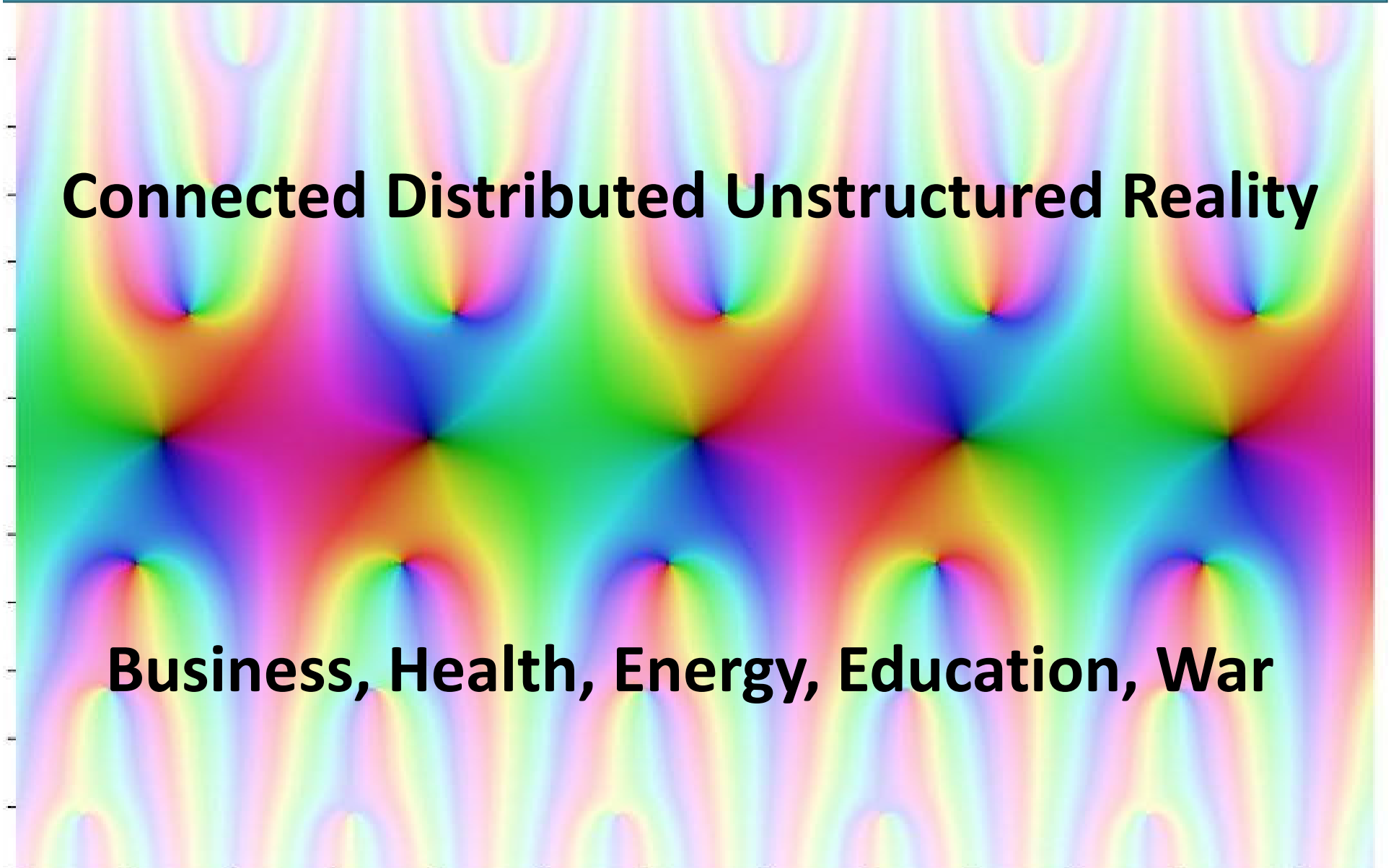
Pay Per Hour insurance reduces barrier to entry and improves penetration

Connect (domestic telematics SaaS) with WSN - IPv6 (self-organizing motion sensors ad hoc mesh)


Consumer
(must pay for)
Interaction
Education
MONEY MAKING SaaS
Education
Institutional Alliances
Sensor Networking Academy
Degree Awarding Open University
BS in Mathematics and Statistics
BS in Computational Mathematics
BS in Computer Science
BS in General Science
BS in Principles of Biotechnology
Health
MONEY MAKING SaaS
HIT
EPIC
Medical Devices
Remote Sensing
Biomed Diagnostics
Mammography Screening

What people may think in the future about the future of reality

Illustration of Ramanujan's Theta Function



Medium …

The magnitude and the multiple dimensions of the inevitable transformation of business is far from what we can conceive for the future if such predictions are to be based on our present knowledge and the wisdom from our past. The ***rate of change*** of business models has accelerated due to technology, cannibalized by constant innovation and buoyed by global flow of finance. The origins of knowledge and information are no longer sequestered by communities, bounded by geographies or constrained by the lack of wealth of nations. Entrepreneurship increasingly triumphs over state endeavors.

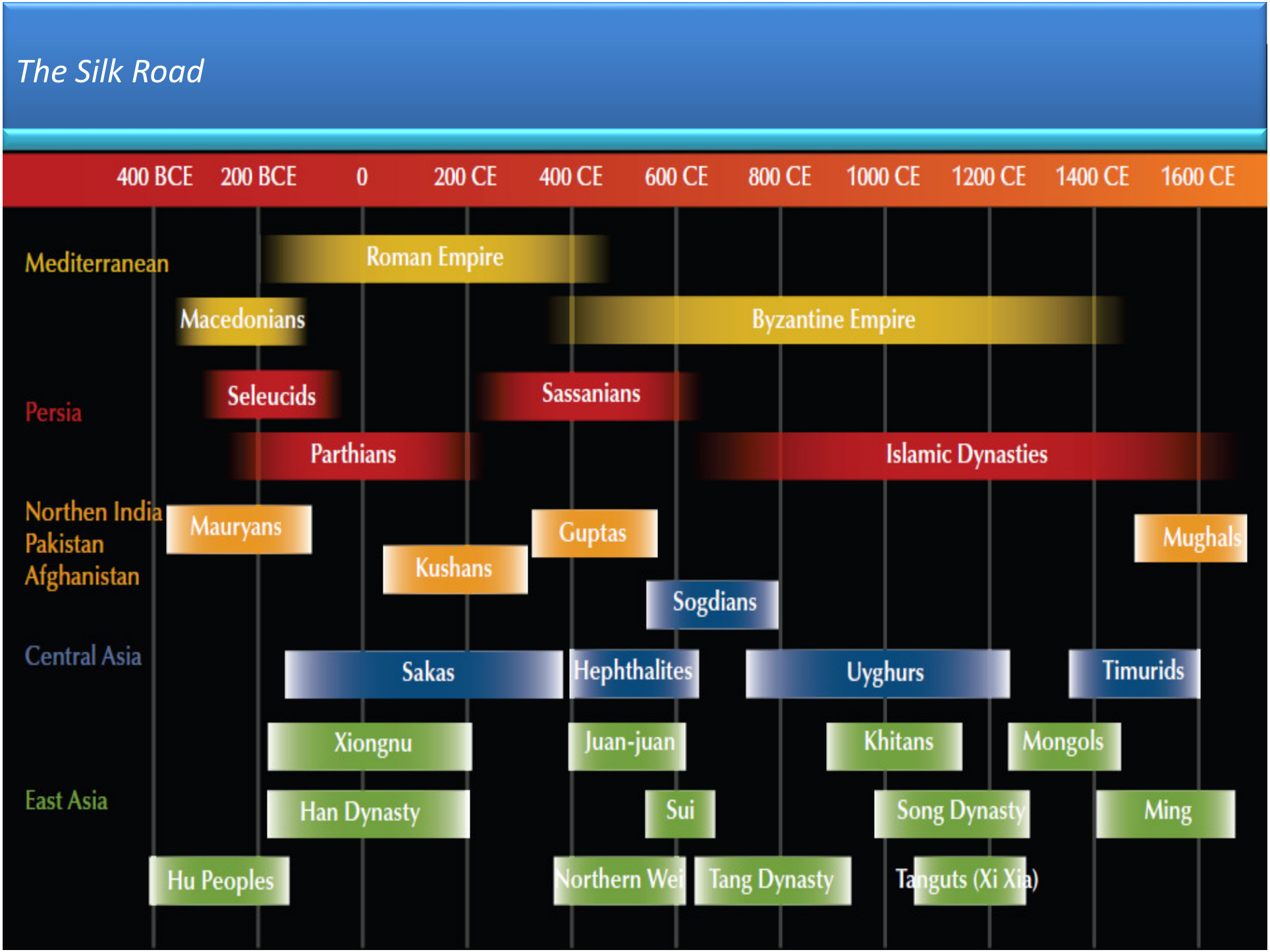
Much of the turbulence ahead is and will be due to the change in the ***medium*** of material business. The physical infrastructure to sell material goods is diminishing in relevance almost in inverse proportion to the increase in demand for services and value-added functions. Management of services was an intensely human capital heavy undertaking even a couple decades ago but the change in medium has decreased the overhead and enabled businesses to focus human capital on the actual delivery, where applicable and necessary (for example, healthcare).

Hence, the access to the new medium of the internet, will continue to dominate the business and economic landscape, in many business verticals. Some of the current models will survive (basic e-retail) but many more functions are likely to germinate. To lead businesses, therefore, senior management must understand the infrastructure of the market and its medium as well as the nature of the demographics that shape the market but segmented as a collection of micro-markets.

Operations management based on classical domains of supply-demand, inventory-replenishment, production-distribution are likely to undergo significant convergence to platforms which can aggregate and differentiate rapidly to trigger adaptability response mechanisms. Analytics based dashboards will become the mainstay for decision support in almost every type of service business as well as politics, policy, security in addition to key verticals (healthcare, energy, commodities, transport, utilities, manufacturing, mining, petroleum, gas, fuel, military and the space industry).

The next few slides present a rather biased slice of the road ahead and points out a few potential (perhaps, obvious) convergence of trends. An attempt, albeit incomplete, has been made to bridge real business with virtual reality of businesses which must deal with the opportunities (and pitfalls) of transacting in cyberspace with global customers.

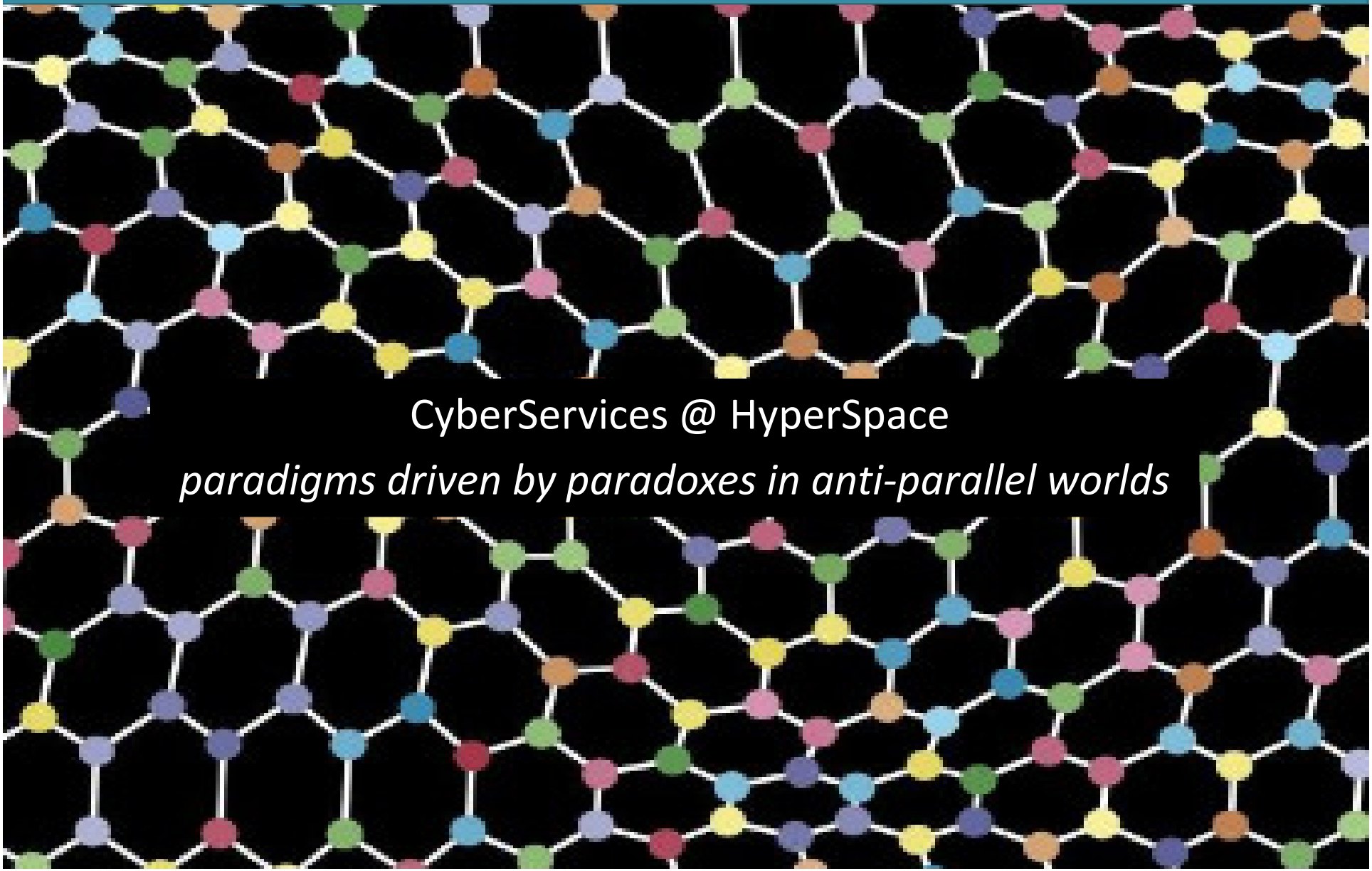
In a separate but related discussion, I will try to illustrate the connected industrial world with the medium of the internet.


The Silk Road
400 BCE
200 BCE
0
200 CE
400 CE
600 CE
800 CE
1000 CE
1200 CE
1400 CE
1600 CE
Mediterranean
Roman Empire
Macedonians
Byzantine Empire
Persia
Seleucids
Sassanians
Parthians
Islamic Dynasties
Northen India
Pakistan
Afghanistan
Mauryans
Guptas
Mughals
Kushans
Sogdians
Central Asia
Sakas
Hephthalites
Uyghurs
Timurids
Xiongnu
Juan-juan
Khitans
Mongols
East Asia
Han Dynasty
Sui
Song Dynasty
Ming
Hu Peoples
Northern Wei
Tang Dynasty
Tanguts (Xi Xia)

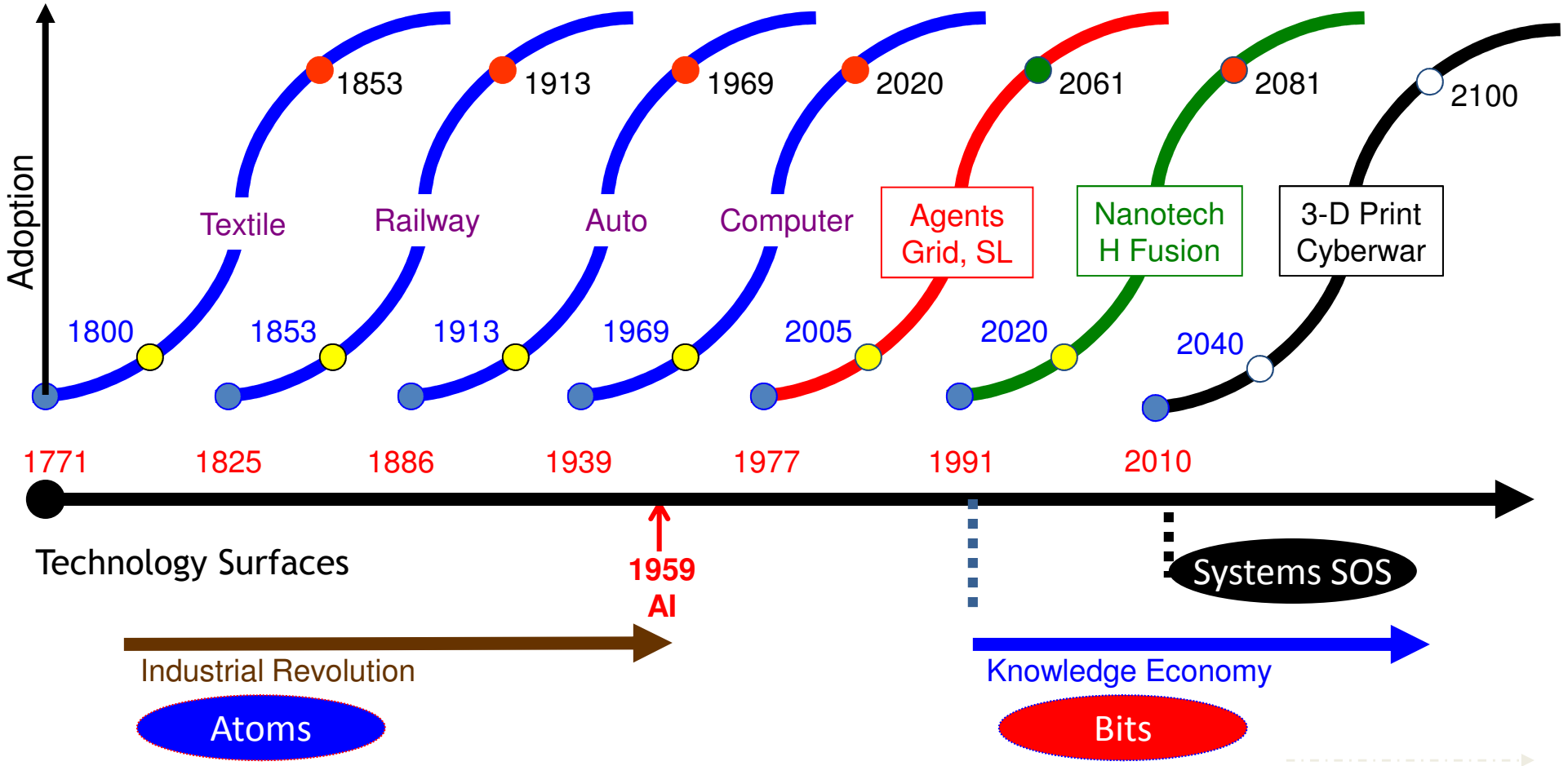
Demand driven business may have roots as ancient as the pre-organization of the Indus Valley Civilization (7000 BC). Business was in full operation in the bazaars of Sumeria in Mesopotamia (modern day Baghdad) which thrived long before the start of written history (3100 BC). Local goods were bartered by local people using wheels on carts (3500 BC) as the ***medium*** of transportation on land. Vessels with oars that can ply on waterways evolved around the same time (3500 BC). By the 1st Century AD the commercial agora in ancient Ephesus (adjacent to Library of Celsus) documents the trading of "eastern" dyes and spices. The ***medium*** of transportation via water and land was improved enough to transact between dynasties on The Silk Road beginning 400 BC. But it was not until the 1950's that *containerization* (transport by sea) paved the path for true globalization. Air transportation germinated when American pioneers Rufus Porter and Frederick Marriott attempted to start "airlines" using airships in the mid-19th century (New York–California) but those attempts floundered. DELAG (*Deutsche Luftschiffahrts-Aktiengesellschaft*) was the world's first airline in the 20th century (founded November 16, 1909) and operated airships manufactured by The Zeppelin Corporation. Although military logistics in the 1940's was sufficiently advanced, in commerce the ***medium*** of air transport did not make a contribution until 1960's. At that time Fred Smith, founder of Federal Express, was a student at Yale University and worked weekends as a charter pilot. While flying passengers and transporting spare parts for IBM, Fred Smith developed an insight that led him to propose his idea for an express delivery service in his 1965 university term paper. With $4 million from his father and $80 million from investors, Fred Smith set up FedEx in 1971 and launched service from Memphis on March 12, 1973. FedEx had just 7 packages for the first night's run. 50 years later (2013) FedEx market cap is around $30 billion. In 2005, global revenue from air freight exceeded $50 billion. Air freight represents 3% of global volume but the value of goods transported by air was about $3 trillion (a third of the estimated $9 trillion global exports).

During the 1940's when military logistics was taking shape, Claude Shannon founded the basics of information theory and published his seminal paper in 1948. However, Shannon is also credited with founding both digital computer and digital circuit design theory in 1937, when, as a 21-year-old master's degree student at the Massachusetts Institute of Technology (MIT), he wrote his thesis demonstrating that electrical applications of boolean algebra could construct and resolve any logical, numerical relationship. This research inspired Vannevar Bush to suggest to Claude Shannon to explore Mendelian Genetics and that resulted in Shannon's doctor of philosophy thesis (PhD, MIT, 1940) entitled *An Algebra for Theoretical Genetics*. Partially based on Shannon's principle, John Licklider of MIT articulated (January 1960) the ideas of a "network" in his landmark paper, *Man-Computer Symbiosis.* In August 1962, John Licklider and Welden Clark published the paper *"On-Line Man Computer Communication"* which may be one of the first descriptions of a networked future. John Licklider was invited to join DARPA in 1962. He helped create the first internet (ARPANET) along with Robert Taylor and Larry Roberts from MIT. The first ARPANET link was established between the University of California Los Angeles (UCLA) and the Stanford Research Institute (SRI) at 22:30 hours on October 29, 1969 when Prof Leonard Kleinrock's lab at UCLA sent the first couple letters of the word "log" over the "net" to SRI. In 1971 the @ sign was introduced by Ray Tomlinson. But, it took another couple decades before the germination of the WorldWideWeb guided by Tim Berners-Lee (TBL) who wrote the first hypertext protocol (web browser) on a NeXT computer (founded by Steve Jobs). TBL completed the first version of www on Christmas day, 1990. TBL released the program at CERN in March 1991, introducing the web to the high energy physics community. WWW was born on August 6, 1991 at CERN, when TBL published the website and web server running on a NeXT computer. The web address of the first webpage was http://info.cern.ch/hypertext/WWW/TheProject.html. In June 1993, Digital Equipment Corporation (Cambridge, Massachusetts) created the first commercial website (ftp://gatekeeper.dec.com/). A turning point for the World Wide Web began with the introduction of the Mosaic web browser in 1993, a graphical browser developed by a team at the National Center for Supercomputing Applications at the University of Illinois at Urbana-Champaign (UIUC) led by Marc Andreessen. Mosaic was cannibalized in 1994 by Andreessen's Netscape Navigator, which was eventually superceeded by Microsoft's Internet Explorer. The Superhighway Summit at UCLA (January 11, 1994) was the first public conference bringing together all of the major industry, government and academic leaders in the field and ignited a national (and perhaps global) dialogue about the Information Superhighway and its implications. March 9, 1996 was the first National Net Day in USA to network schools in California. Jeff Bezos is probably the pioneer in ecommerce based on the new ***medium*** of the internet. Bezos incorporated Cadabra in July 1994 and the ebusiness started online as amazon.com in 1995. With revenues approaching $50 billion (2011) and nearly 70,000 employees, it is a signal of what transformation of the ***medium*** to cyberspace can do for business. The growth of e-commerce is in its infancy with only one third of the world's population connected to the internet. A minor fraction of those who are connected may actually transact.

Permanently anticipate and mitigate unanticipated changes to steer a sense of pseudo-equilibrium amidst the constant volatility of supply-demand disequilibrium in business.

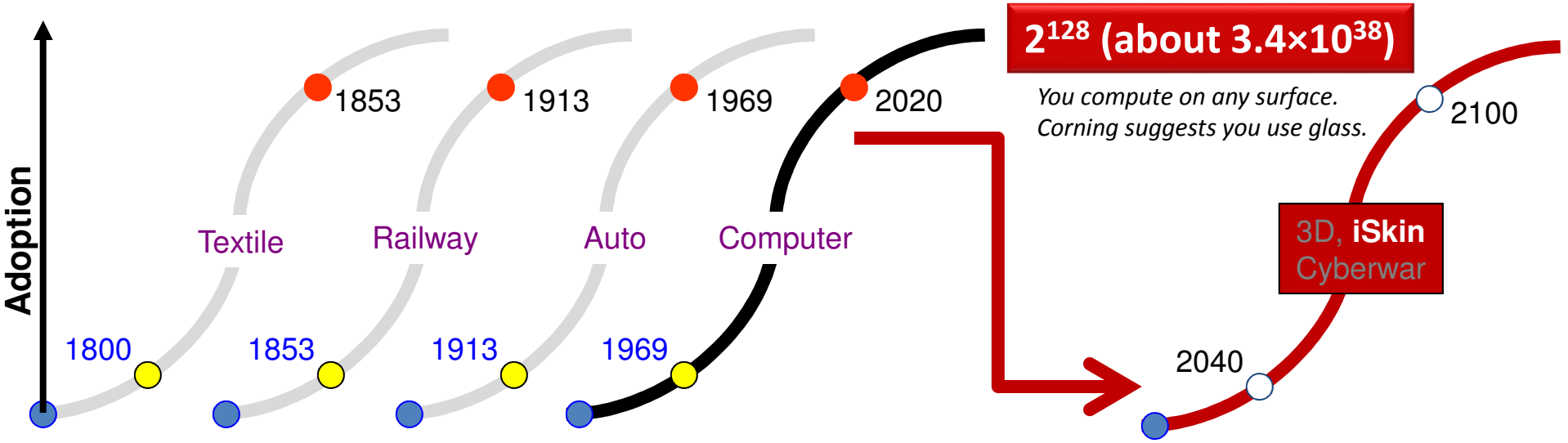


Time to reach functional equilibrium?

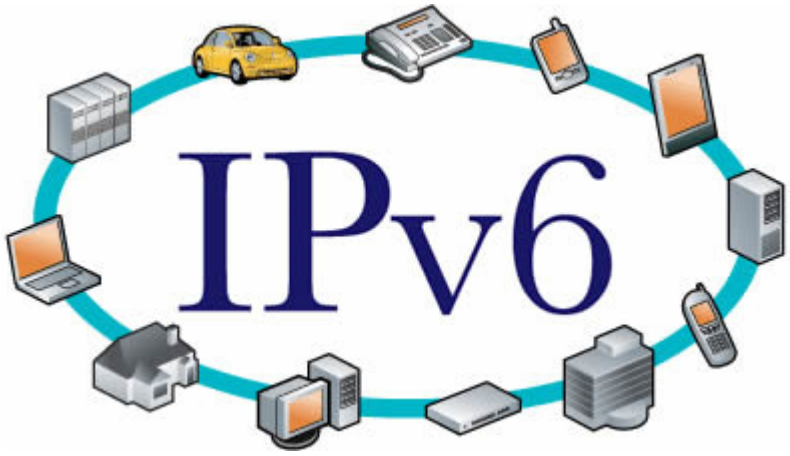


Economic history data related to Textile, Railway, Automobiles and Computers provided by Norman Poire

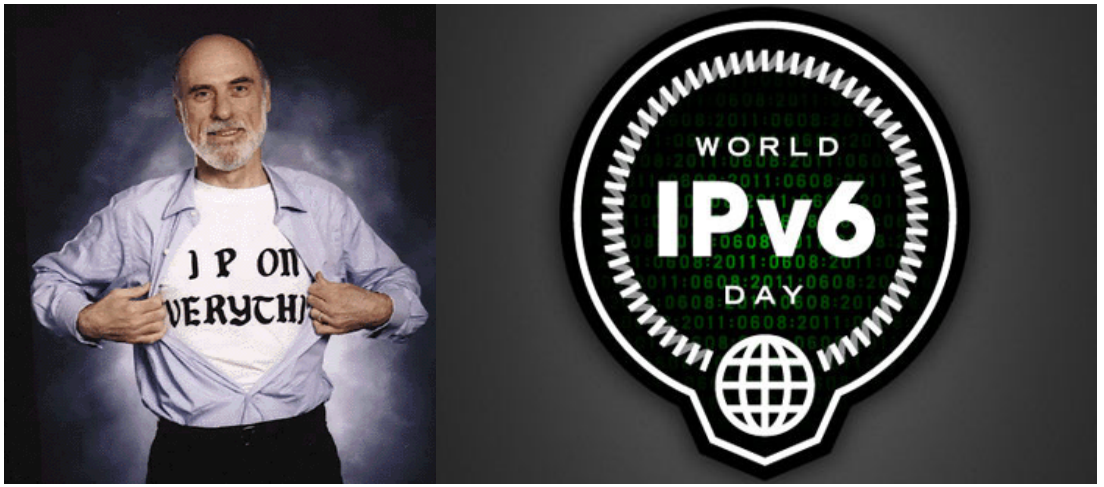
iSkin - Ubiquitous Computational Layer - partial replacement for device dedicated surfaces



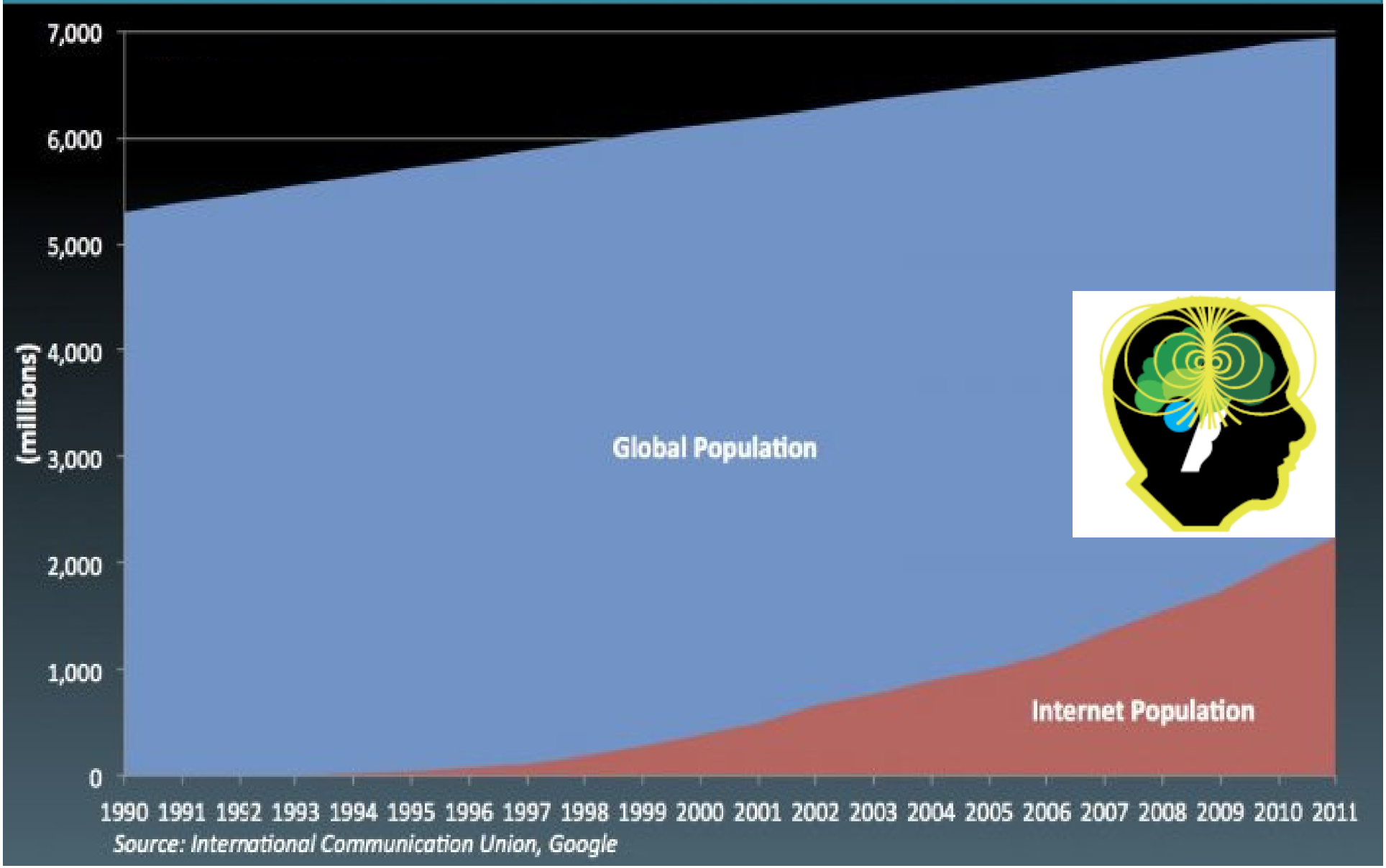
340,282,366,920,938,000,000,000,000,000,000,000,000 unique IP addresses



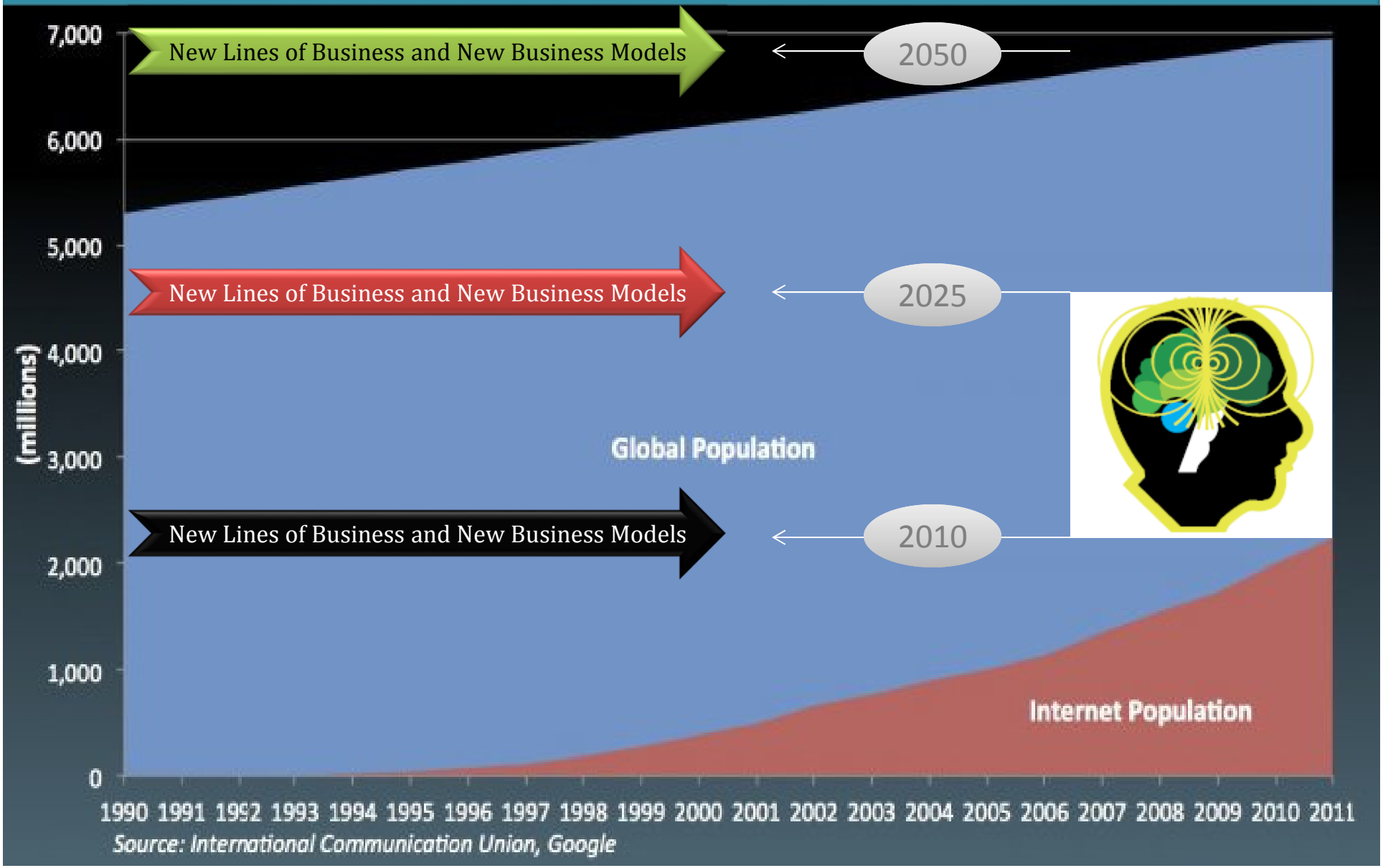
Compute on your bathroom mirror or refrigerator door or car window



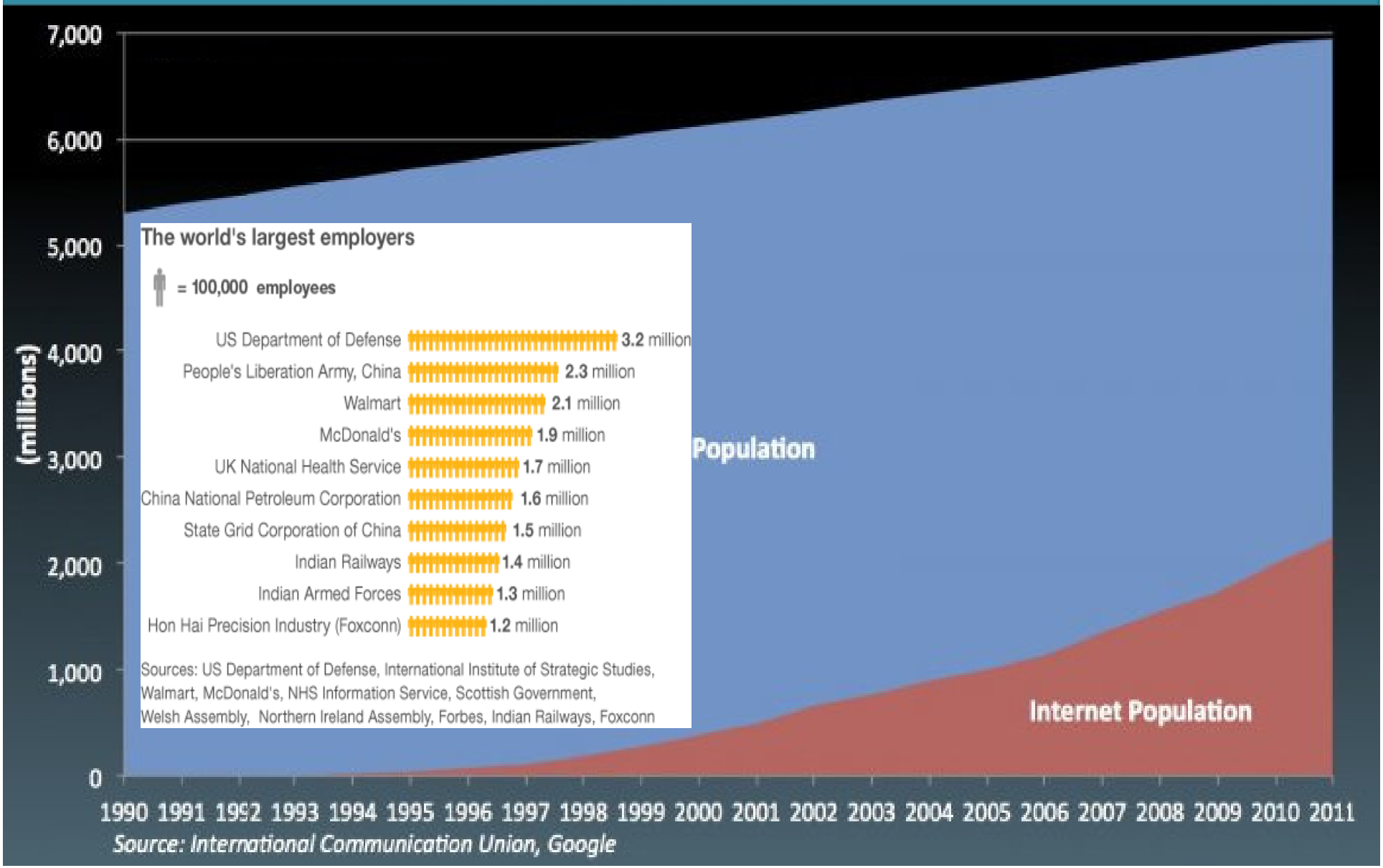
Let us start at the beginning - 2500 years to travel via the Silk Road to the CyberSphere



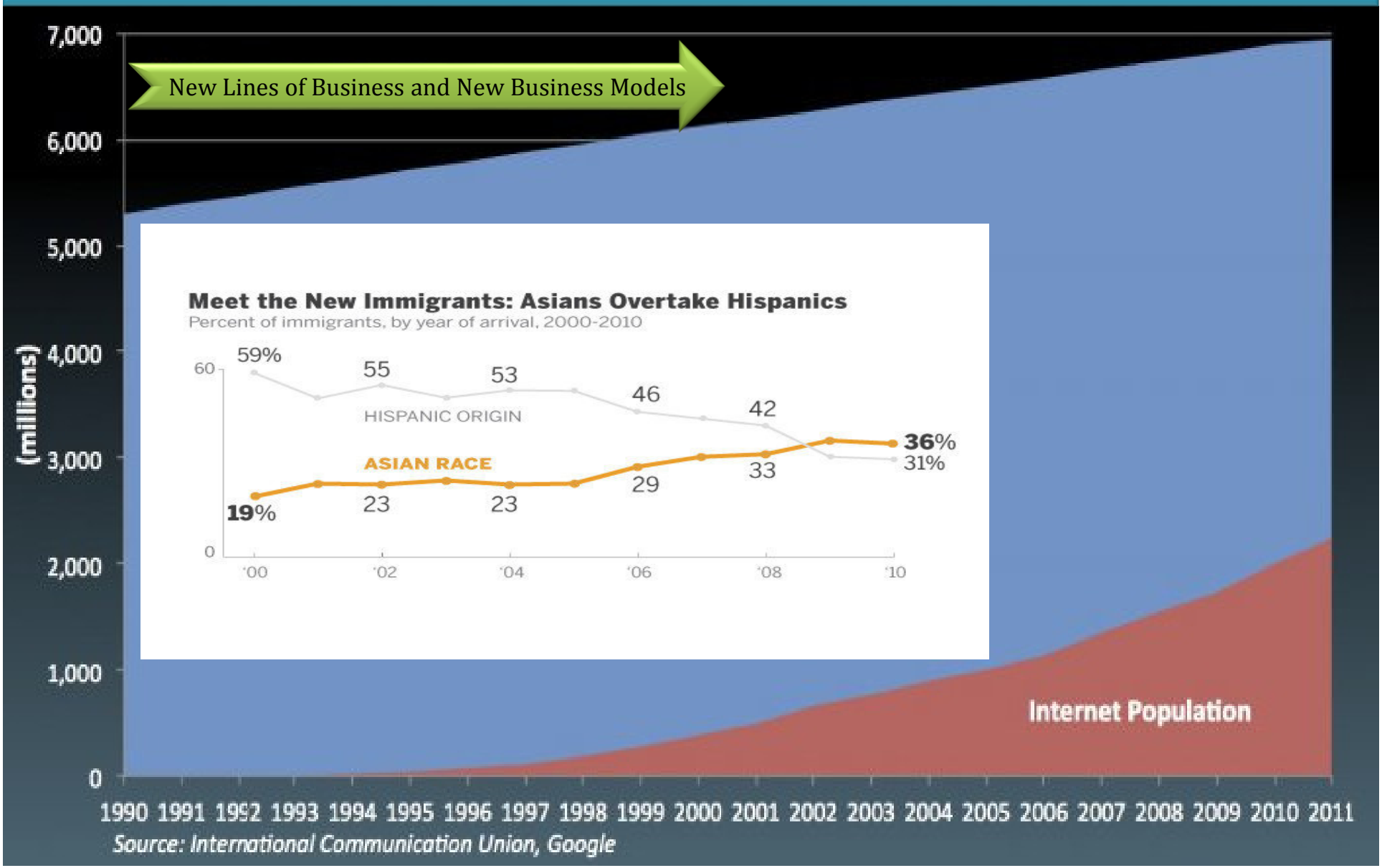
The cycle of re-inventing business, business models and shifting business paradigms



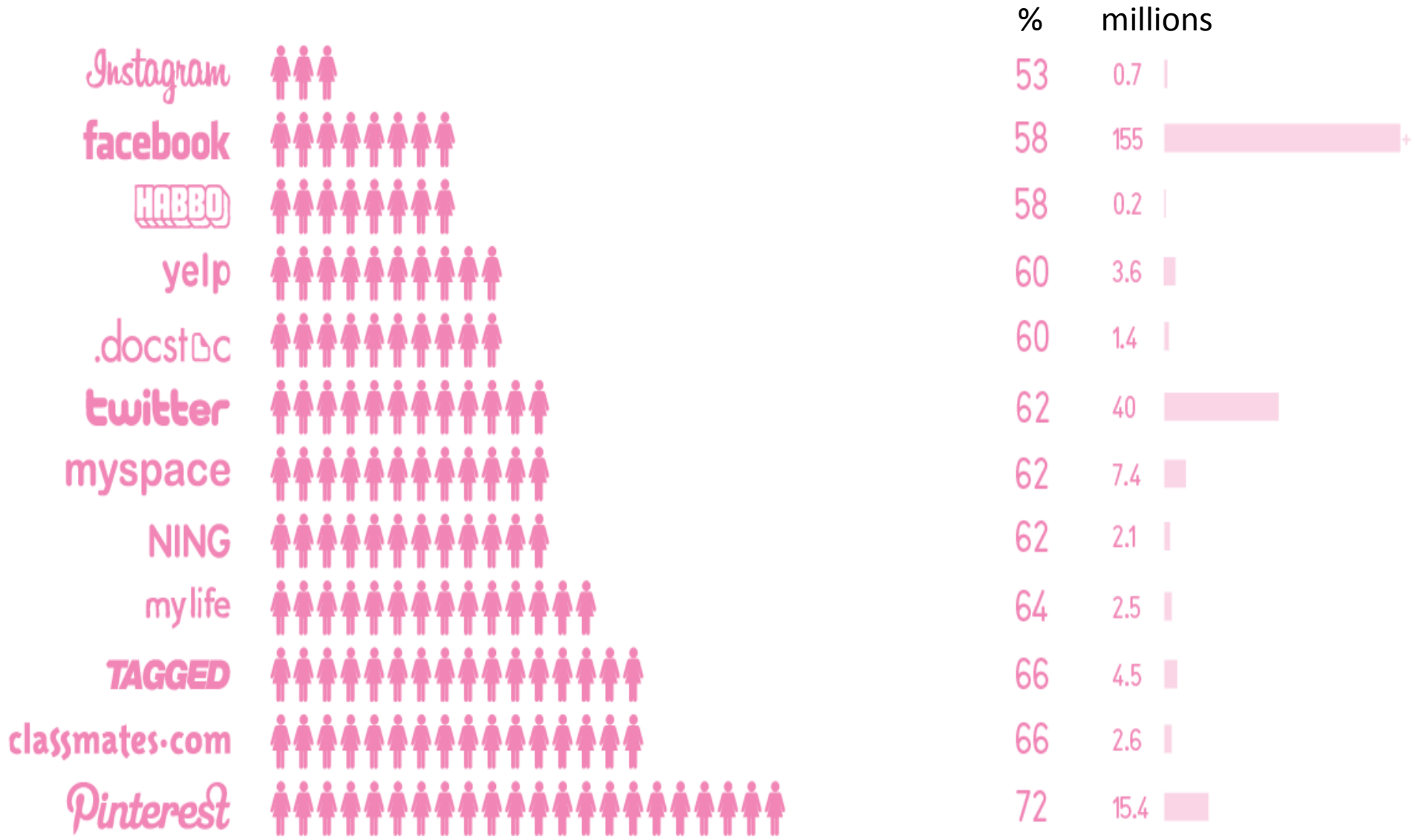
Internet access may not parallel employment, usage, e-commerce and online services



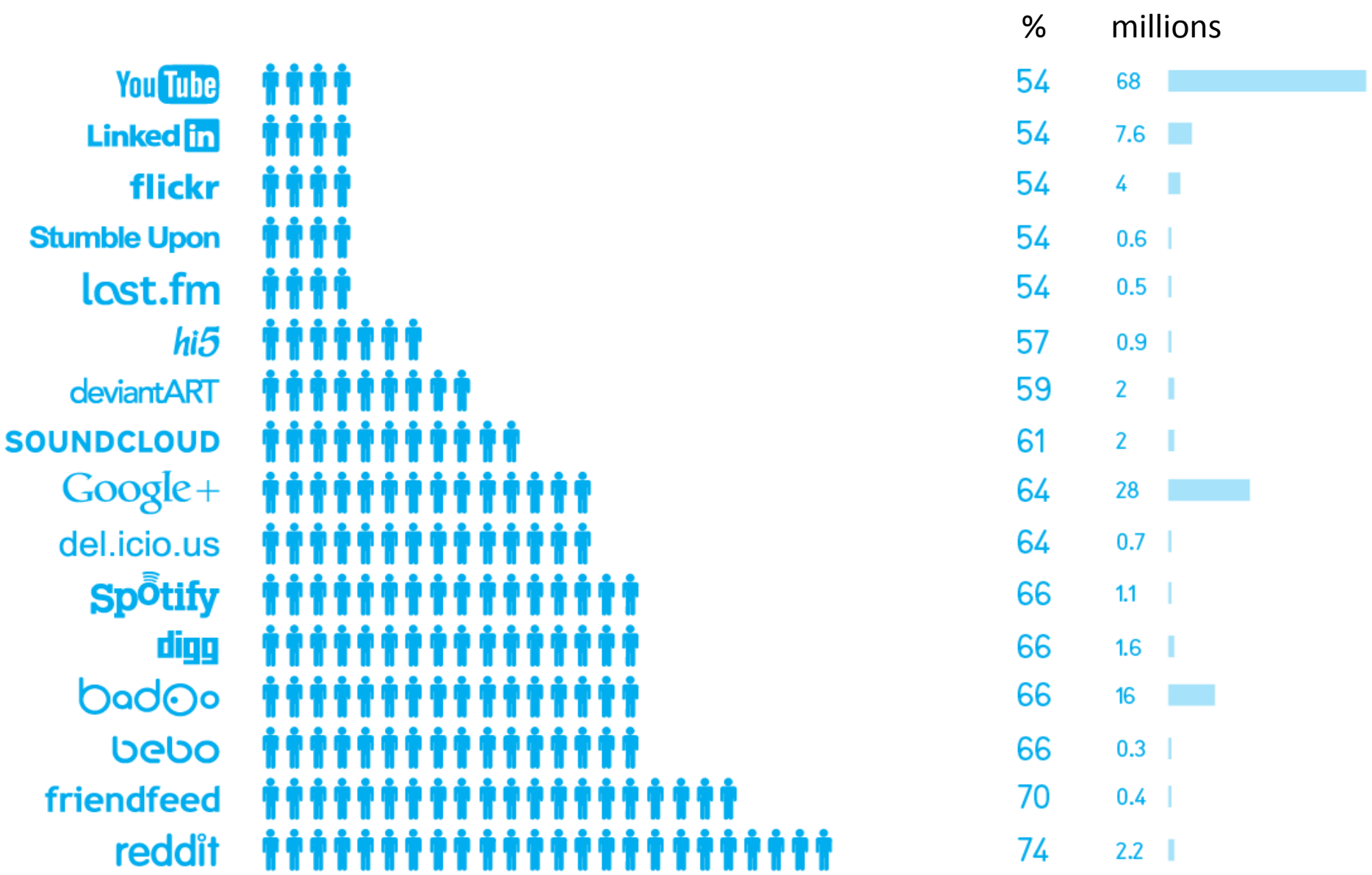
Metamorphosis of cyber-services with increased bandwidth and demographic changes



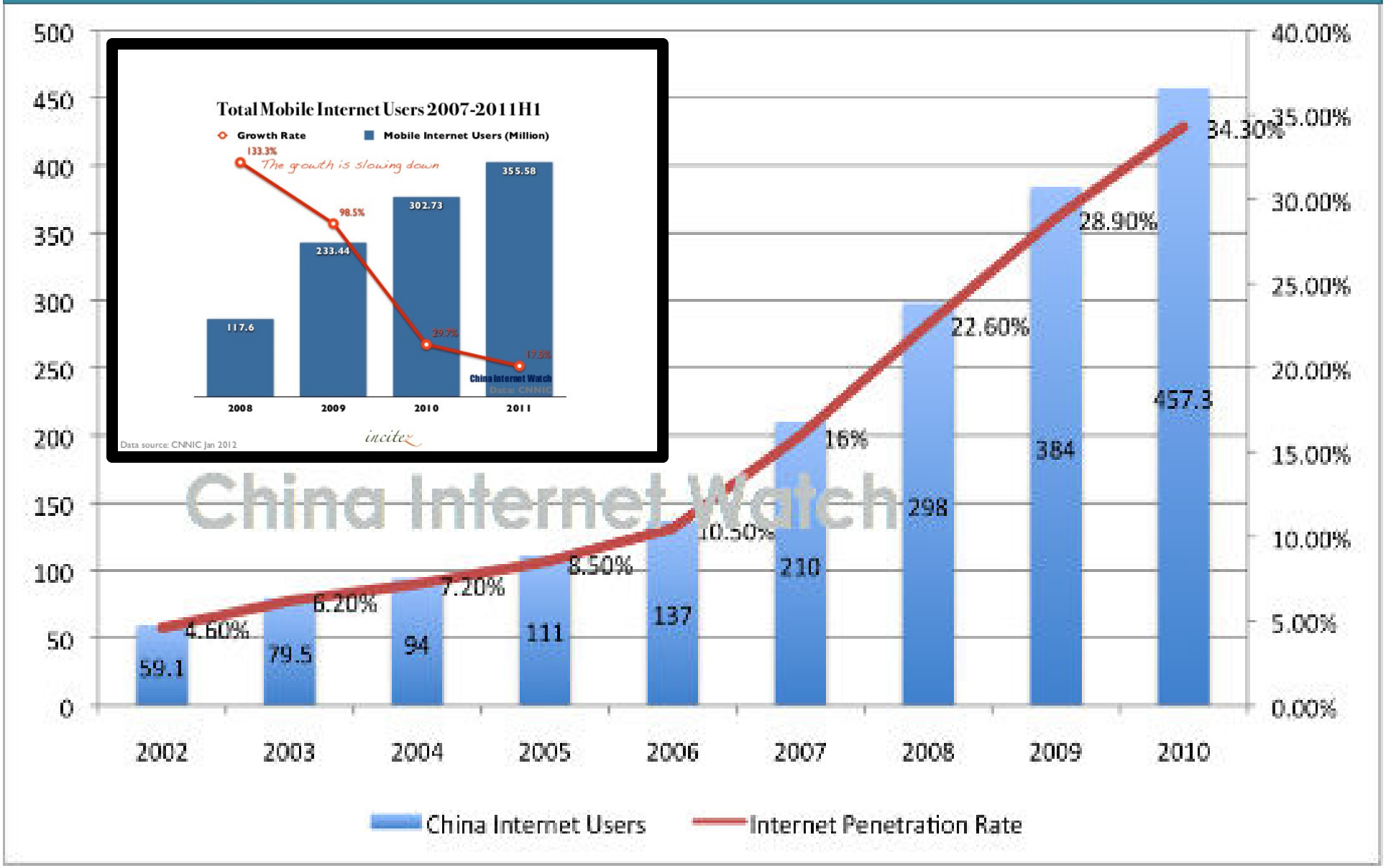
Gender and cyber-services – 100 million more females than male visitors per month



Preferred by males



Internet access in China – *Does it equate to nearly 450 million Chinese customers?*



China – *Is there a chasm between subscribers, IM-ers and actual paying customers?*

987.58

Million Mobile Subscribers by Jan 2012

1 billion

30.58 Million

Mobile Internet Payment Users in China

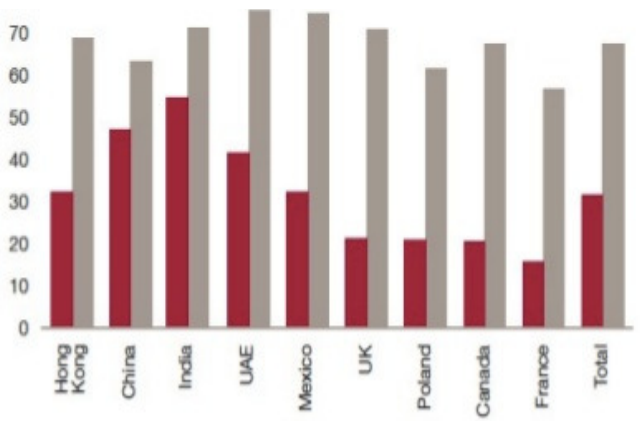
3 %

83.1%

Mobile Internet users use instant messaging, which is the number one application on mobile Internet

Financial Products Purchased

% Mobile vs % Internet

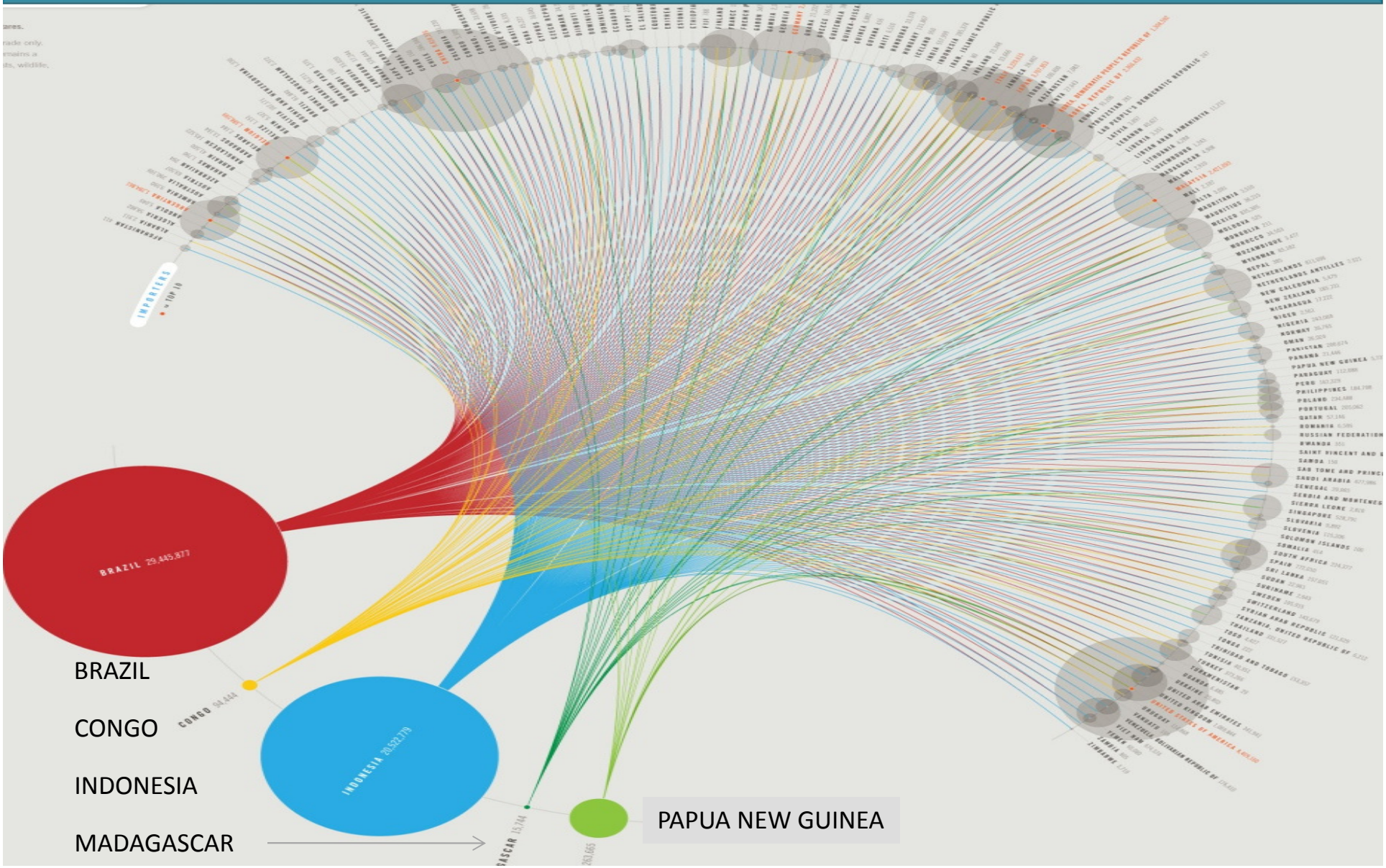


What is the fundamental reason for existence of business - with paying customers?

Need – *necessity is the mother of invention*

Is necessity still the mother of invention? ***http://vimeo.com/56772409***

Need → Demand → Market → Business → Timber producers & countries they supply



Need → Demand → Market → Business

Nestlé

VINCI CONSTRUCTION | FRANCE

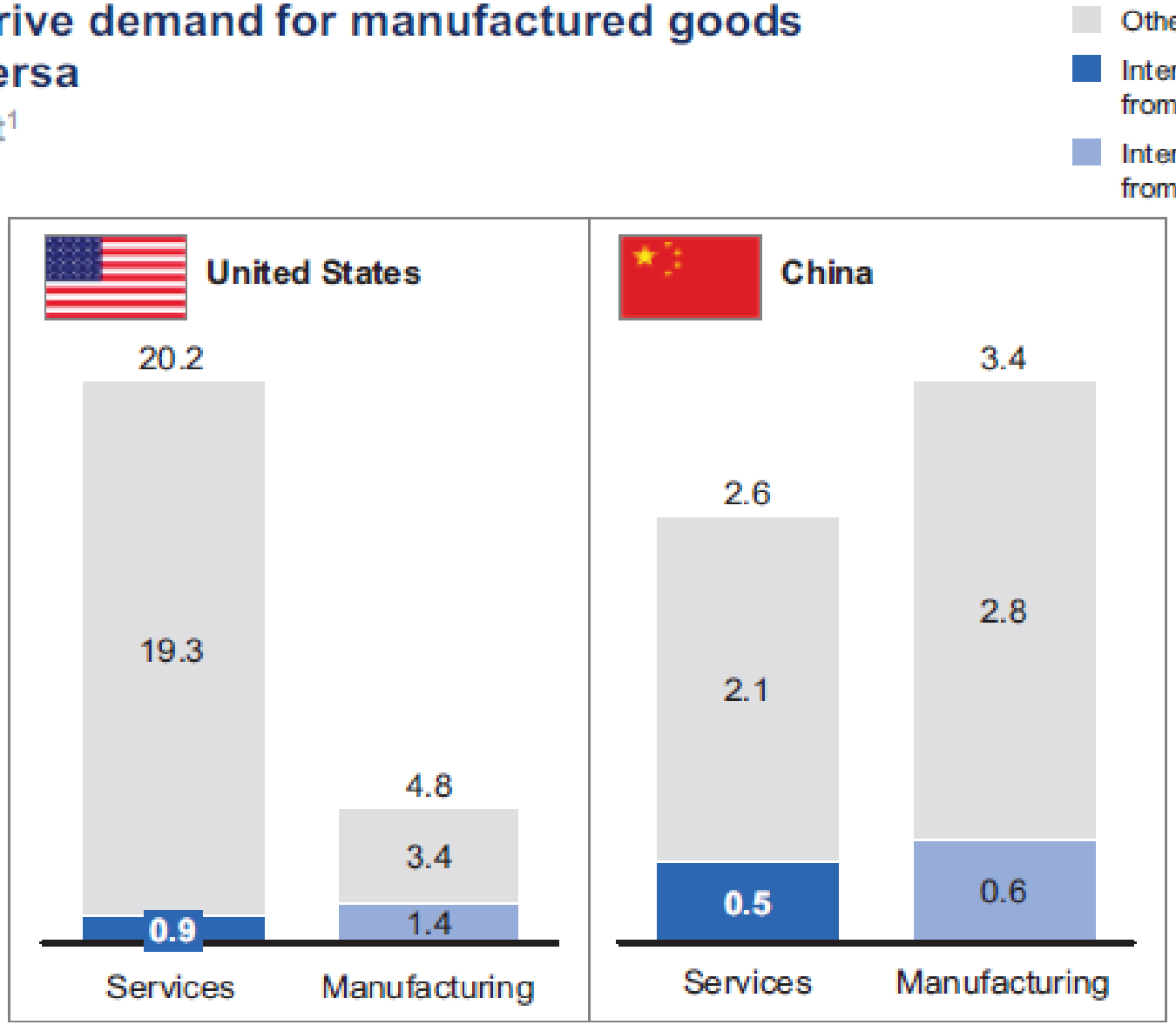
Processed food sales worldwide > $3 trillion

Market value - construction industry > $5 trillion

GOODS + VALUE ADDED SERVICES - demand for services is a driver for manufacturing

Services drive demand for manufactured goods and vice versa

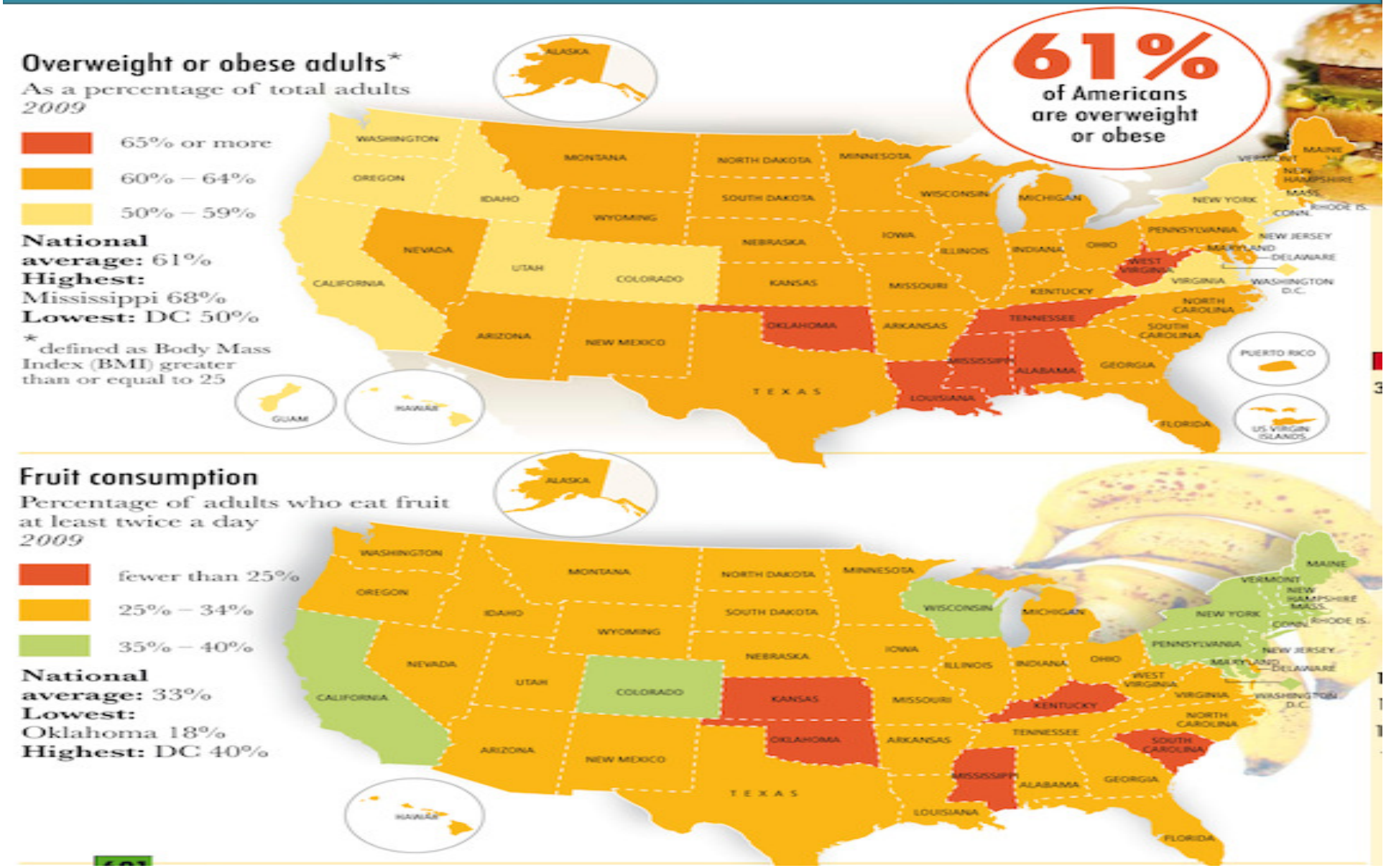
Gross output[1]
$ trillion



SERVICES • *The present is an egg laid by the past that has the future inside its shell.*

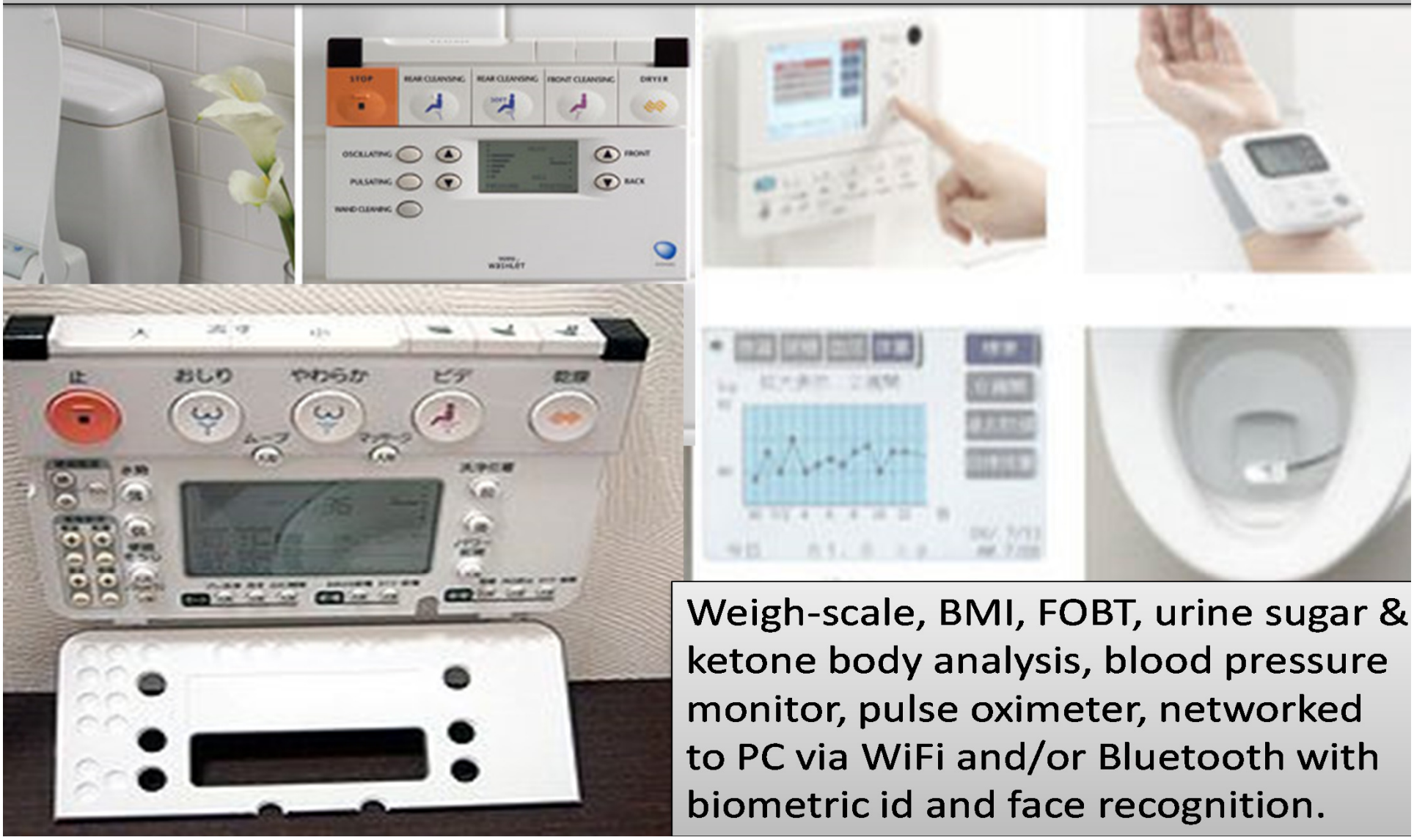
iPhone App reads Heart Rate

POOR LIFE CHOICES > POOR LIFESTYLE < Transforming bad habits into medical costs



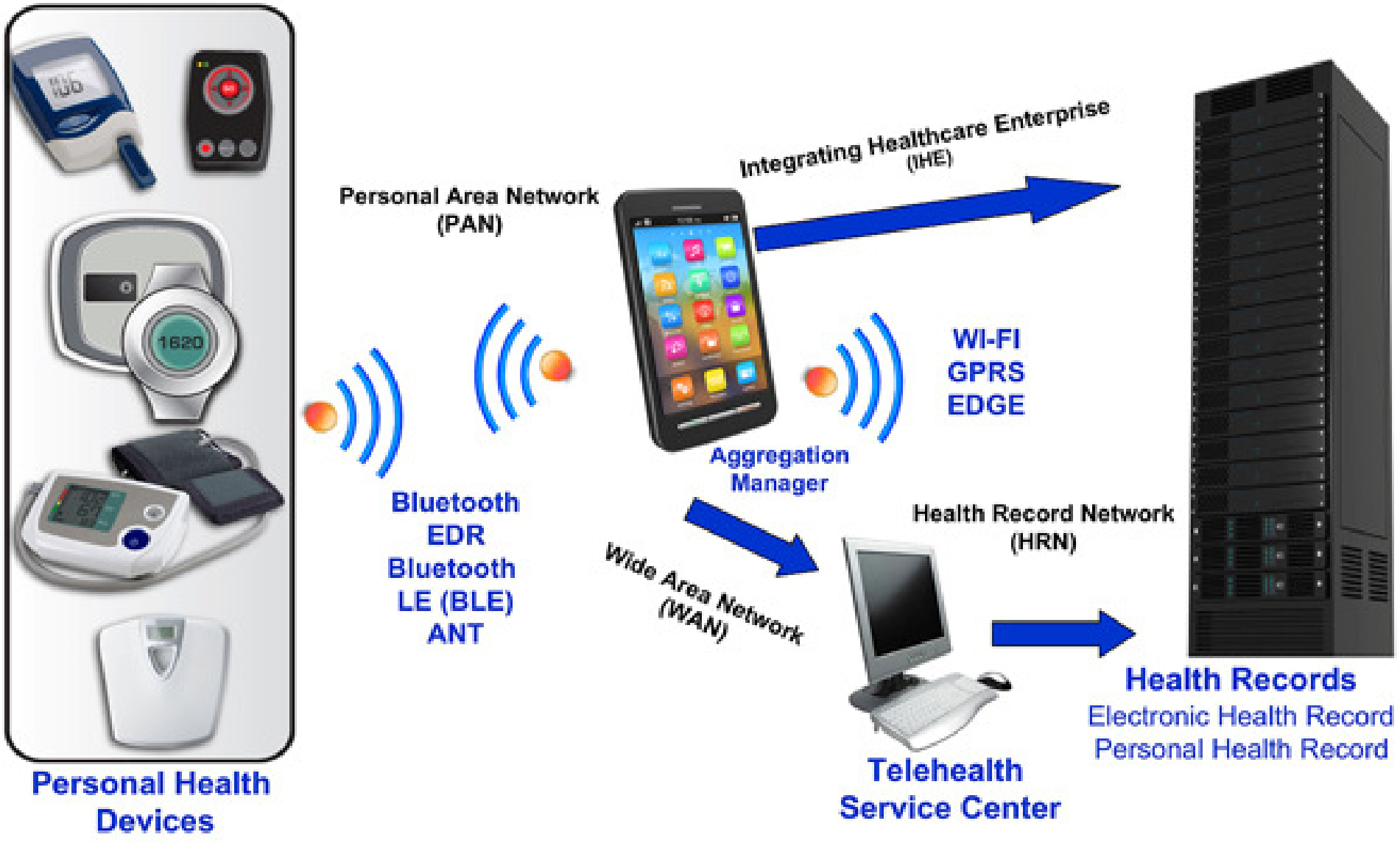
Healthcare Services likely to stimulate precision instrumentation and manufacturing

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.

LIFESTYLE SERVICES are likely to influence the future of manufacturing and healthcare

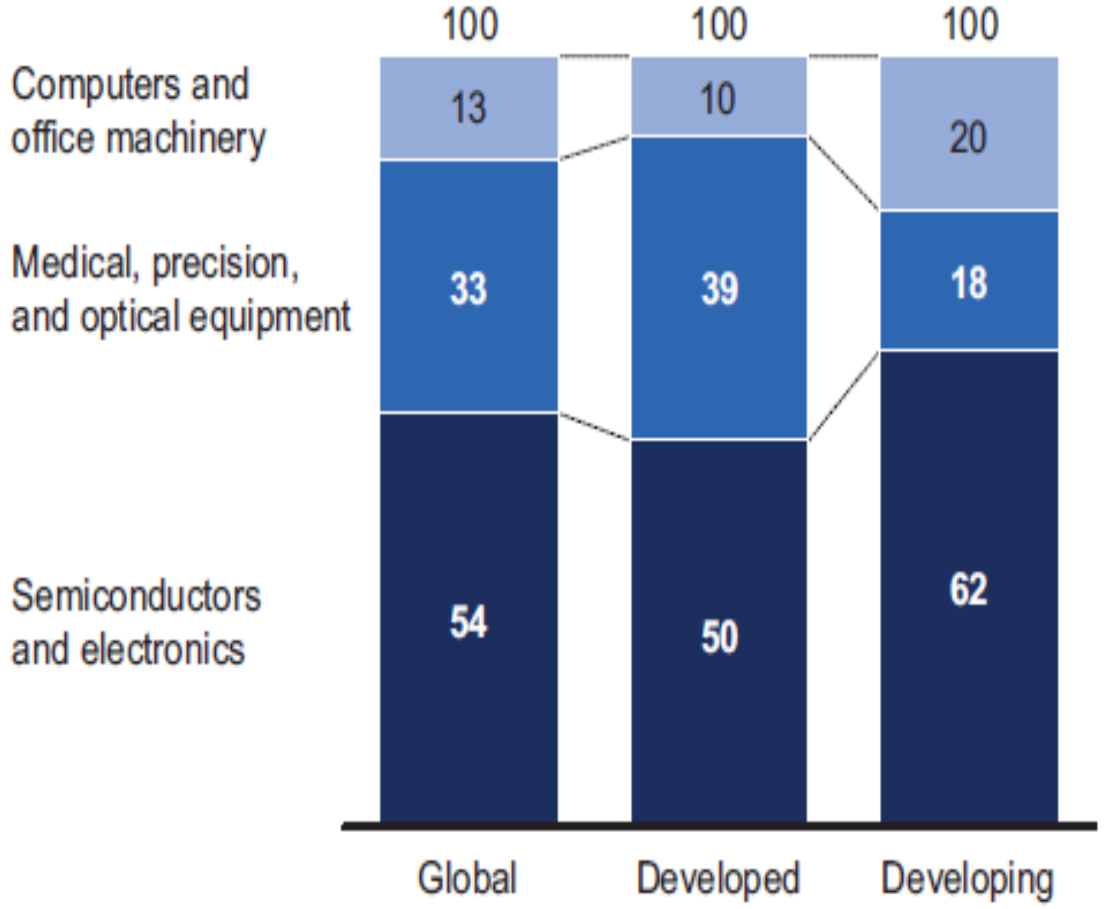


Services are central to manufacturing – it is so obvious that it escapes our notice

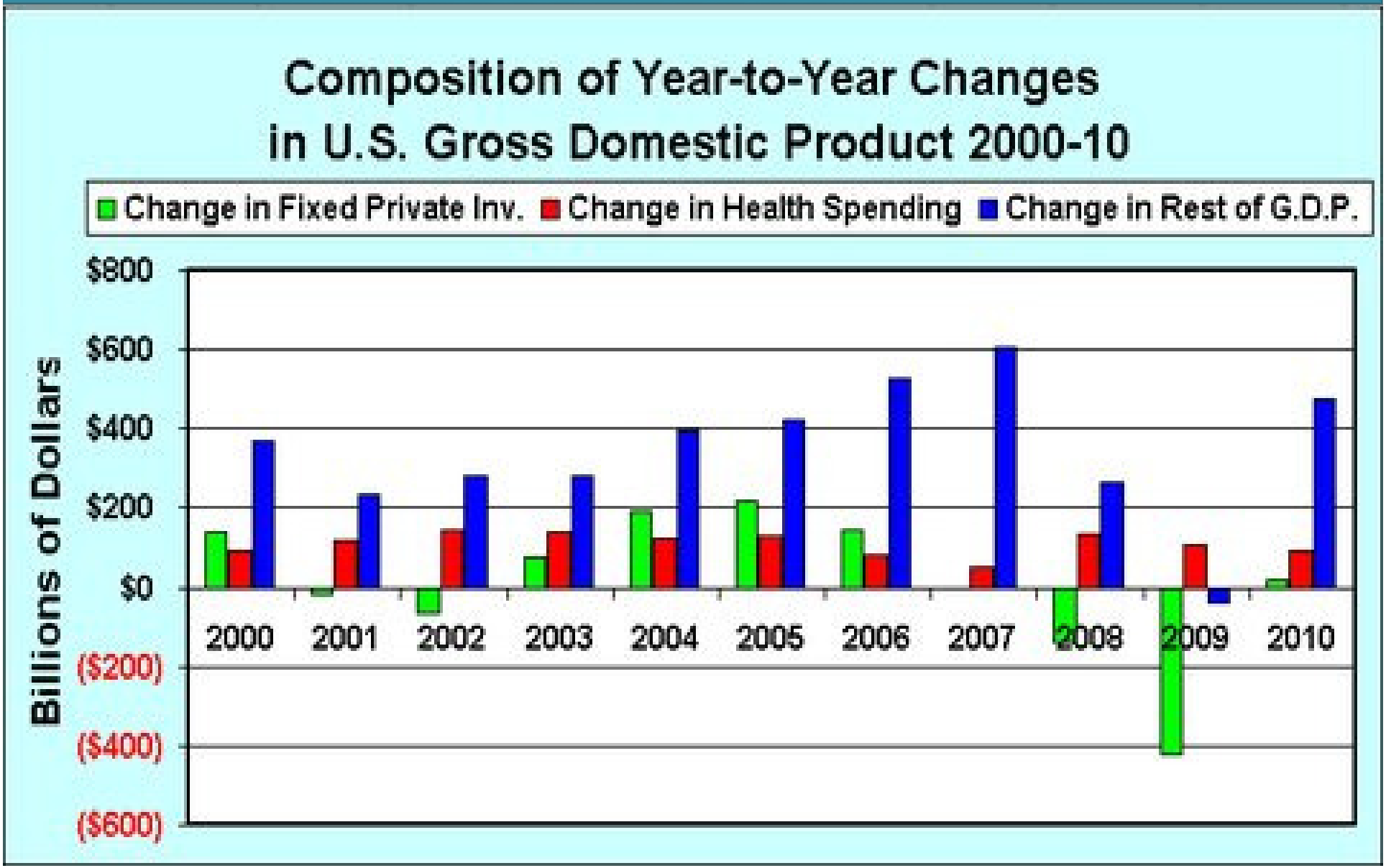
Semiconductors and electronics is the largest industry in global technologies/innovators, with 54 percent of global value added

Global value added by industry, 2010

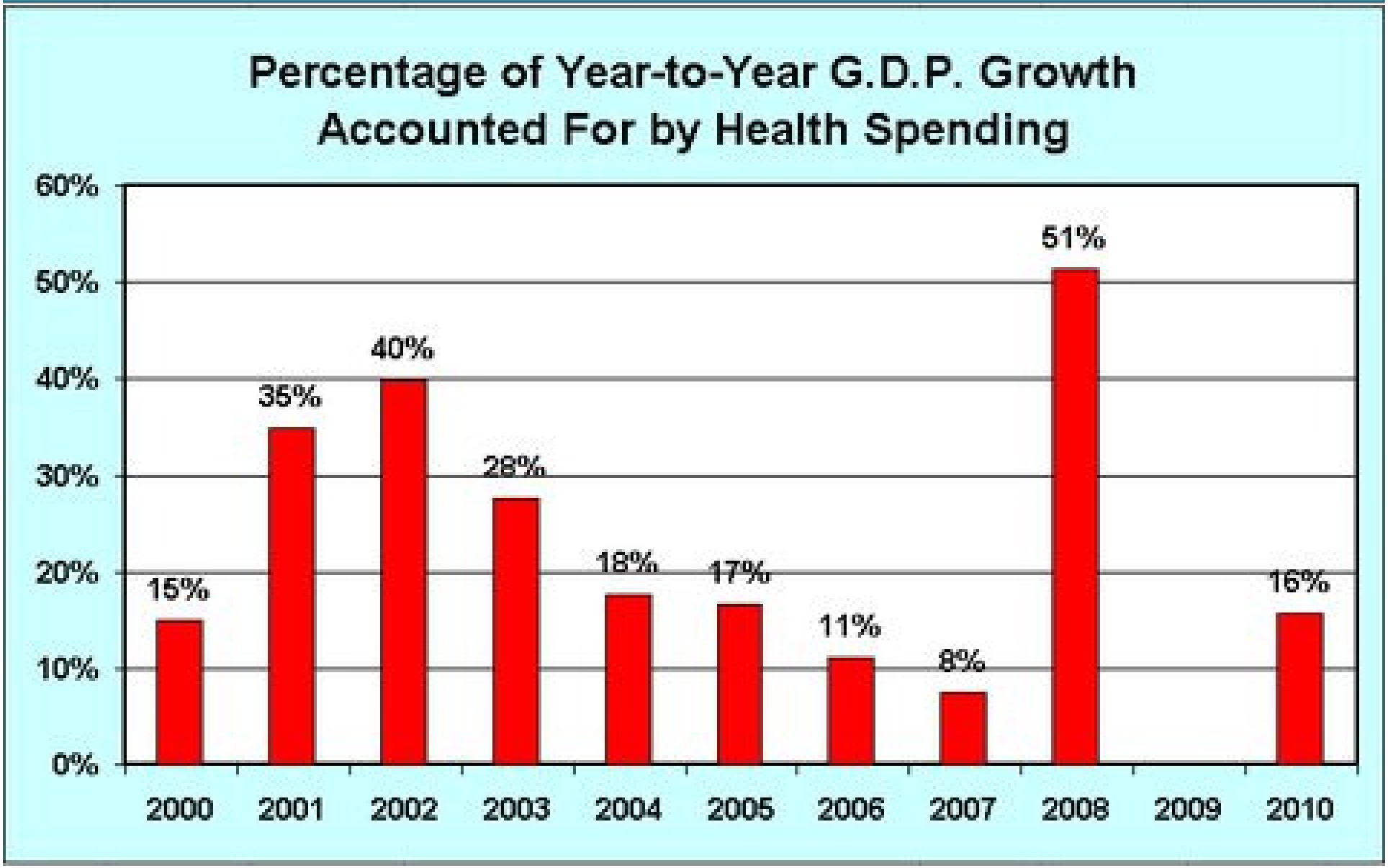
%



Healthcare Services and Manufacturing – Key to US GDP



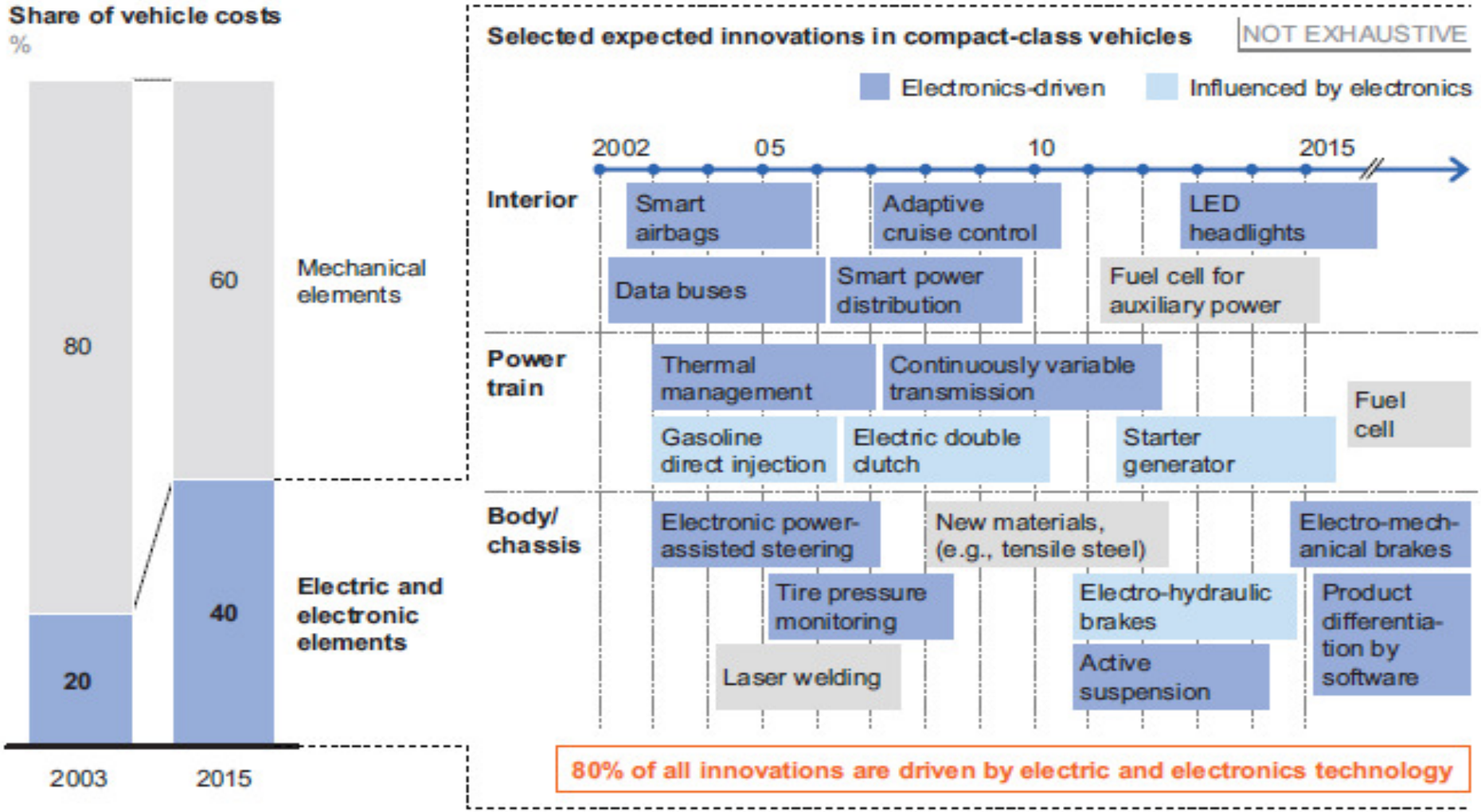
Healthcare Services and Manufacturing Ecosystem



Automotive Manufacturing Ecosystem

Innovations in electric and electronic technologies are the main drivers of auto industry value creation

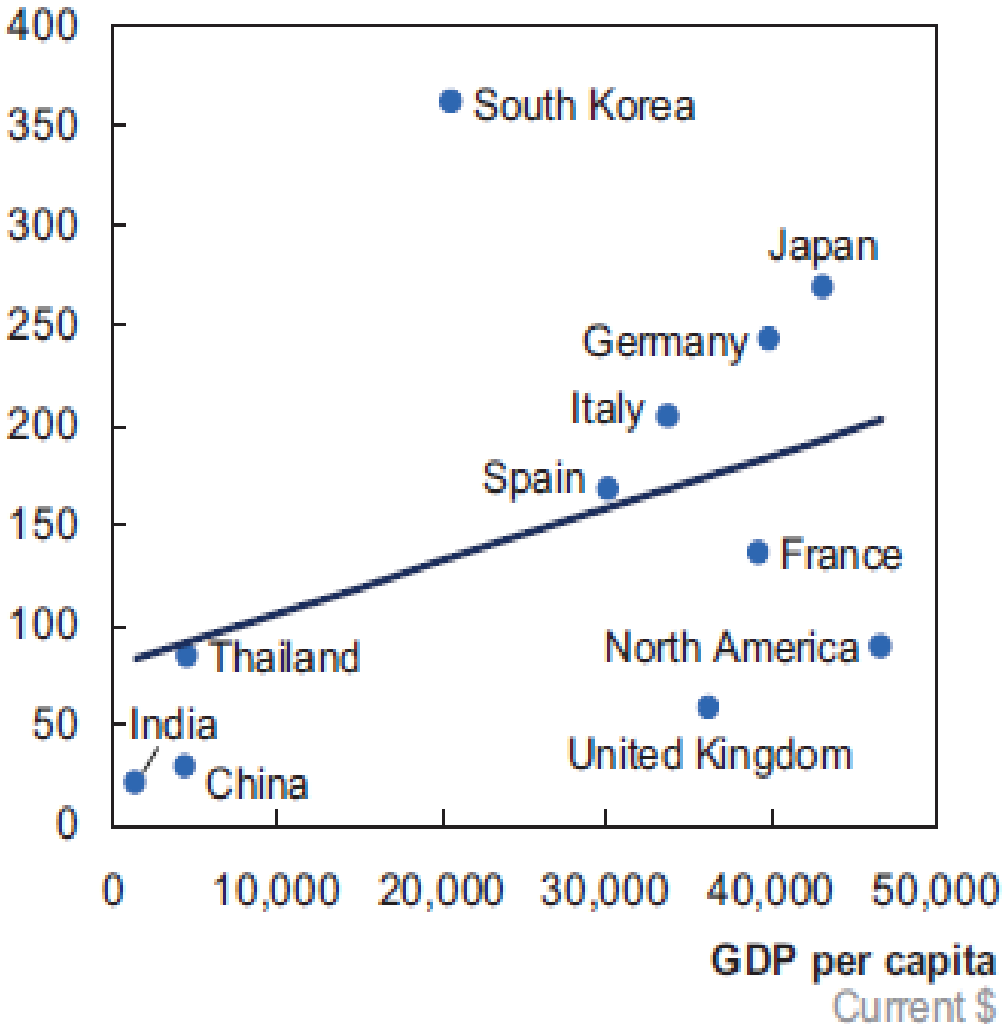
ILLUSTRATIVE



Ecosystem of ICT driven automotive manufacturing triggered growth of robotics

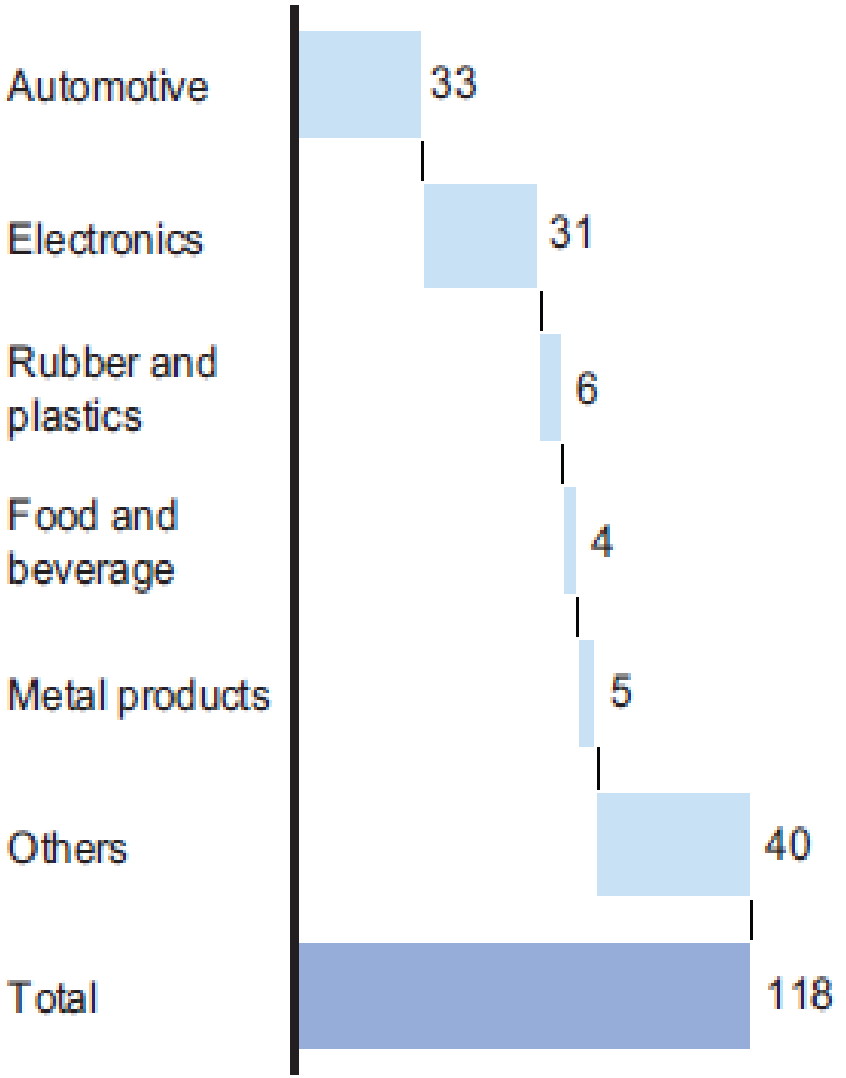
Installed capacity of industrial robots per manufacturing output

Number of robots per $ billion output



Global sales of industrial robots, 2010

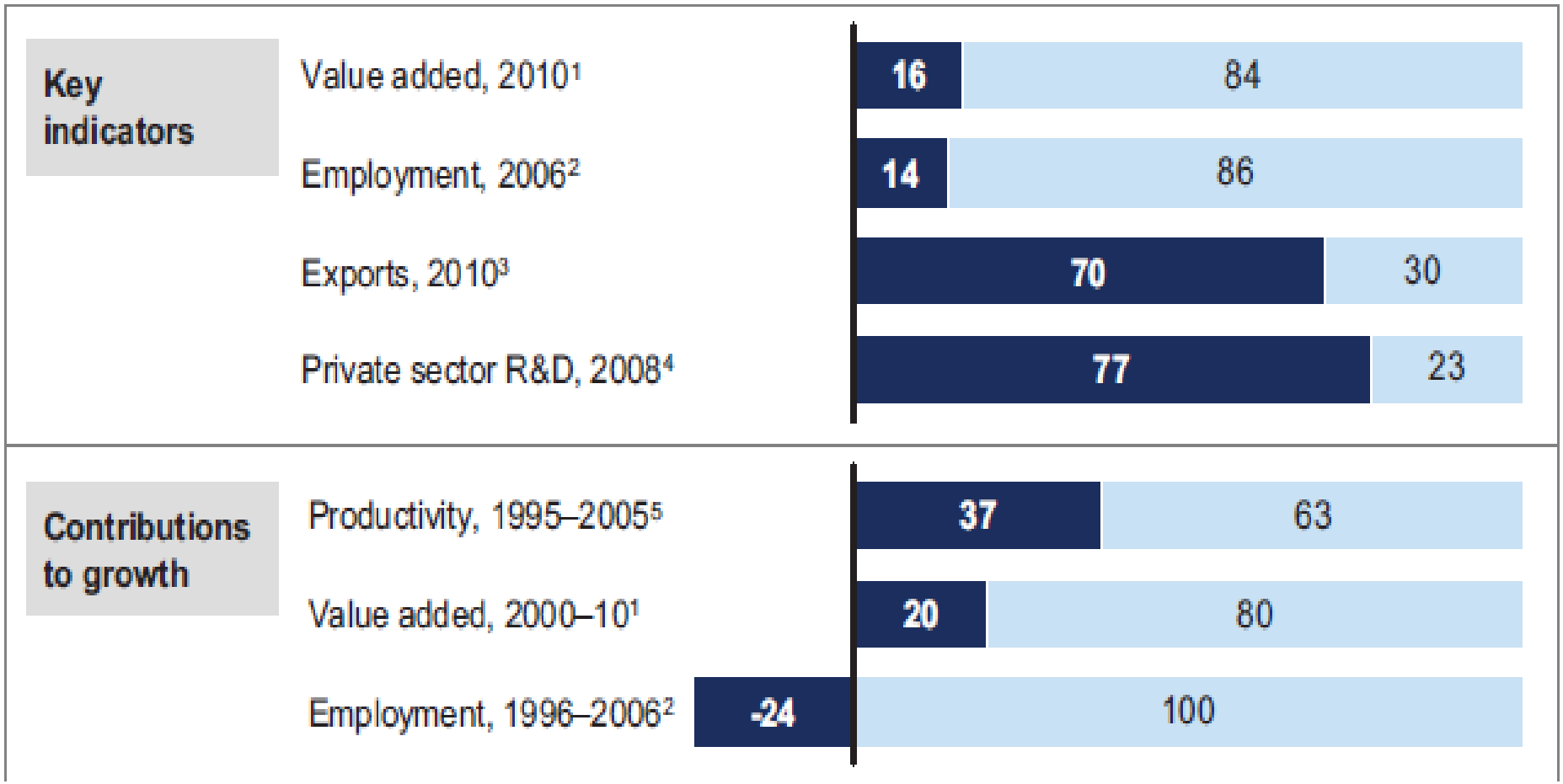
Thousand units



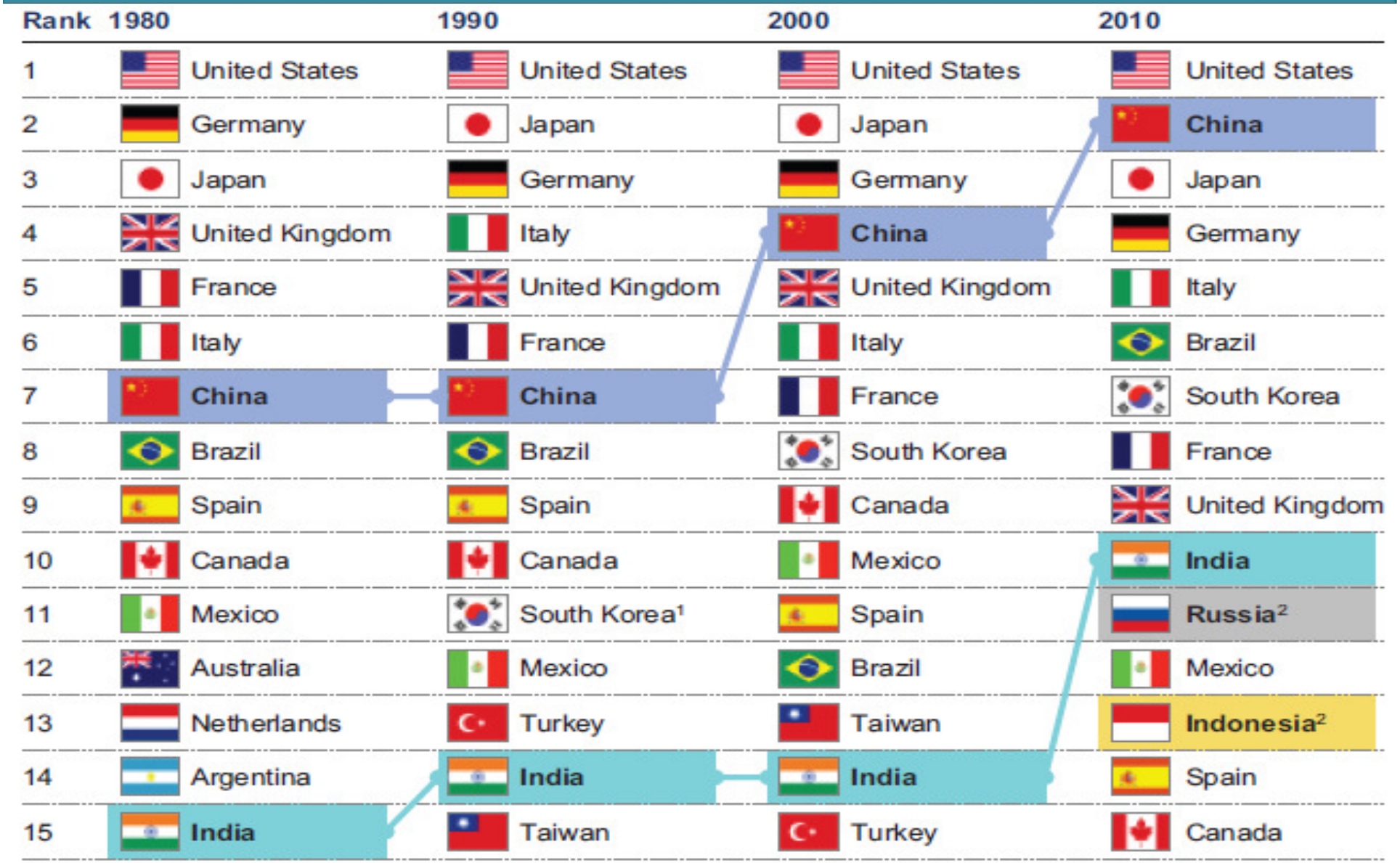
Taken together, manufacturing influences GDP growth

Manufacturing contributes disproportionately to exports, innovation, and productivity growth

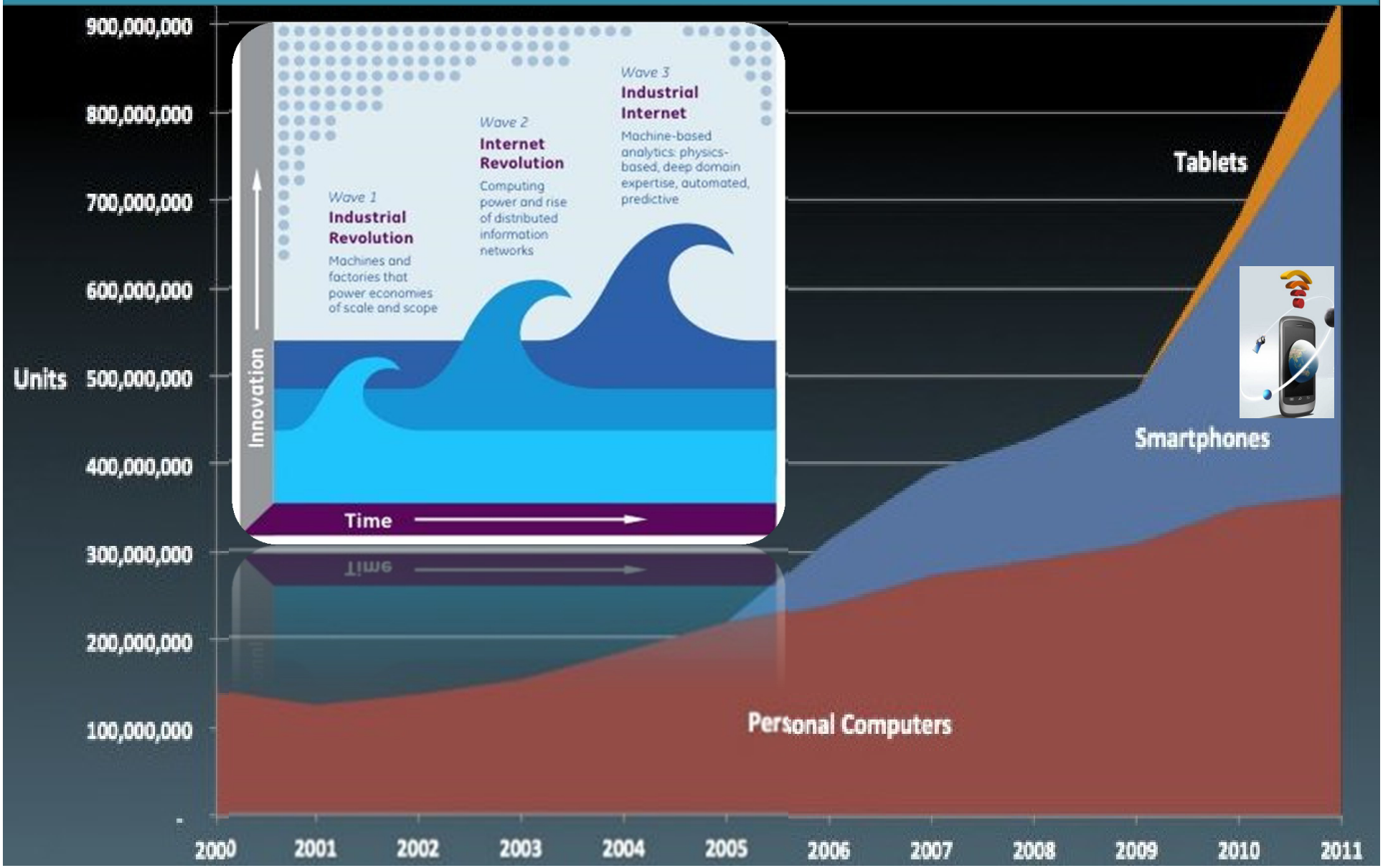
%



Traditional Manufacturing Trends and Ranks – Are they on the brink of disruption ?

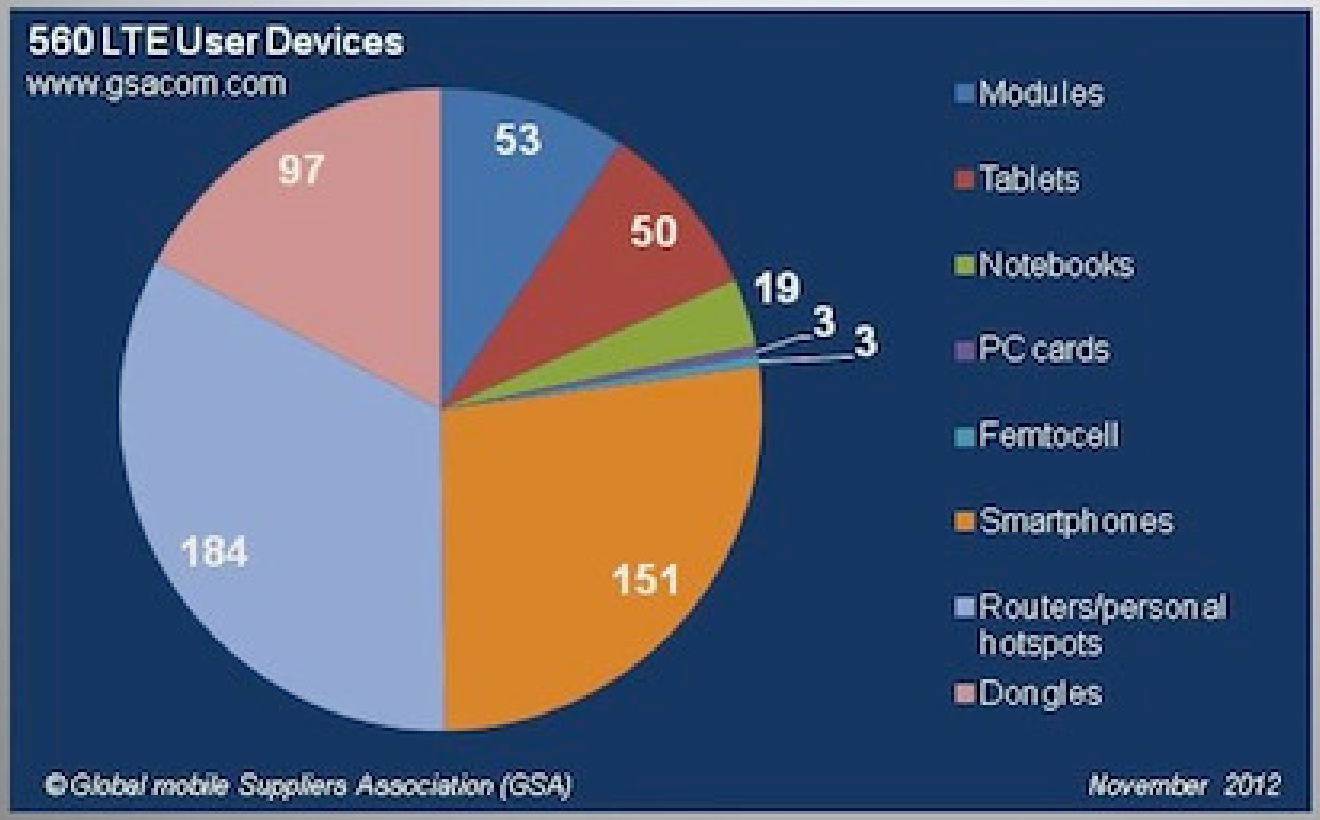


Industrial Internet - catalyze new products, new manufacturing & internet of services



Ecosystem of internet devices

83 manufacturers



560 = 3x number of devices reported by GSA a year ago

Number of manufacturers grew 73% in the same period

151 LTE smartphones *including operator and frequency variants*

LTE is supported in the leading smartphone brands and models

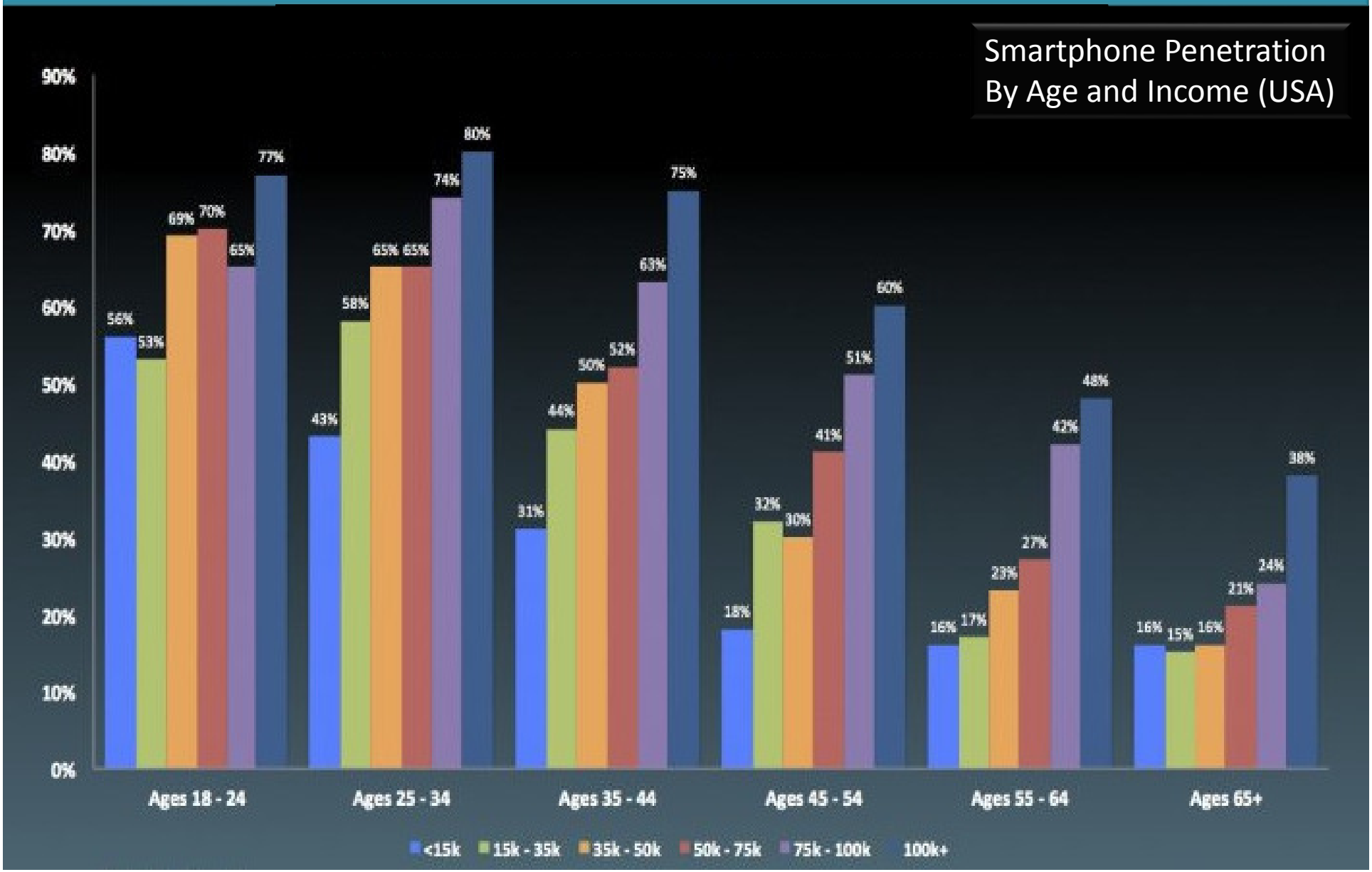
115 LTE TDD user devices announced by 29 manufacturers

LTE FDD	
700 MHz	251 devices
800 MHz *Band 20*	115 devices
1800 MHz *Band 3*	130 devices
2600 MHz *Band 7*	158 devices
800/1800/2600 MHz	93 devices
2100 MHz *Band 1*	72 devices
AWS *Band 4*	111 devices

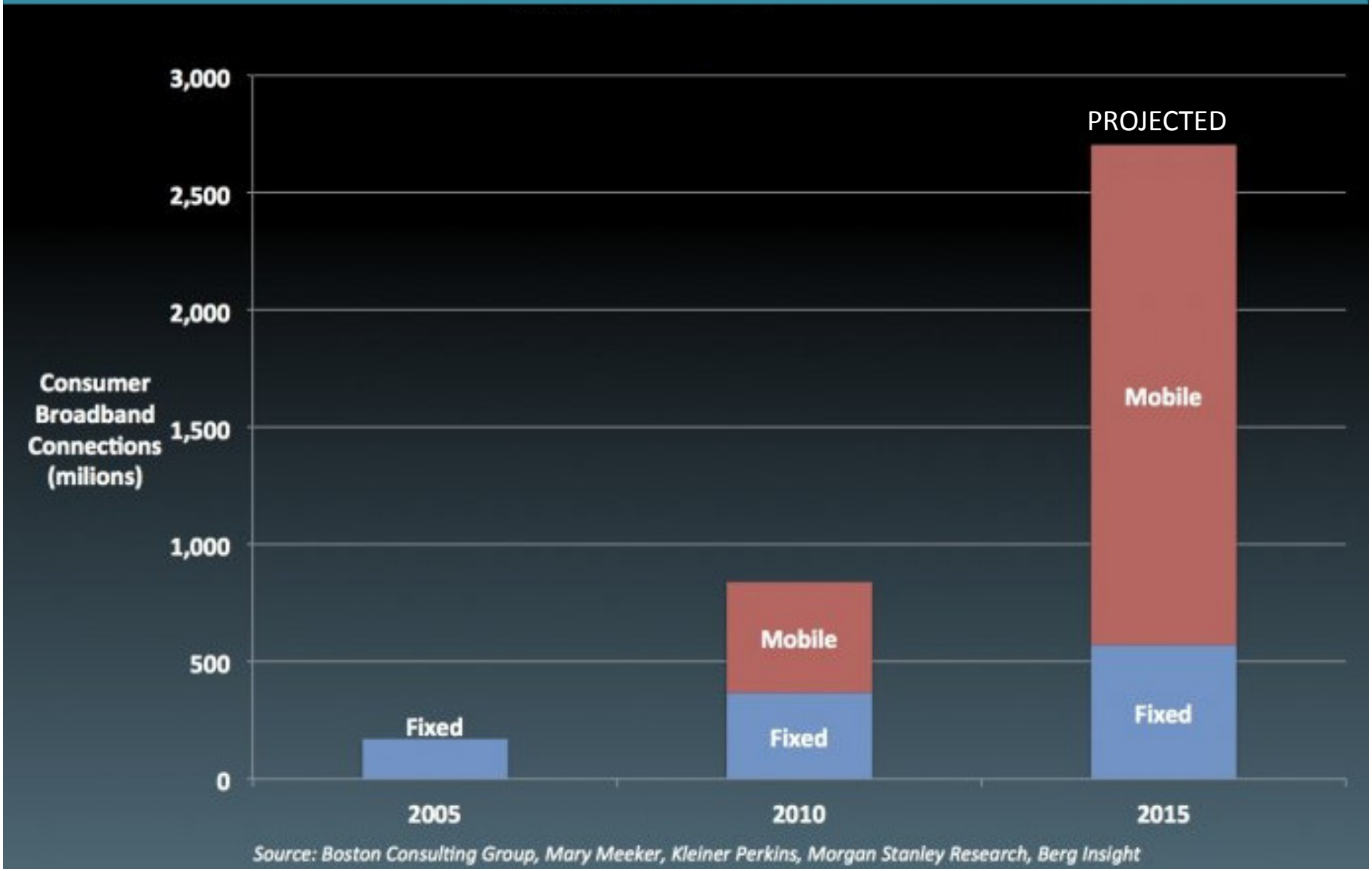
LTE TDD	
2300 MHz *Band 40*	77 devices
2600 MHz *Band 38*	94 devices
2600 MHz *Band 41*	19 devices

Source : Status of the LTE Ecosystem report
©GSA – November 23, 2012
www.gsacom.com

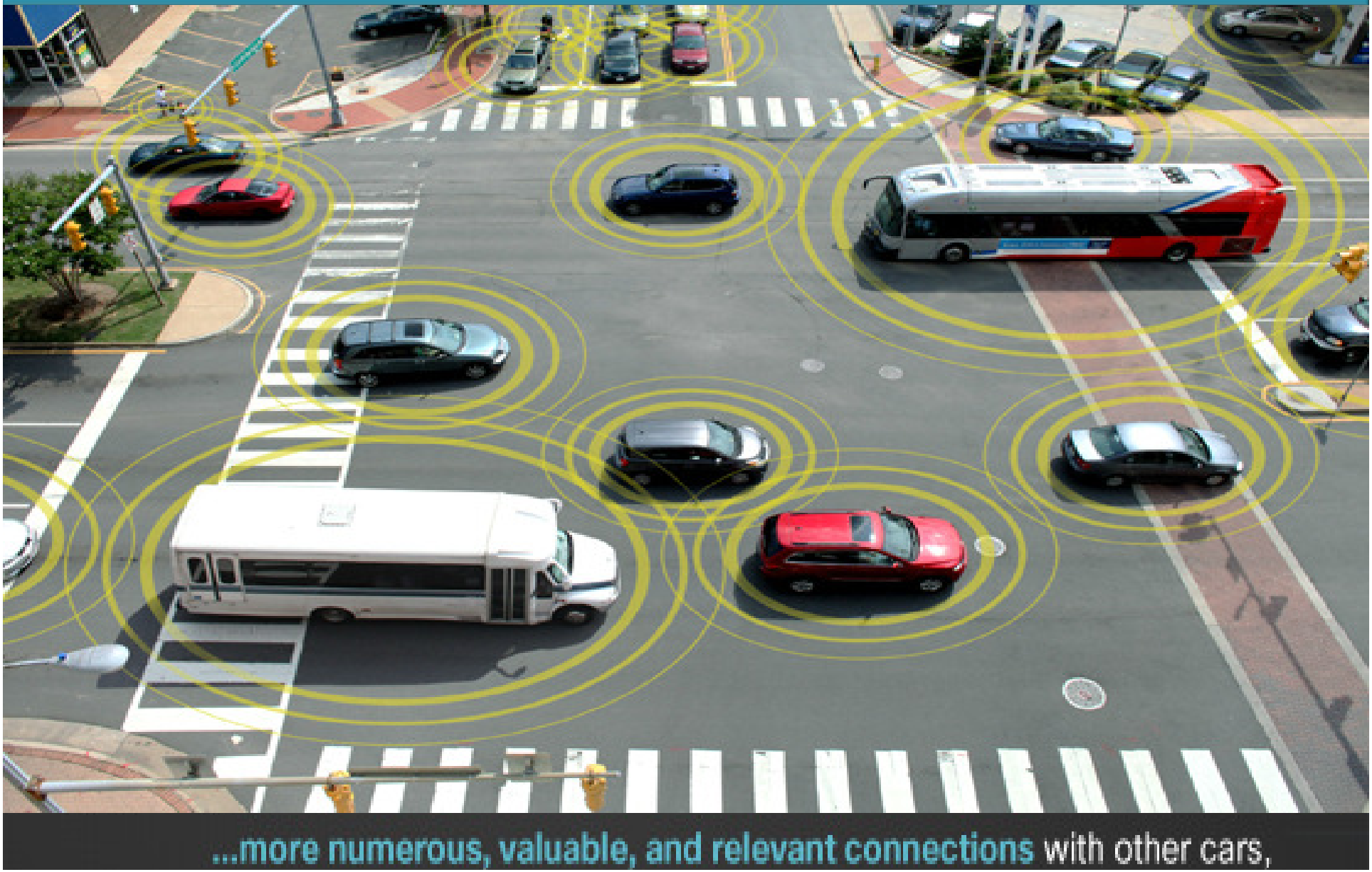
Delivery of services depends on the ecosystem of internet devices and their adoption



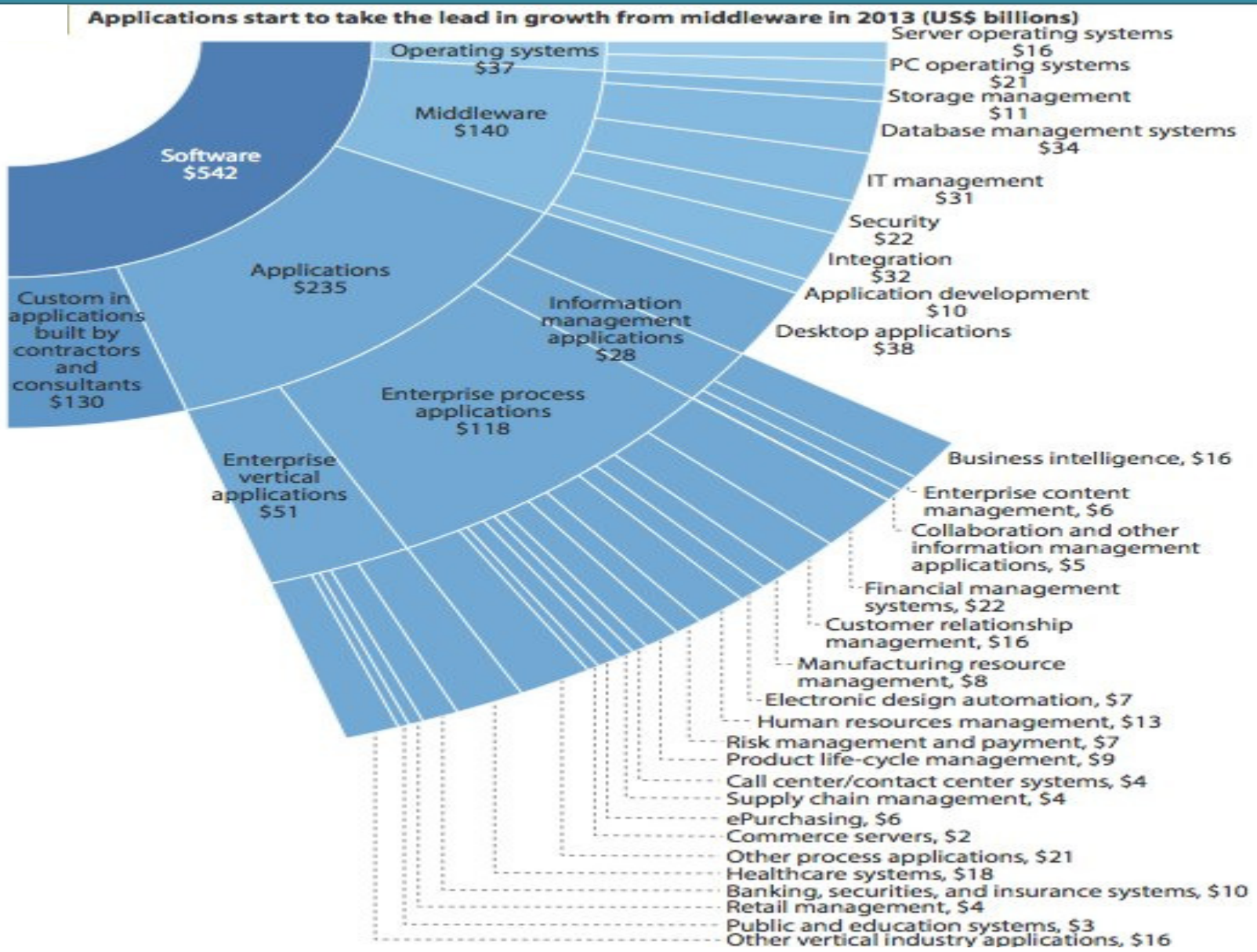
Rate limiting link in the supply chain of service delivery is the availability of bandwidth



Industrial Internet of service delivery: flow of information proportional to connectivity



ECOSYSTEM of service delivery – proportional to connectivity software and apps



ECOSYSTEM of service delivery – connectivity is key but device intelligence is lacking

The real value of the **Internet of Everything** lies in the value of connections among **people, process, data, and things,** not simply in the sheer number of things that are connected.

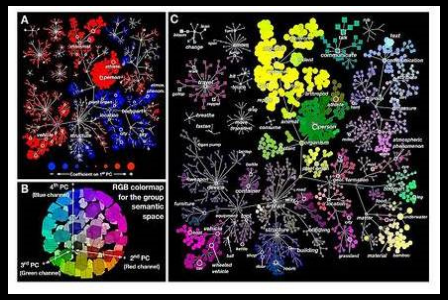
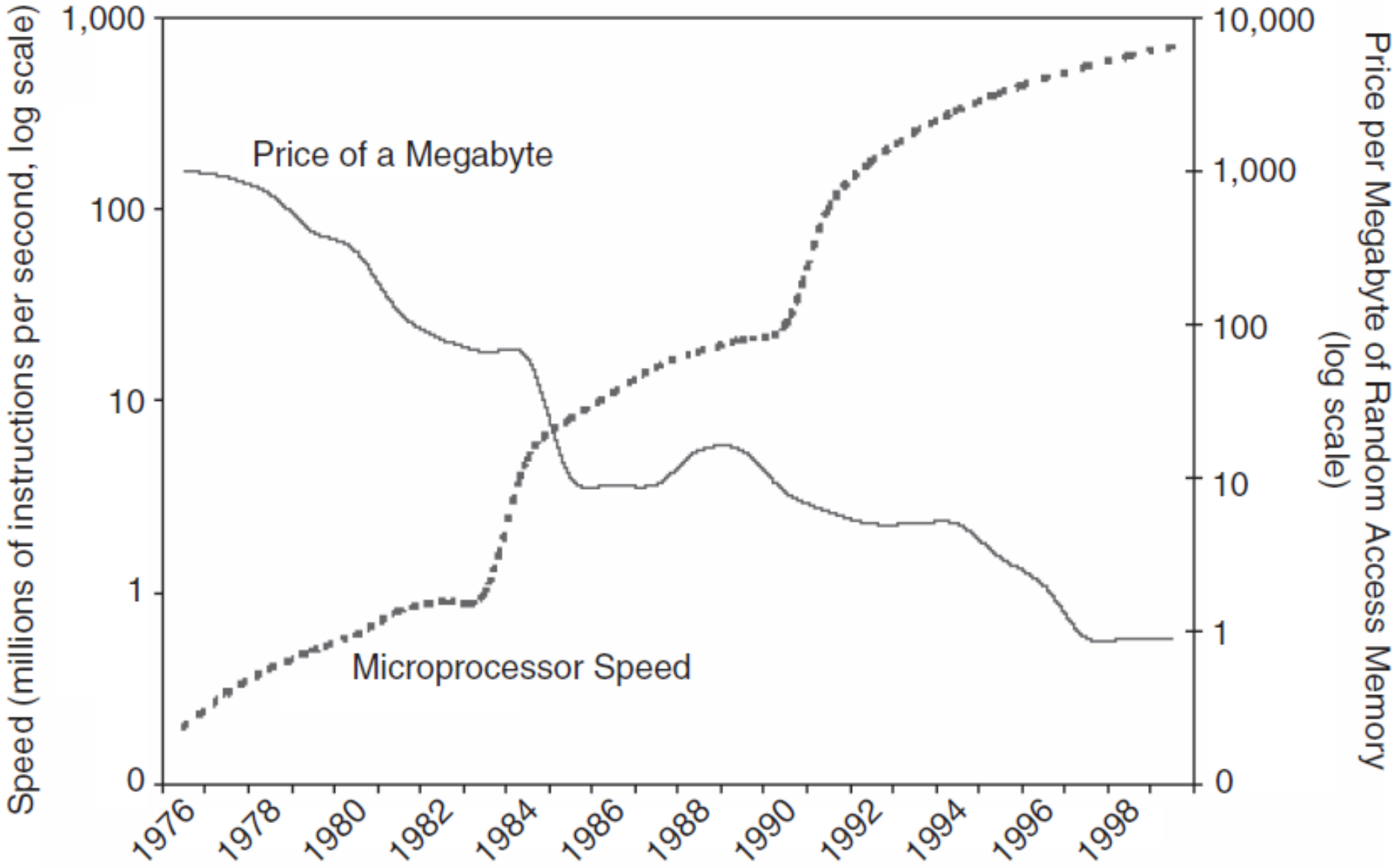
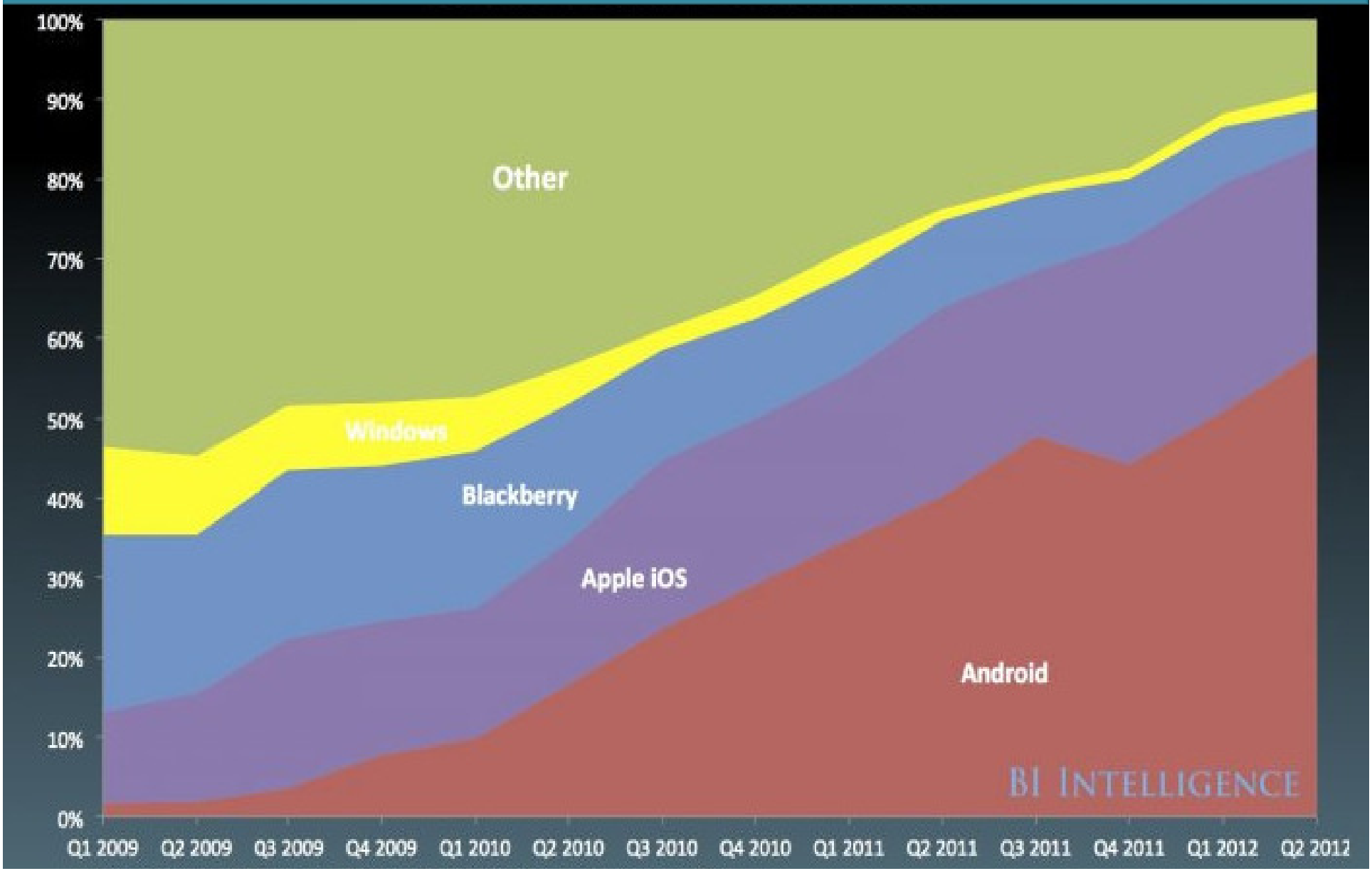


Illustration (left) of the semantic map of our brain which helps us relate to context. But computers do not “understand” context in our syntactic web. The paper proposes a digital link www.mediafire.com/view/?kqutb76vpmenc53

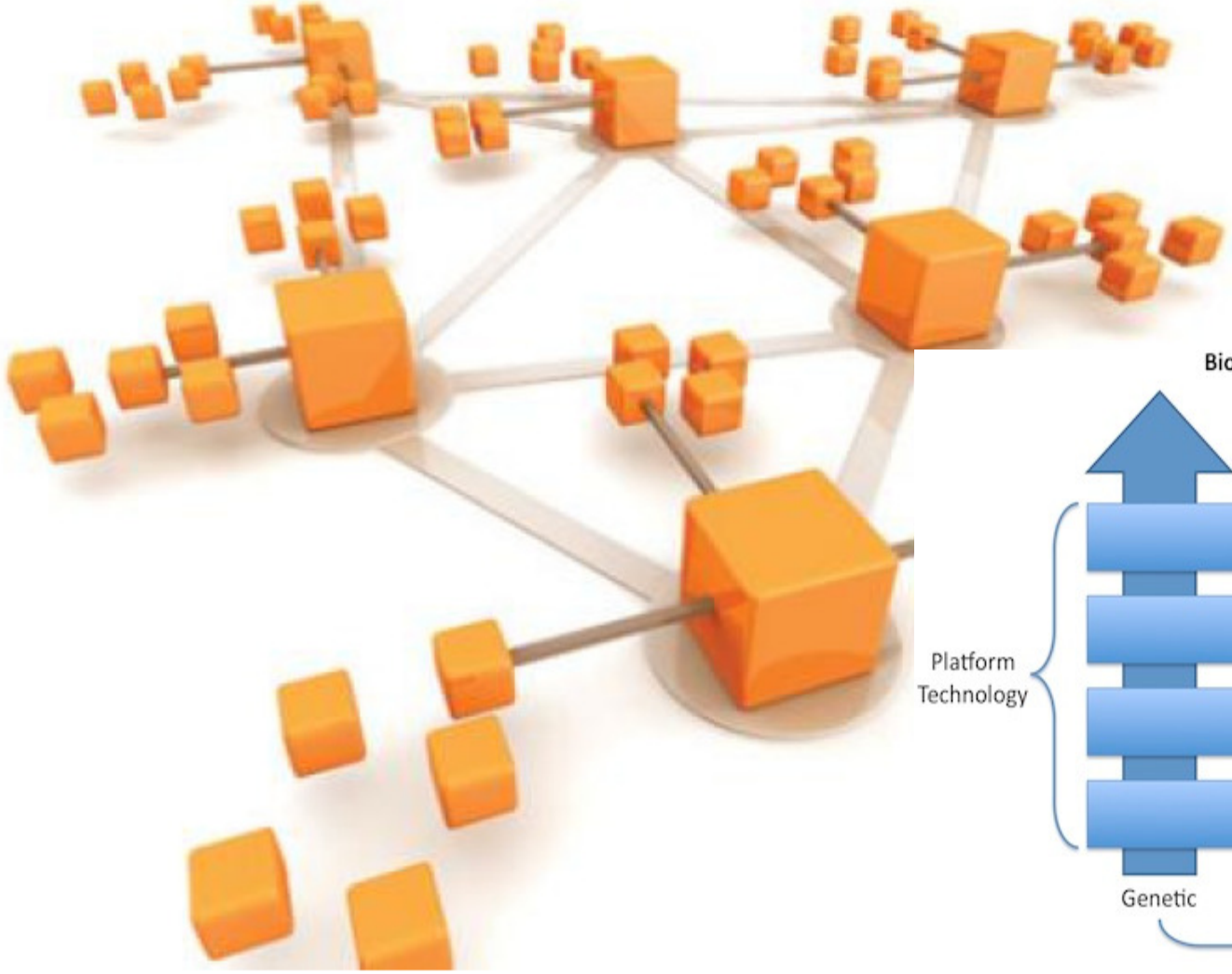
Cheaper service delivery – cloud based data stores and in-network processing cost

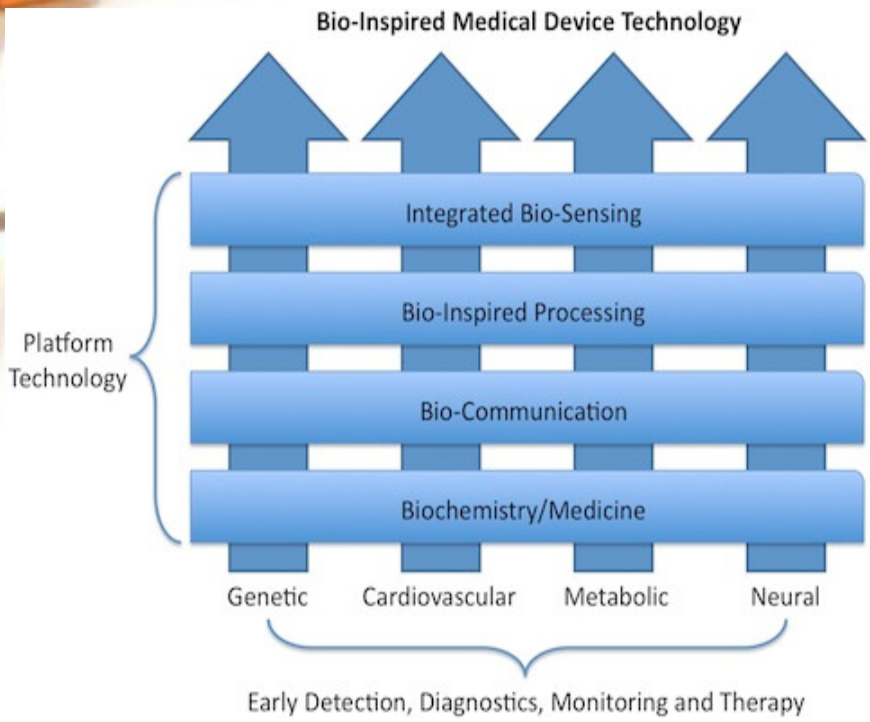


ECOSYSTEM of service delivery – interoperability between “dumb” platform providers



ECOSYSTEM of service delivery – health information exchanges – dumb and disjointed

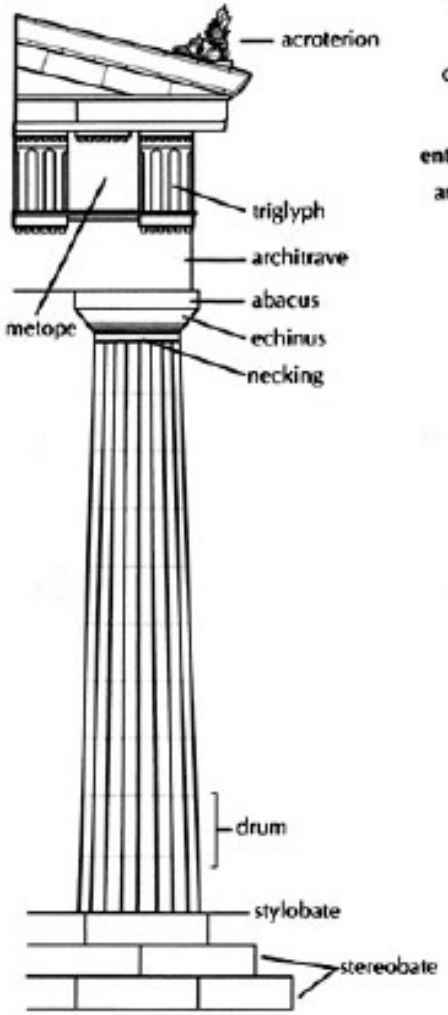




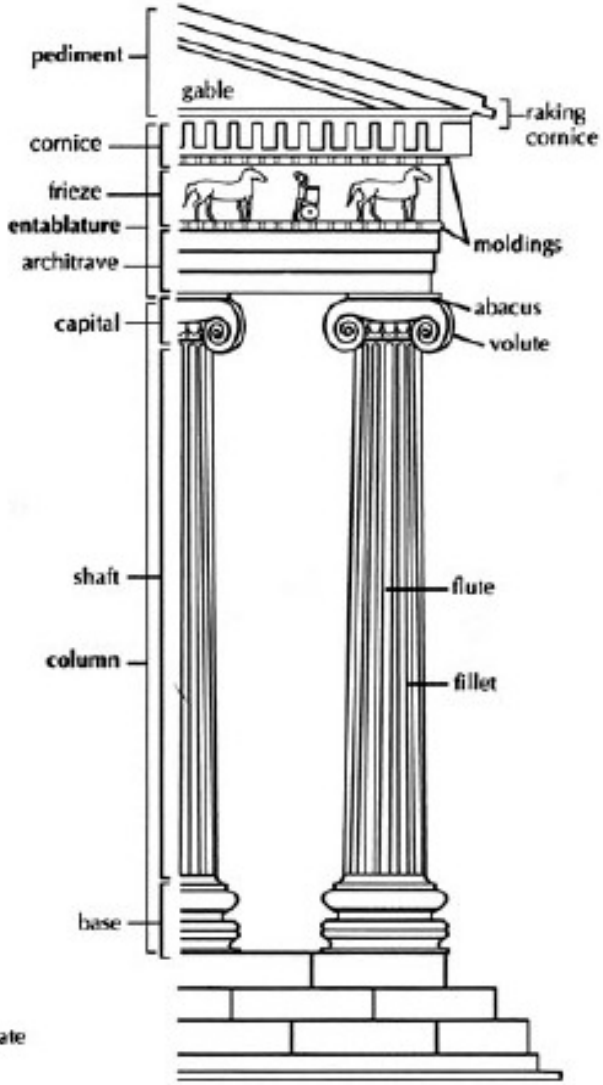
Satisfaction with health information exchange vendors is lagging as they struggle to produce the level of interoperability that providers want, according to a November report

Health information exchanges – ancient architecture?

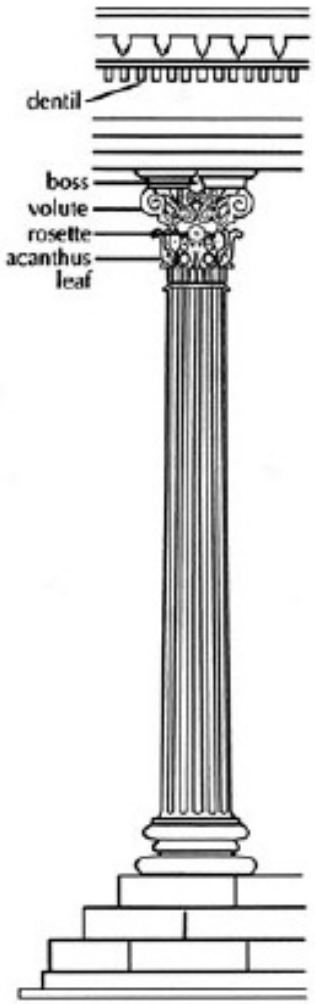
Doric

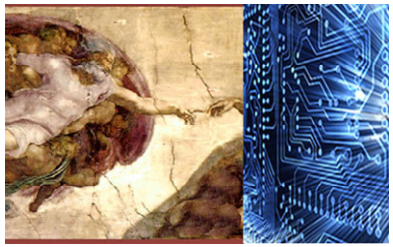


Ionic

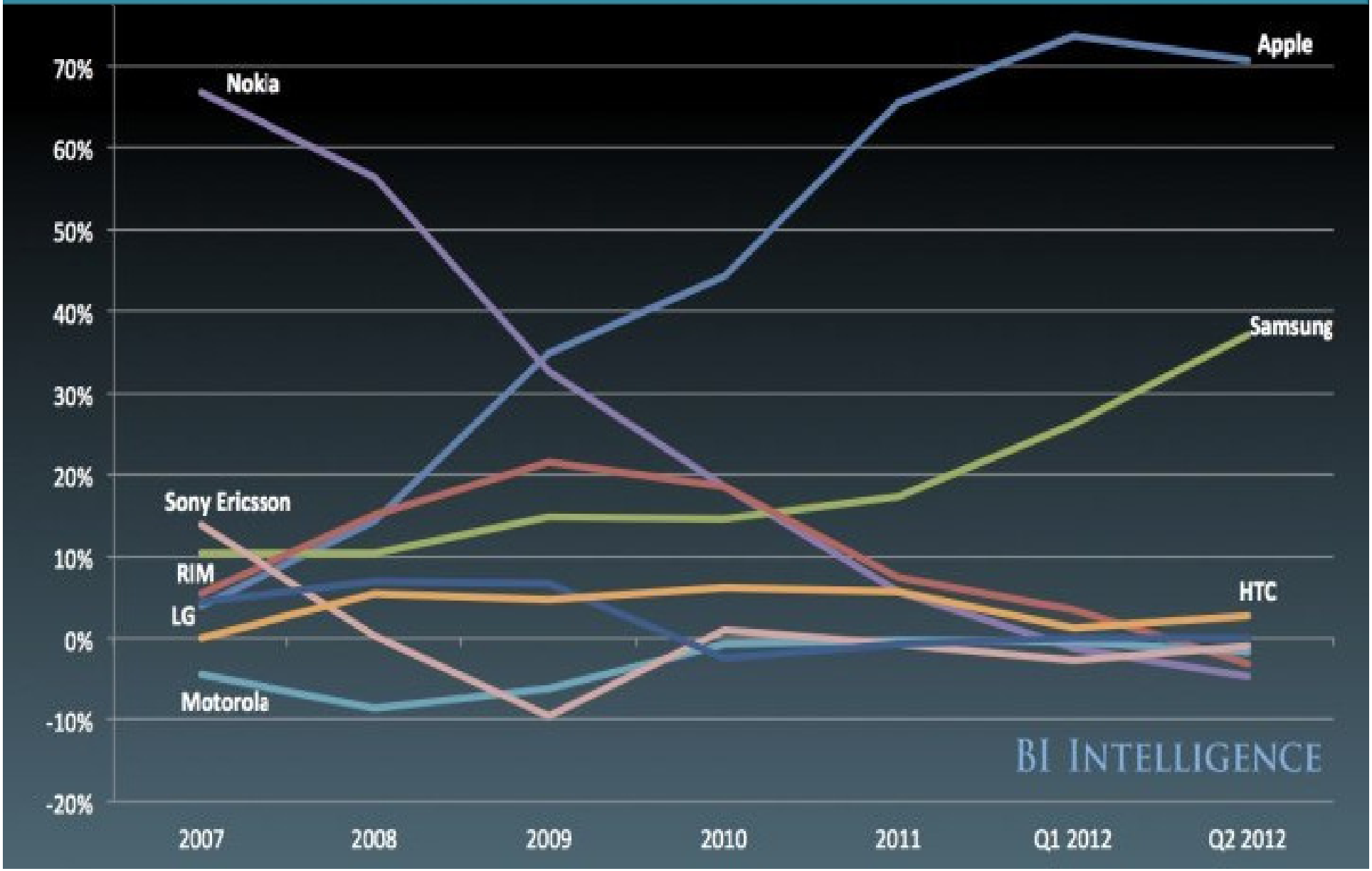


Corinthian

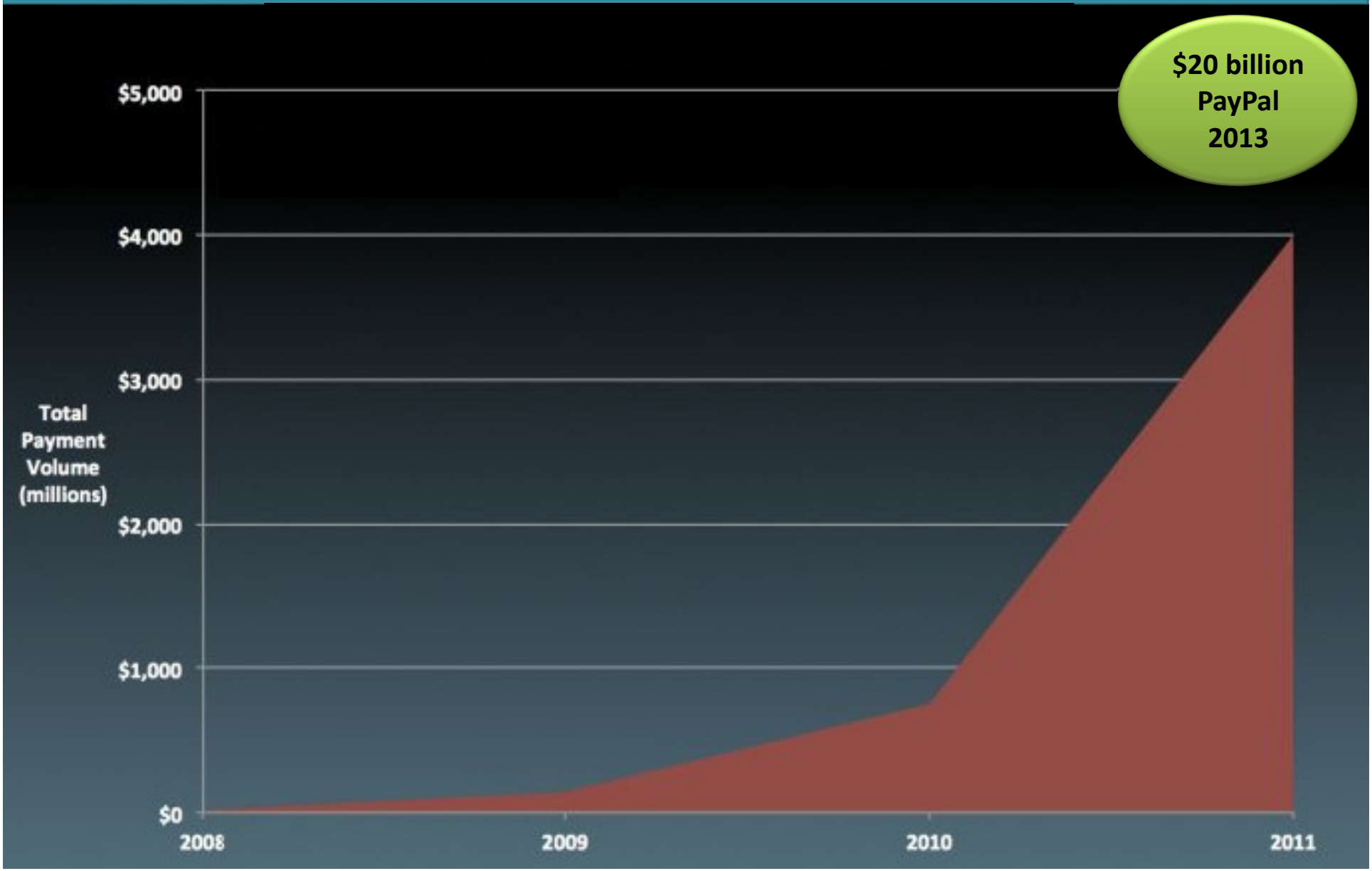




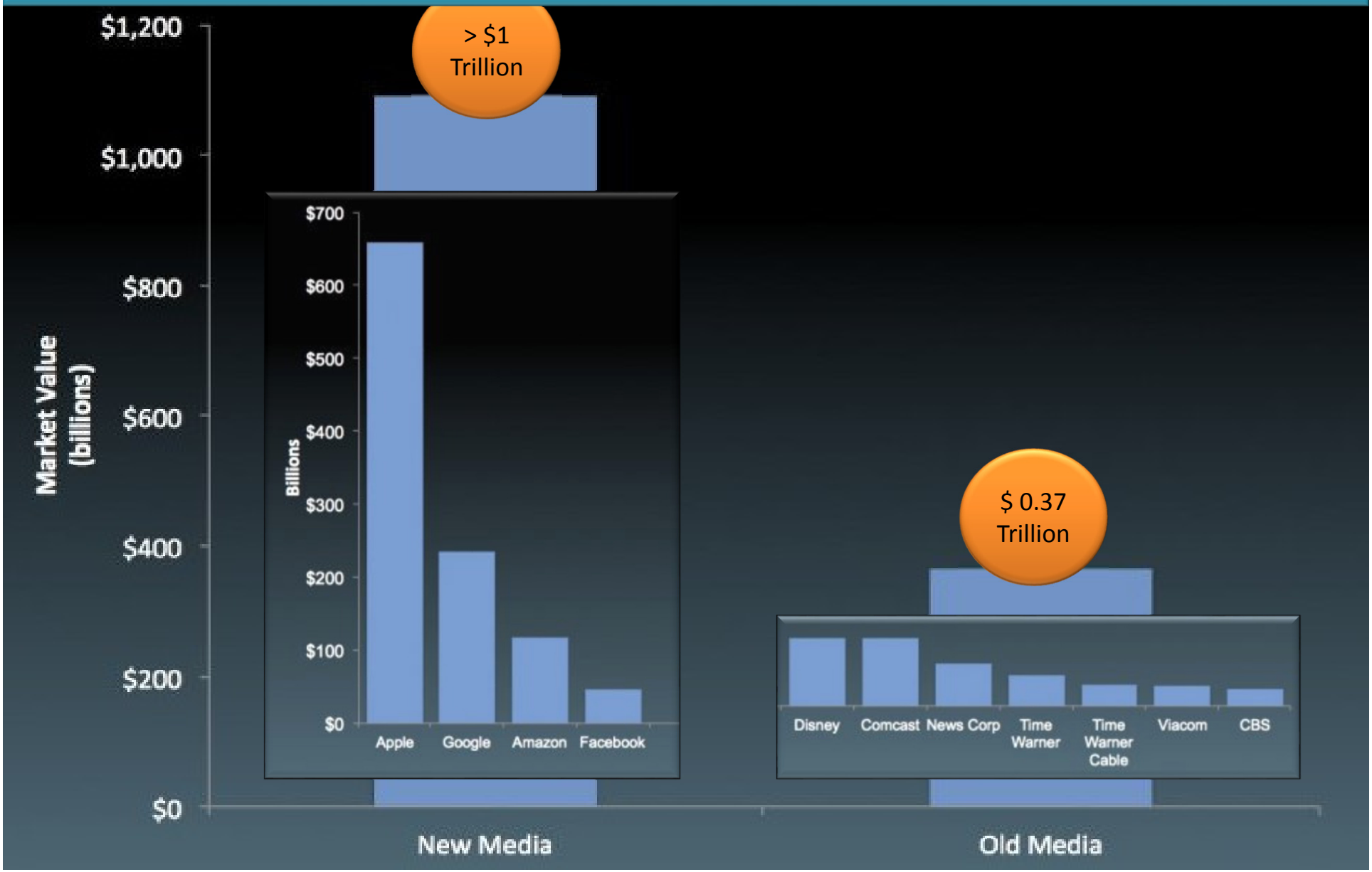
ECOSYSTEM of service delivery – mobile operators can influence the range of services



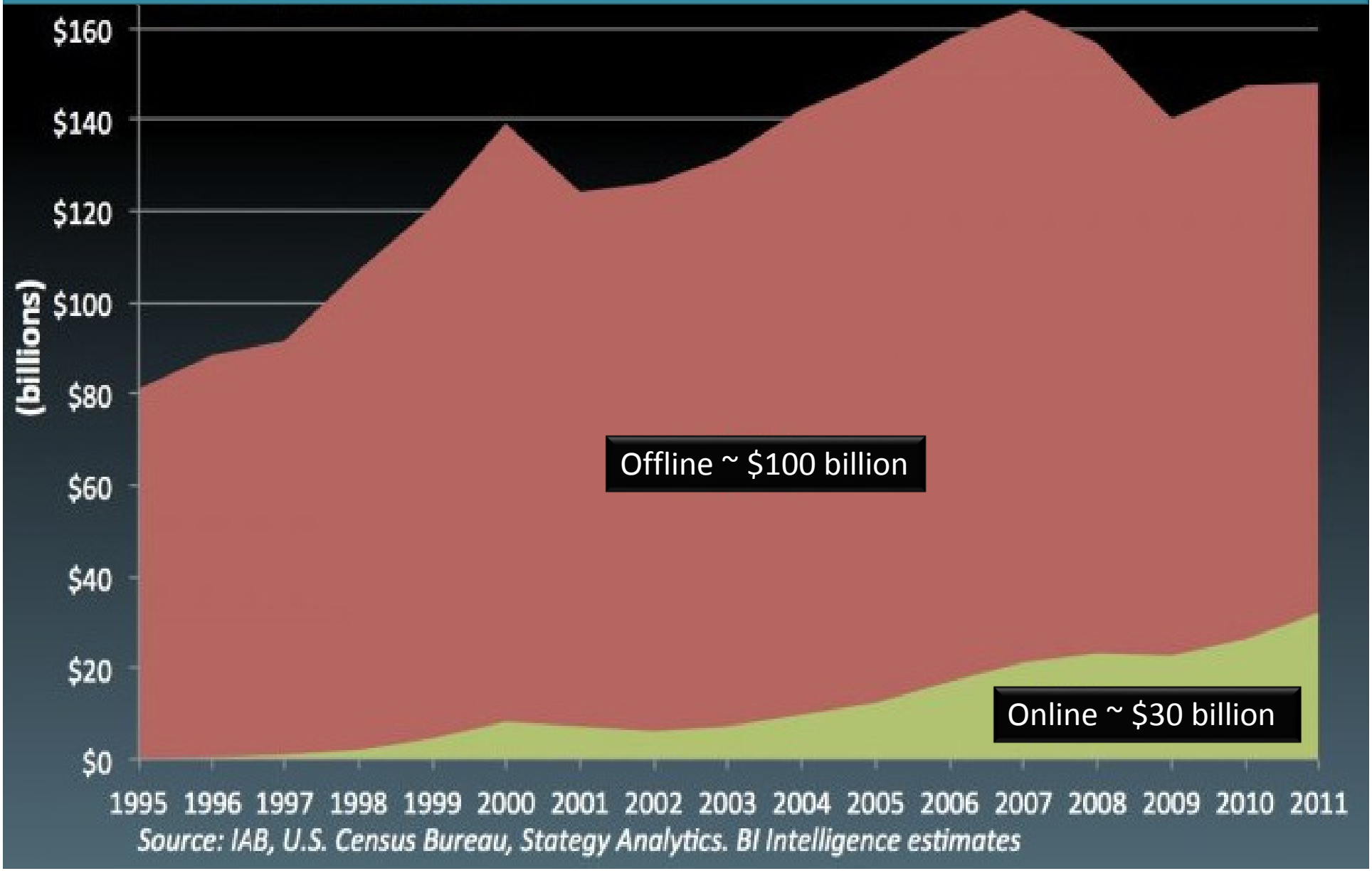
ECOSYSTEM of service delivery – billing and payment



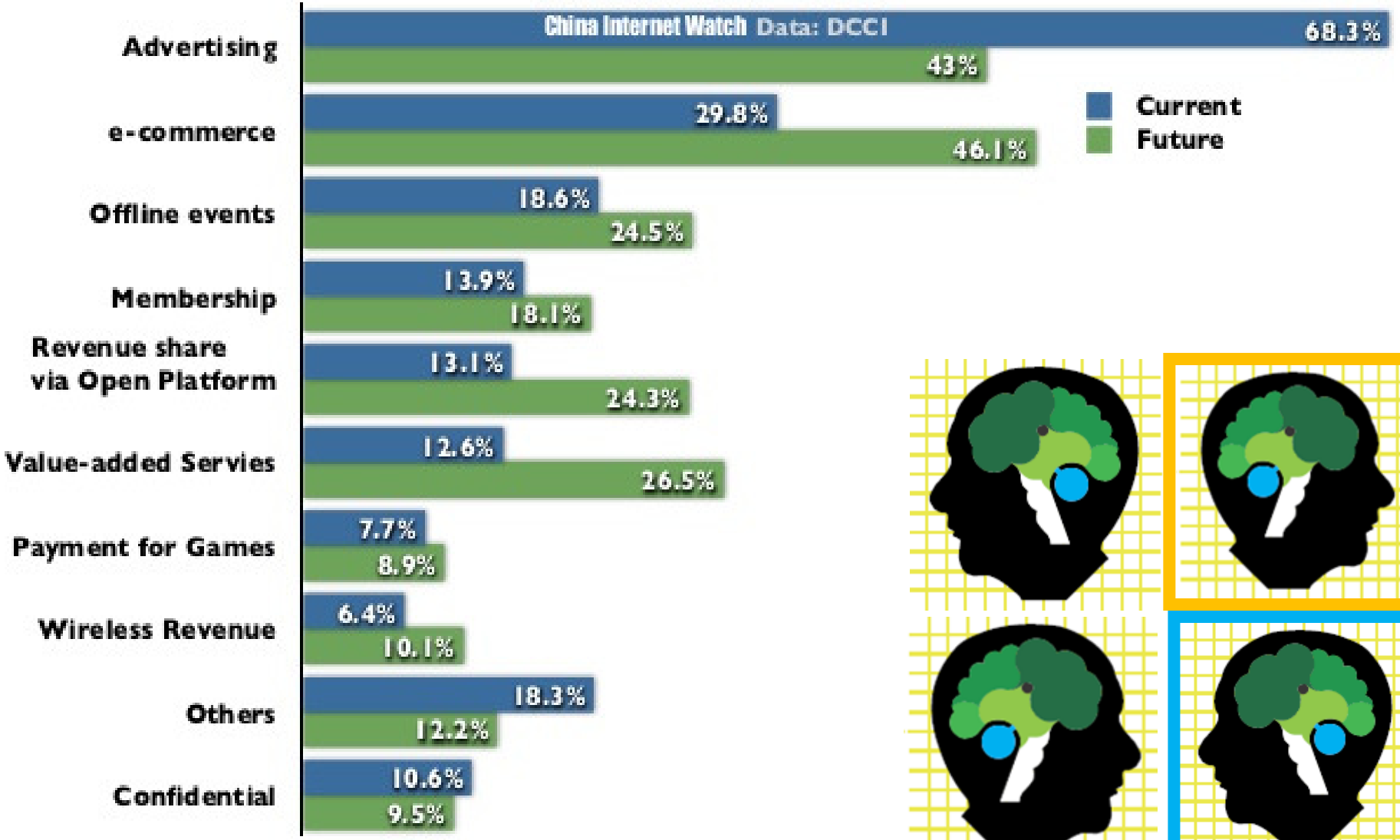
Service delivery and profitability still immature – advertising moves in to fill the void

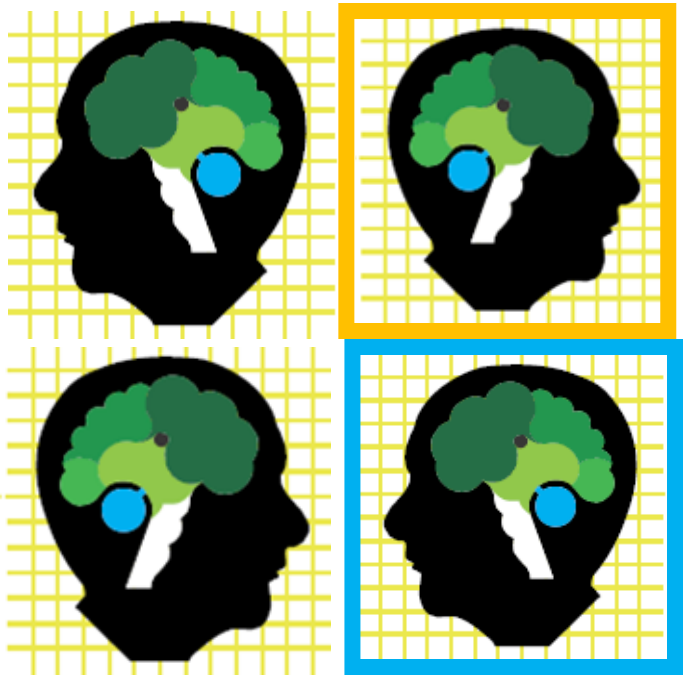


Advertising Revenue influenced by emerging trends in mobile life style

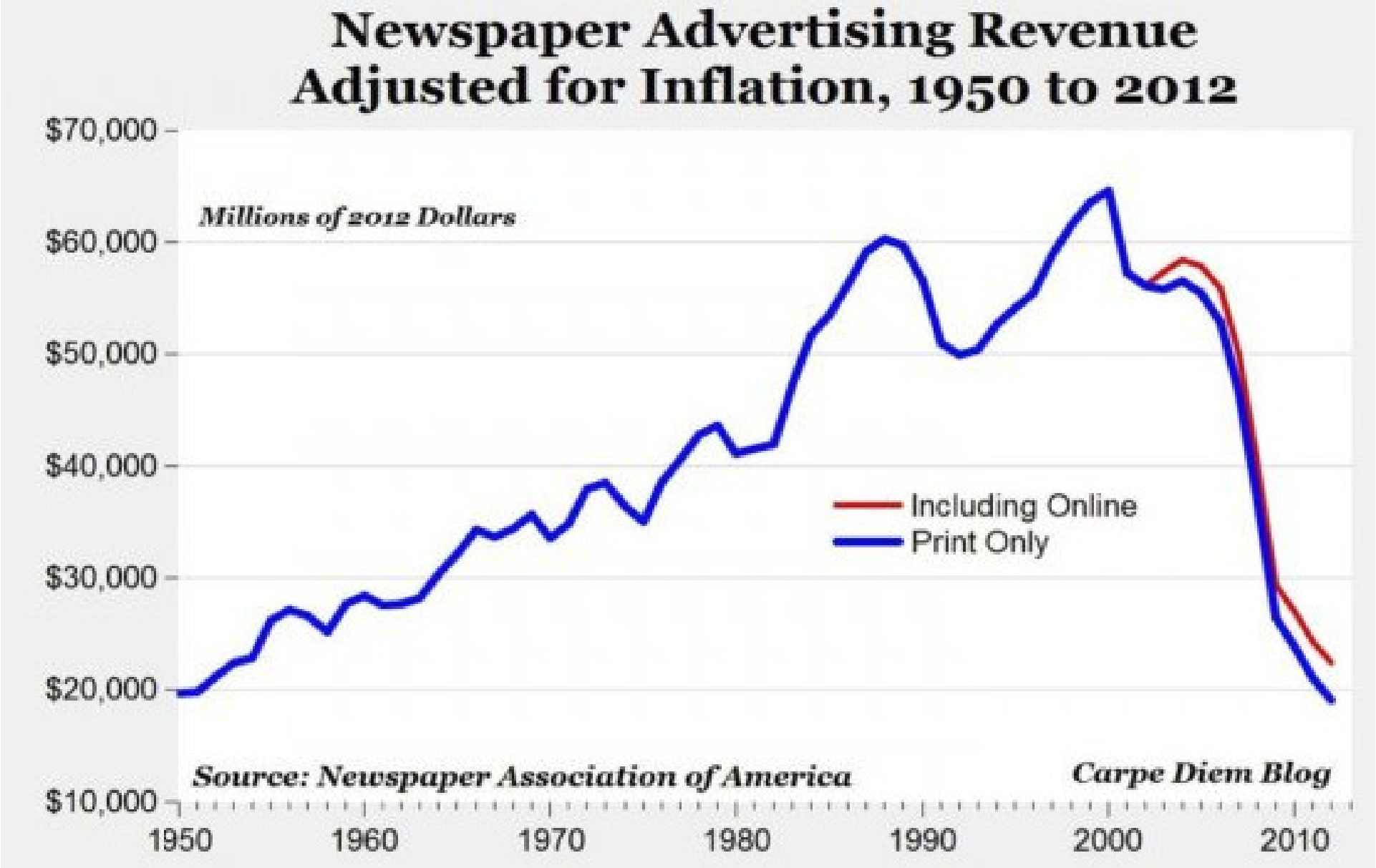


Advertising Revenue - significant proportion of website monetization model in China



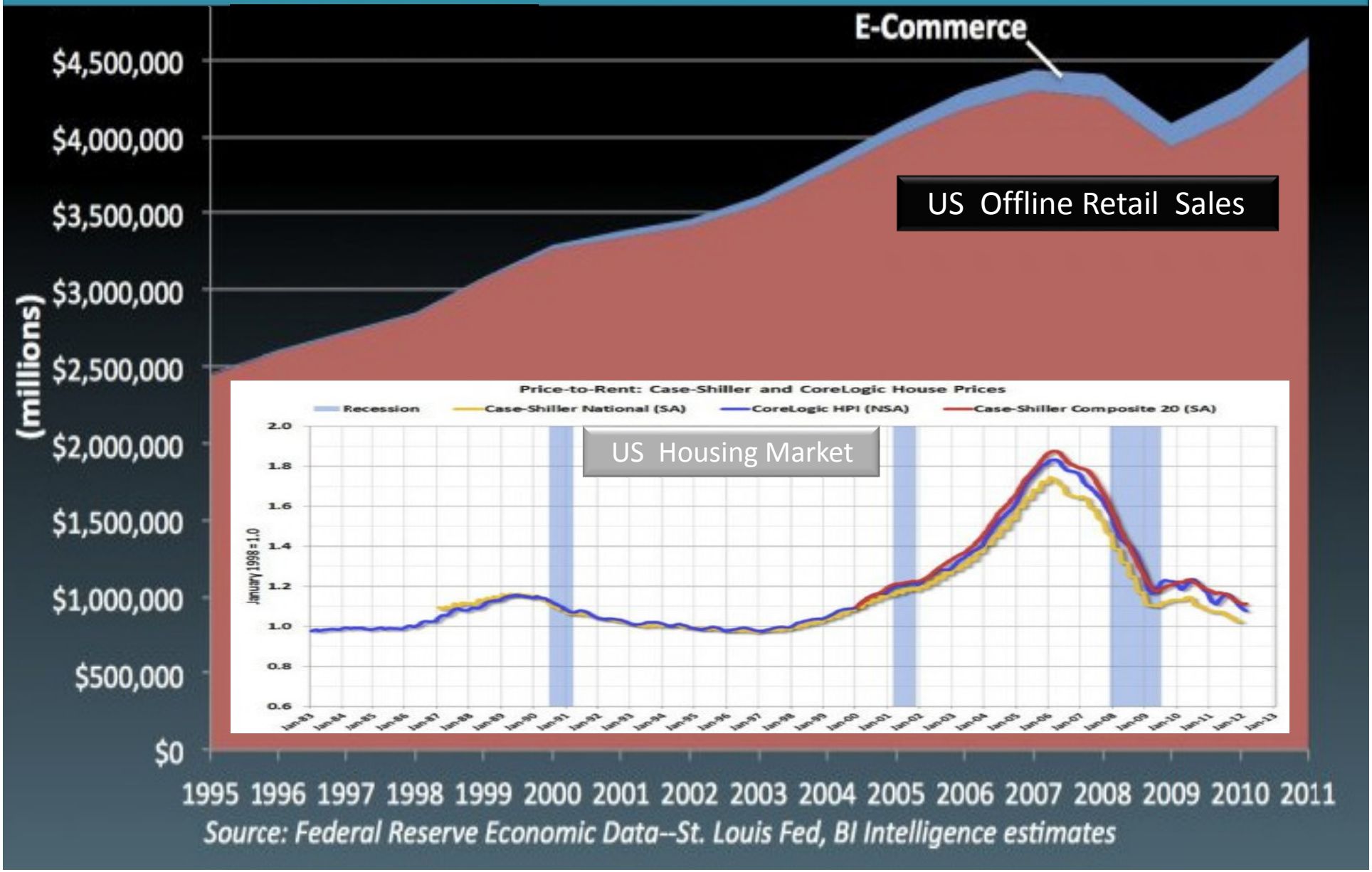


Digital Divide - static print at odds with mobile life style



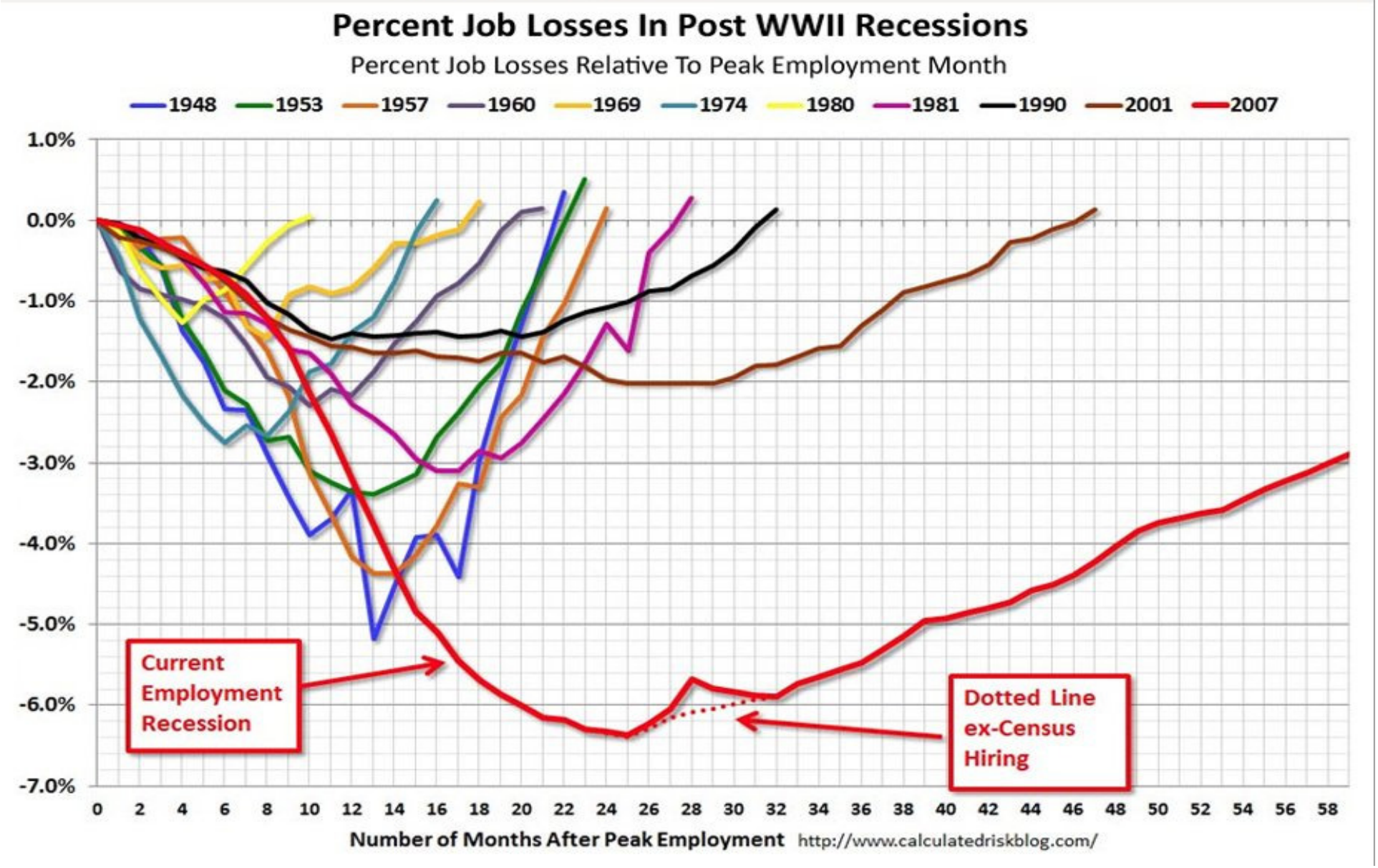
Bridging static print with mobile up-selling / cross-selling from cyber-stores in clouds

Bridge is in place but e-commerce profitability in its infancy compared to offline sales

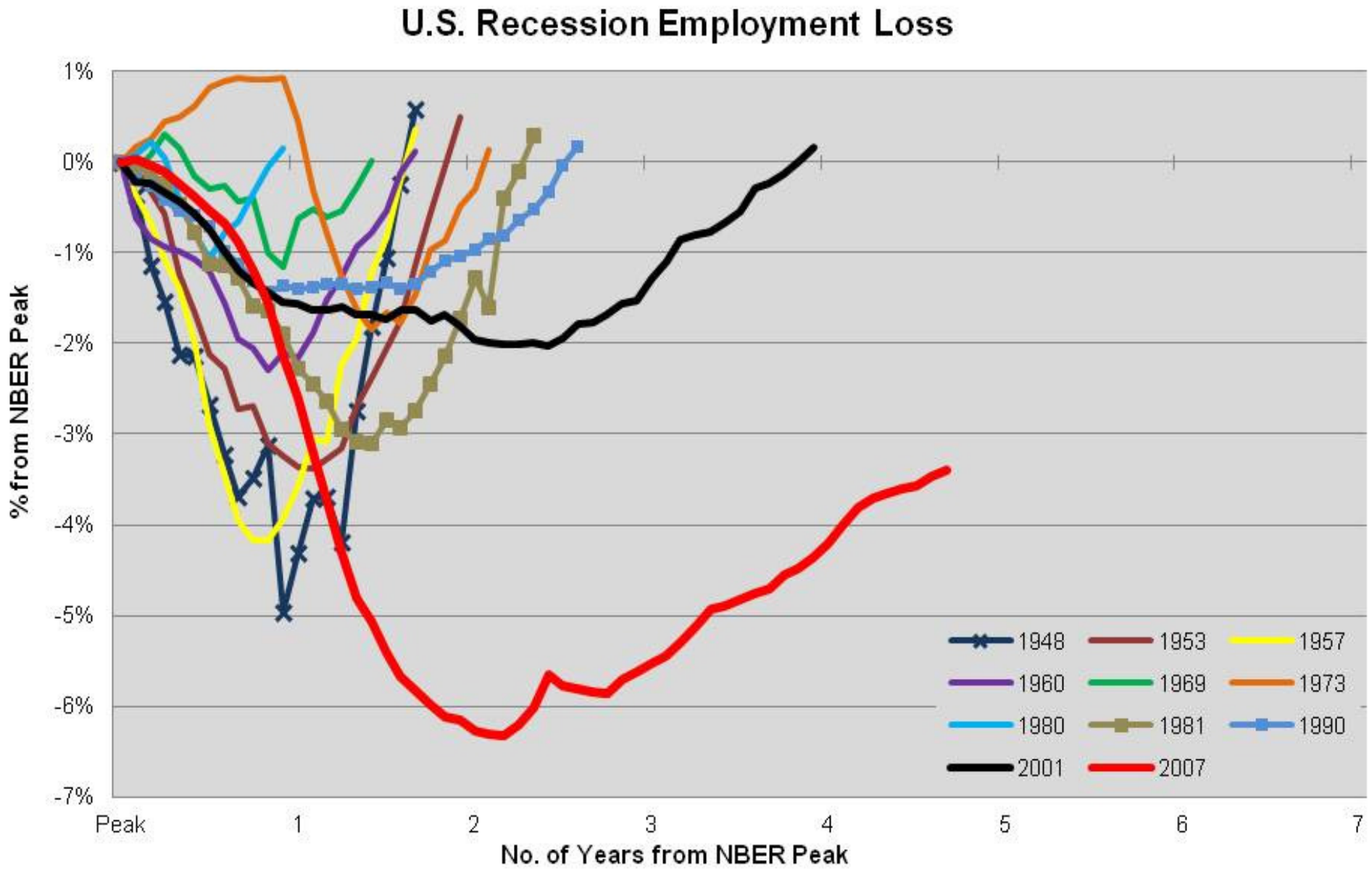


Source: Federal Reserve Economic Data--St. Louis Fed, BI Intelligence estimates

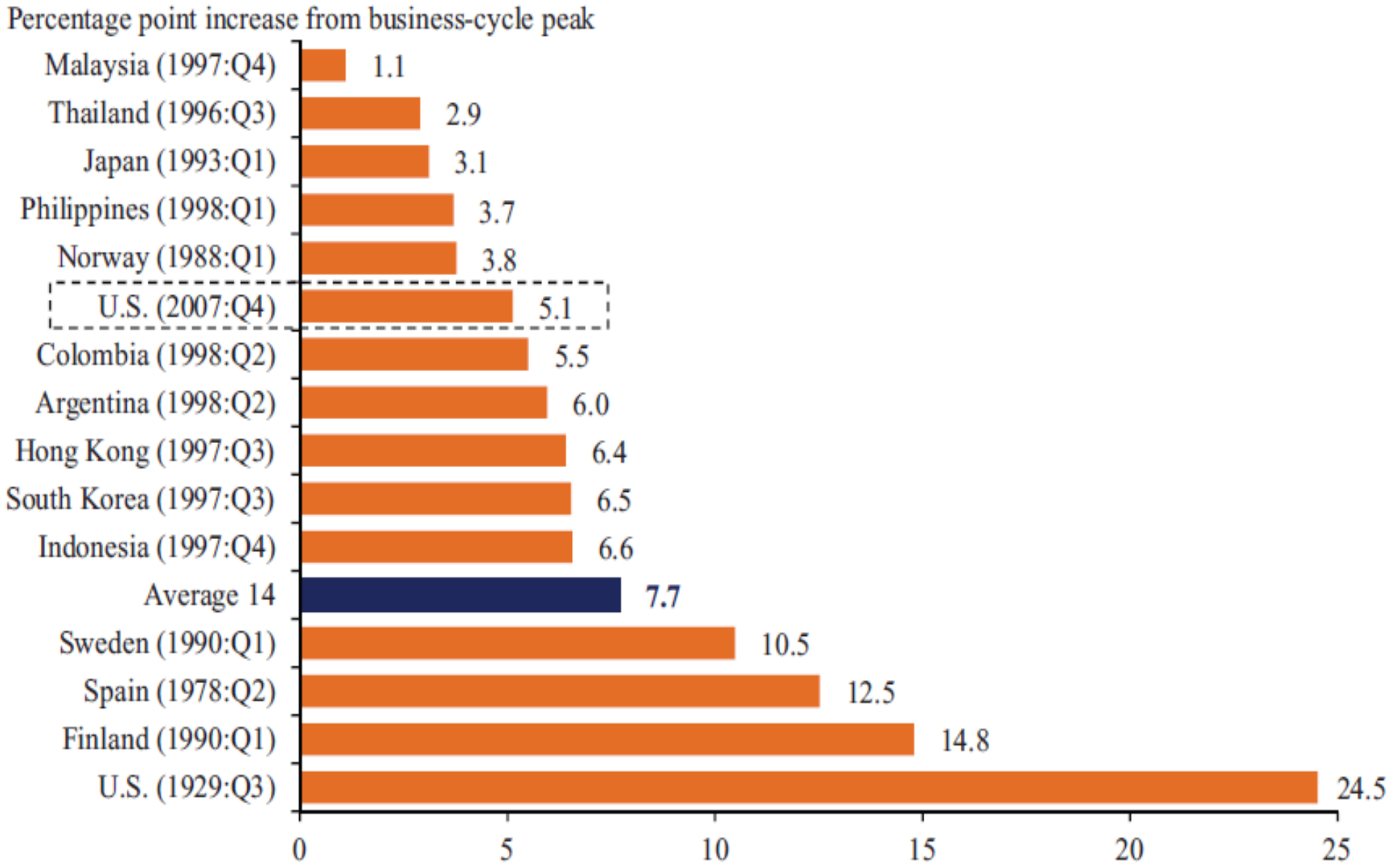
Occasional blows to e-commerce profitability



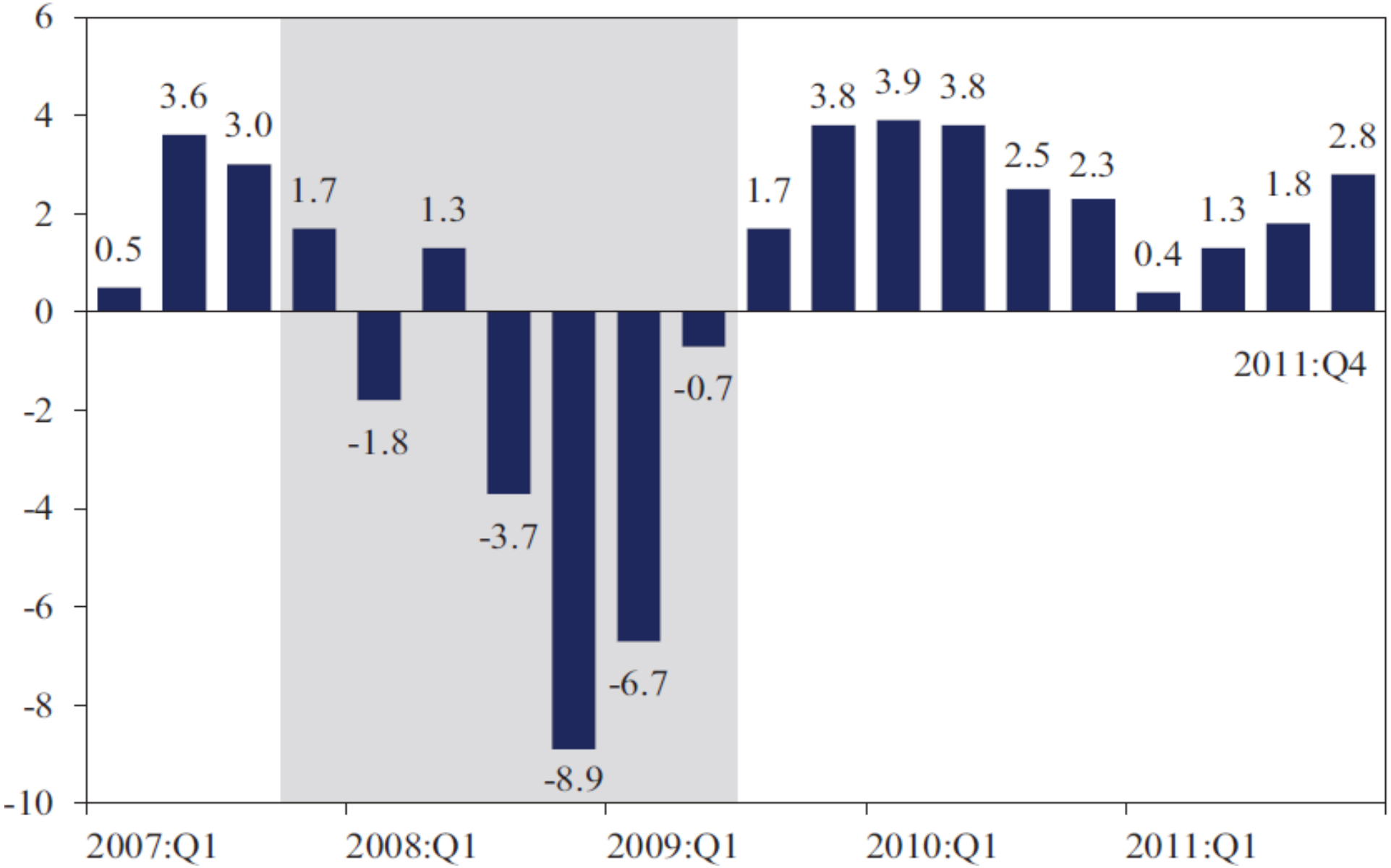
Human salvation lies in the hands of the creatively maladjusted. (MLK Jr)



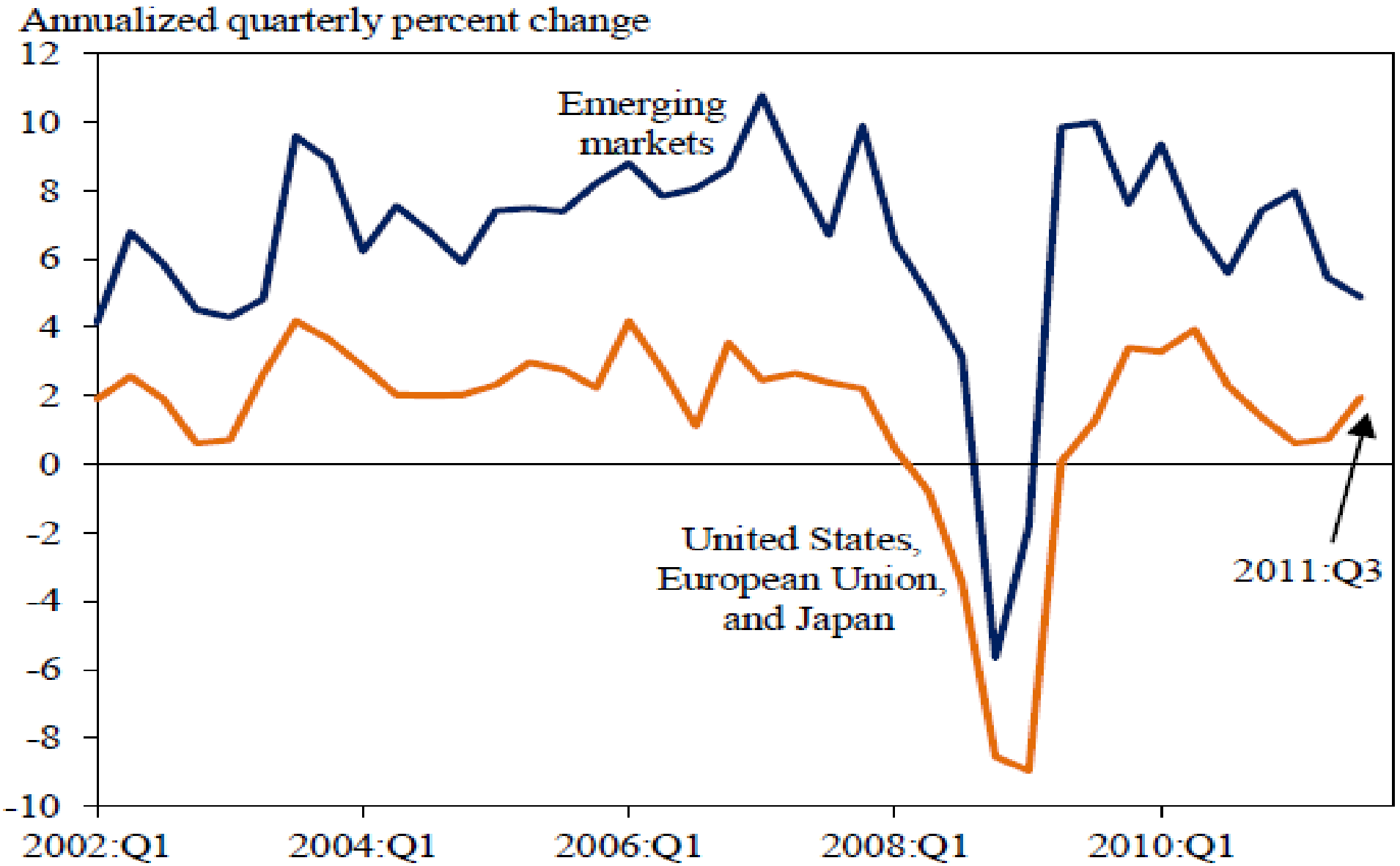
Unemployment Rate Increases in Recessions Associated with Financial Crises



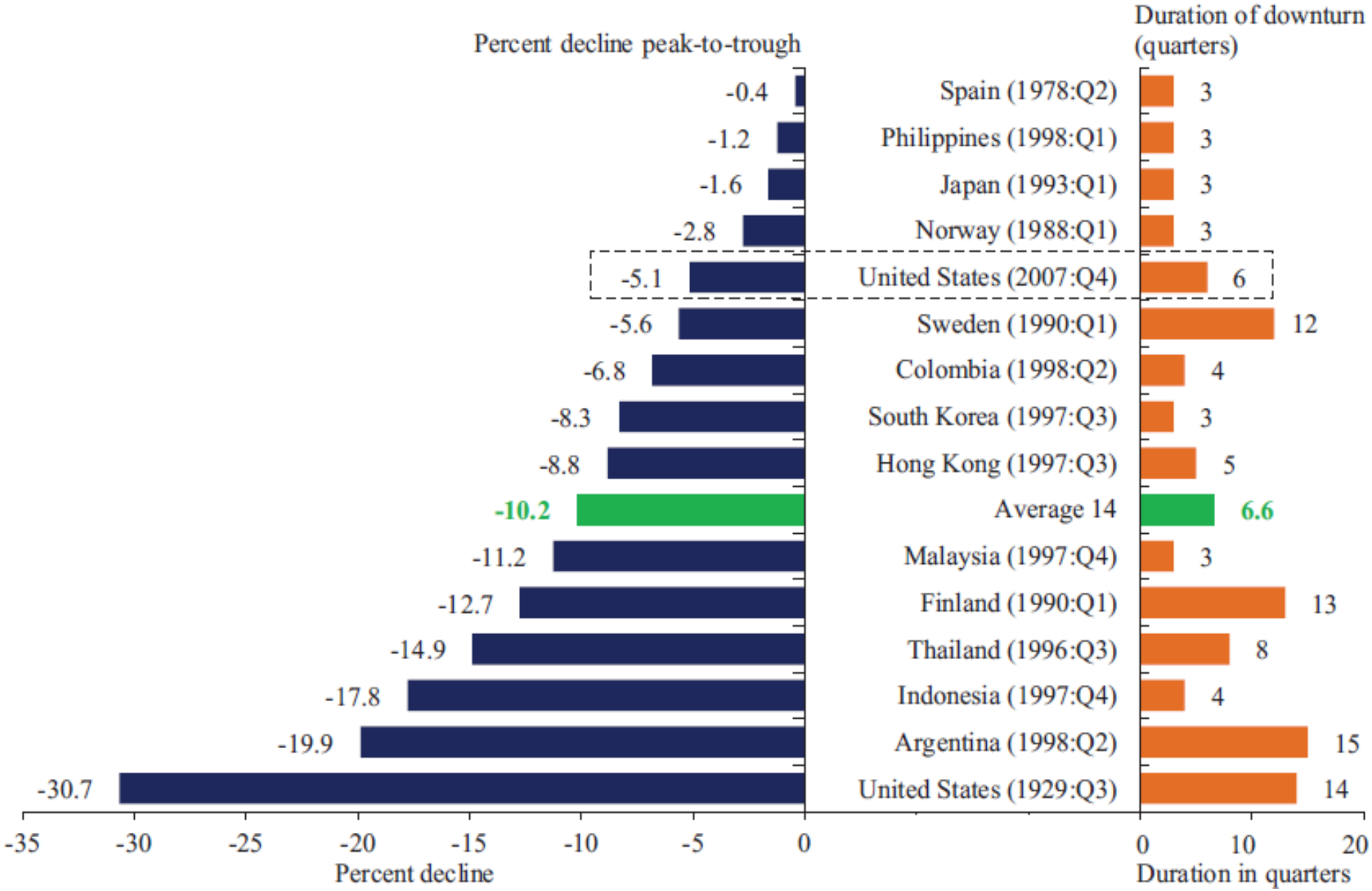
US Recession and US Real GDP Growth (percent change – annual rate)



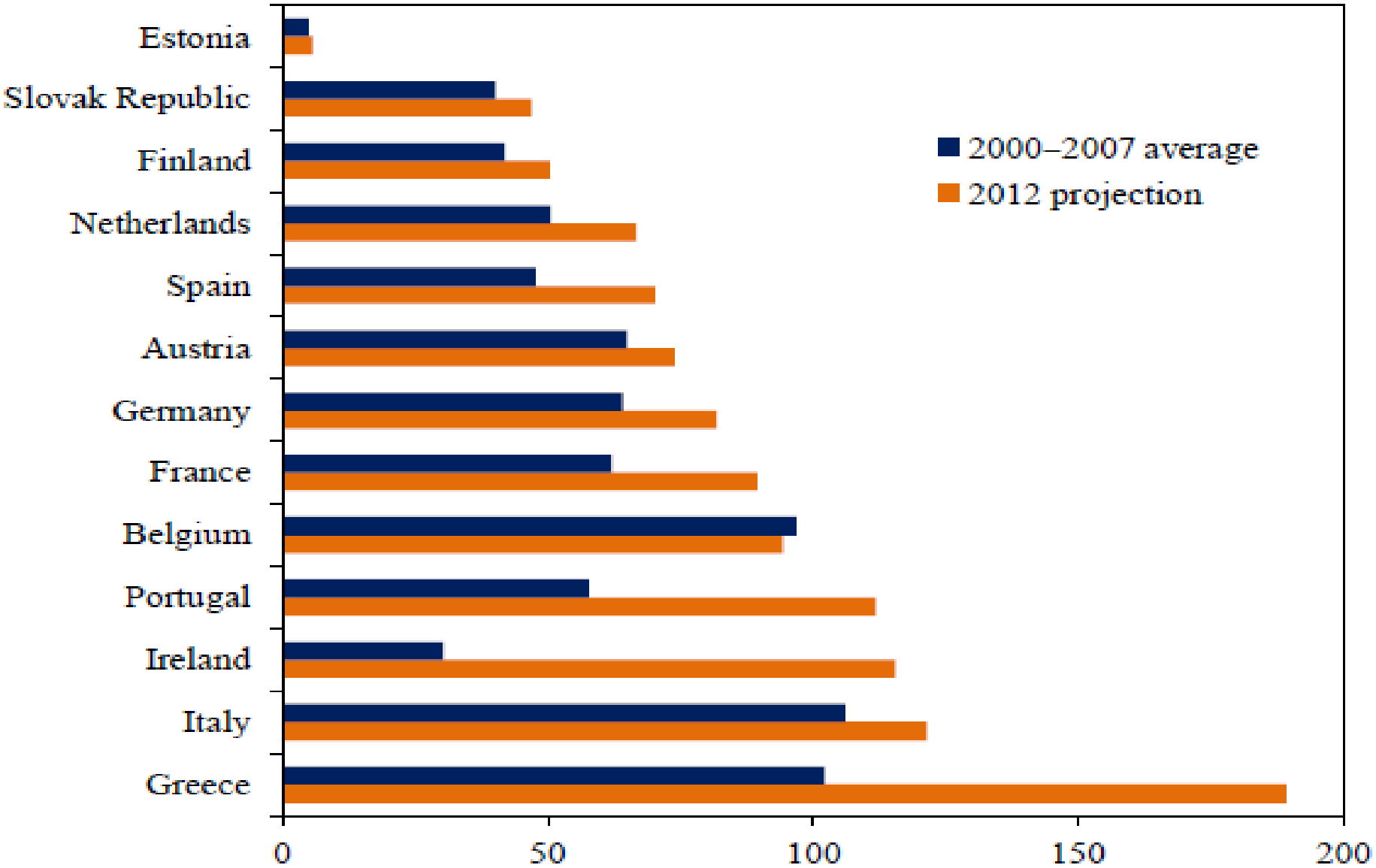
Real GDP Growth



Real GDP in Recessions Associated with Financial Crises

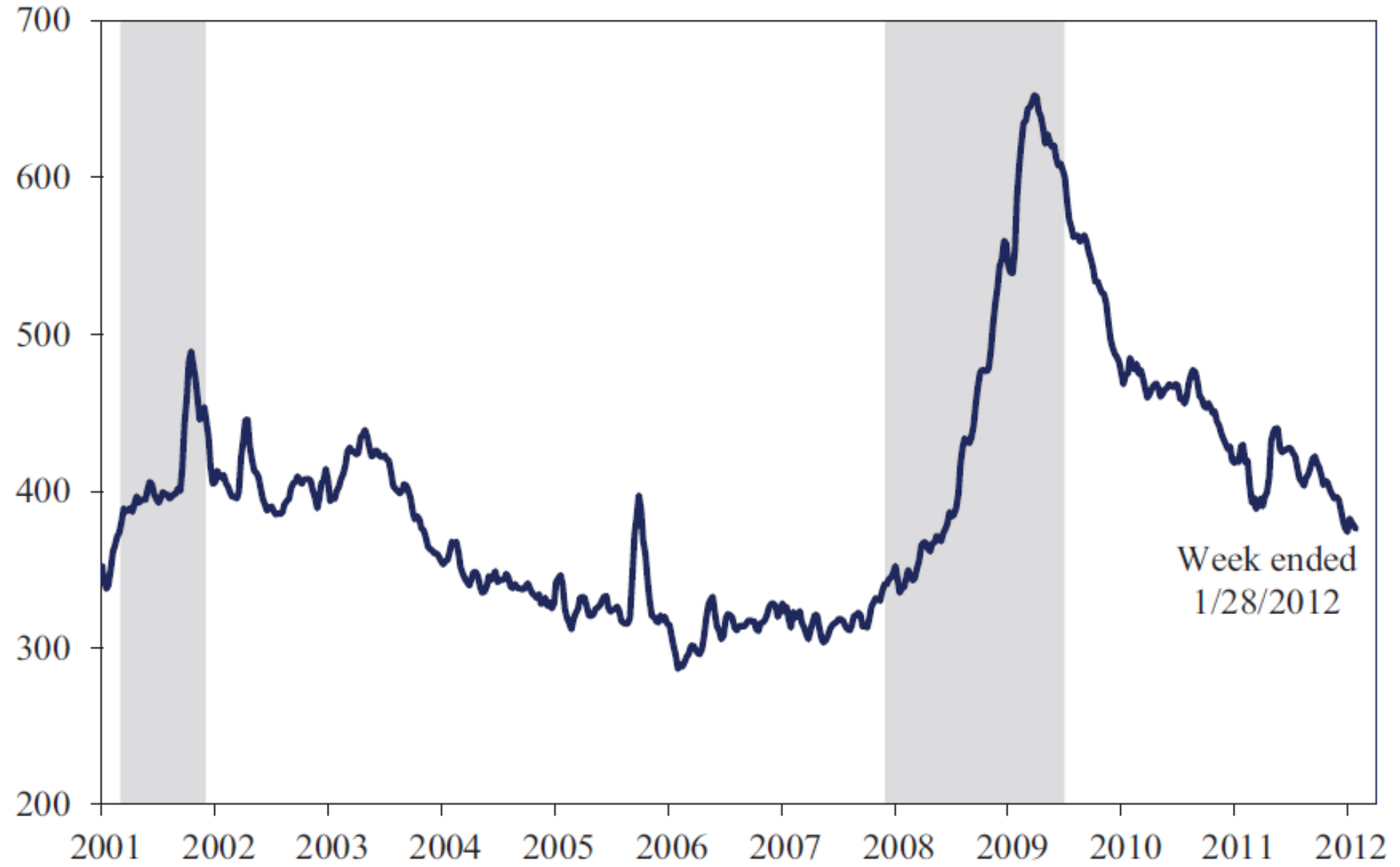


Public Debt to GDP Ratio

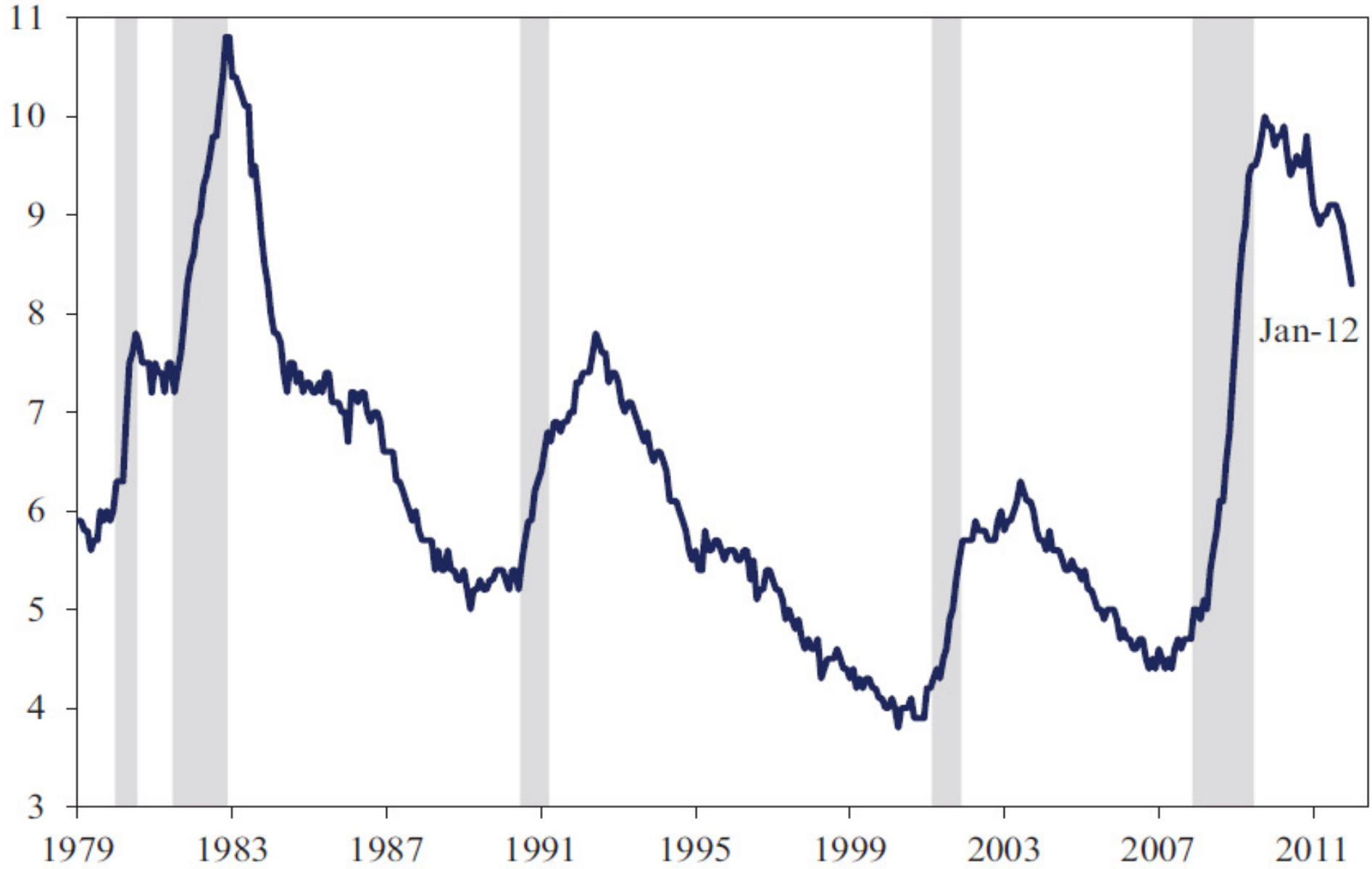


Source: International Monetary Fund, World Economic Outlook, September 2011.

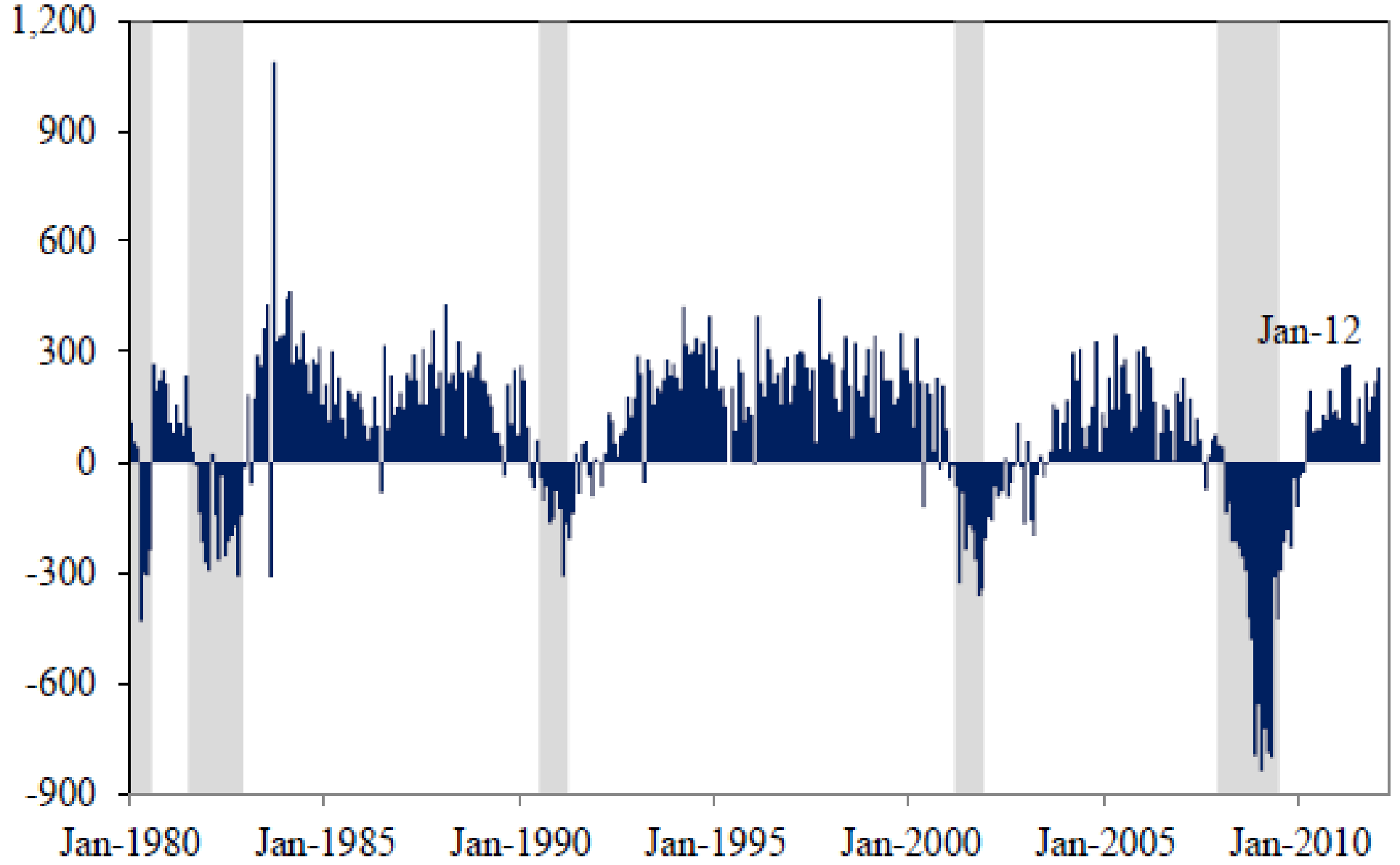
US Unemployment Insurance Claims (000's)



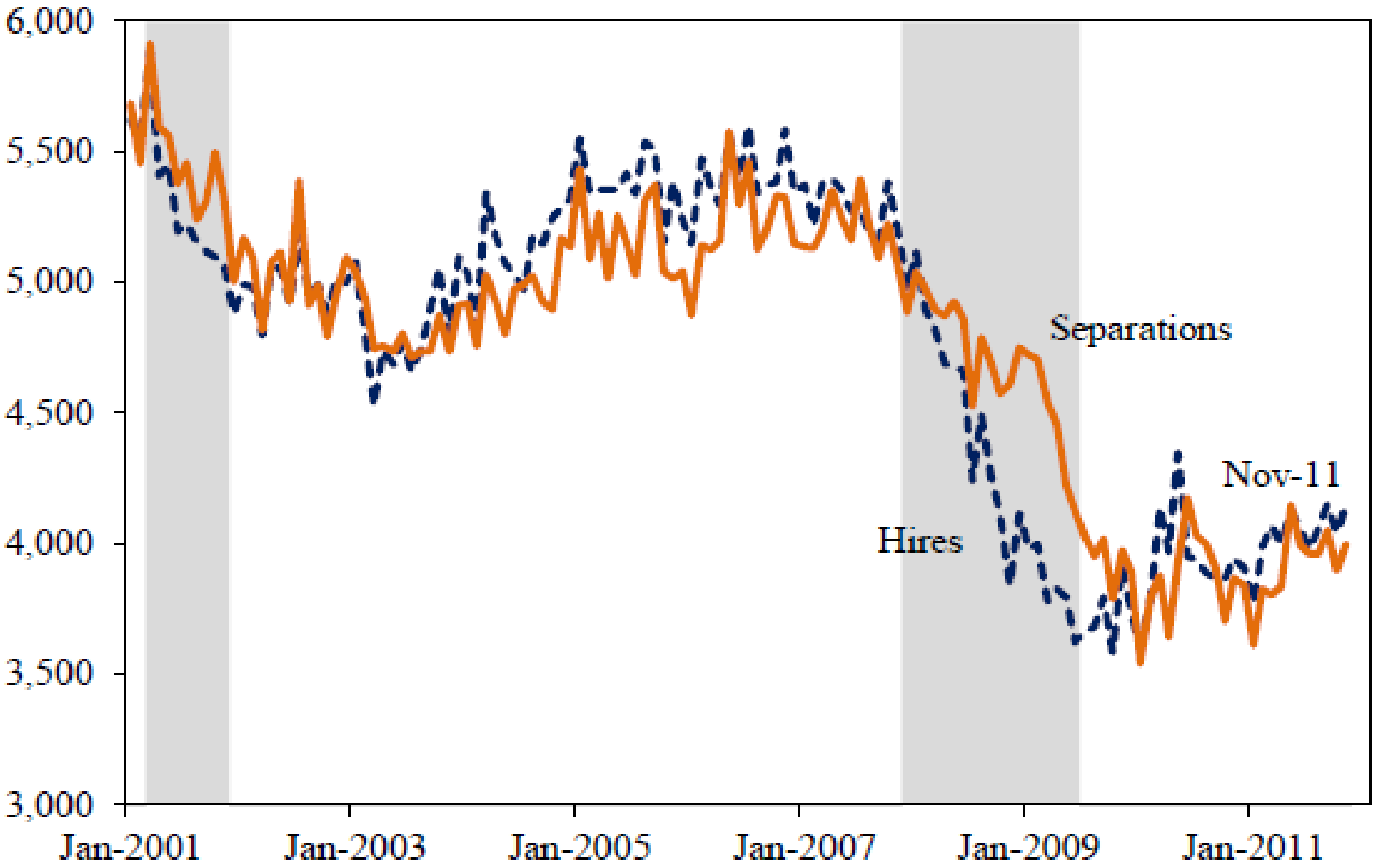
US Unemployment (%) during recessions (1979-2012)



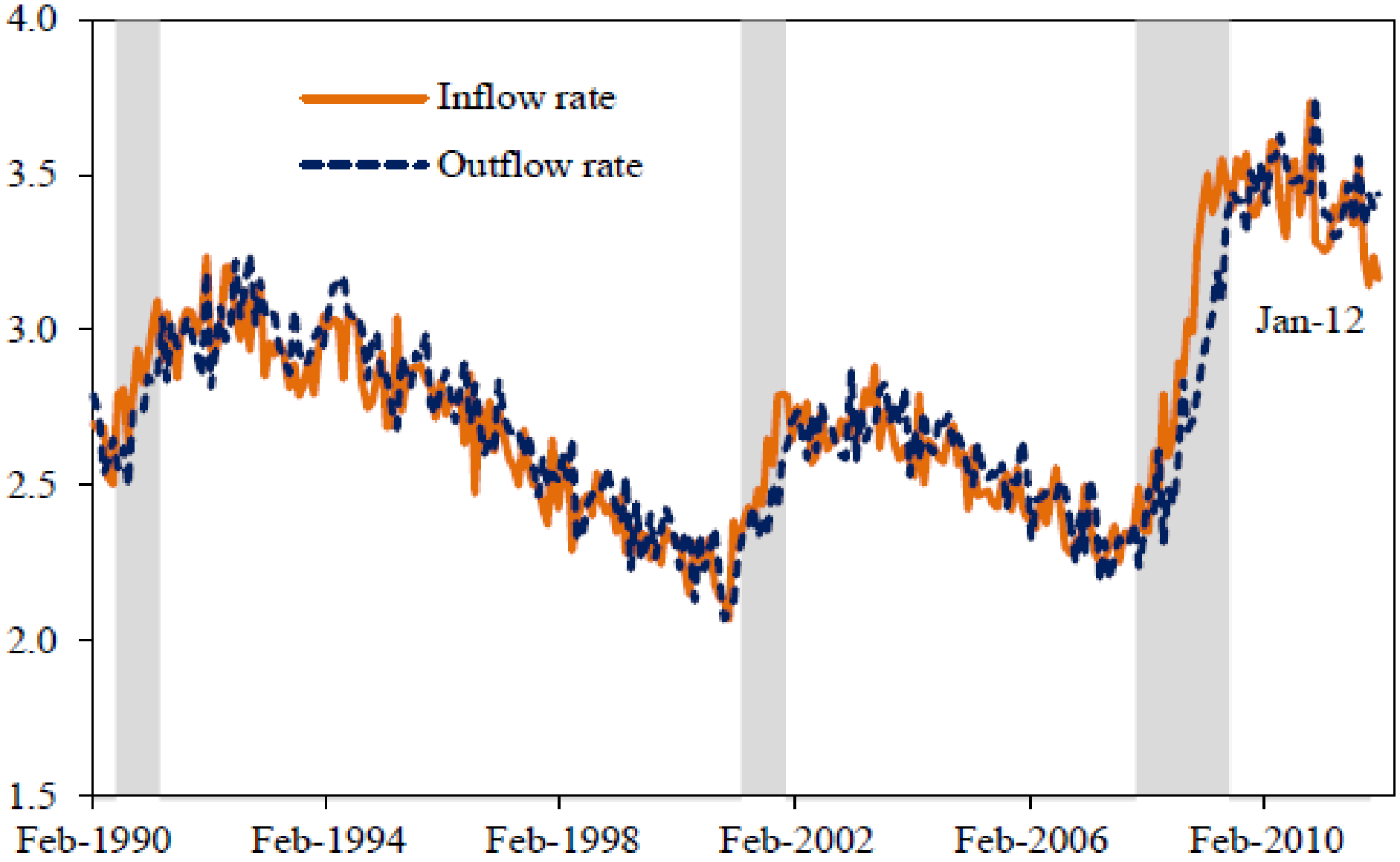
US Private sector employment (000's) 1980-2012



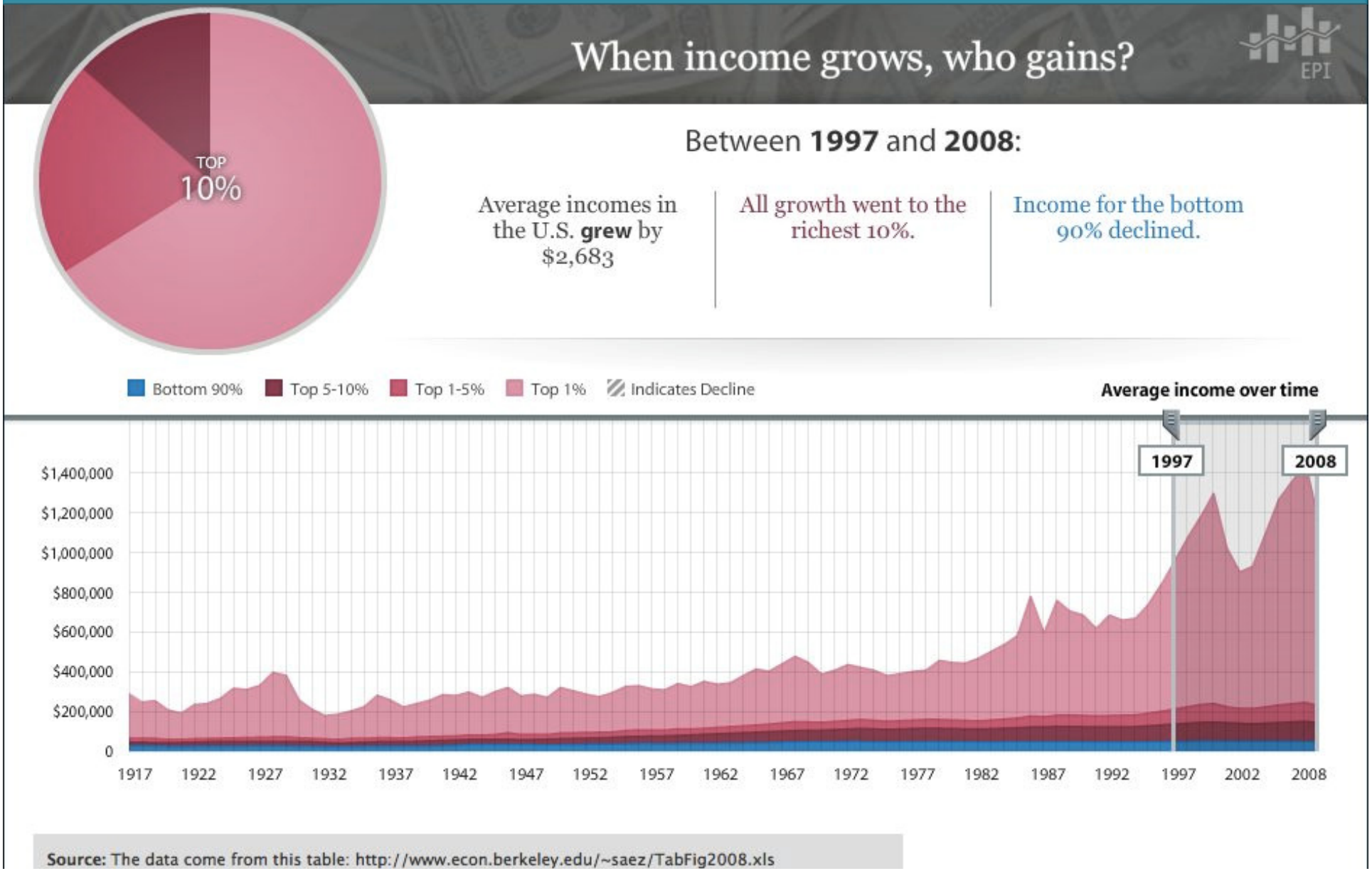
US Hires vs Separations (000's)



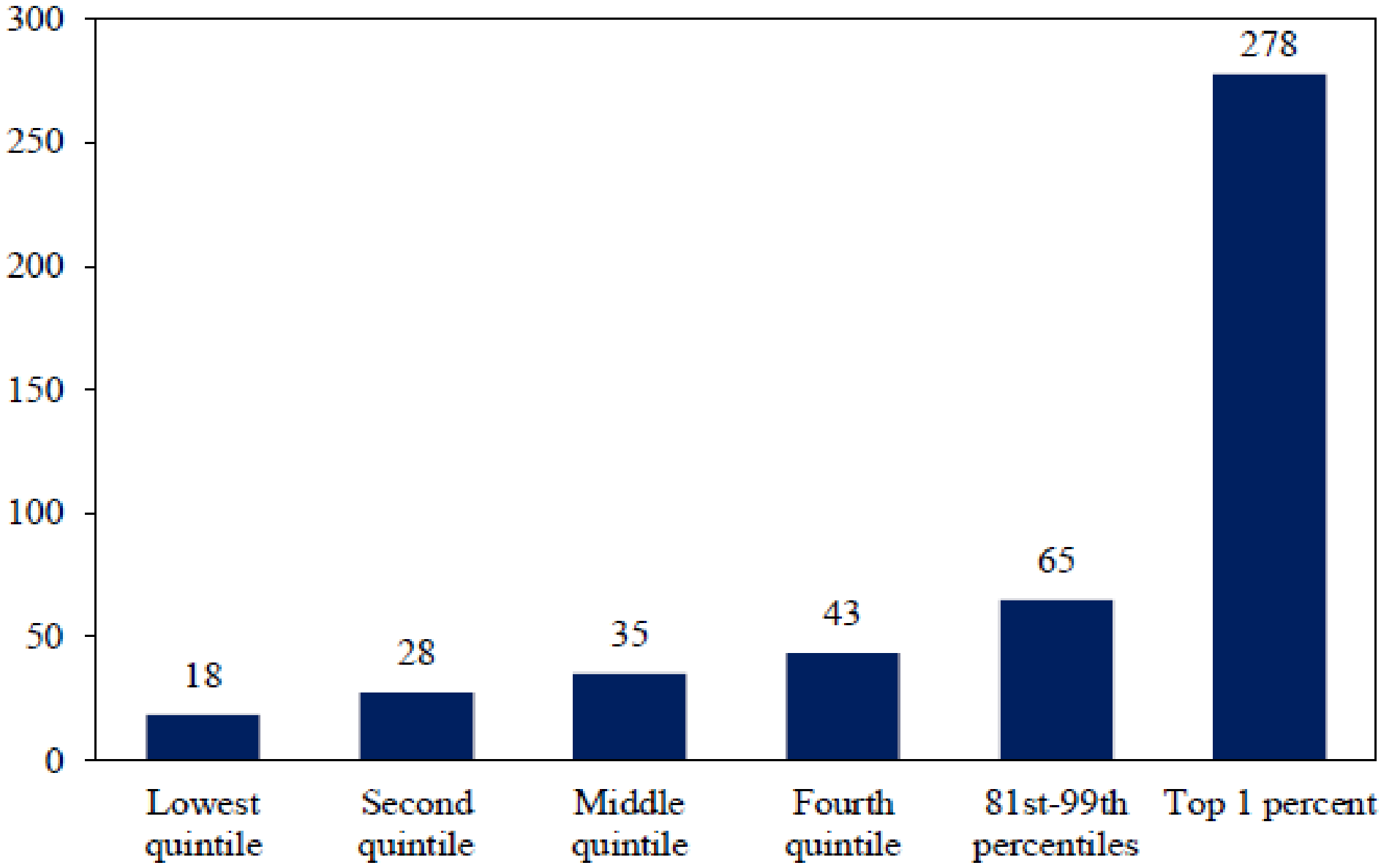
US Flows in and out of employment (as a percentage of labor force)



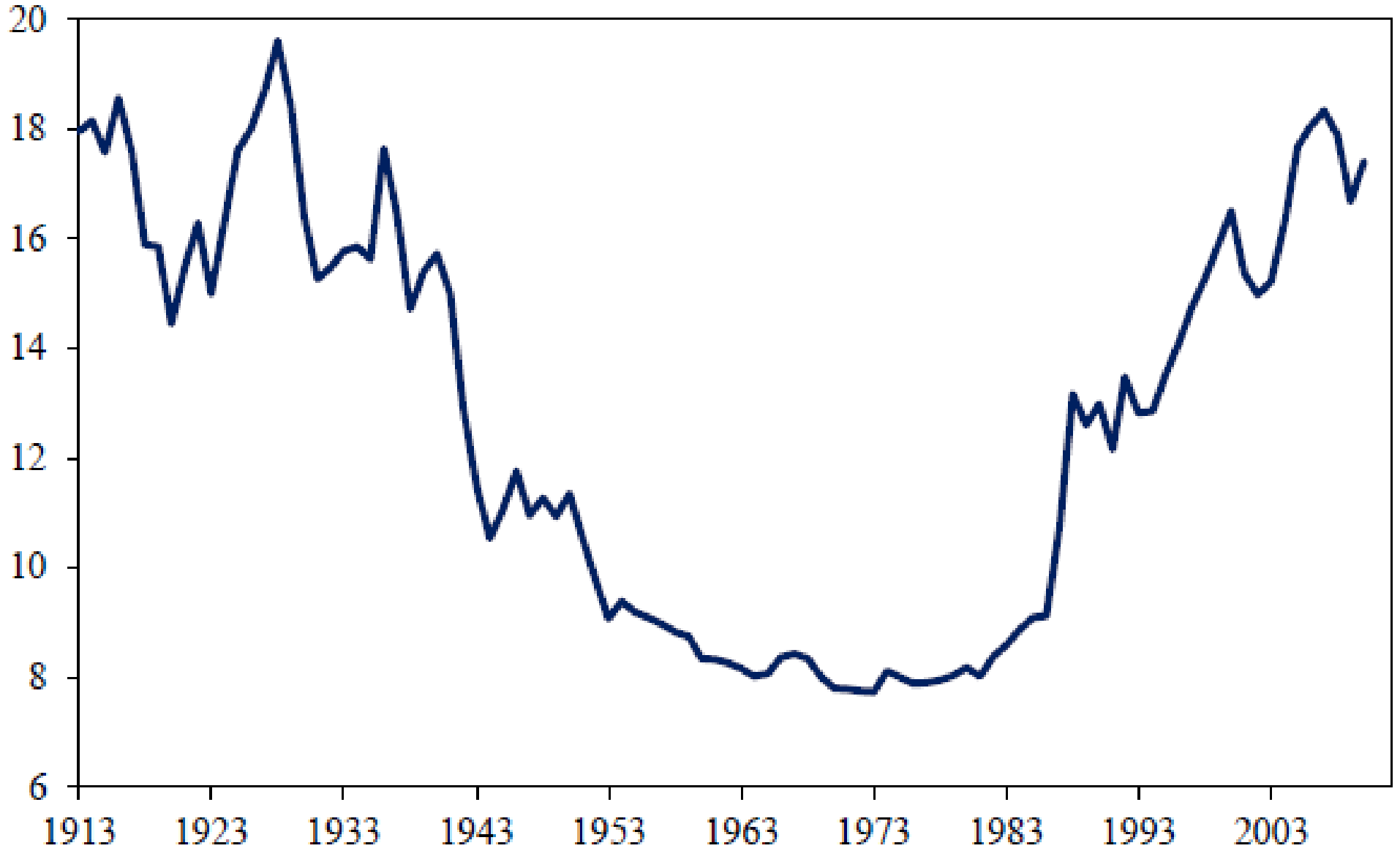
US Income Growth Prior to Recent Recession



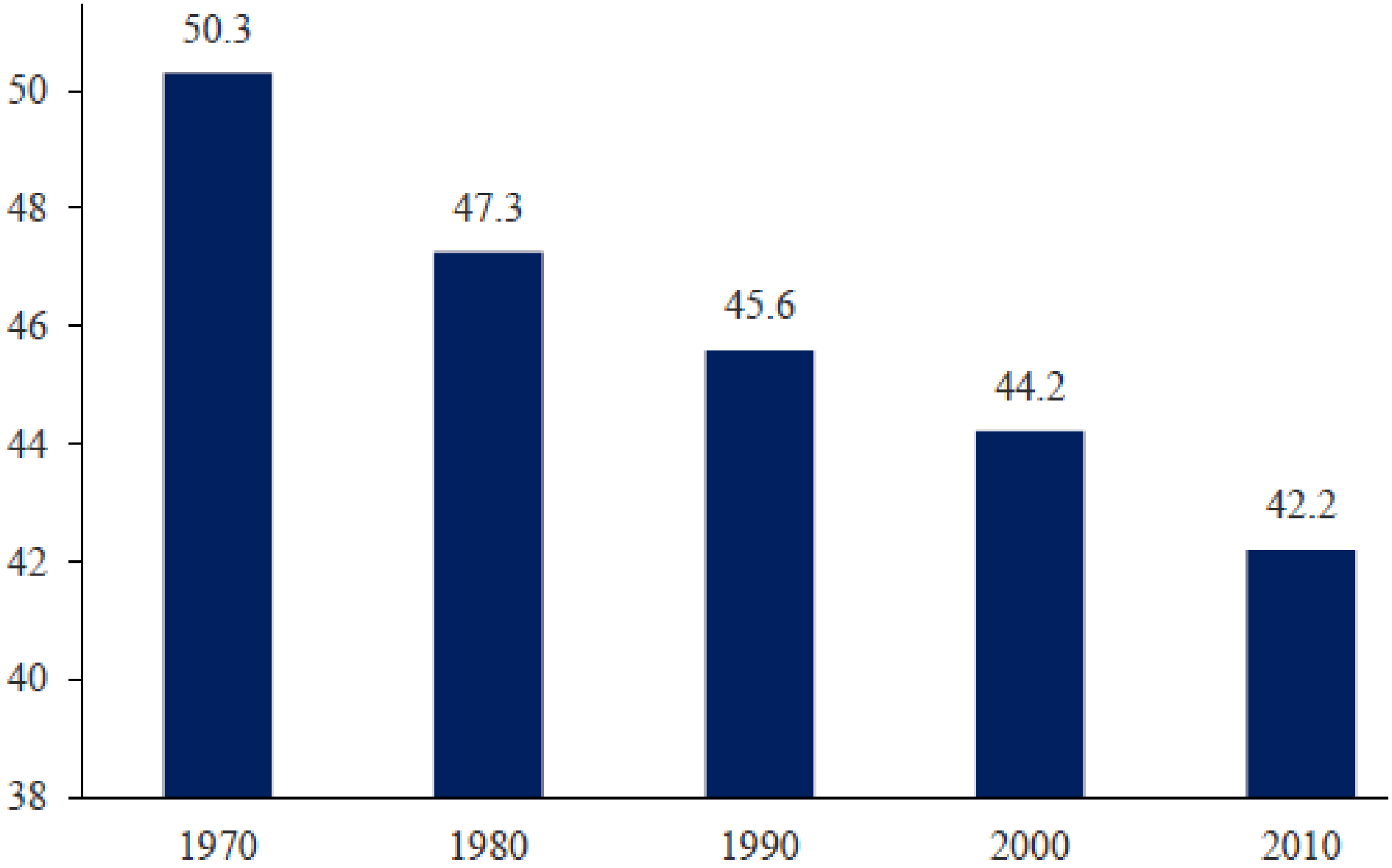
US Income Growth <> Percent Change in Real Growth after Income Tax (1979-2007)



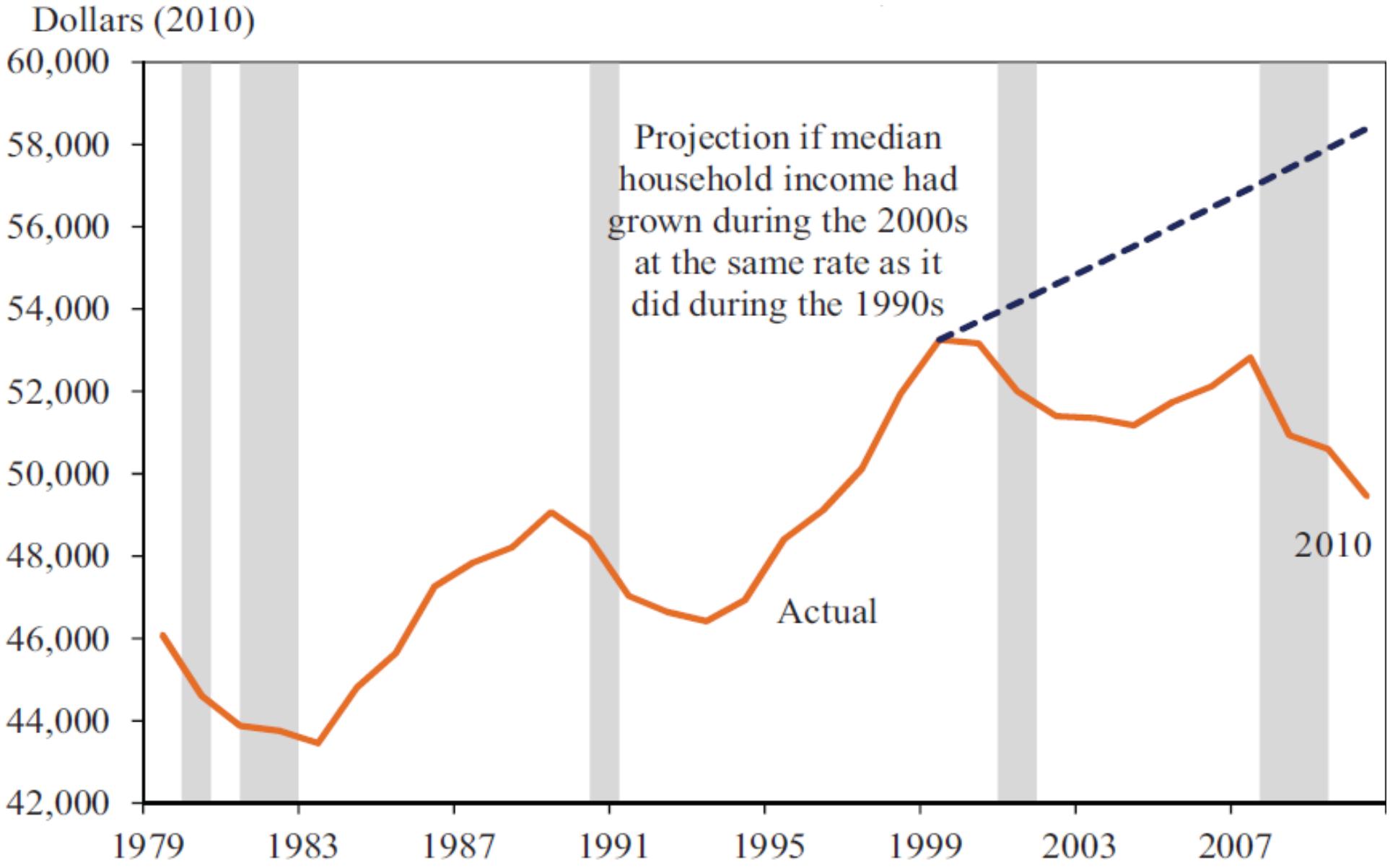
US Income Growth <> Percent of Total US Income Earned by Top 1% (1913-2010)



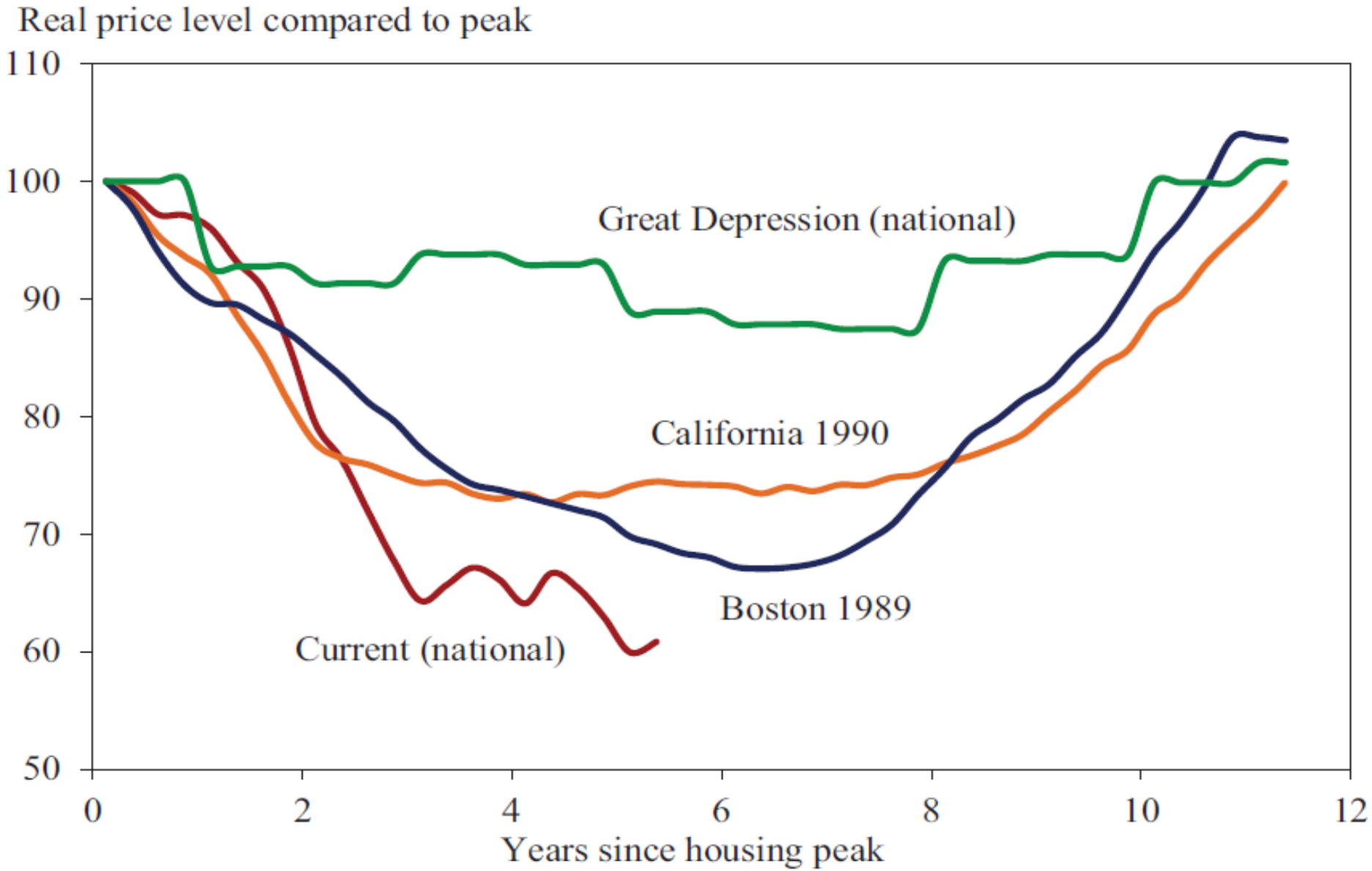
US Income Growth <> Percent Households with annual income within 50% of median



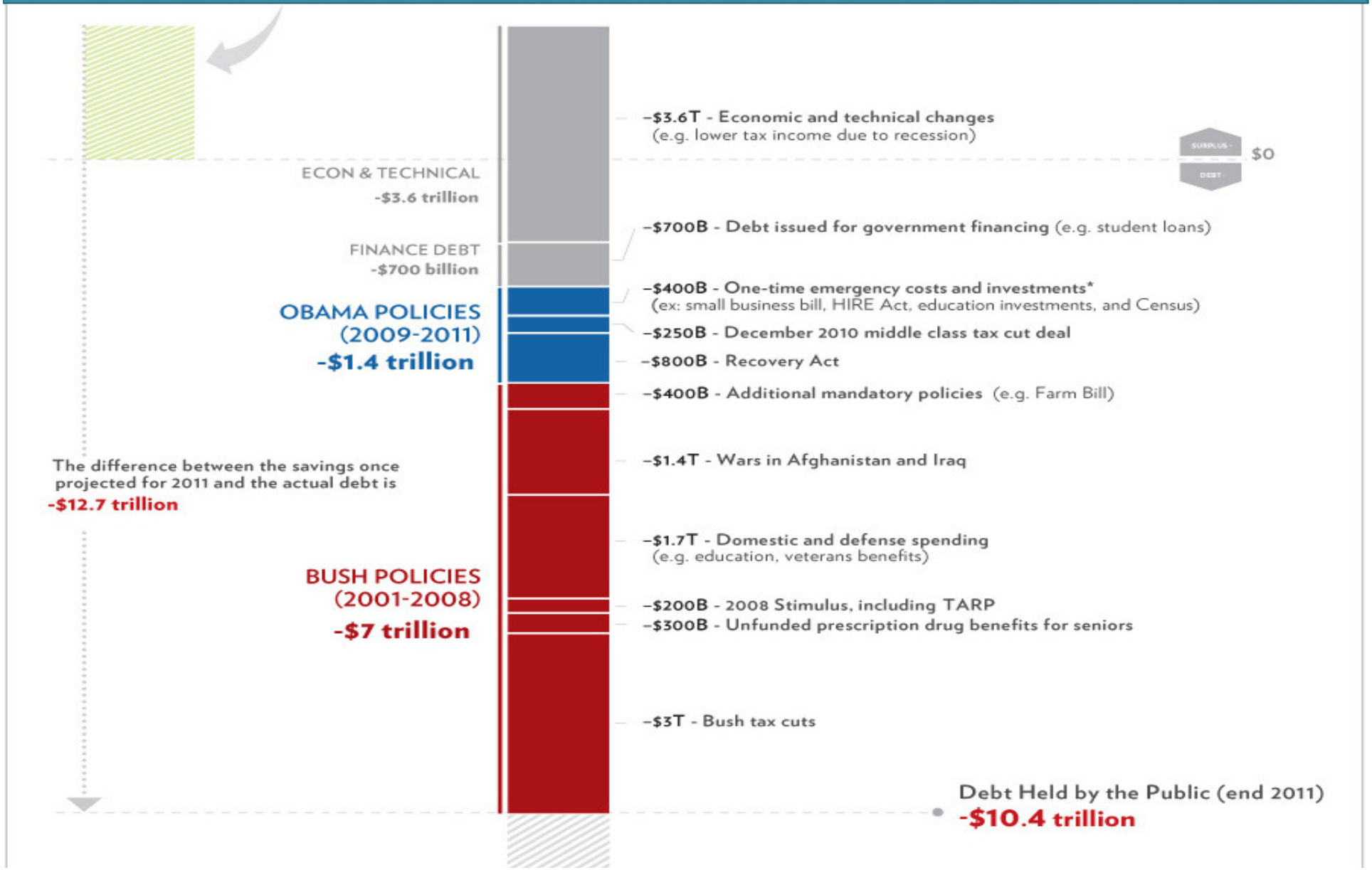
US Income Growth <> The “what-if” scenario



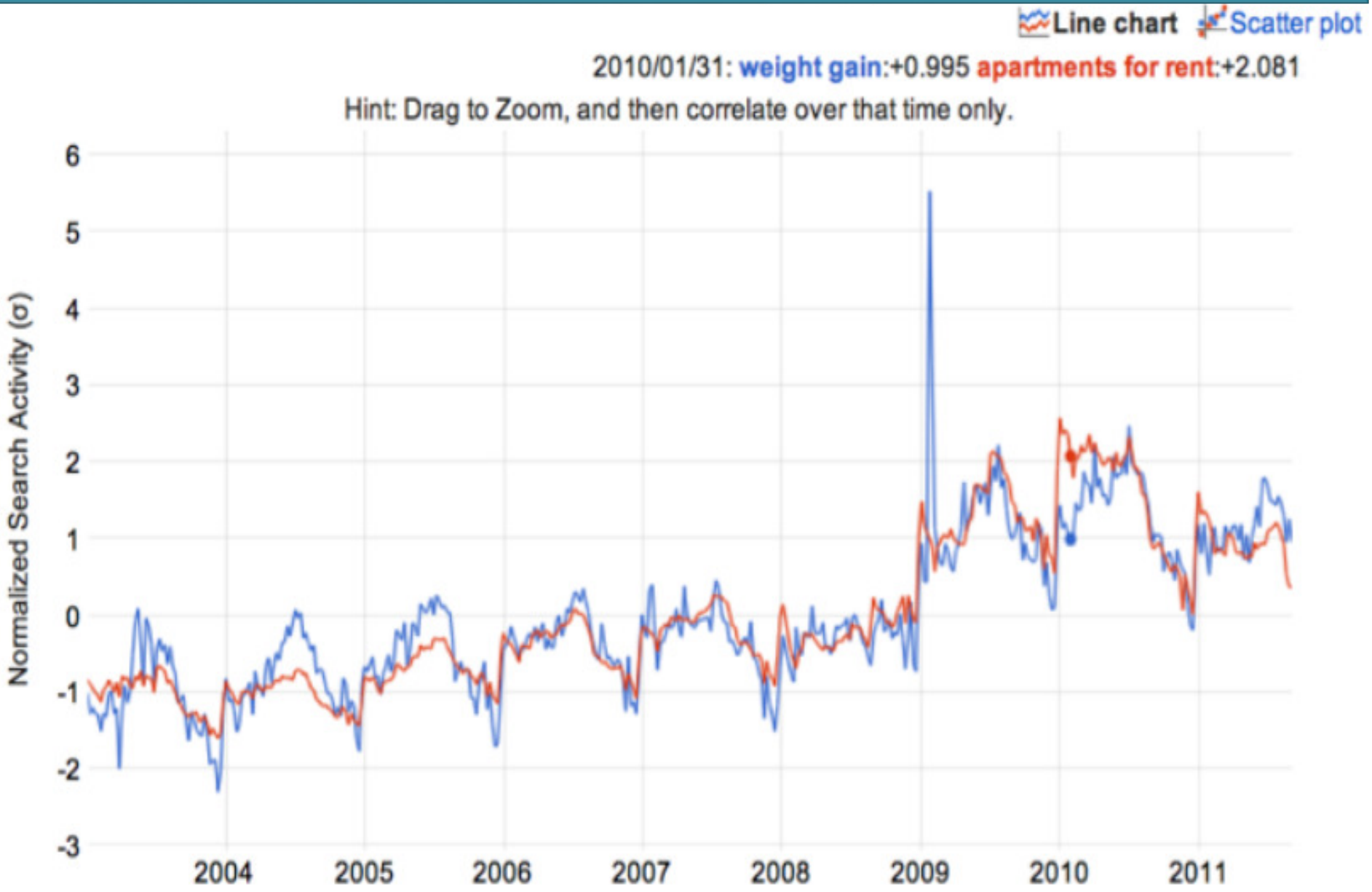
US Housing Busts



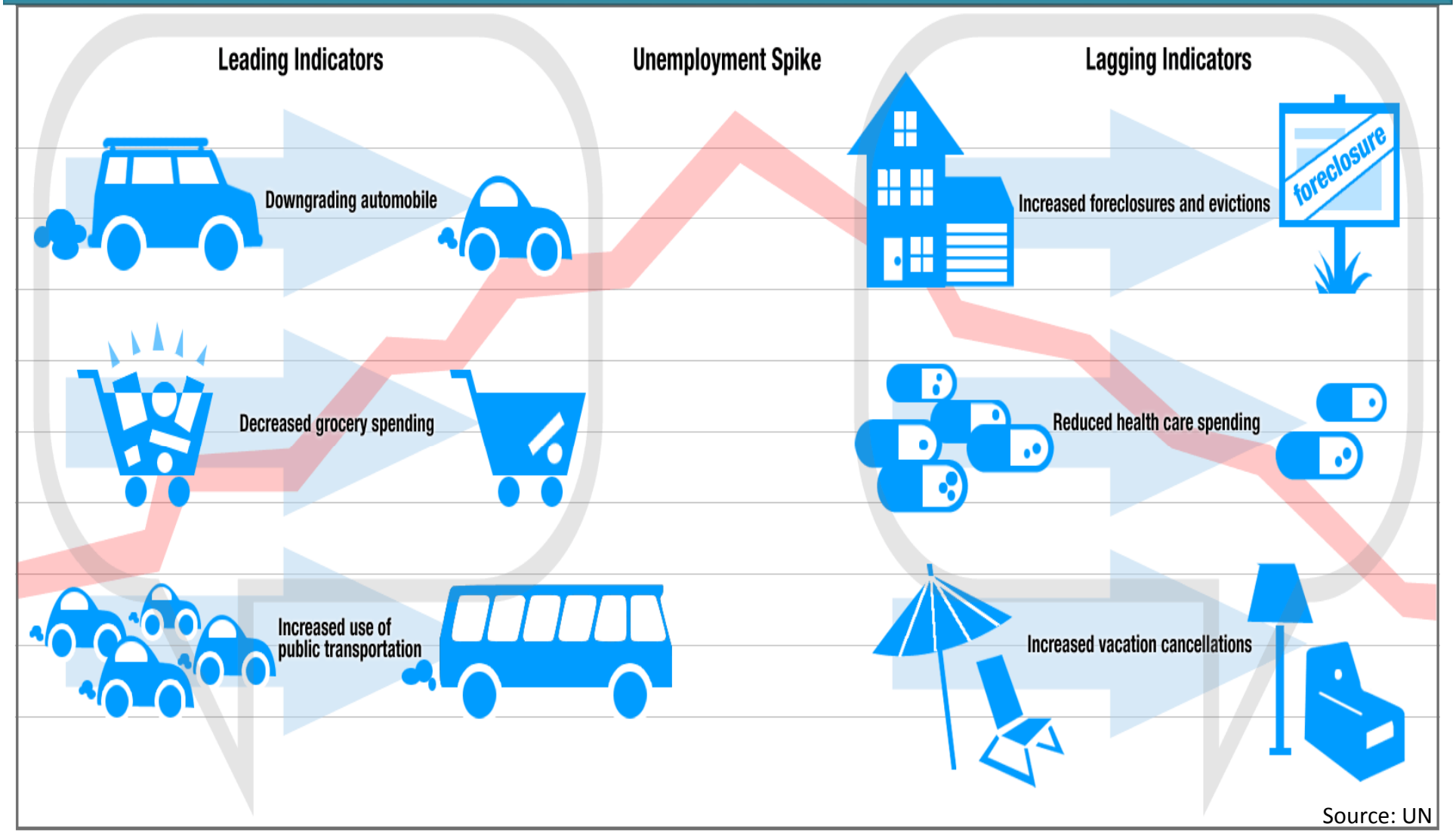
US Income – influenced by approximately $13 trillion debt added over the last decade



Caution – Data Correlation does not mean Causation



Big Data Analytics - part of the unanticipated changes which may re-equilibrate norms

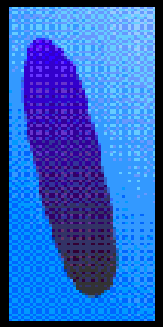


Analysis of social media using SAS shows increases in chatter about certain topics that are leading and lagging indicators of a spike in unemployment.

Big Data is Broad, Unstructured, Asynchronous, Non-relational, Diffuse

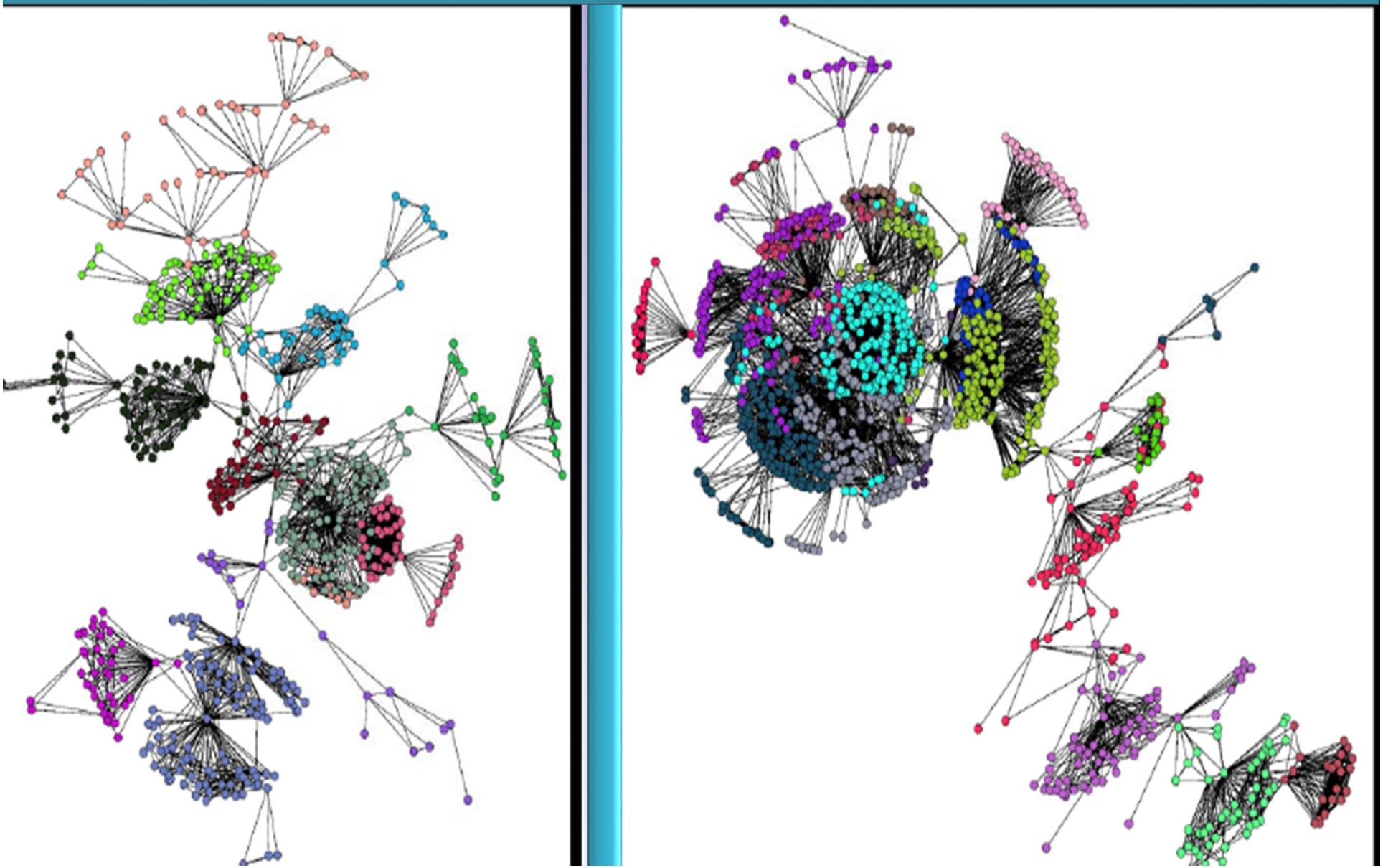
- Volume
- Velocity
- Variety
- Volatility
- Variability
- Vulnerability

Big Data Analytics – cautionary tale

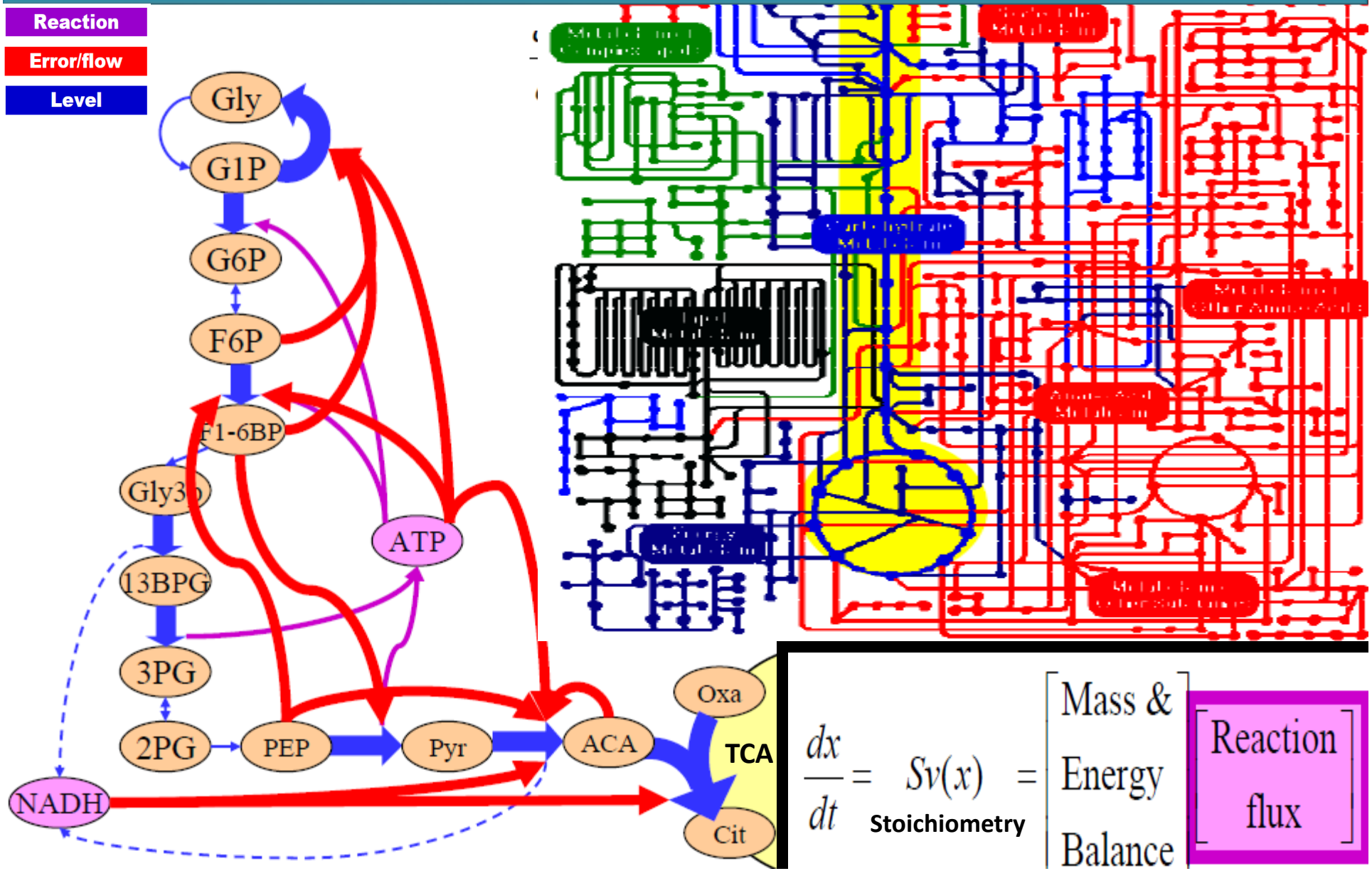


What is this ?

Data – Insight from network structure



Data Analytics benefit from bio-inspired understanding of network layers and controls

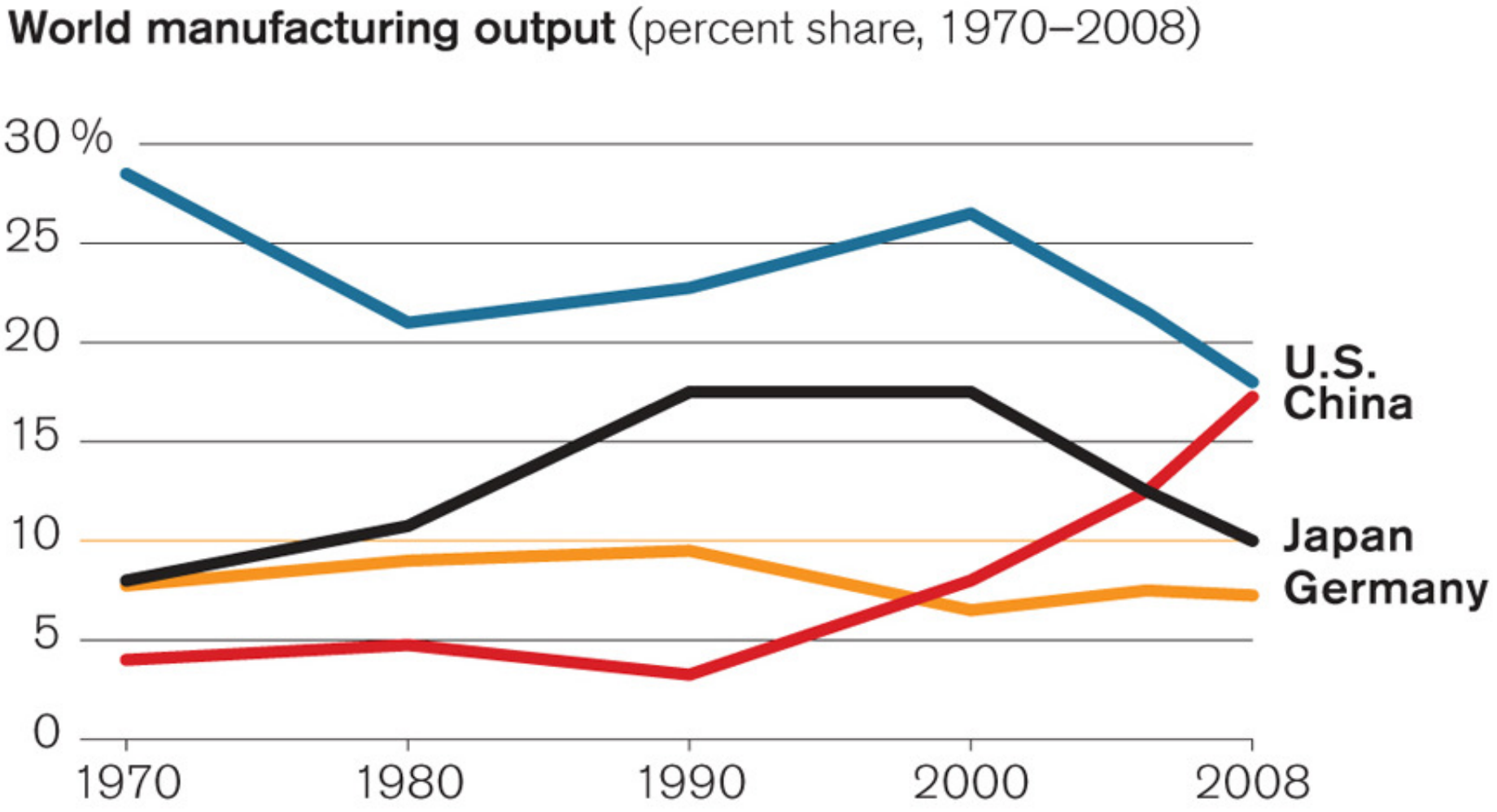


Big Data Analytics may reveal life style changes which may influence manufacturing

	R&D and design	Supply-chain manage-ment	Produc-tion	Market-ing and sales	After-sales service
Build interoperable, cross-functional R&D and product design databases to enable concurrent engineering, rapid experimentation, simulation, and co-creation	✓		✓		
Aggregate and share customer data to improve service, increase sales, and enable design-to-value	✓	✓		✓	
Source and share data through virtual collaboration sites (idea marketplaces to enable crowdsourcing)	✓		✓	✓	
Implement advanced demand forecasting and supply planning across suppliers and use external variables		✓	✓	✓	✓
Implement lean manufacturing; model and optimize production; develop dashboards			✓		
Implement sensor data-driven analytics to improve throughput and enable mass customization			✓		
Collect real-time after-sales data from sensors and customer feedback to trigger services and detect flaws		✓	✓	✓	✓
Improve supply-chain visibility through control towers and organization-wide collaboration		✓	✓	✓	✓

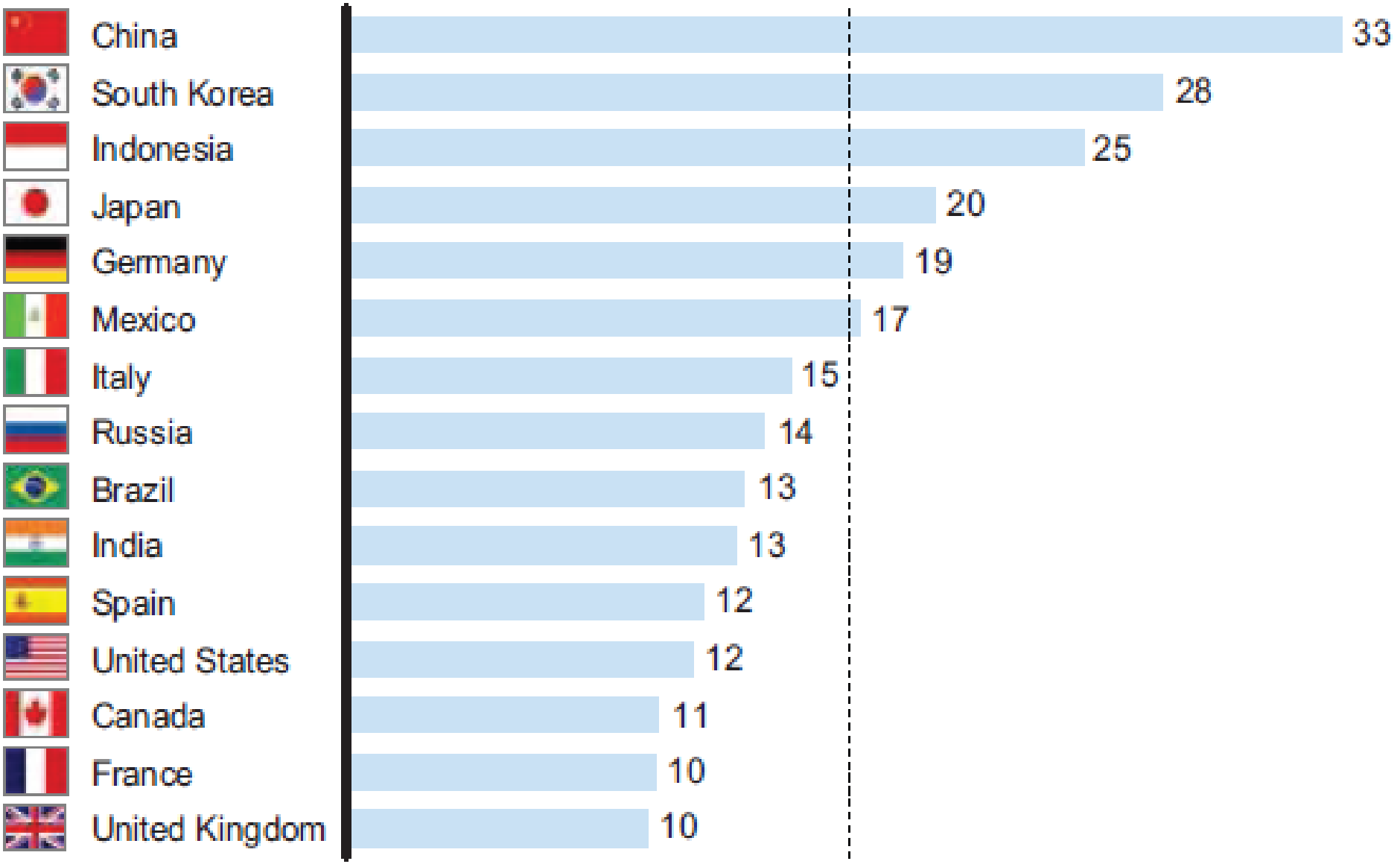
Big Data may be a Big Bubble if applied without intuition, experience, foresight, vision

Even without Big Data - life style technologies will influence manufacturing-as-usual

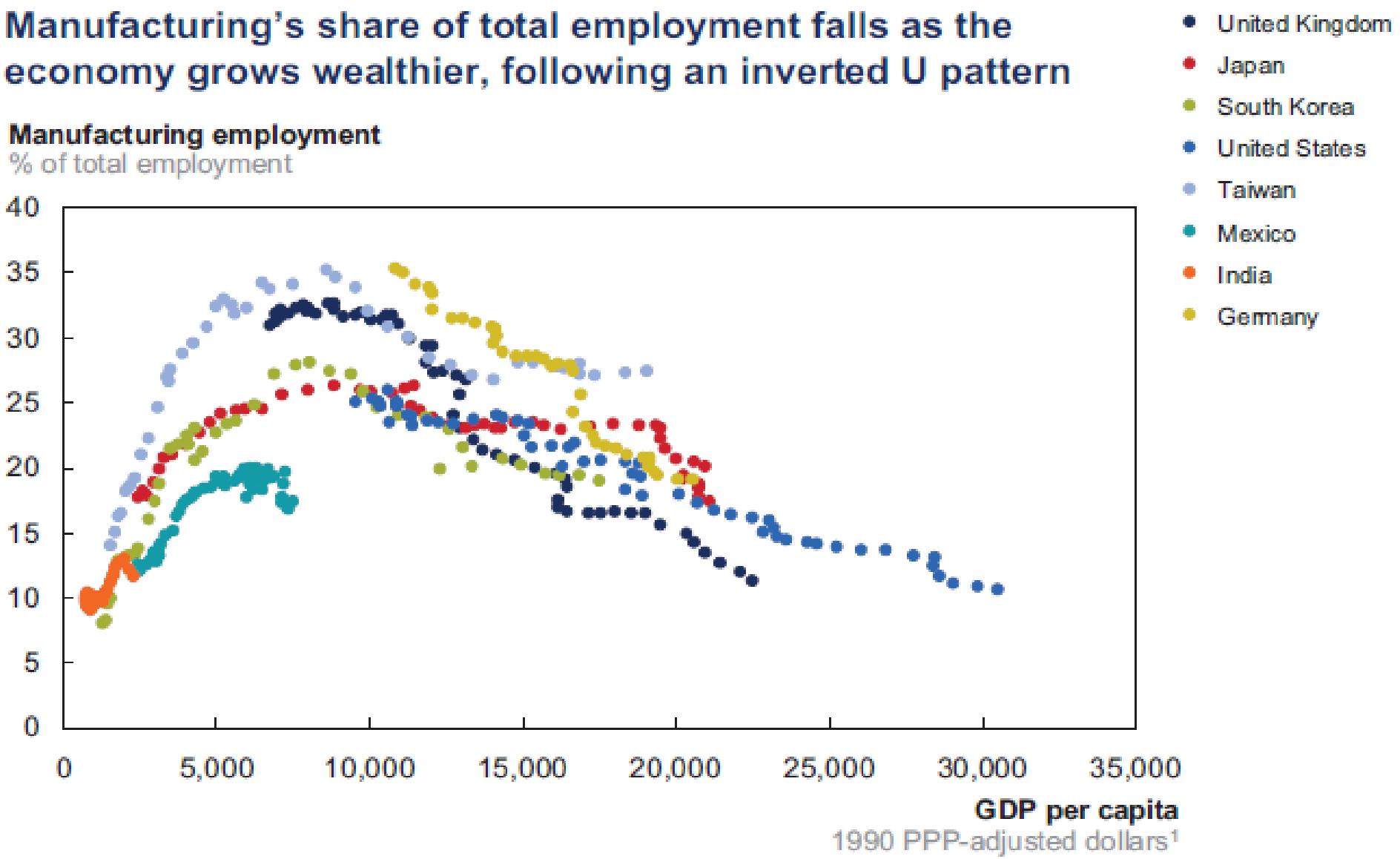


Sources: United Nations Conference on Trade and Development, ITIF

Manufacturing Contribution to GDP – Profile may be in reverse equilibrium in 50 years



Manufacturing's Contribution – Classical models and analysis subject to disruption

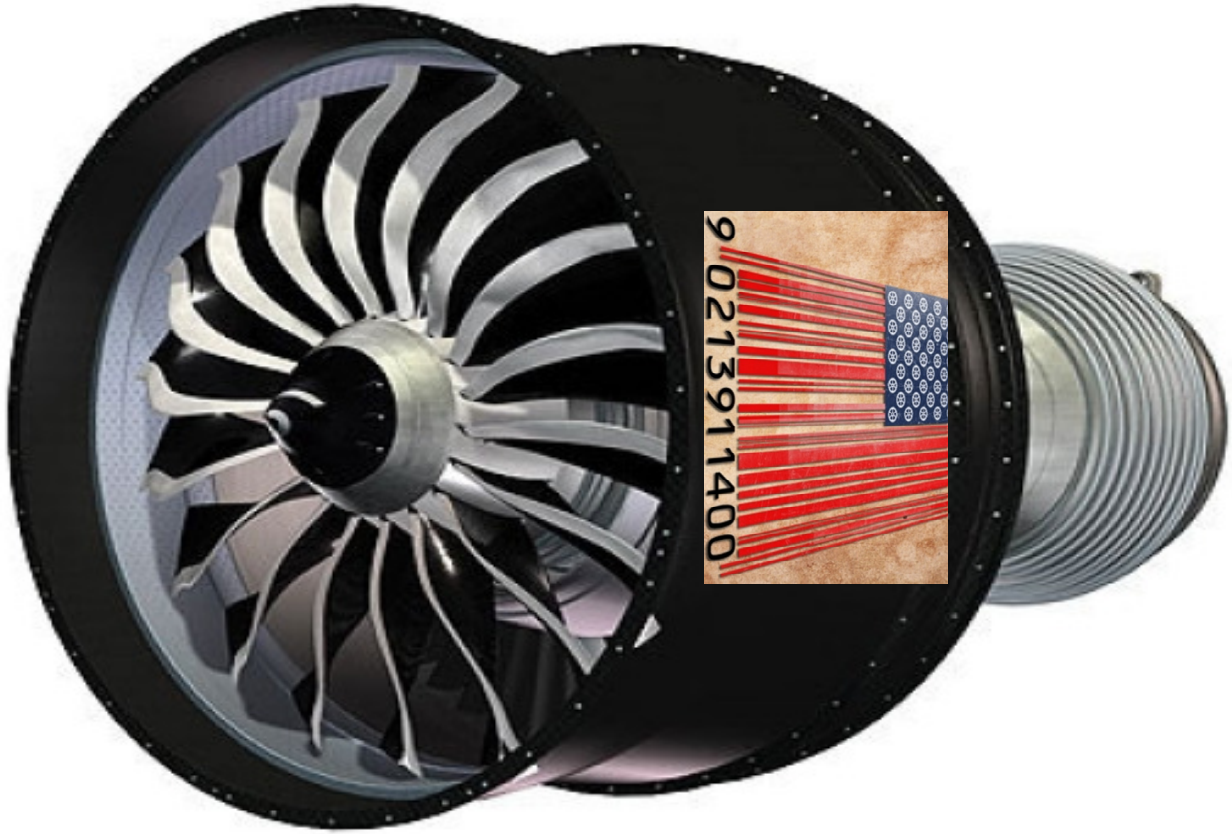


Disrupt Manufacturing 2050 - invention, innovation, imagination & Industrial Internet

Additive manufacturing
Print me a jet engine

Nov 22nd 2012, 12:54 by P.M.

Did not entail being right all the time. It was rather to dare, to propose new ideas and then to verify them and to know how to admit errors.
Pierre-Gilles de Gennes (1932-2007)
After the 1991 Nobel Prize for Physics



Supply Chain 2050 - What is inventory of spare parts? Who needs inventory?

NASA Looks to 3D Printing for Spare Space-Station Parts

Jeremy Hsu, InnovationNewsDaily Senior Writer
Date: 07 December 2011 Time: 05:45 PM ET

In Cooperation With: INNOVATION NEWSDAILY

The International Space Station is featured in this image photographed by an STS-133 crew member on space shuttle Discovery after the station and shuttle began their post-undocking relative separation on March 7, 2011.
CREDIT: NASA
View full size image

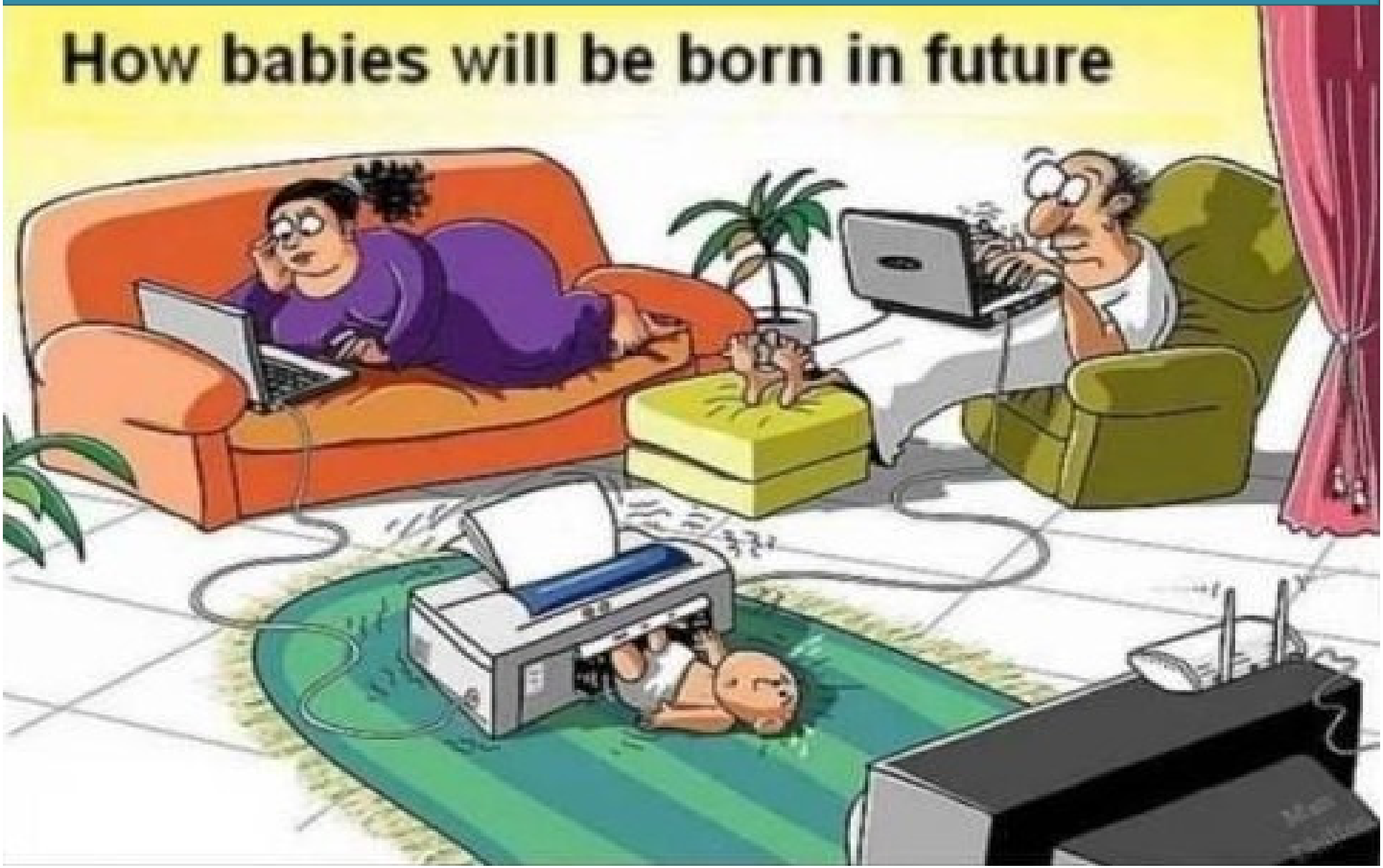
Launch $1-billion-worth of spare parts to the International Space Station, and you can keep Earth's orbital outpost going for another decade. Send up some 3D-printing devices, and you invest in the ability to build everything on demand in space: space-station parts, astronaut tools, satellites, even spacecraft.

A first step toward space factories may come from NASA's recent selection of a U.S. startup's proposal to build a 3D printer for the space station. Such printing technology could build any number of objects, layer by layer, based on designs uploaded from mission control. Astronauts would only need "feedstock" material, such as plastic or metal, to make new tools or spare parts on the fly.

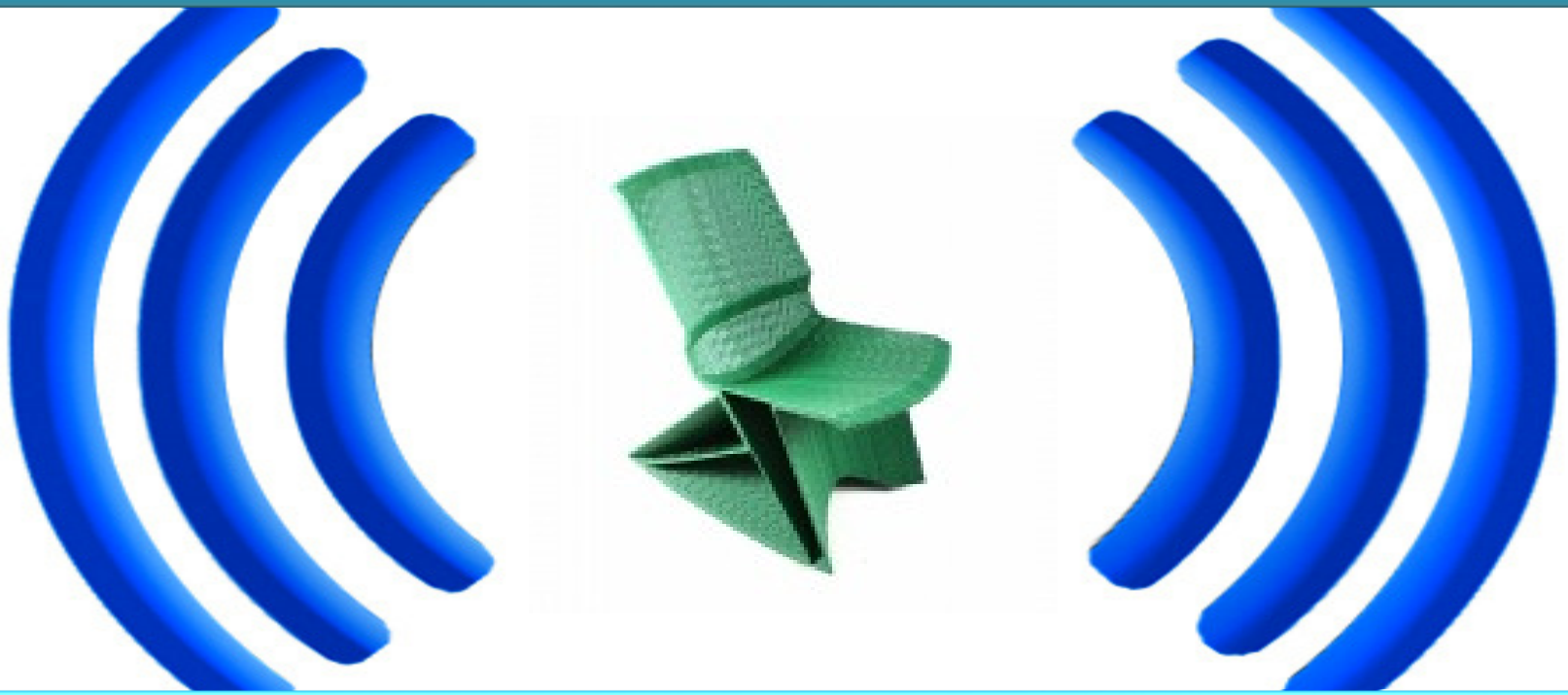
PRINTERS IN THE FUTURE

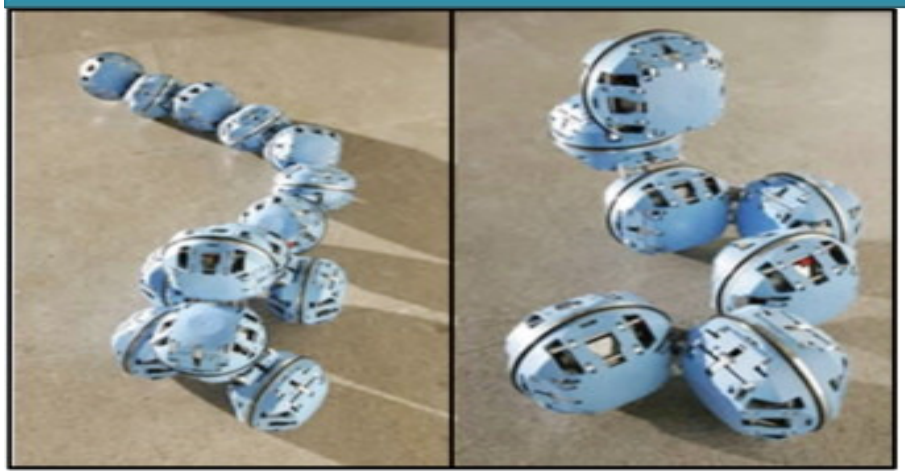
RETAIL STORE OF THE FUTURE

The Future of 3D Printing – The Supply Chain of Babies



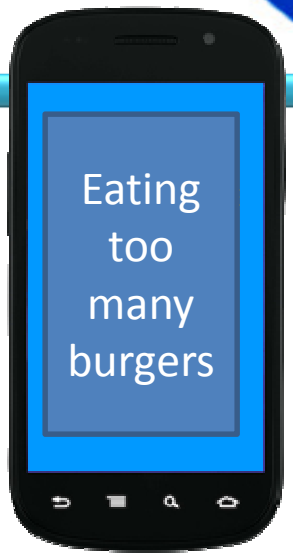
2050 – WiFi controlled reconfigurable micro-robots can change the shape of furniture



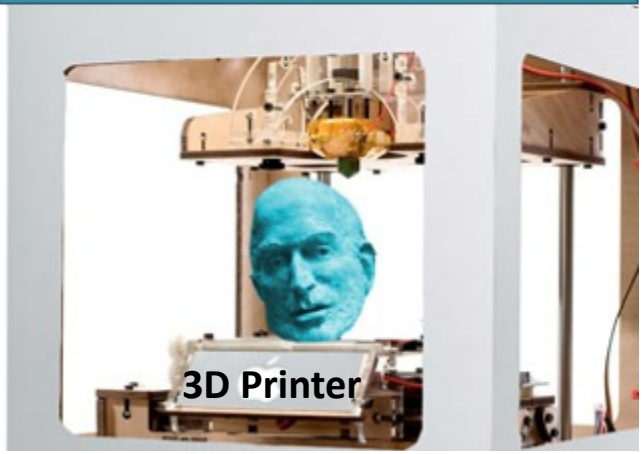


Your spouse can “call” your chair and ask whether you are working on your upright chair or if you have reconfigured it to a recliner and snoozing in your office. Your spouse can also find out if you are snoozing or snogging on the chair with someone!

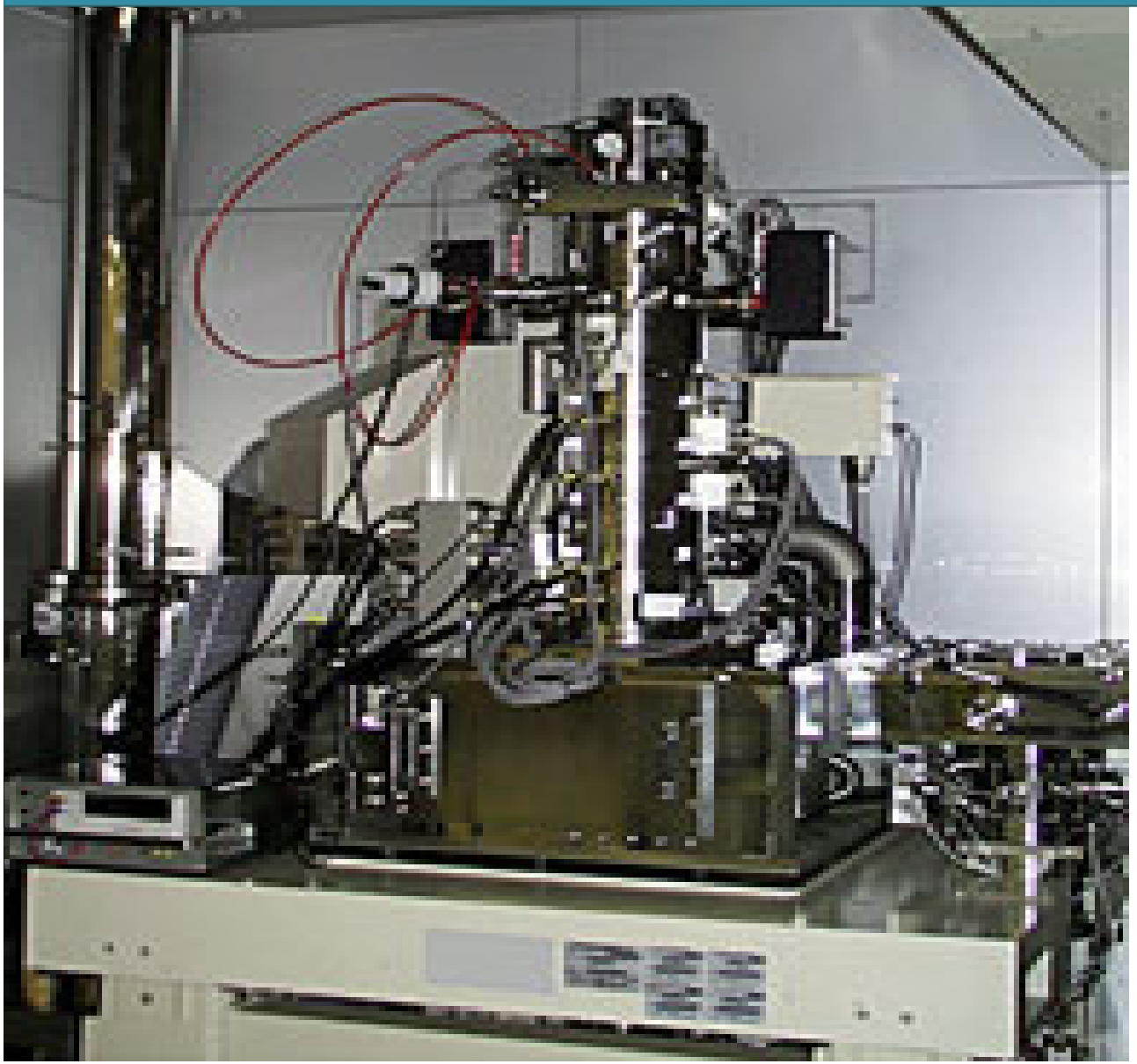
2050 – Printed hamburger wrapped in touch-code paper which can talk to your iPhone



Your burger calls your doctor to report that you are eating too many burgers.



Kitchen of the Future – i Print on Demand – iPod my food



WYSIWYG

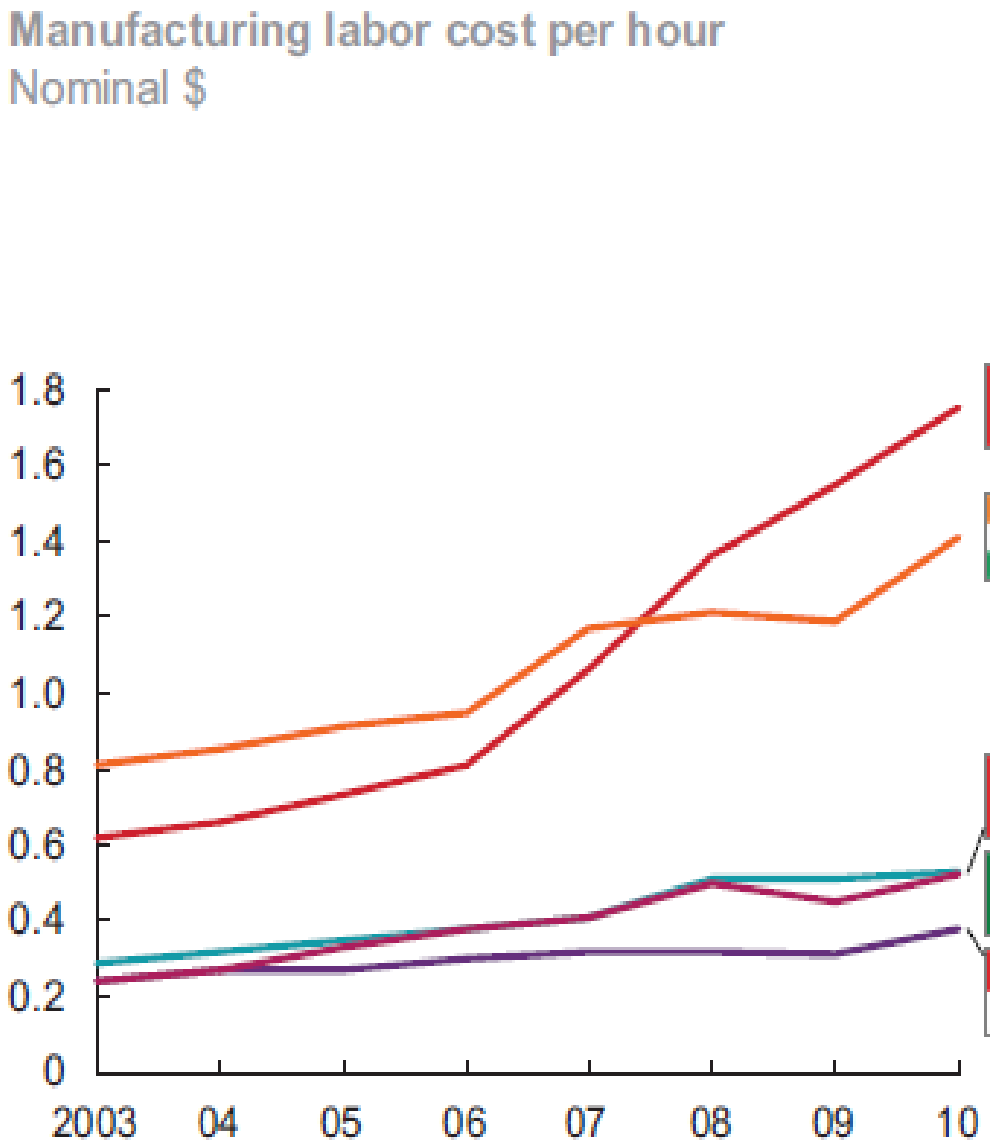
What You See Is What You Get

What You Print Is What You Eat

WYPIWYE

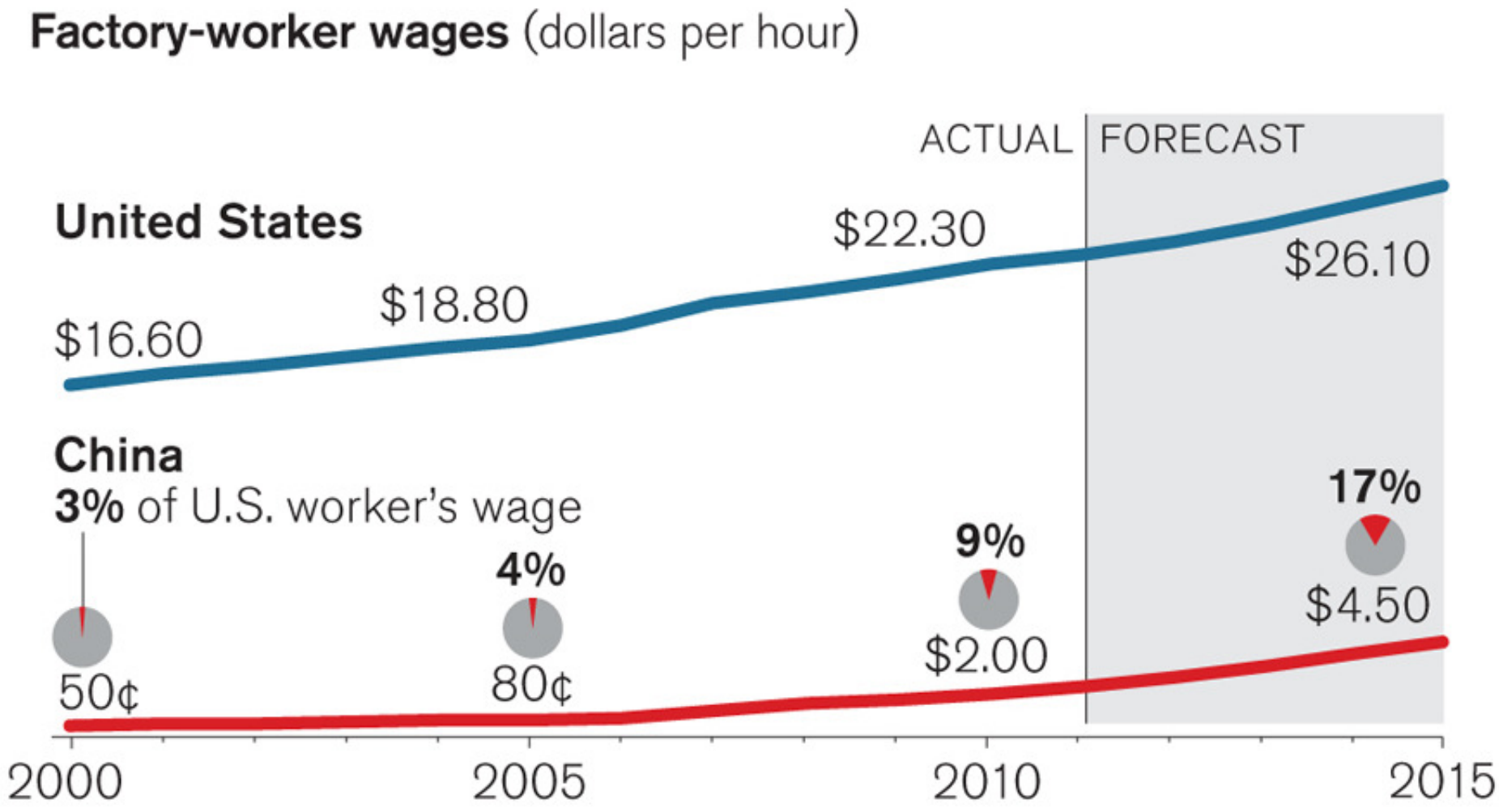
Electron Beam Photo Lithograph from the ancient era modified as a domestic food printer connected to commodity pipelines (flour, milk, cheese)

Nano-Micro Manufacturing - labor cost may not be the key economic driver indicator



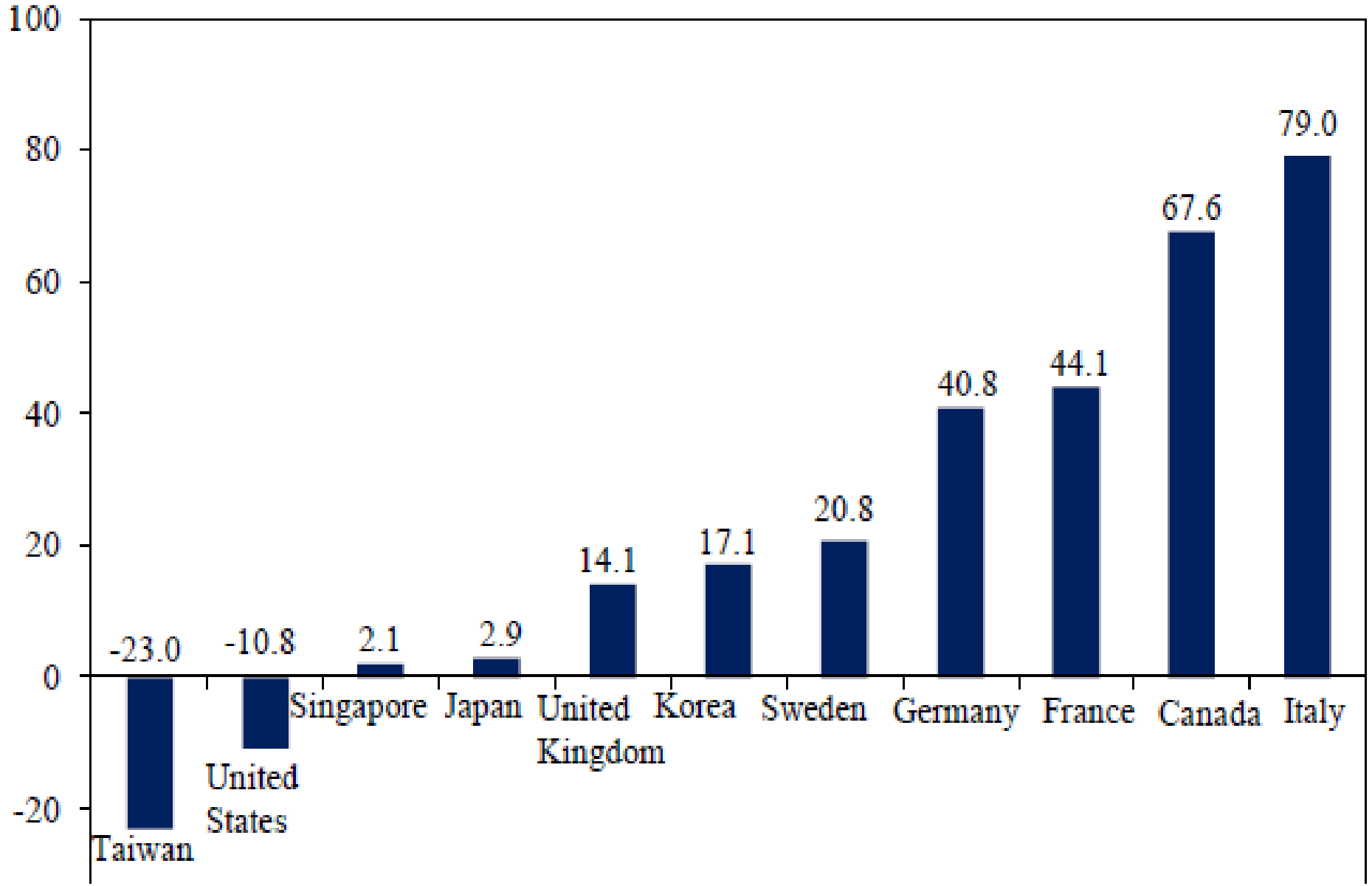
Compound annual growth rate, 2003–10 (%)	Increase in labor cost per hour	Increase in value added per employee
China[1]	16	14
India	8	17
Vietnam[2]	9	9
Nigeria[3]	14	15
Indonesia	7	12

The gulf between labor cost is closing

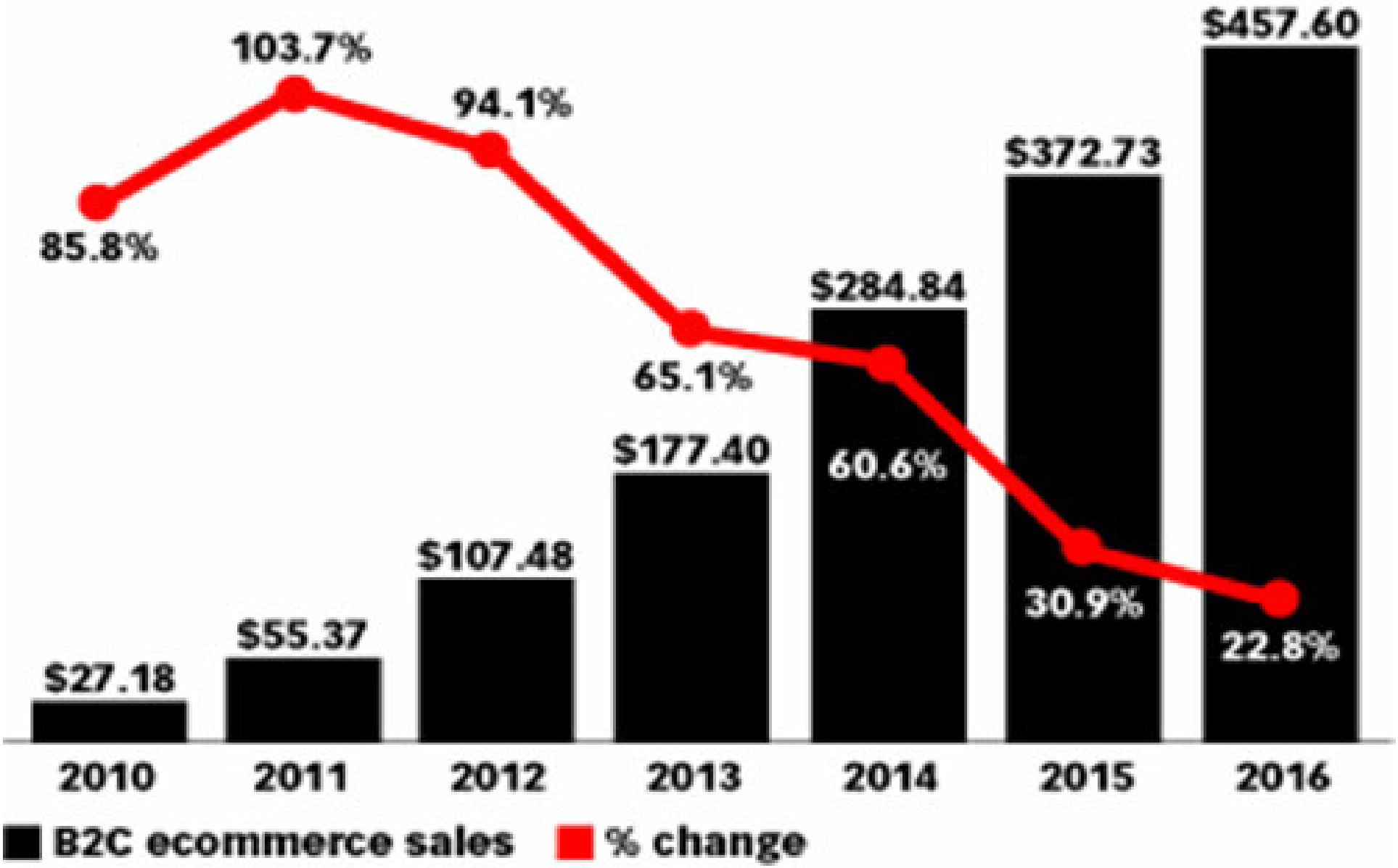


Sources: Economist Intelligence Unit; U.S. Bureau of Labor Statistics; selected company data; BCG analysis

Manufacturing unit labor cost (percentage change) 2002-2010



The growth rates are diminishing – Ecommerce projections for China



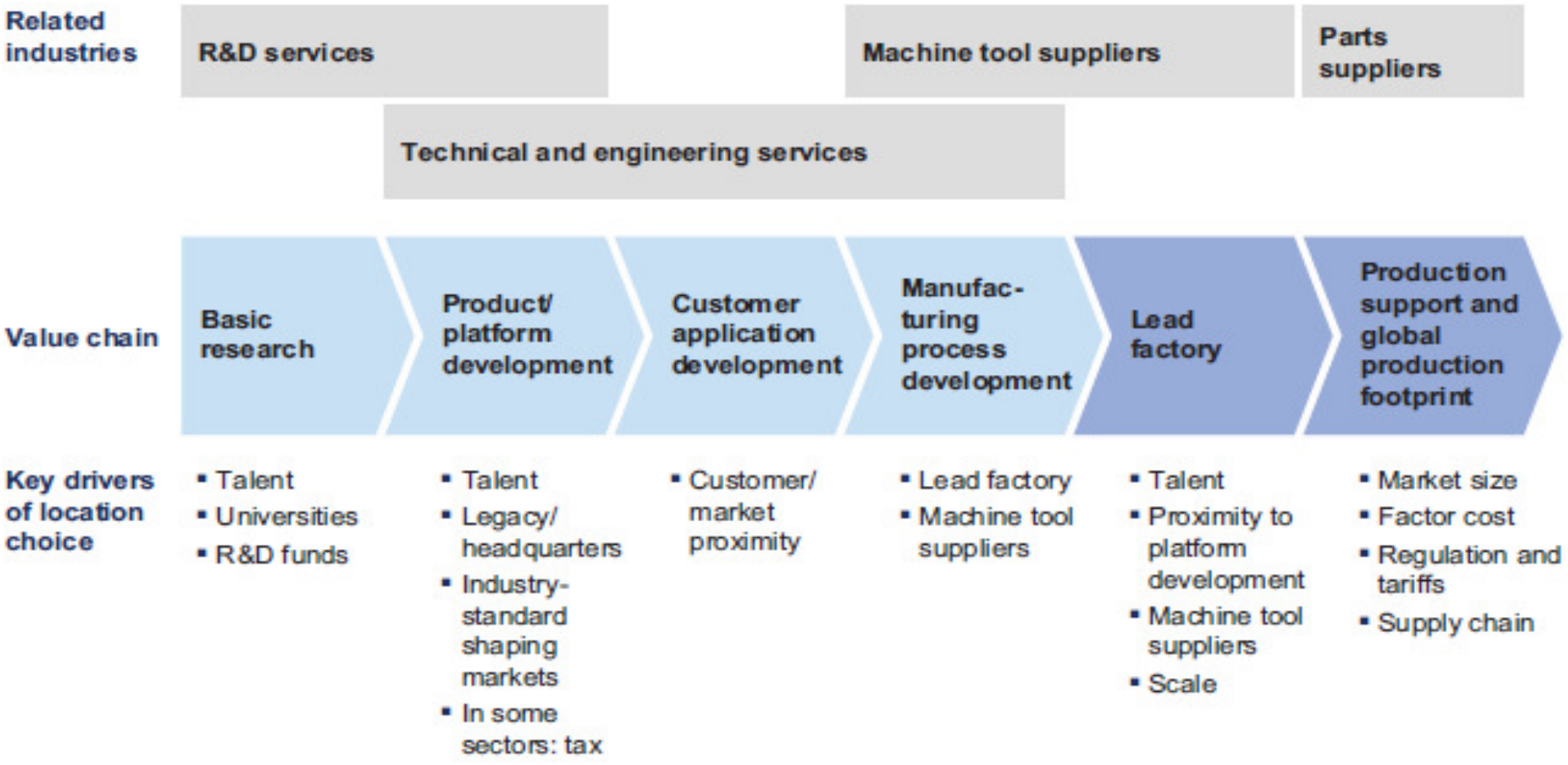
Manufacturing 2050 - education, innovation and R&D resources will evolve as new KPI

Different phases of innovation and production require proximity to different types of R&D resources

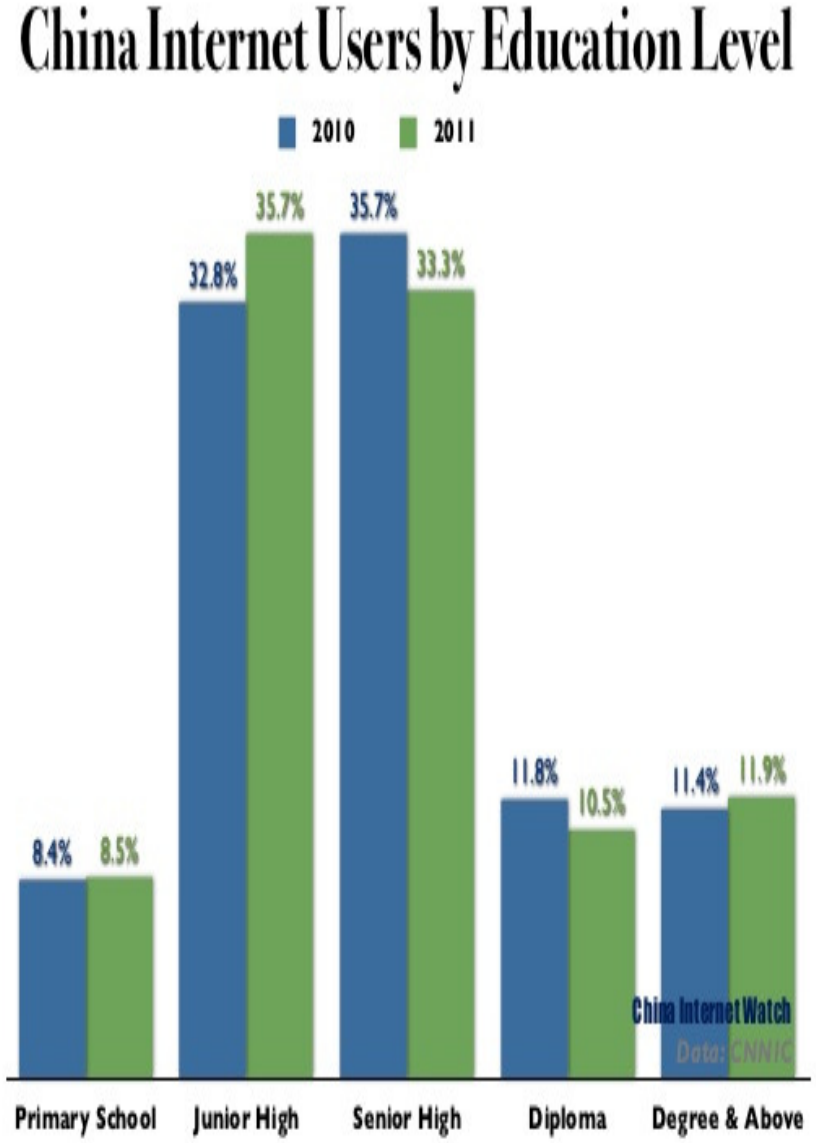
ILLUSTRATIVE

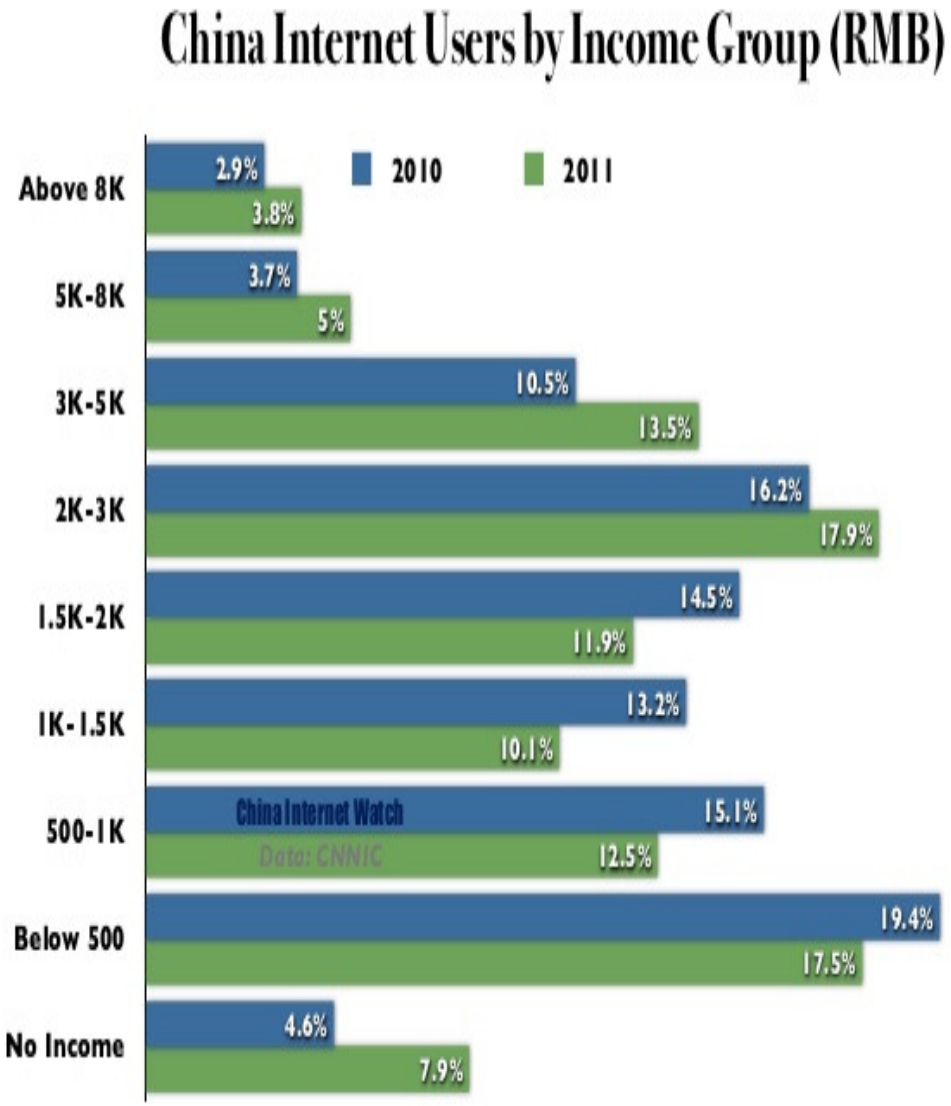
Innovation

Production

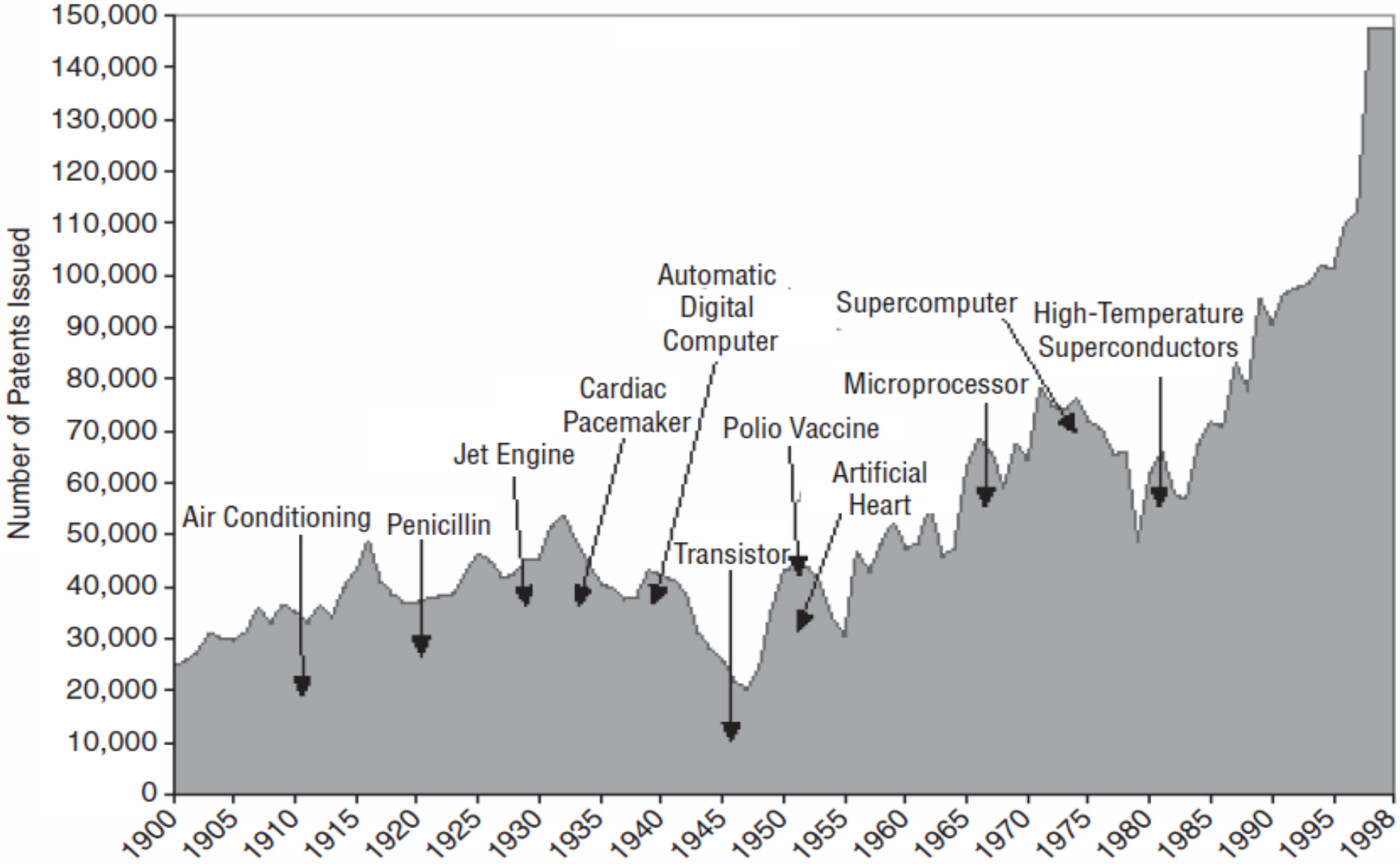


Consumption 2050 - market segmentations

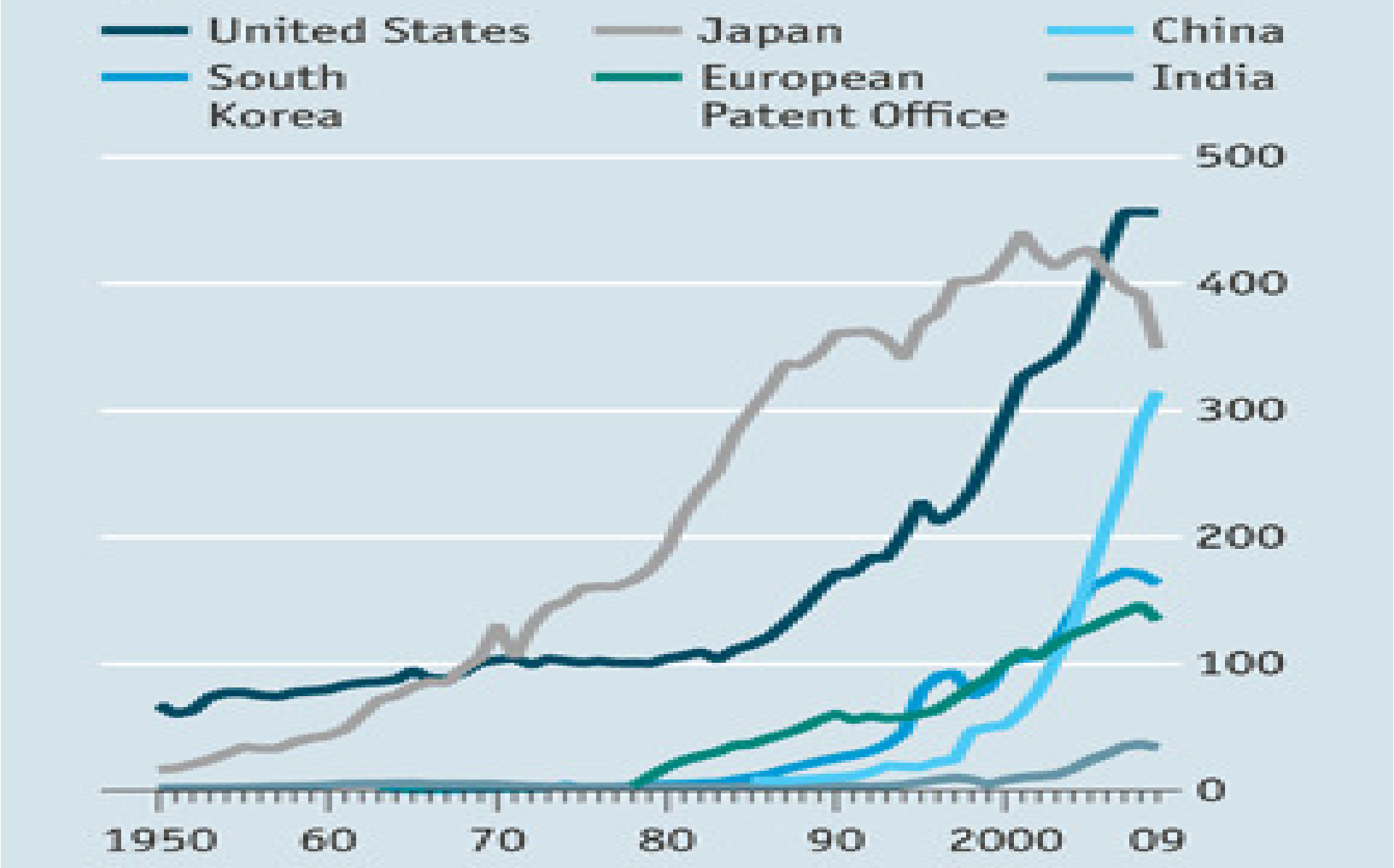




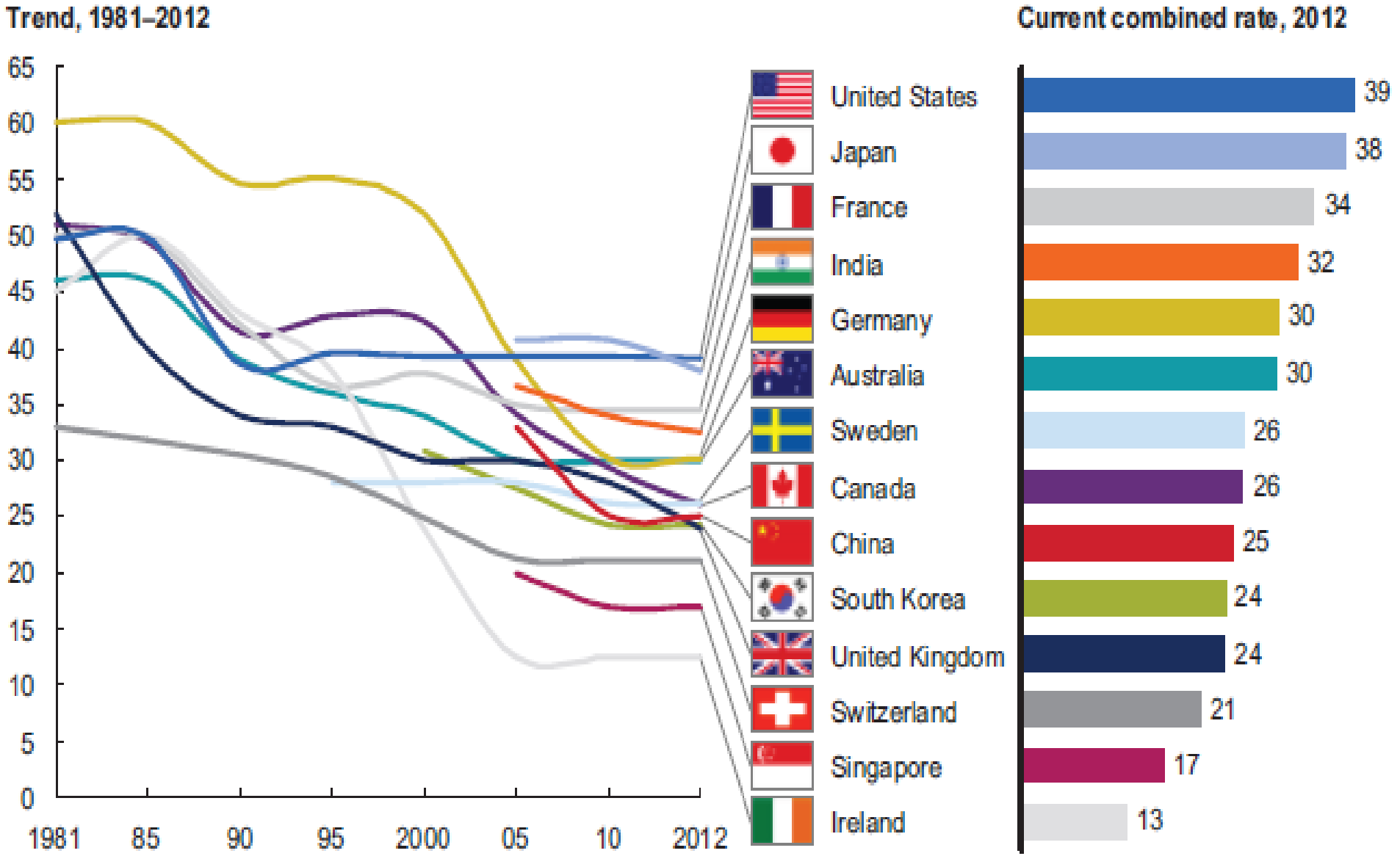
Manufacturing 2050 - will it be influenced by the 20th century success of US patents ?



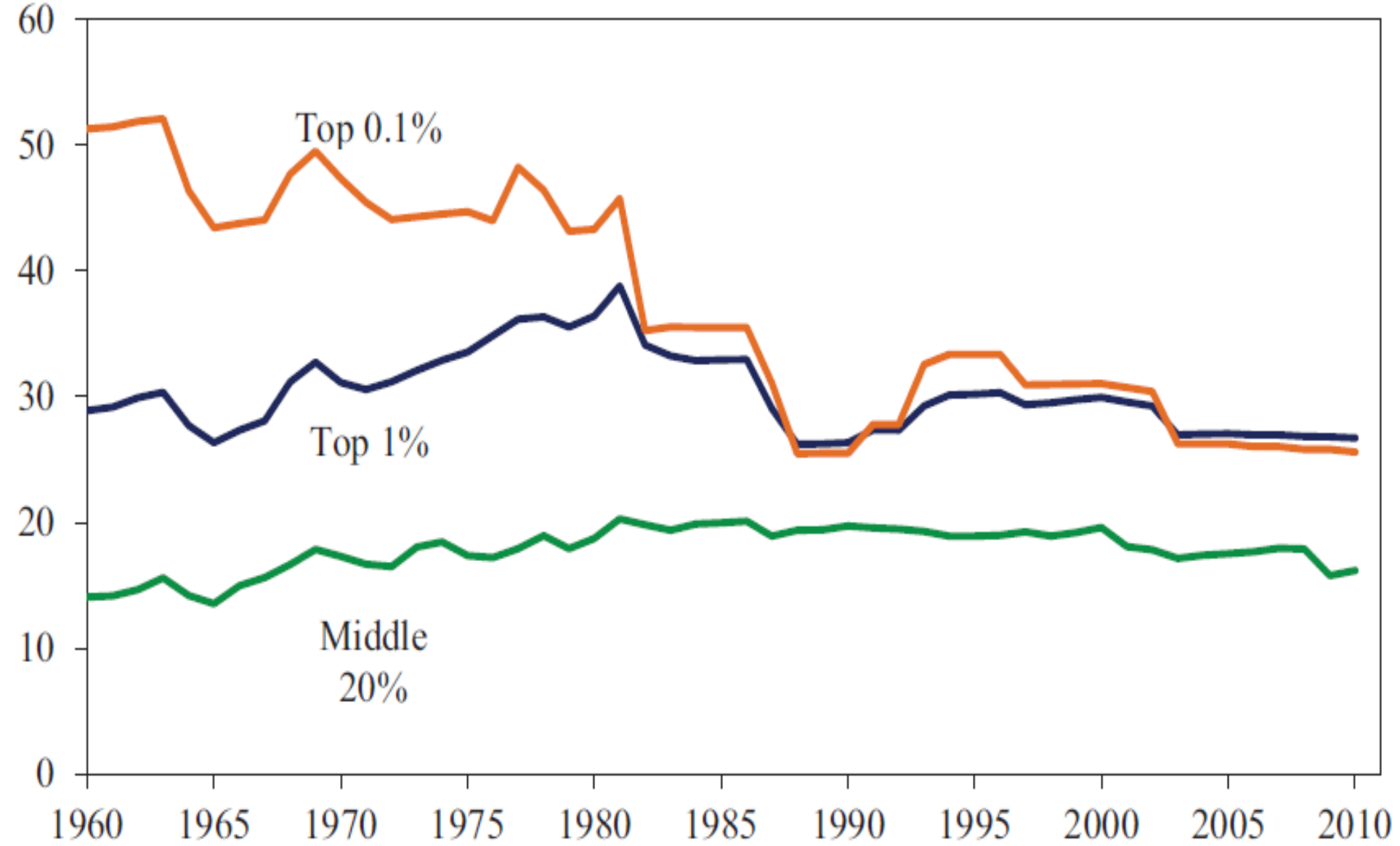
Surging Patent Applications (‘000) - not necessarily an index of disruptive innovation



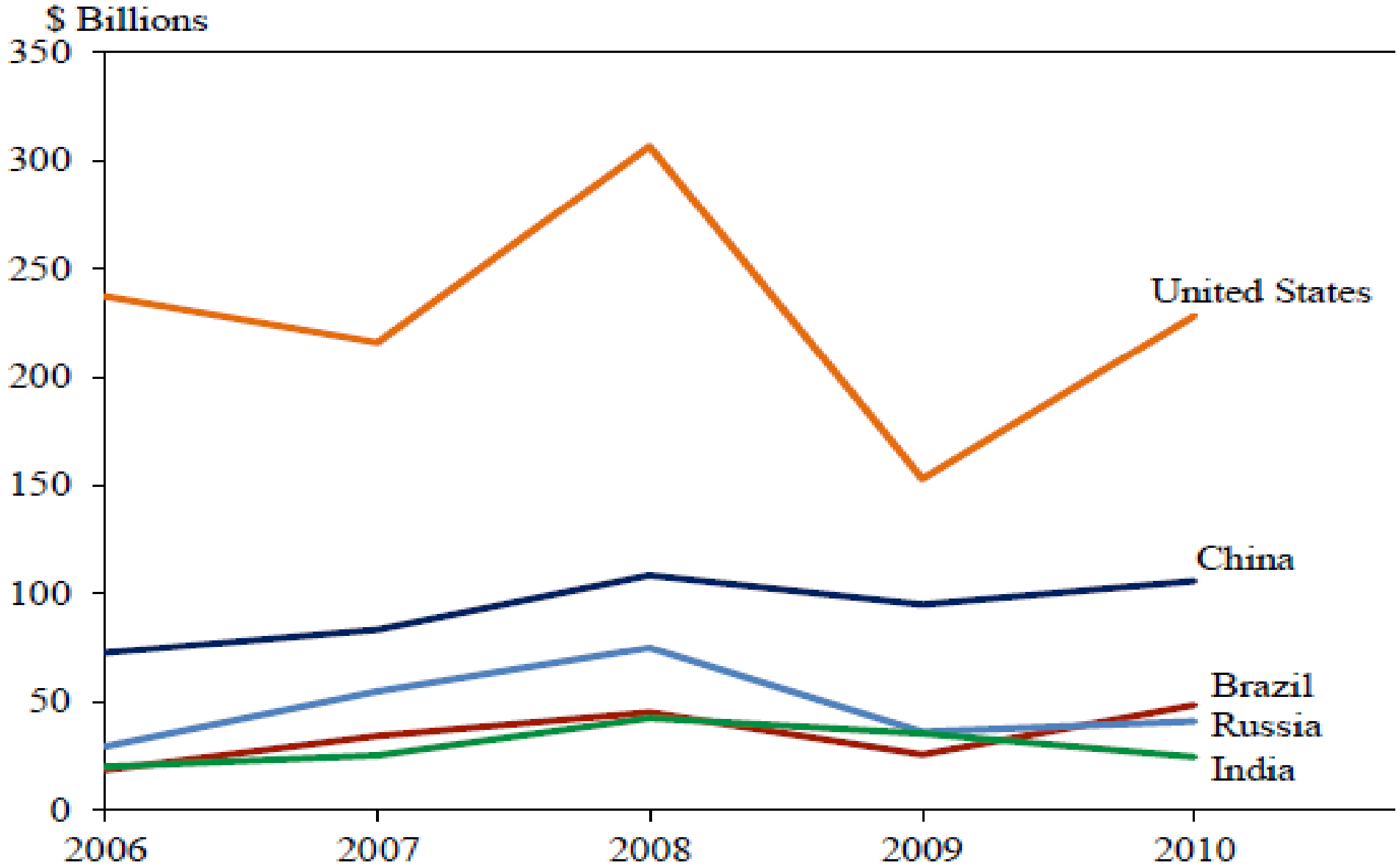
Manufacturing 2050 - corporate tax rates may still influence assembly and distribution



US Average Federal Tax Rates (select income groups)



Annual FDI Inflow



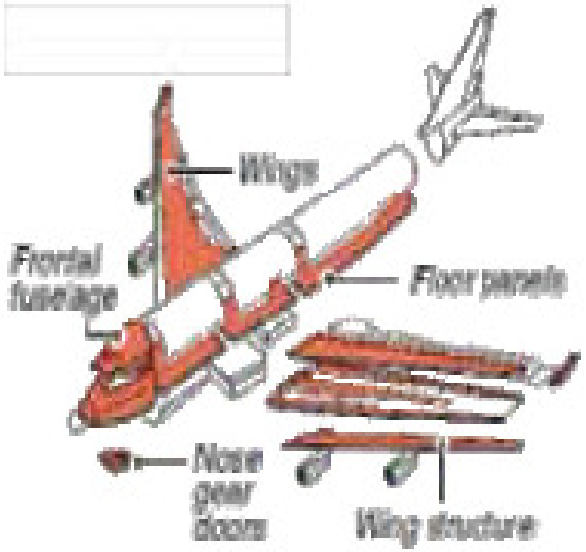
Manufacturing 2050 - traditional manufacturing leaders will be product integrators

737 Classic at start of production

10% outsourced

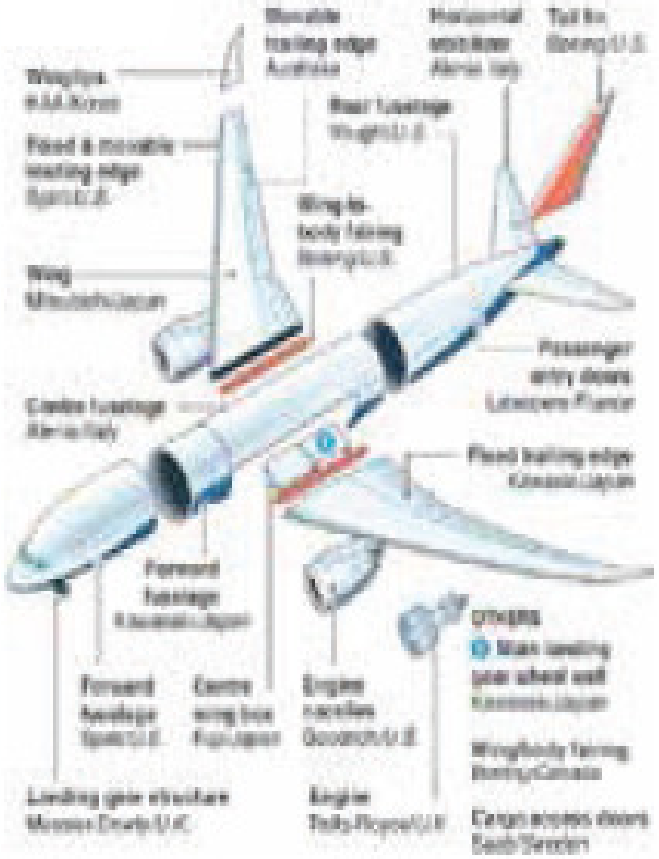
747 series at start of production

20% outsourced[1]

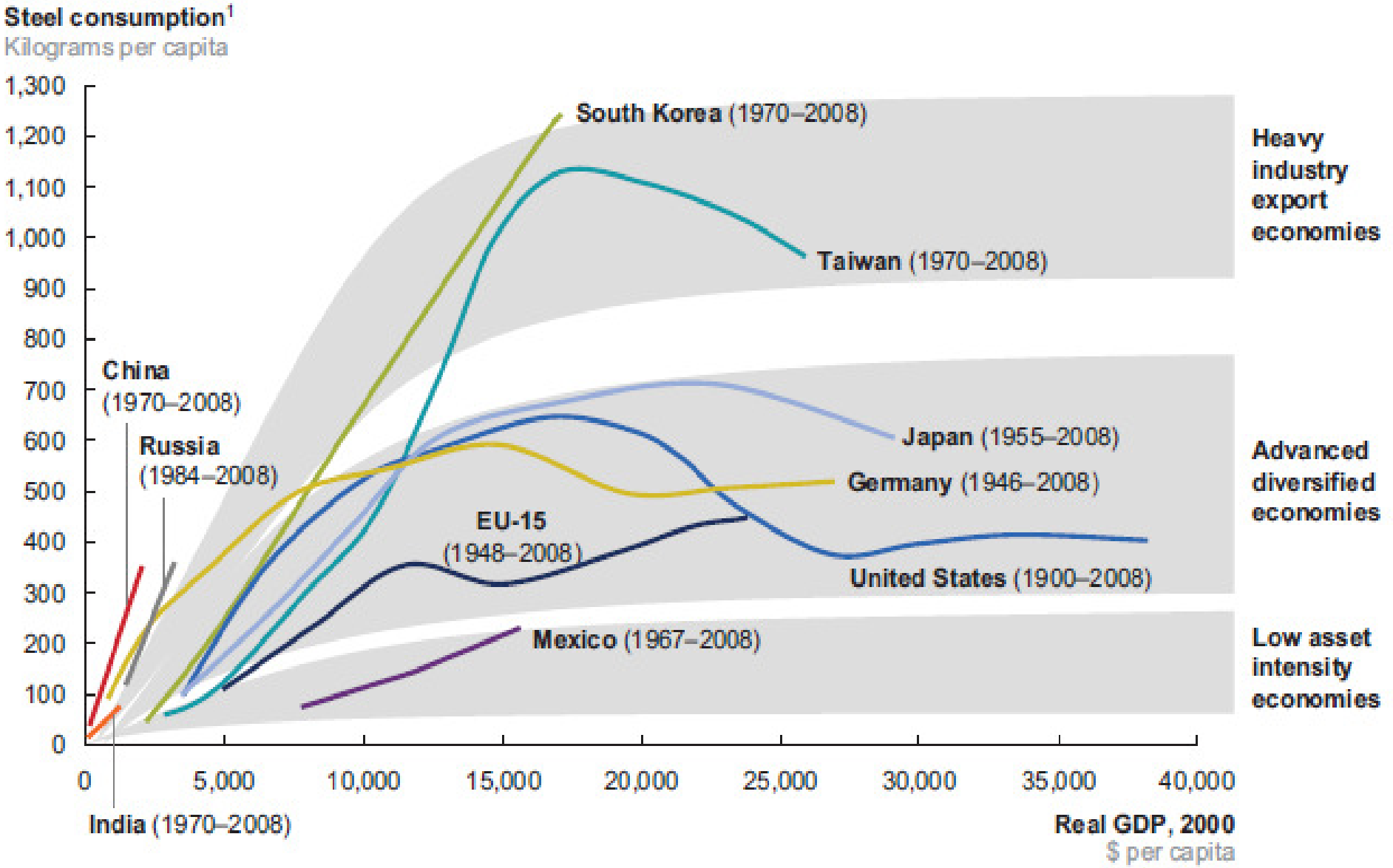


787 Dreamliner at start of production

80% outsourced[2]



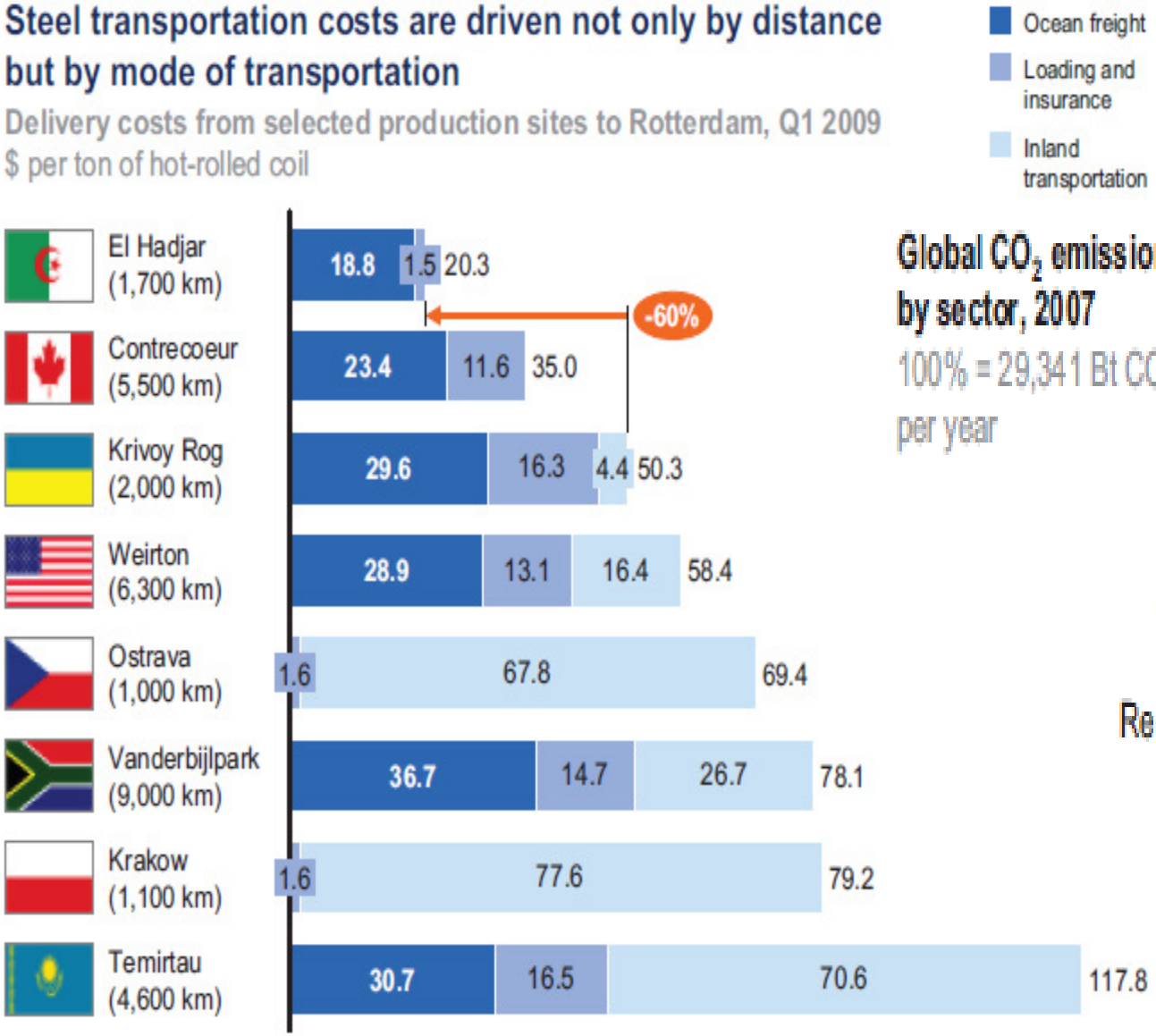
Predicting consumer havens for 2050 using global steel consumption as a reference



Sustainability 2050 may drive closer alignment of production and consumption sites

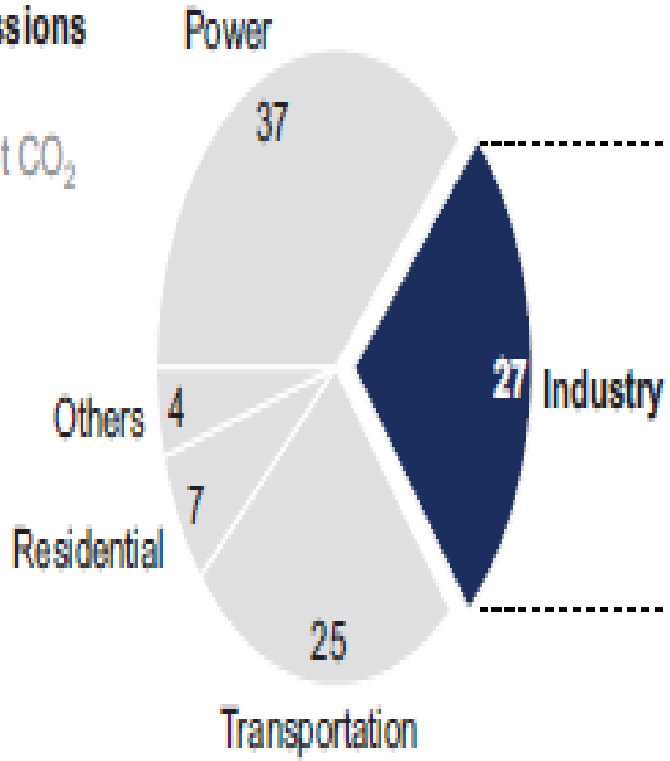
Steel transportation costs are driven not only by distance but by mode of transportation

Delivery costs from selected production sites to Rotterdam, Q1 2009
$ per ton of hot-rolled coil



Global CO_2 emissions by sector, 2007

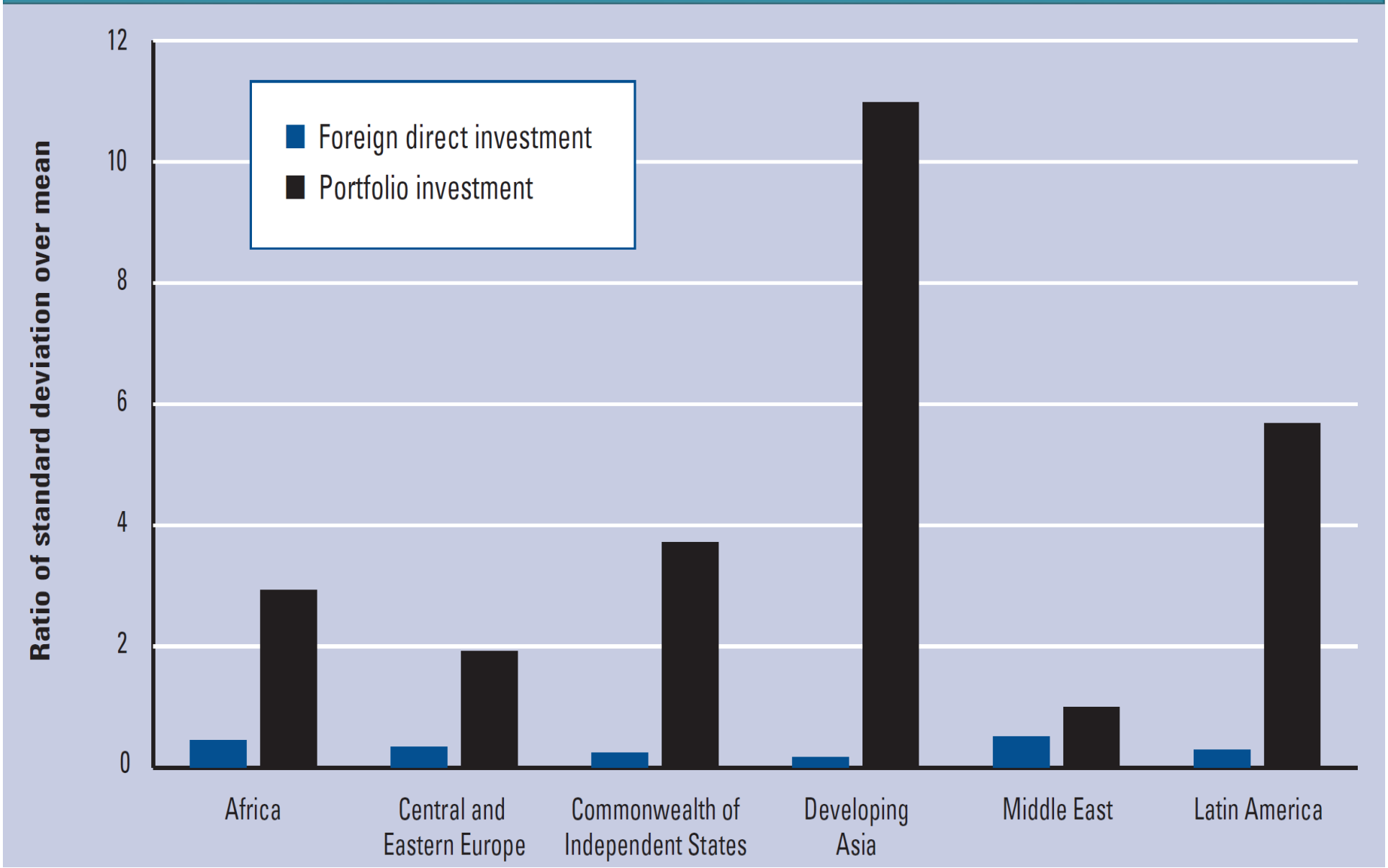
100% = 29,341 Bt CO_2 per year



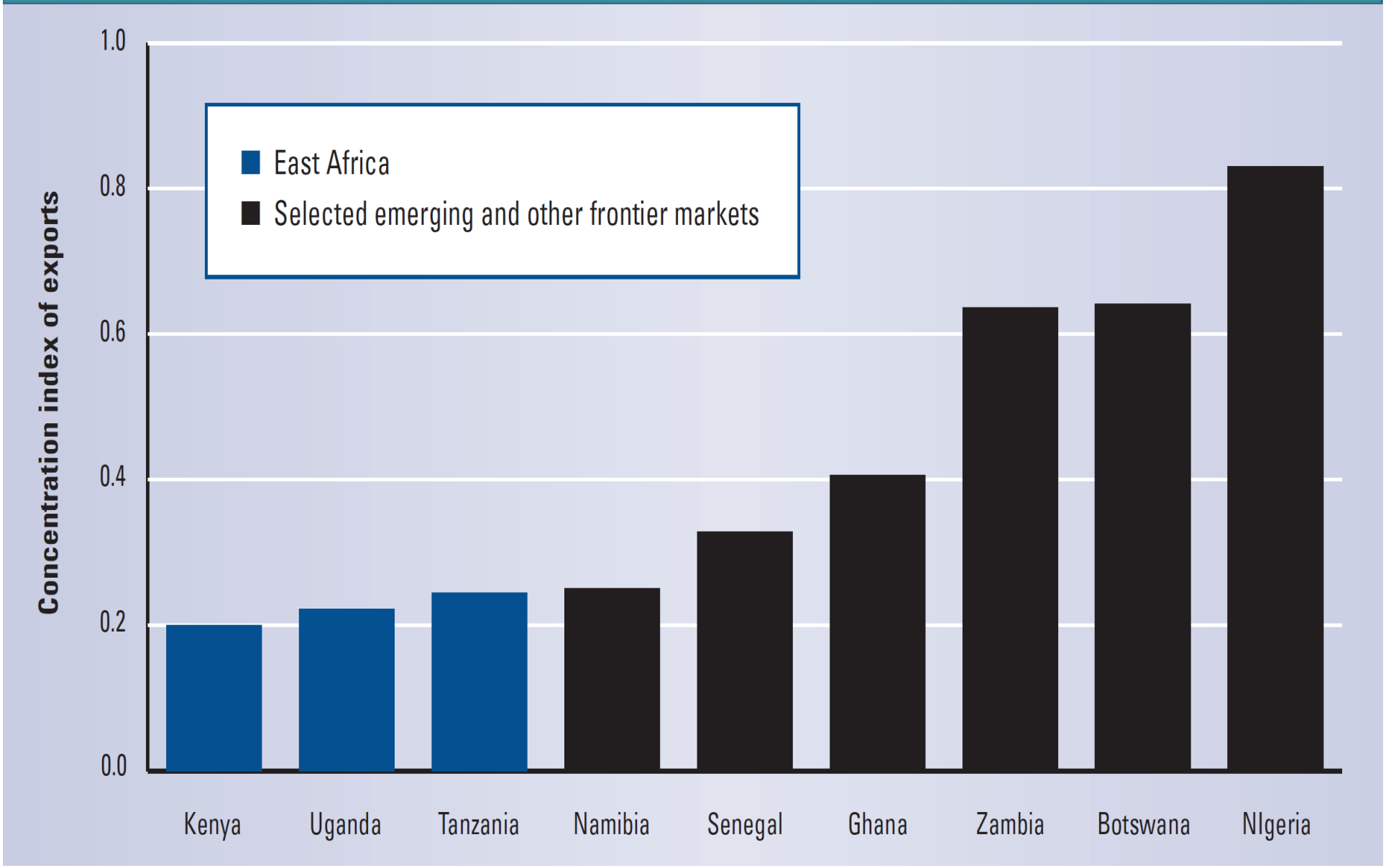
Sustainability may re-design TSR logistics – Connect Shanghai to Cape Town by Railroad

13 km can change geo-politics

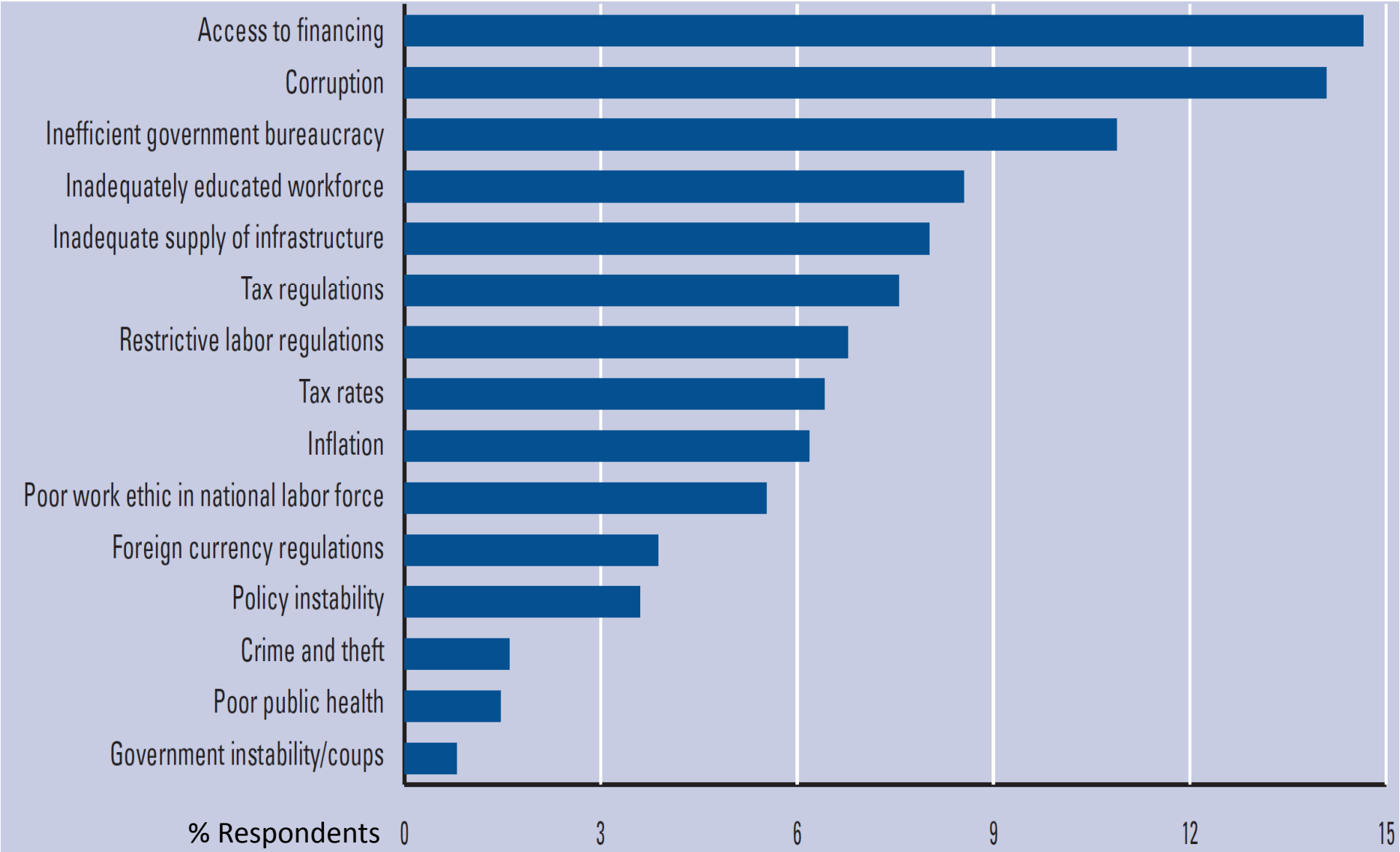
The future production and consumption zones are evolving



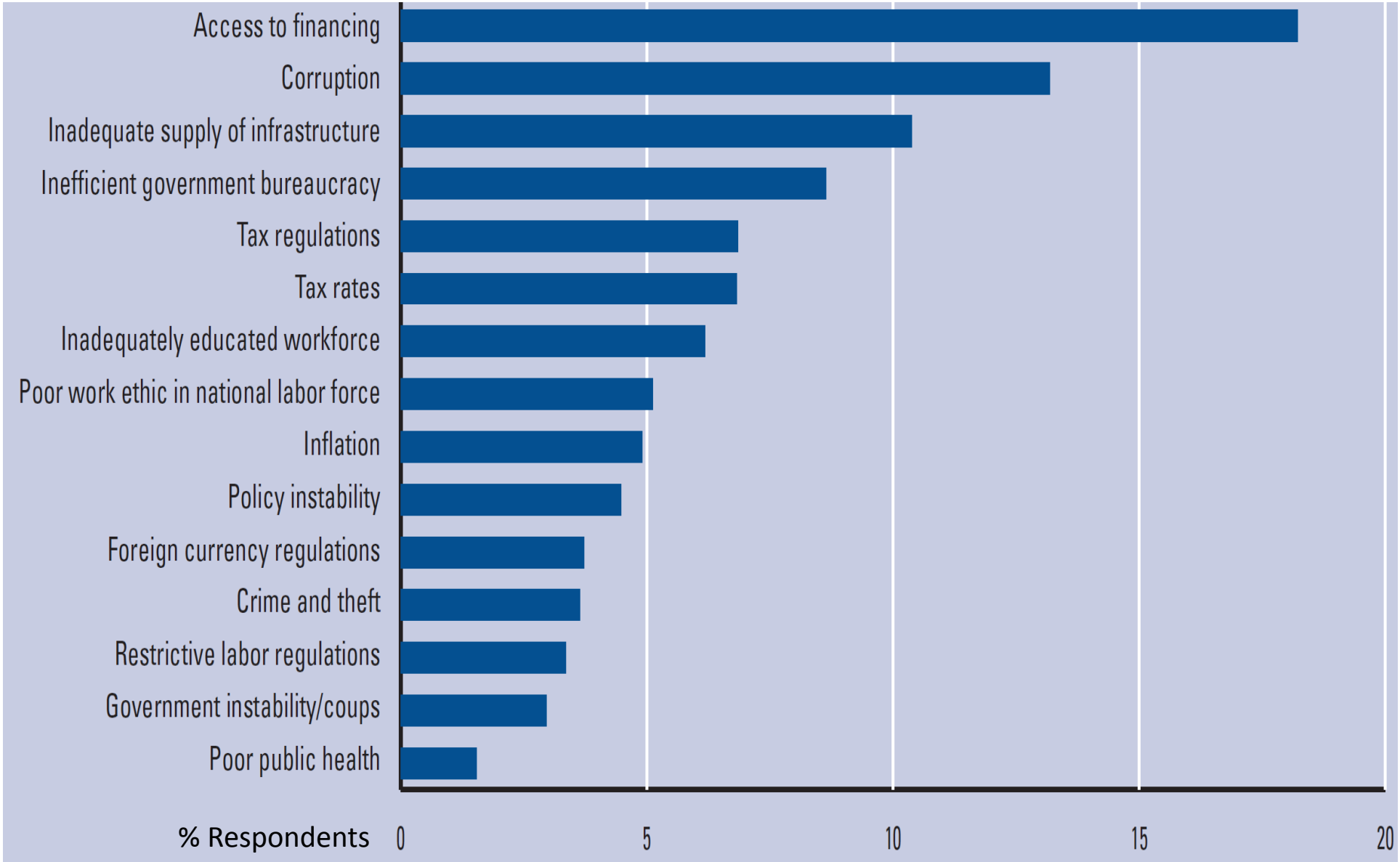
Emerging Frontier Markets



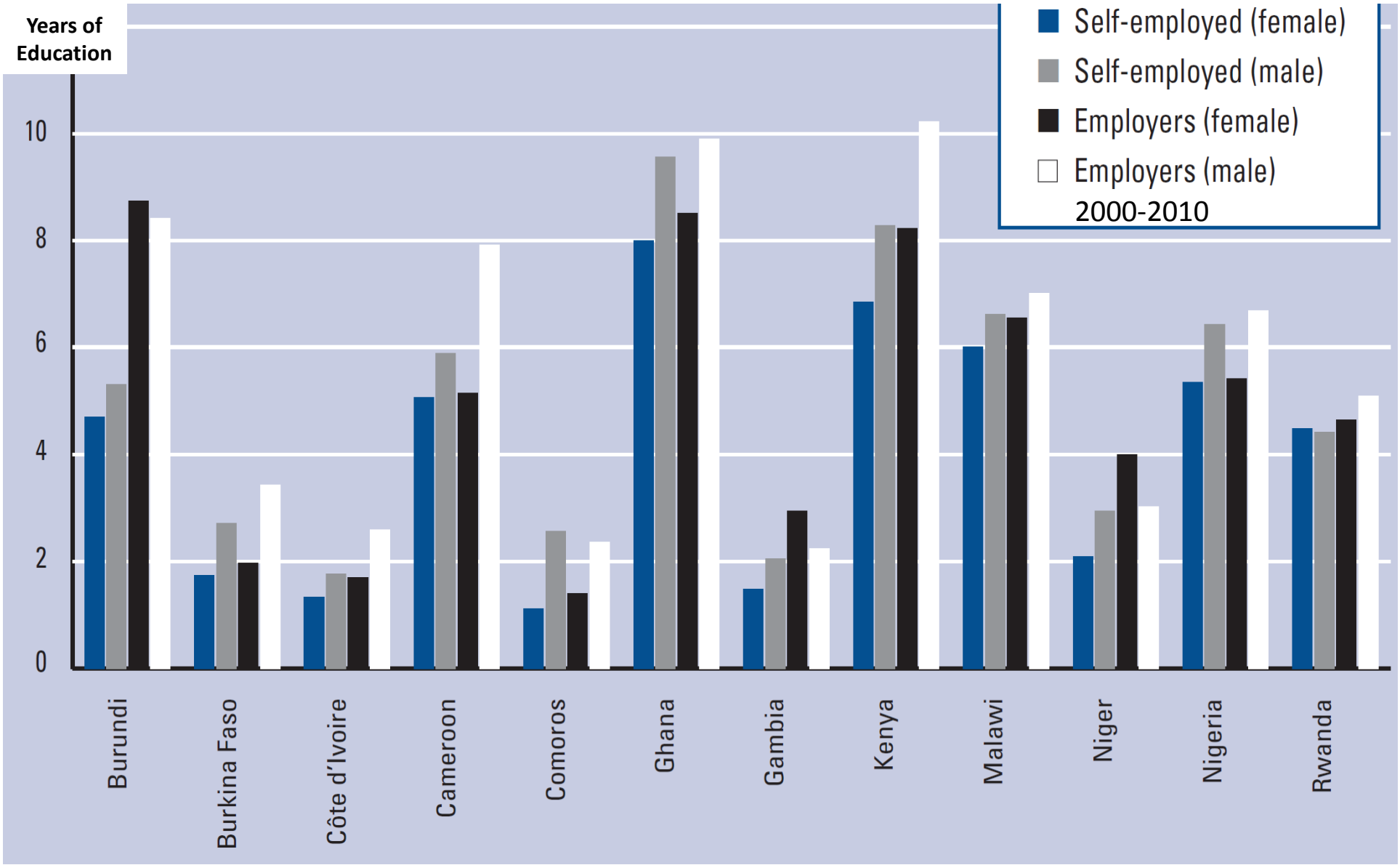
Emerging Frontier Markets – Factors Inhibiting Commerce in North Africa



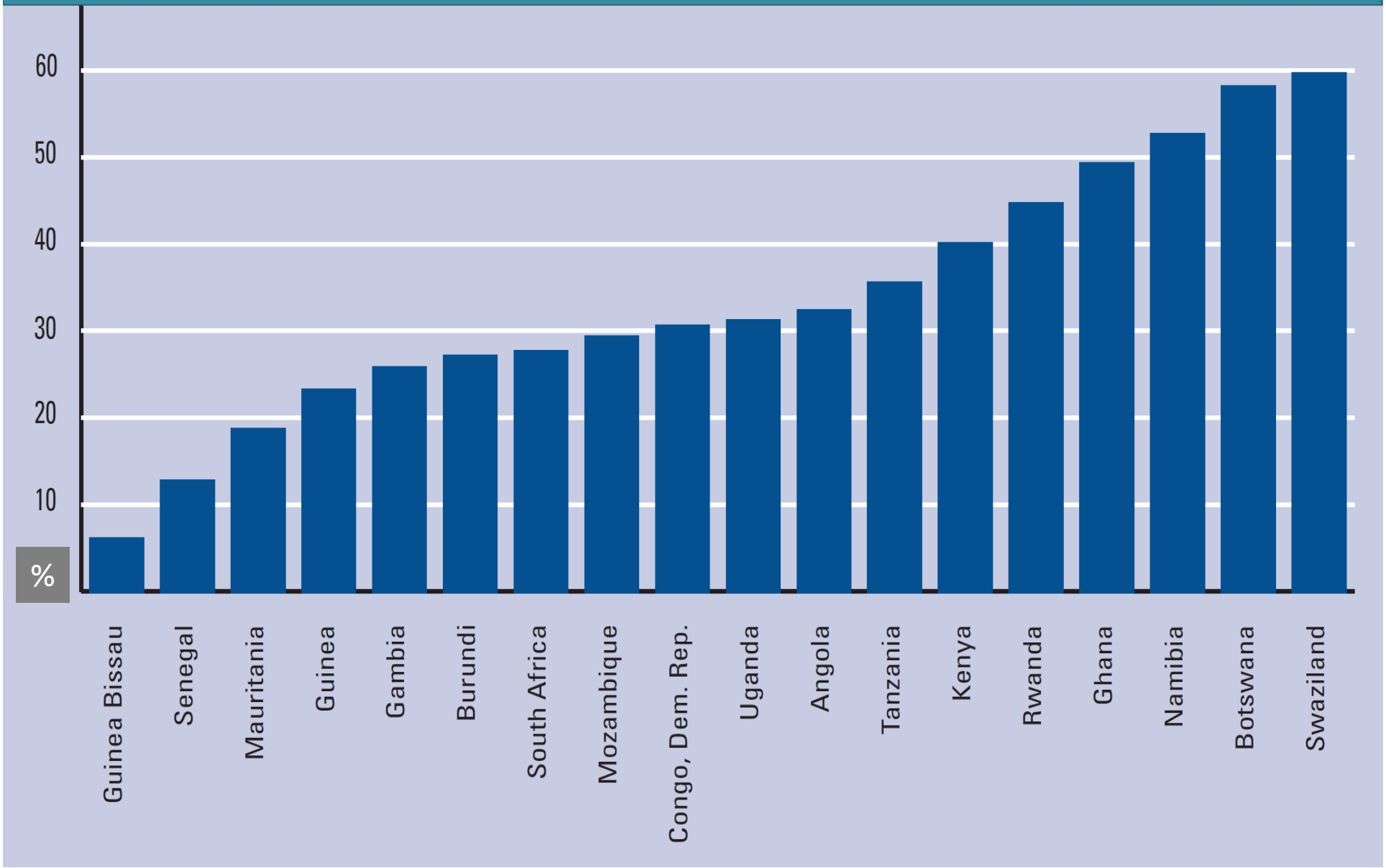
Emerging Frontier Markets – Factors Inhibiting Commerce in Sub-Saharan Africa



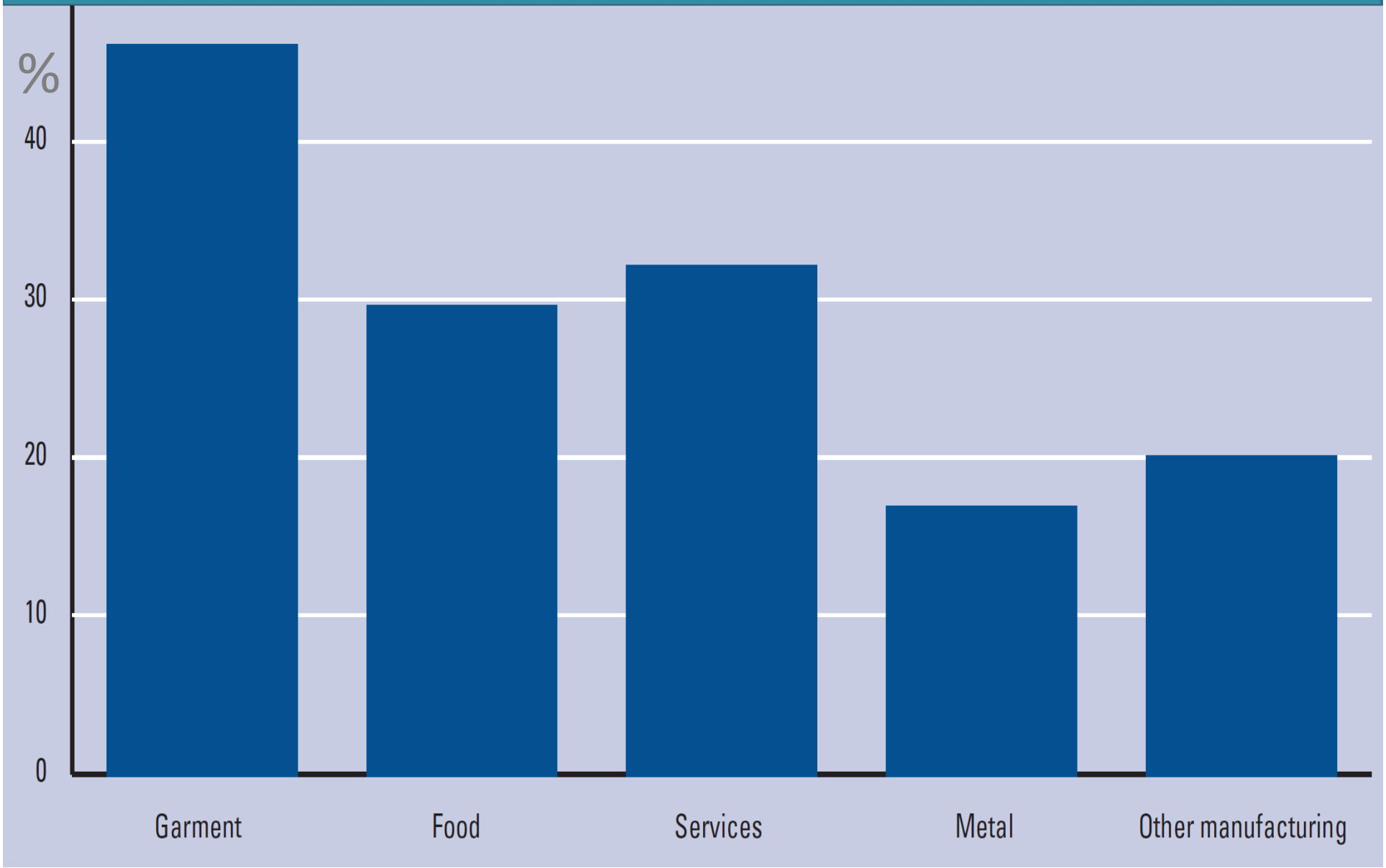
Emerging Frontier Markets – Education of Women and Accelerated Economic Growth



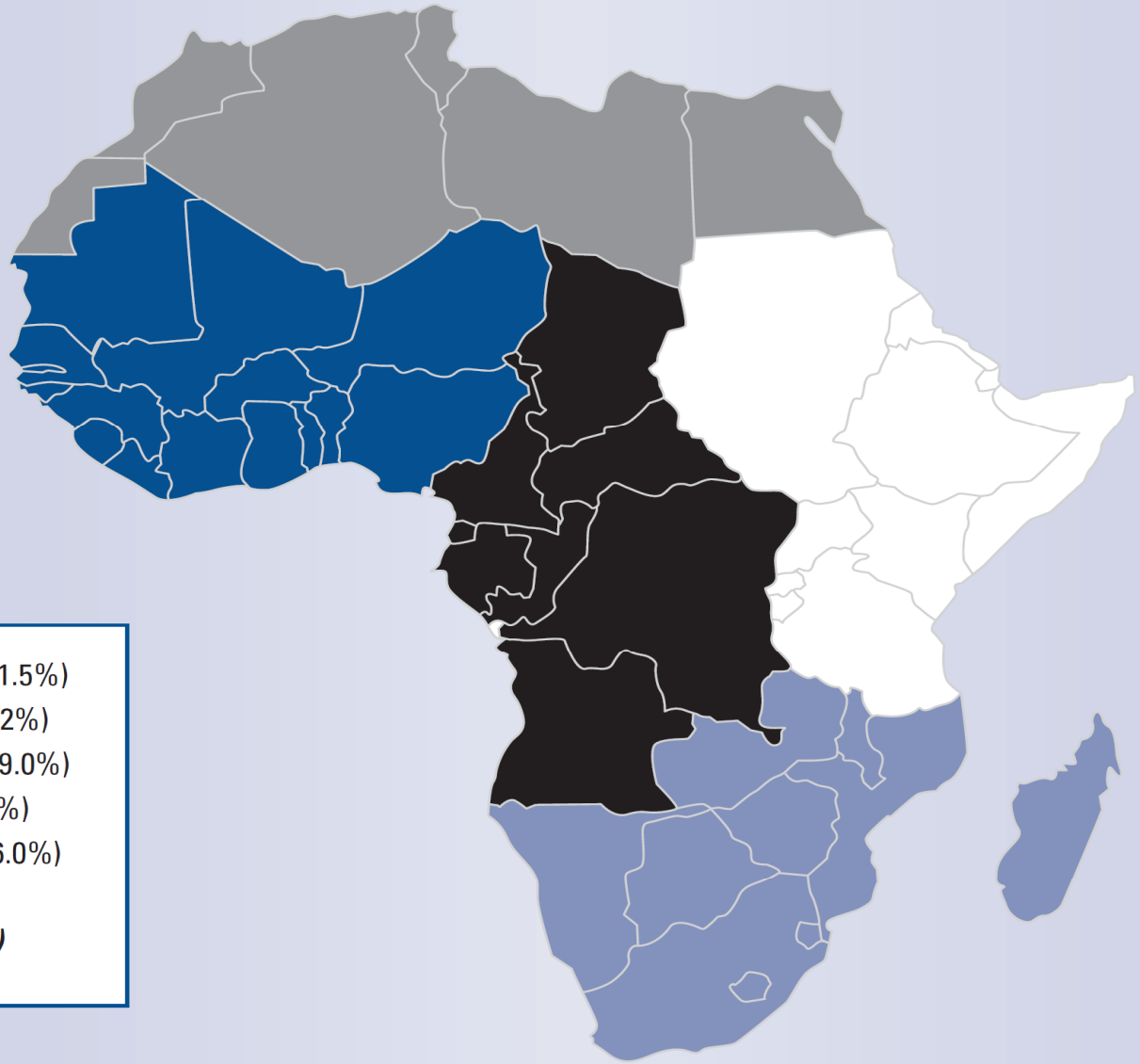
Emerging Frontier Markets – Women Ownership of Informal Enterprises



Emerging Frontier Markets – Women Ownership by Industry in Africa



Emerging Frontier Markets – Non-Stop Daily Seats on scheduled air transport in Africa



- Northern Africa (21.5%)
- Eastern Africa (14.2%)
- Southern Africa (29.0%)
- Central Africa (5.1%)
- Western Africa (16.0%)

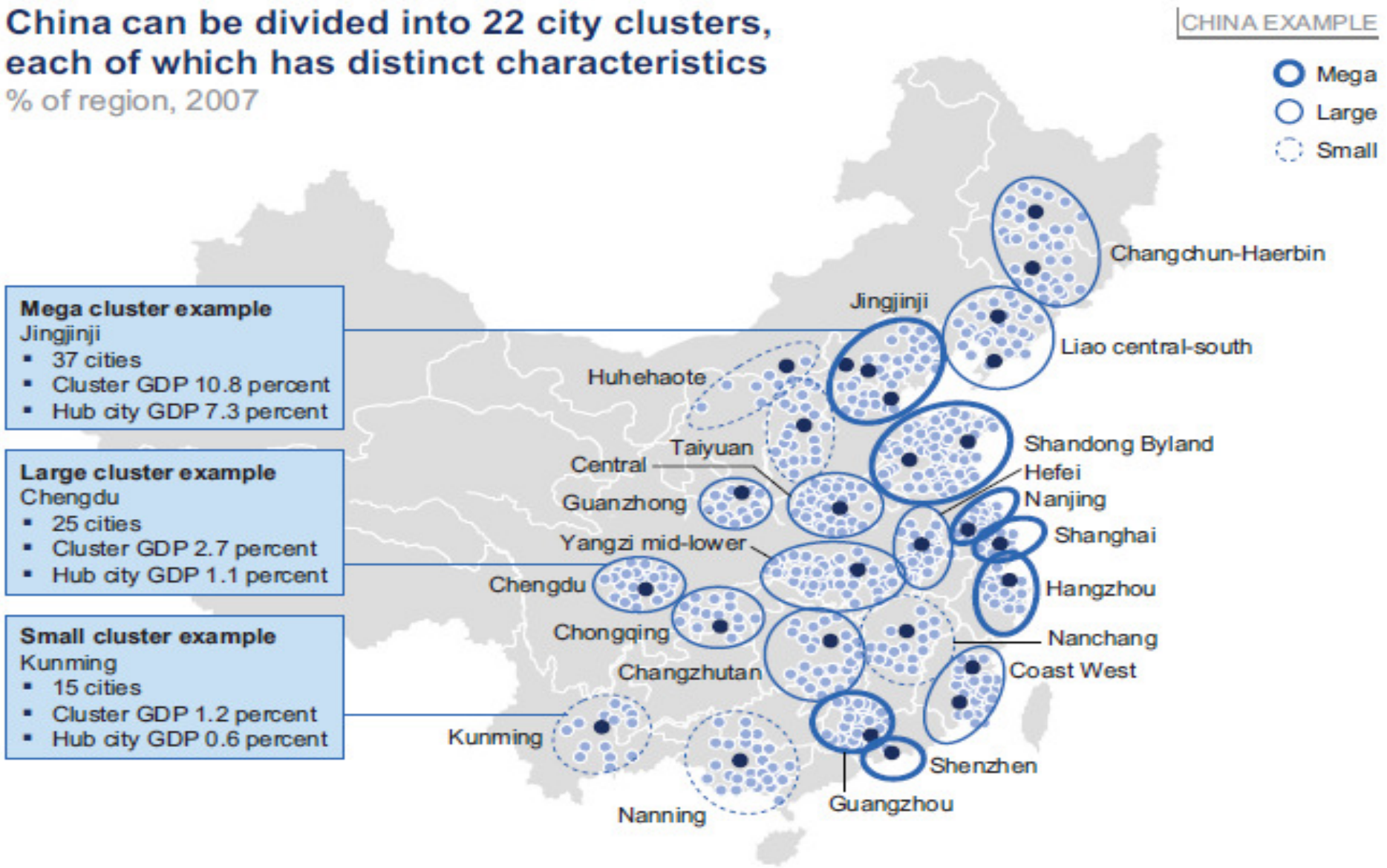
Inter-regional (14.2%)

August 2010

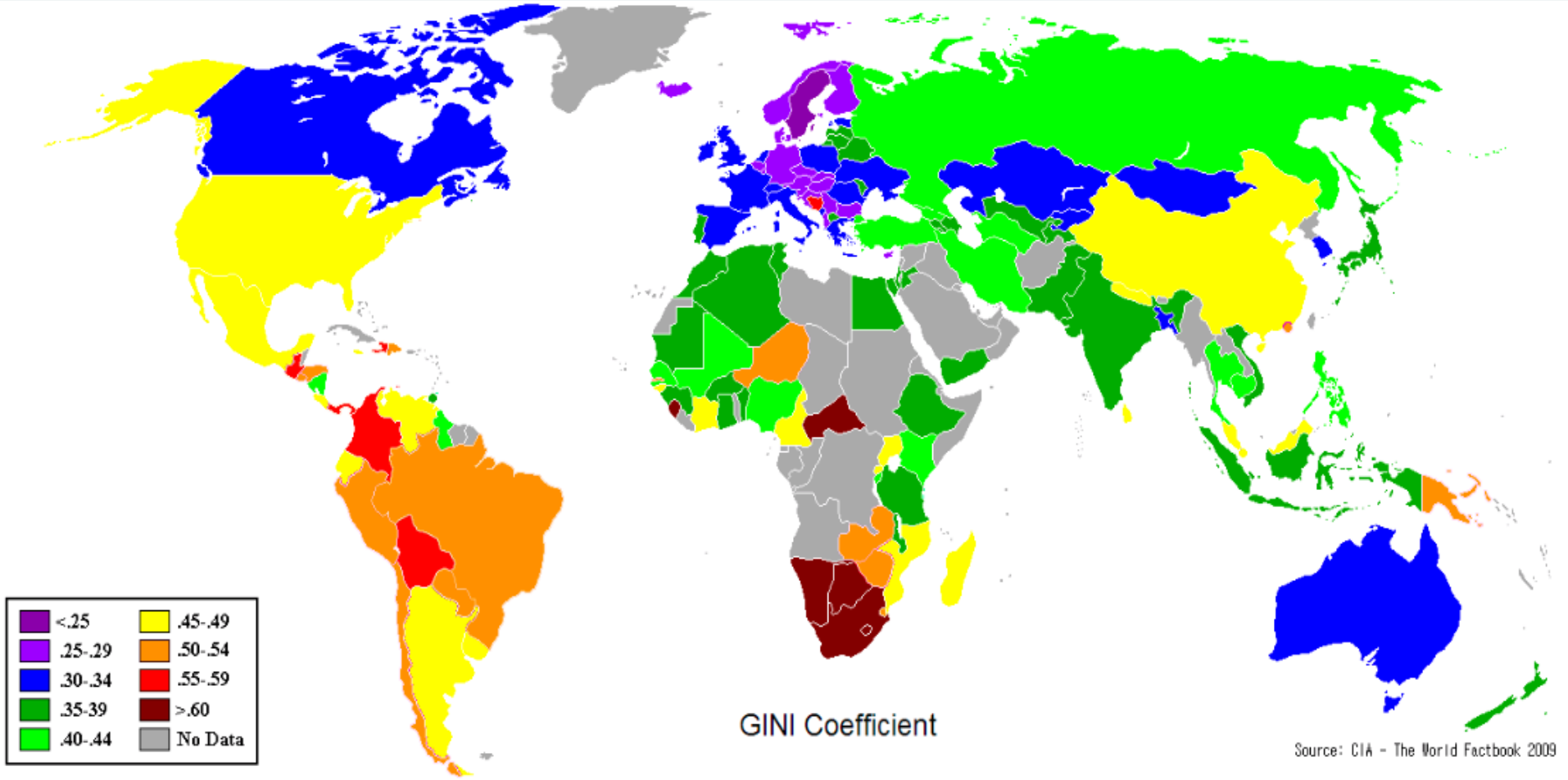
Life style technologies and services will drive intra-national market differentiation

China can be divided into 22 city clusters, each of which has distinct characteristics

% of region, 2007

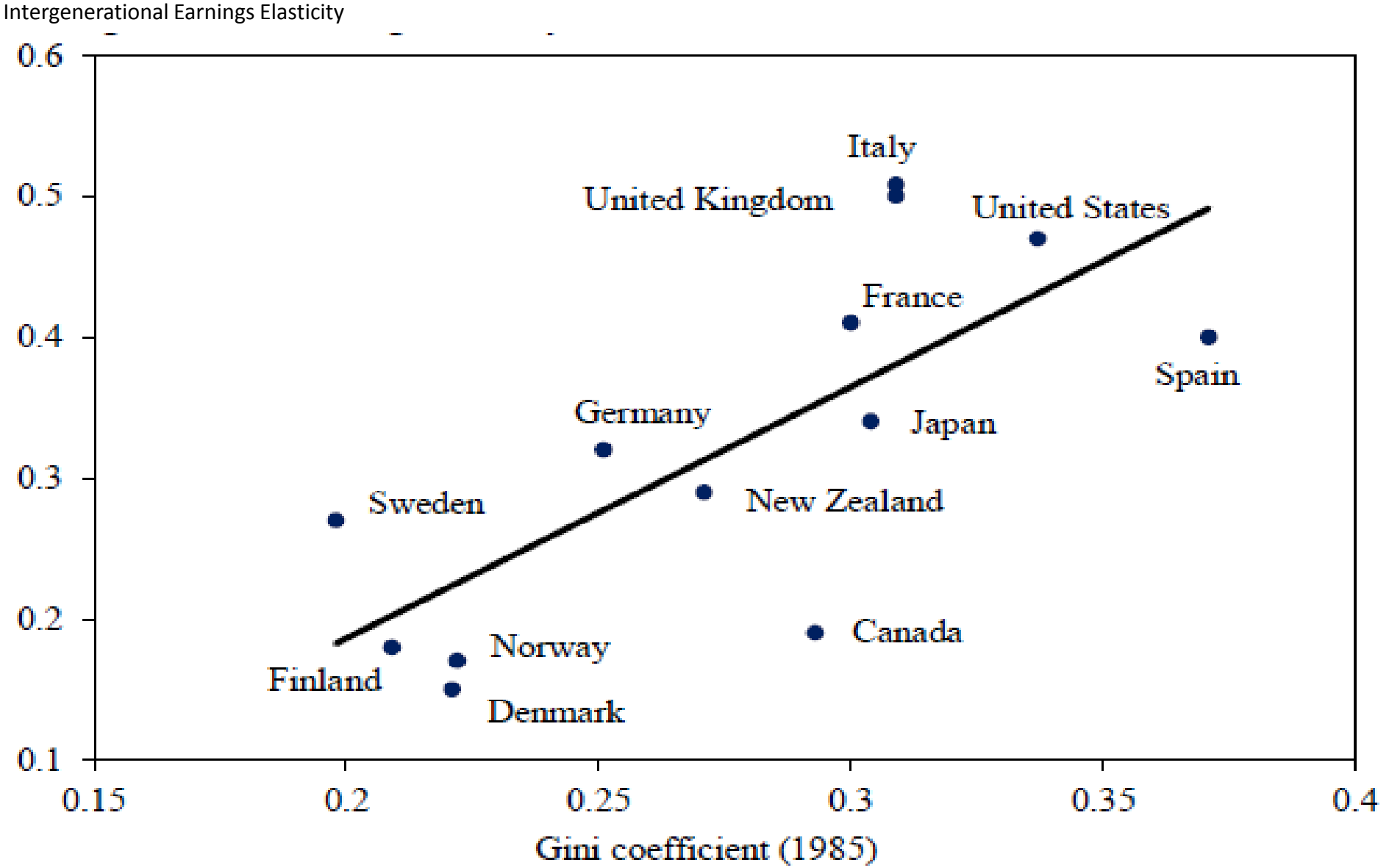


Talking Burgers are cute but the reality is different – Think Purchasing Power Inequality

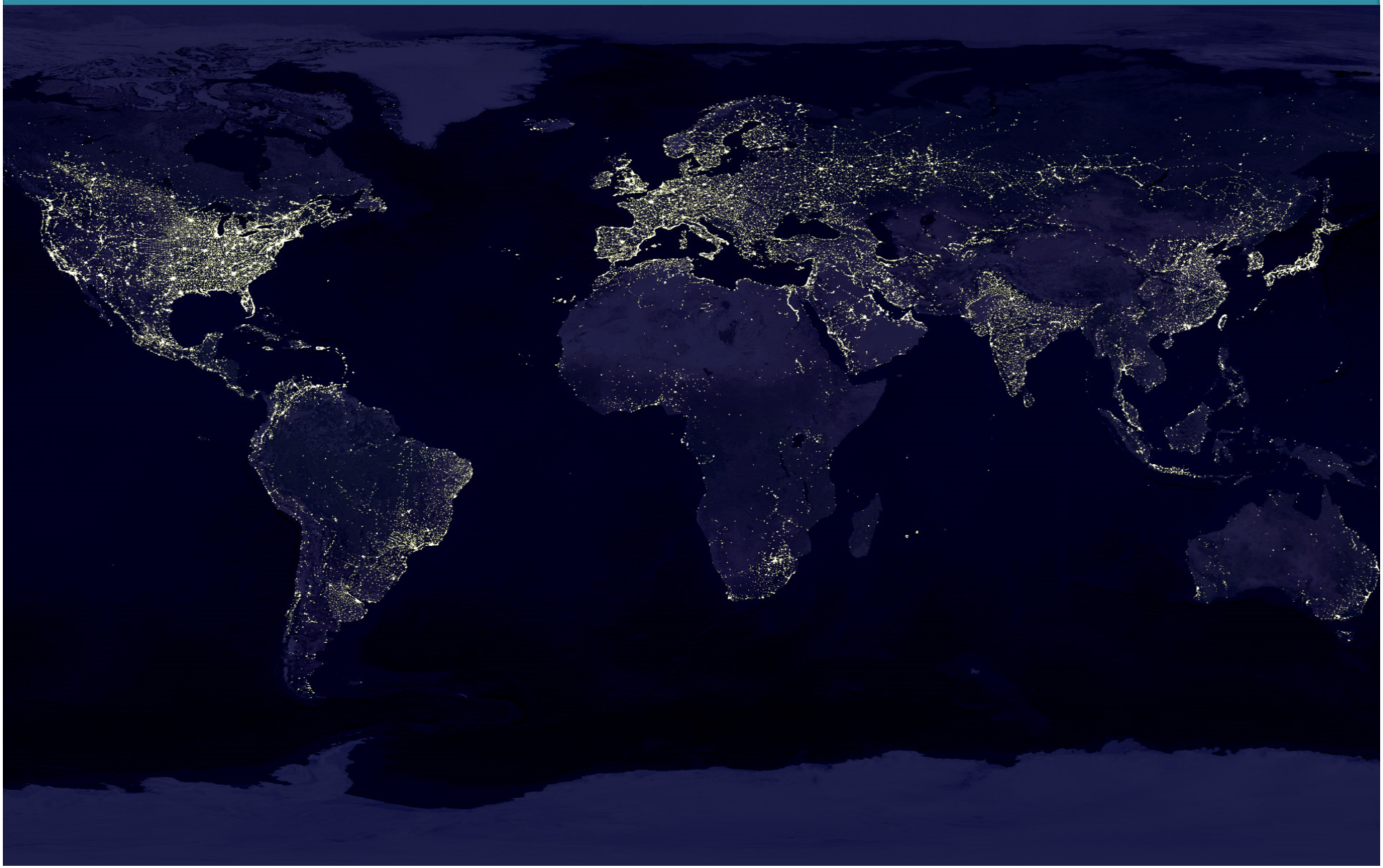


Gini coefficient measures the inequality among values of a frequency distribution (for example levels of income). Coefficient = zero expresses perfect equality (everyone has an exactly equal income). Coefficient = 1 expresses maximal inequality (where only 1 person has all the income).

Inequality


Intergenerational Earnings Elasticity
0.6
0.5
0.4
0.3
0.2
0.1
0.15
0.2
0.25
0.3
0.35
0.4
Gini coefficient (1985)
Italy
United Kingdom
United States
France
Spain
Germany
Japan
Sweden
New Zealand
Canada
Norway
Finland
Denmark

Market development proportional to infrastructure and dependent on energy resource



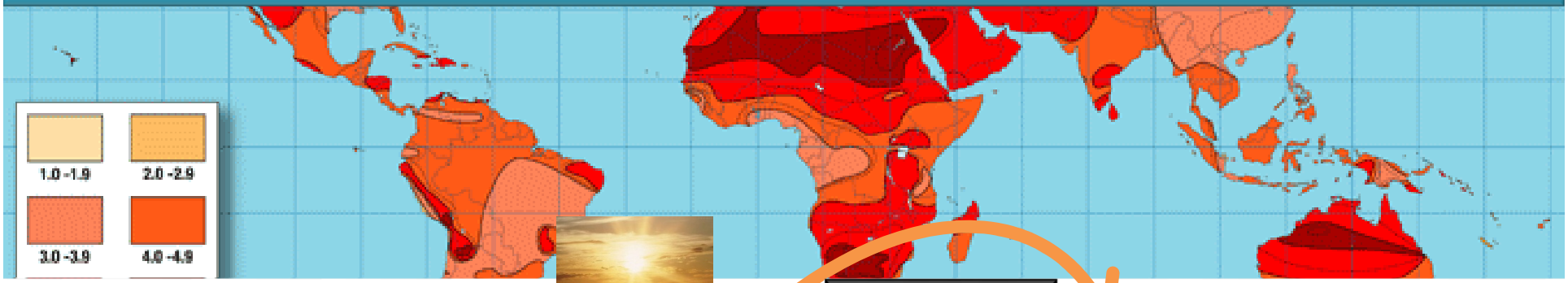
The Next Energy Frontier

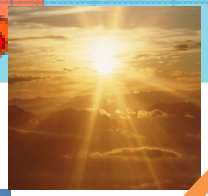
Mainframe computers to handheld iPads provides the analogy for the future of energy. Oil behemoths to renewable bio energy generators for commercial or domestic purposes using butanol or glucose. Micro-scale production and aggregation.

mREM

micro (renewable energy) manufacturing

Think Energy – Domestic Micro-Manufacturing Non-fossil Carbon-Neutral Liquid Fuel





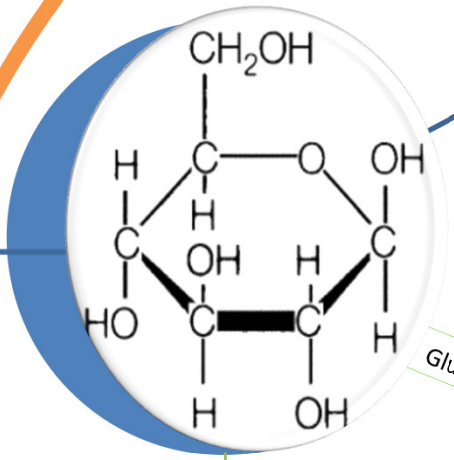
High Insolation

C 4
C 5

Butanol
Pentanol

Micro Algae

Cyano Bacteria



Glucose

Glucose

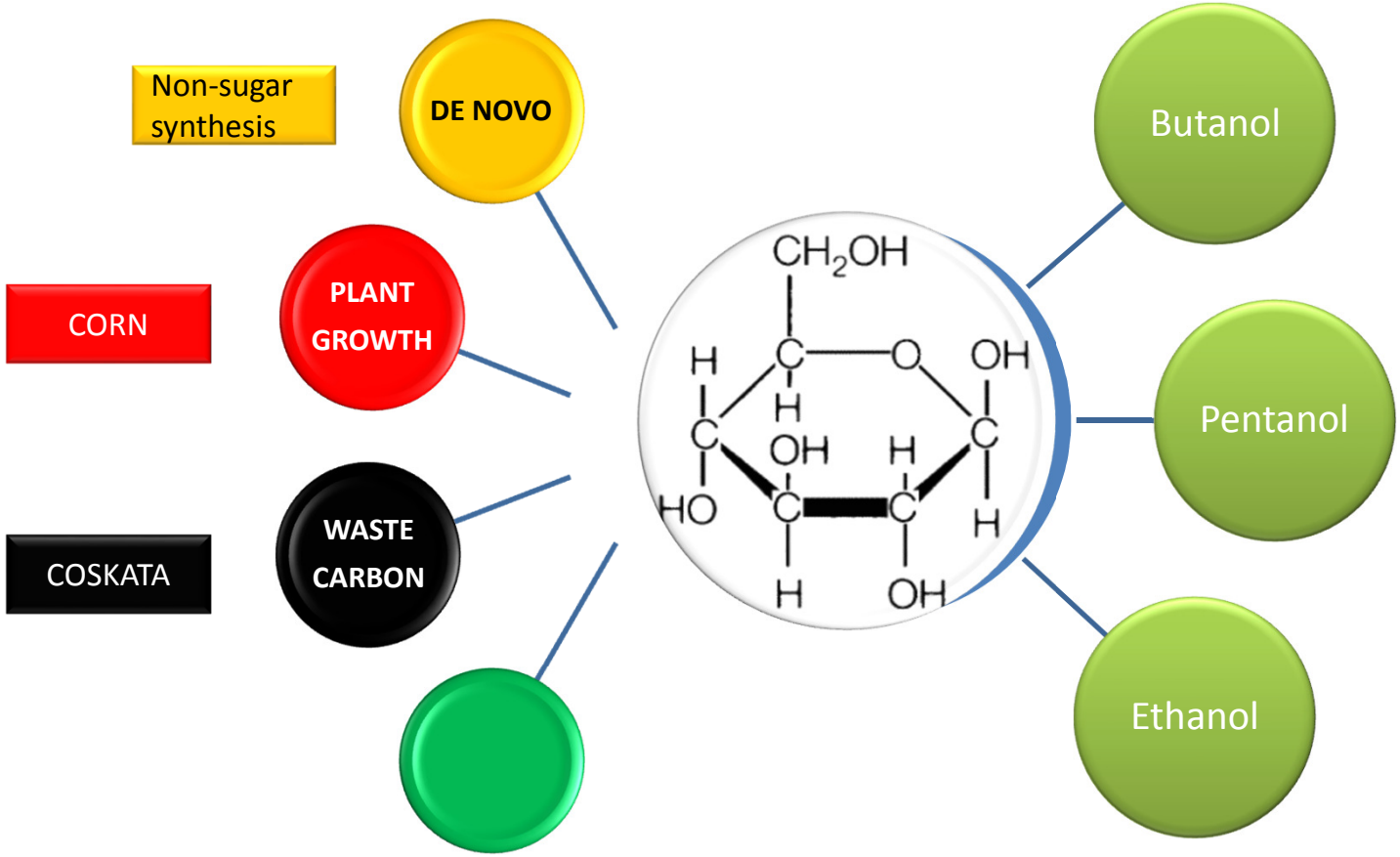
Liquid Fuel Generator

C 6

Glucose

Low Insolation Commodity

The World Is Not Flat – Hydrogen, Fission, Fusion & Liquid Carbon-Neutral



Glucose as a Commodity for Liquid Fuel Supply Chain
Is Glucose an intermediary in low insolation zones?

FUTURE
Post-2100

Chloroplast nano-chip

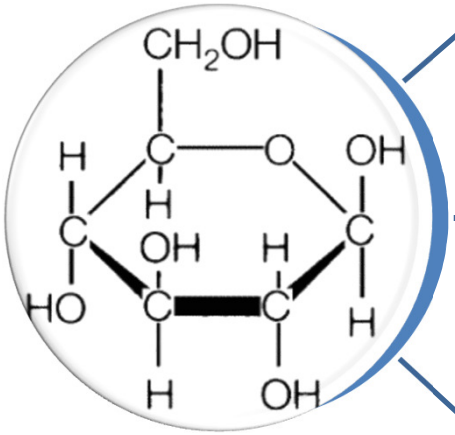
Non-sugar Synthesis

DE NOVO

Butanol

CORN

PLANT GROWTH



Pentanol

Personal Electricity Generator

COSKATA

WASTE CARBON

Ethanol

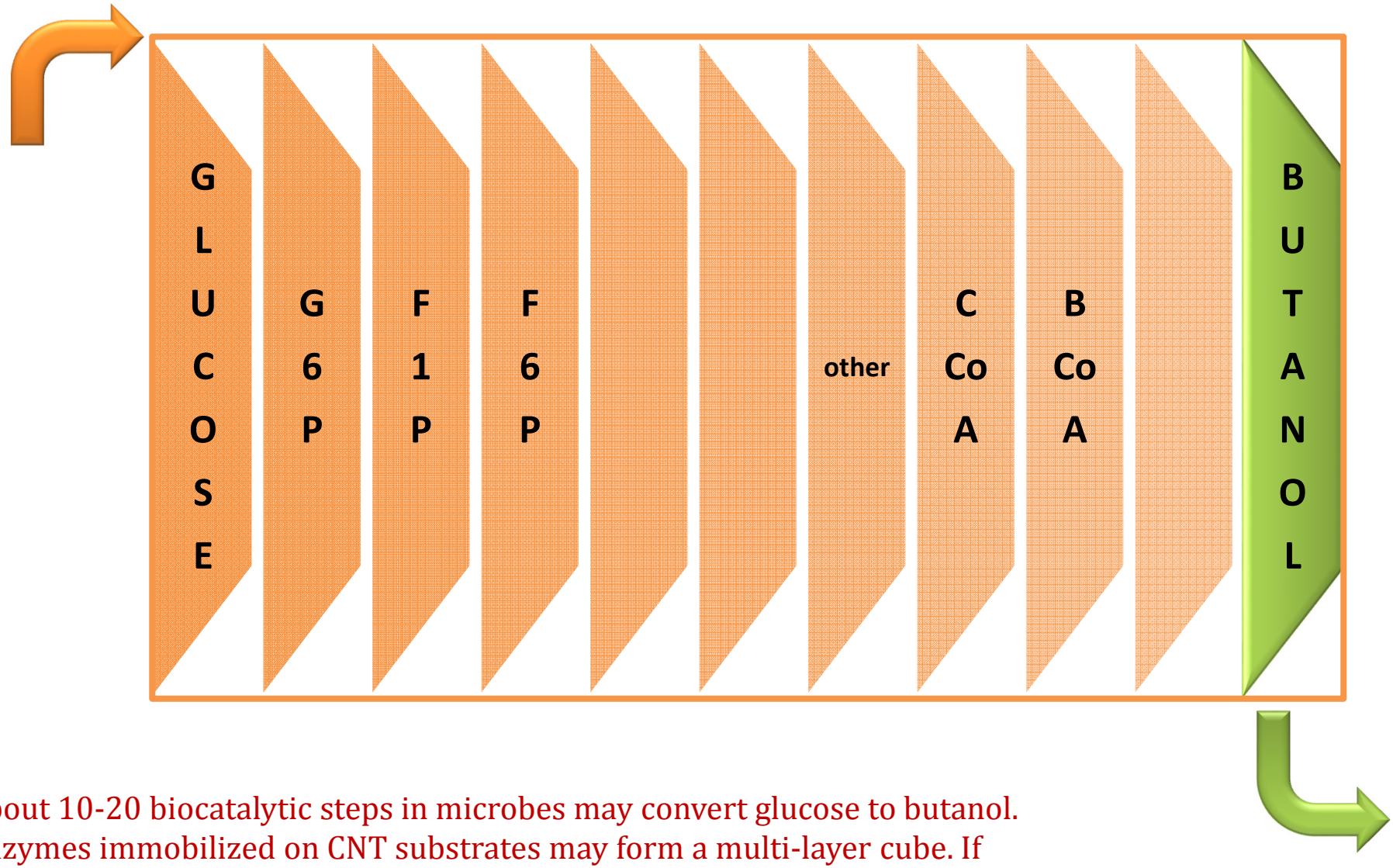
Bacteria Algae

PHOTO

Immobile Enzymes

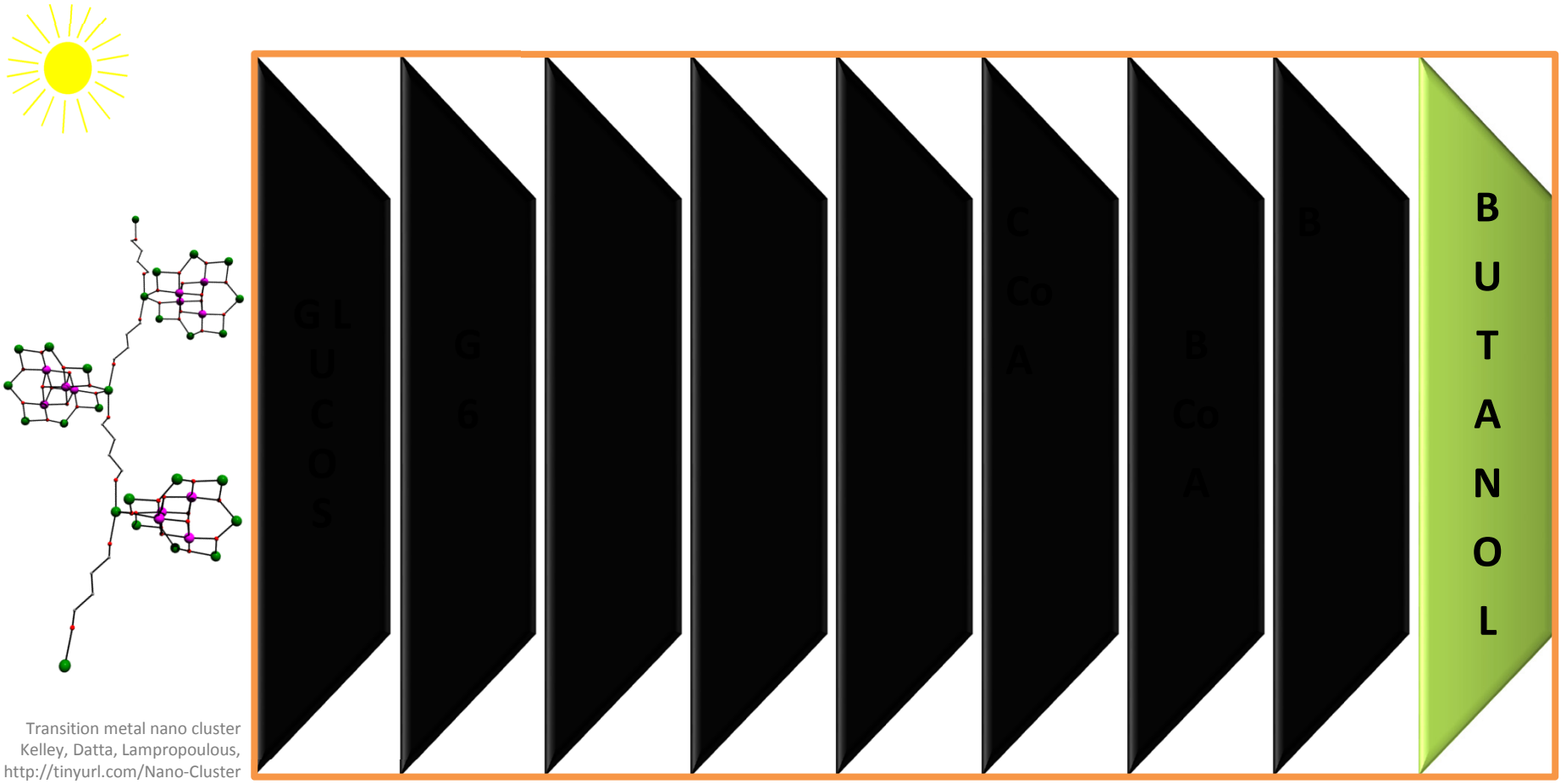
Home Butanol Generator

Butanol Battery 2050 • Enzymes adsorped on CNT tubes may catalyze glucose to butanol



About 10-20 biocatalytic steps in microbes may convert glucose to butanol. Enzymes immobilized on CNT substrates may form a multi-layer cube. If functional, the cascade may convert glucose (commodity) directly to butanol.

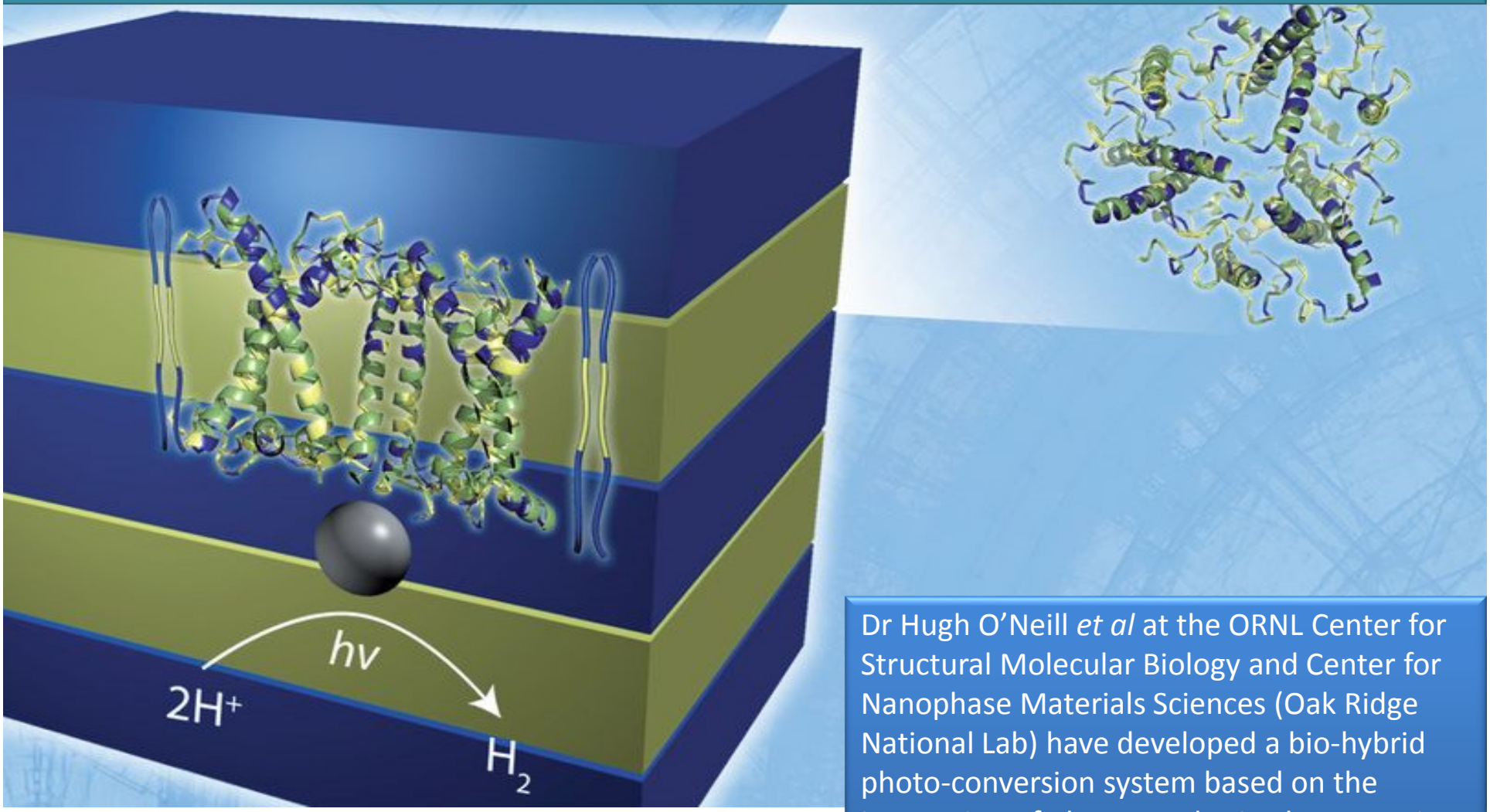
2100 → Mass Manufactured Nano-Chloroplasts ← Nano-Molecular Switched MOF



Transition metal nano cluster
Kelley, Datta, Lampropoulous,
http://tinyurl.com/Nano-Cluster

Light-dependent (photosystem I and II) and light-independent reactions of photosynthesis may be difficult (but not impossible) to functionalize due to the vast number of integral proteins in thylakoids in chloroplasts.
Black boxes [?] → embedded proteins in nano-clusters or metal organic frameworks (MOF)

Supra-molecular Assembly of Bio-hybrid Photo-conversion System → To Nano-Chloroplast ?



Supramolecular Assembly of Biohybrid Photoconversion Systems
Mateus B. Cardoso, Dmitriy Smolensky, William T. Heller, Kunlun Hong and Hugh O'Neill
Energy and Environmental Science (2011) **4** 181-188
DOI: 10.1039/C0EE00369G

Dr Hugh O'Neill *et al* at the ORNL Center for Structural Molecular Biology and Center for Nanophase Materials Sciences (Oak Ridge National Lab) have developed a bio-hybrid photo-conversion system based on the interaction of photo-synthetic plant proteins with synthetic polymers which can convert visible light into hydrogen fuel.

Based on proven gross inefficiencies of the internal combustion engine in converting chemical energy to mechanical energy (about 15%) it is clear that the future is electric. Then, why pursue scaling production of liquid fuel (C4, C5) from bacteria?

The answer is not simple but at least one simple answer is that predictions are difficult, especially when the question at hand requires one to forecast when rapid-charge car batteries will commence mass production. Reducing the re-charge time from 30-60 minutes to 5-10 minutes may be the disruptive factor that catalyzes or inhibits mass adoption of electric vehicles.

Can liquid fuel alternatives stand the economic stress test?

Electric Vehicles (EV)

- Automobile Engineering
- Charging Infrastructure
- Repair - Maintenance

Flex Fuel Vehicles (FFV)

- Liquid Fuel Production

MANY PARALLEL CHANGES NECESSARY FOR SUCCESSFUL ADOPTION OF EV

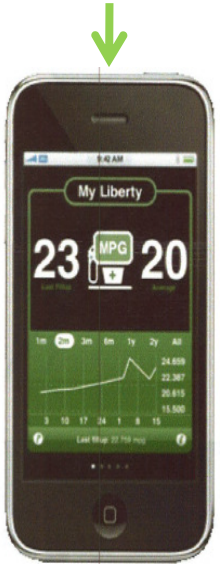
INFRASTRUCTURE NECESSARY FOR SUCCESSFUL ADOPTION OF EV

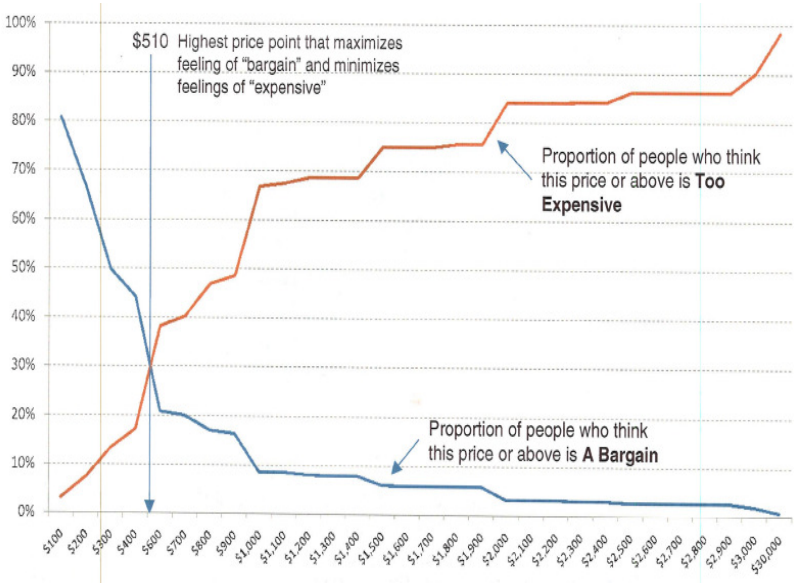
Electric Vehicle (Low Carbon / Neutral)

- Vehicle Engineering
- Charger Units (220V & 440V)
- Charging Stations
- Loss of 160,000 gas stations in US
- Loss of distribution assets
- Jobs lost versus created
- 1 source dependence - power grid
- Home chargers & remote control
- Wireless sensor data to phones

Flex Fuel Vehicle (Low Carbon / Neutral)

- Production scalability
- Photo bio-reactors / bioreactors
- Wireless sensor data to phones





Is liquid fuel still necessary when Lithium ion nano-phosphate batteries become standard?

Electric Vehicles (looks good)

- 90% efficiency from electric motors
- About 5-10 minutes for full charge
- RoboTrespa for short use/commute
- Diminished range anxiety and cost
- Vehicles as grid energy storage (peak)

Flex Fuel Vehicles (looks bad)

- 15% efficiency (chemical-mechanical)
- Alternate fuel for emergency vehicles
- Jet and bunker fuel (unless nuclear)

Non-fossil carbon-neutral renewable liquid fuel from photosynthetic microorganisms can be used for power generation for domestic users as well as grid based electricity distribution in countries where nuclear fission or fusion or high efficiency turbines are less readily available.

INNOVATION IN BANKRUPTCY → A123 Systems

One Billion Vehicles in 2020

2010 Automobiles

- 800 million vehicles in current use

2020 Automobiles

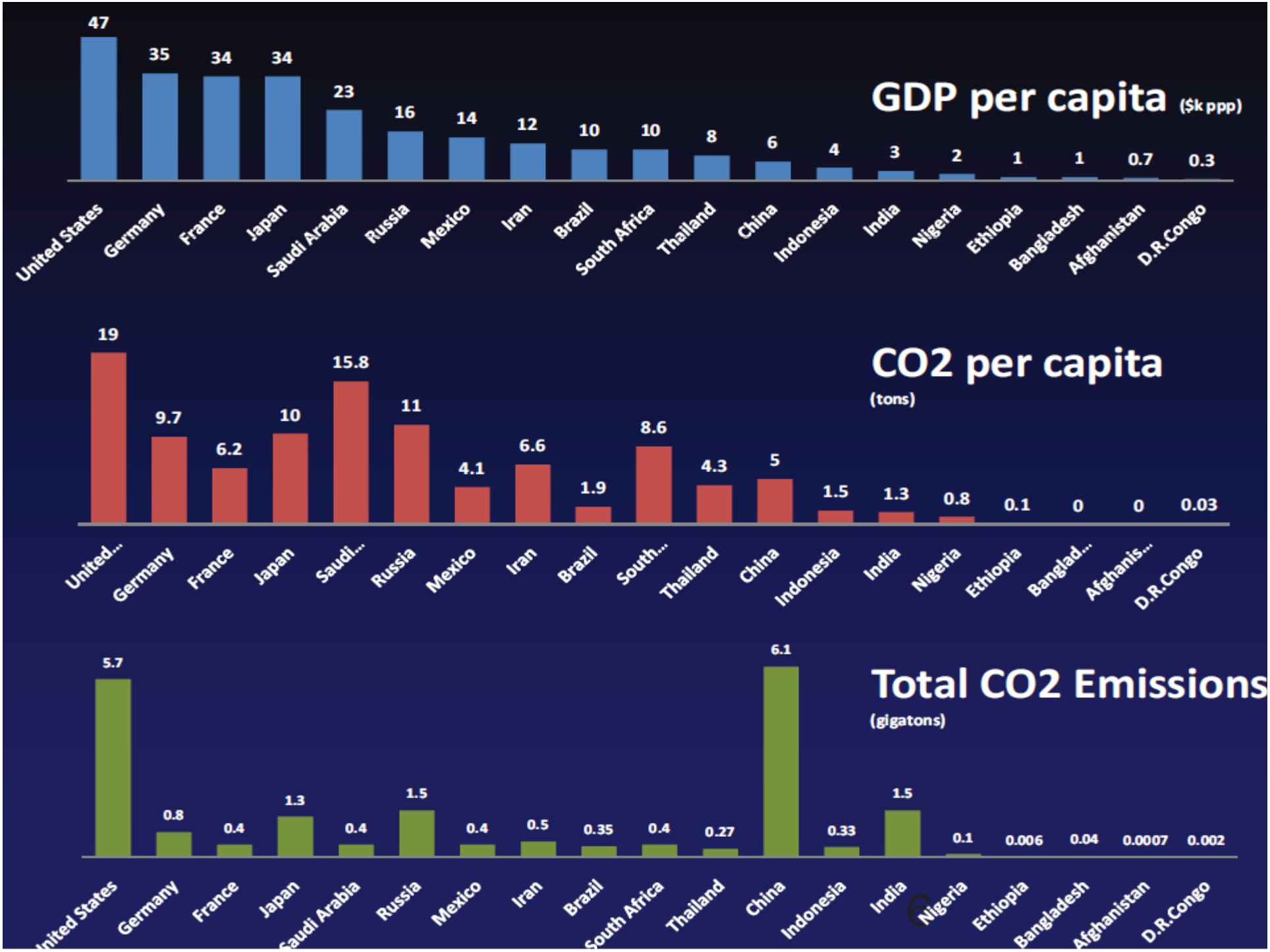
- 200 million vehicles to be added
- Conservative estimate : China , India
- Lacks systemic initiatives for EV
- Biofuel generates low paying job
- Carbon-neutrality controls GHG
- Wait & See : grid / battery innovation

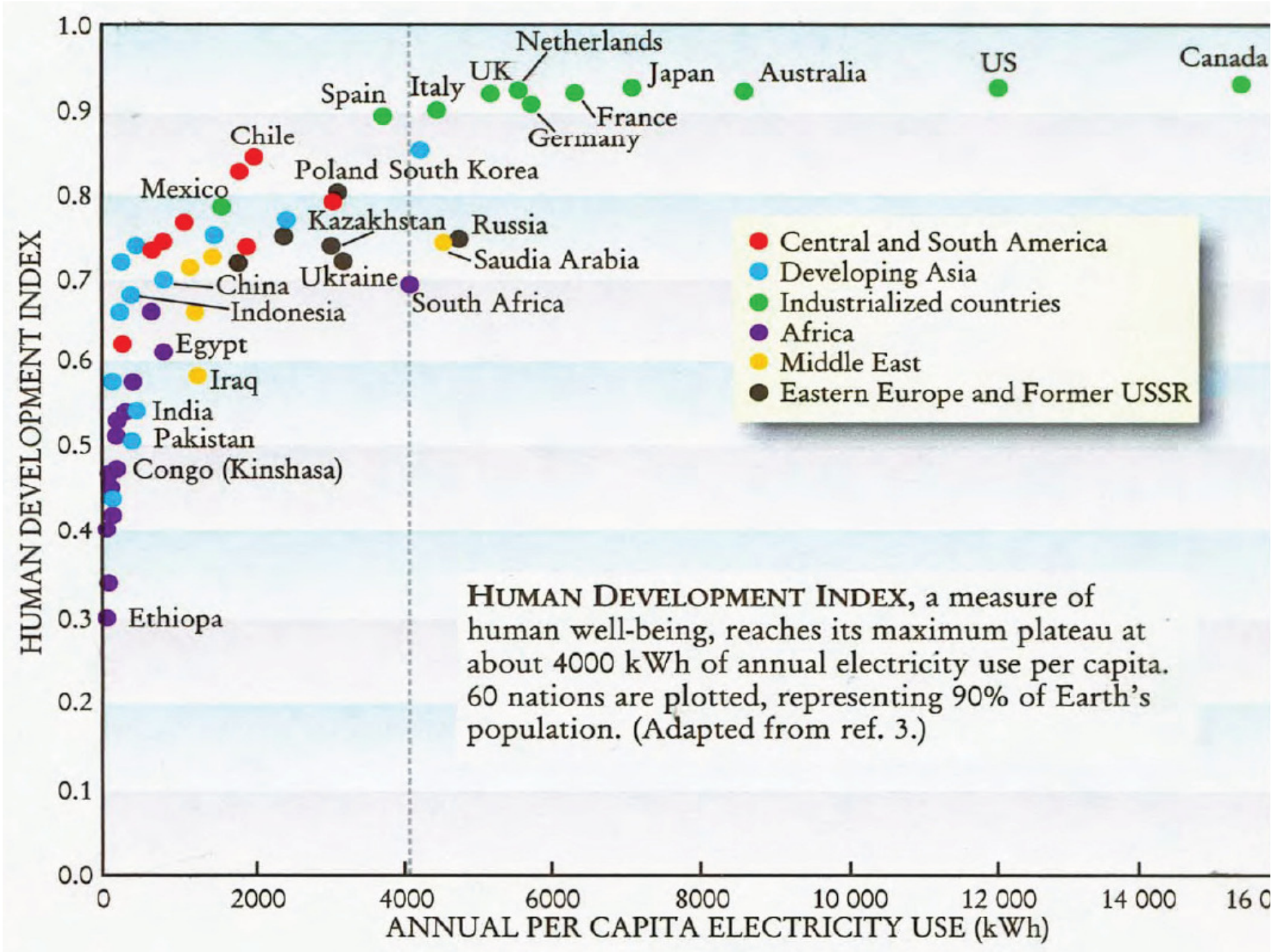
Non-fossil liquid fuel may be a solution for several decades.
Fossil fuel will still be available but at what economic cost?
Other non-fossil possibilities include methanol & biodiesel.

Is there a need for alternatives? Oil Reserves 1.5 trillion barrels?

Source: CIA

1	Saudi Arabia	264,600,000,000	1 January 2010 est.
2	Canada	175,200,000,000	1 January 2010 est.
3	Iran	137,600,000,000	1 January 2010 est.
4	Iraq	115,000,000,000	1 January 2010 est.
5	Kuwait	104,000,000,000	1 January 2010 est.
6	United Arab Emirates	97,800,000,000	1 January 2010 est.
7	Venezuela	97,770,000,000	1 January 2010 est.
8	Russia	79,000,000,000	1 January 2009 est.
9	Libya	47,000,000,000	1 January 2010 est.
10	Nigeria	37,500,000,000	1 January 2010 est.


GDP per capita ($k ppp)
47
35
34
34
23
16
14
12
10
10
8
6
4
3
2
1
1
0.7
0.3
United States
Germany
France
Japan
Saudi Arabia
Russia
Mexico
Iran
Brazil
South Africa
Thailand
China
Indonesia
India
Nigeria
Ethiopia
Bangladesh
Afghanistan
D.R.Congo
CO2 per capita
(tons)
19
9.7
6.2
10
15.8
11
4.1
6.6
1.9
8.6
4.3
5
1.5
1.3
0.8
0.1
0
0
0.03
United...
Germany
France
Japan
Saudi...
Russia
Mexico
Iran
Brazil
South...
Thailand
China
Indonesia
India
Nigeria
Ethiopia
Banglad...
Afghanis...
D.R.Congo
Total CO2 Emissions
(gigatons)
5.7
0.8
0.4
1.3
0.4
1.5
0.4
0.5
0.35
0.4
0.27
6.1
0.33
1.5
0.1
0.006
0.04
0.0007
0.002
United States
Germany
France
Japan
Saudi Arabia
Russia
Mexico
Iran
Brazil
South Africa
Thailand
China
Indonesia
India
Nigeria
Ethiopia
Bangladesh
Afghanistan
D.R.Congo


HUMAN DEVELOPMENT INDEX
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
0
2000
4000
6000
8000
10 000
12 000
14 000
16 0
ANNUAL PER CAPITA ELECTRICITY USE (kWh)
Netherlands
UK
Japan
Australia
US
Canada
Spain
Italy
France
Germany
Chile
Poland
South Korea
Mexico
Kazakhstan
Russia
Saudia Arabia
Ukraine
China
South Africa
Indonesia
Egypt
Iraq
India
Pakistan
Congo (Kinshasa)
Ethiopa
Central and South America
Developing Asia
Industrialized countries
Africa
Middle East
Eastern Europe and Former USSR
HUMAN DEVELOPMENT INDEX, a measure of human well-being, reaches its maximum plateau at about 4000 kWh of annual electricity use per capita. 60 nations are plotted, representing 90% of Earth's population. (Adapted from ref. 3.)

Reality Check - Coal and Gas

COAL – Emissions & Reserves

- 0.9 kg-CO2/kWh-e
- 900 billion tons
- 4,000 billion barrels oil eq

GAS – Emissions & Reserves

- 0.4 kg-CO2/kWh-e
- 16,200 Trillion cubic feet
- 2,700 billion barrels oil eq

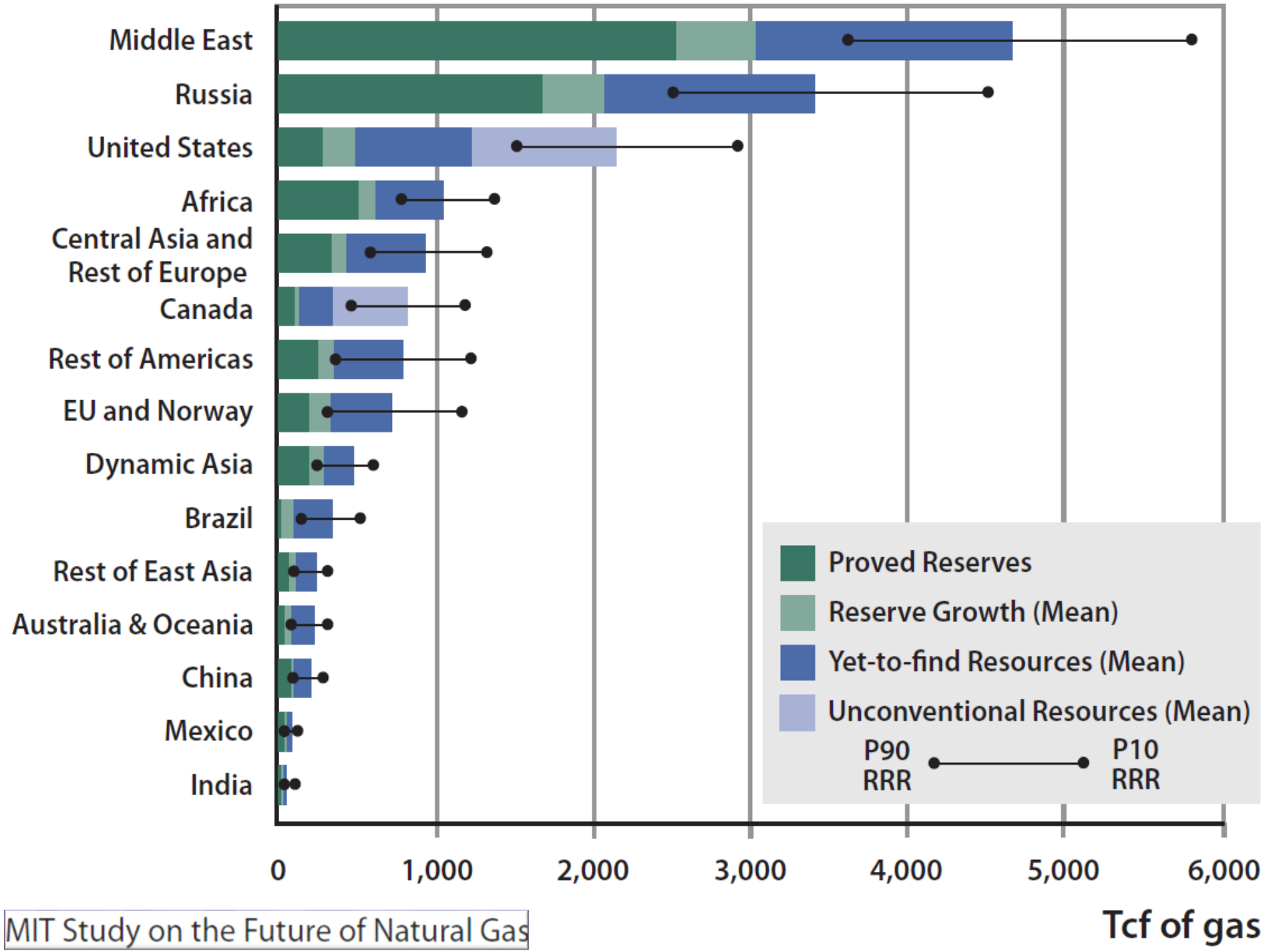
Can LNG be a part of the bridge to the hydrogen economy? Current oil consumption = 30 billion barrels, coal = 6 billion tons and gas consumption = 100 trillion cubic feet per year. Coal provides 70% energy in China (2.2 billion tons oil eq).

Reason for Silent Resistance to NonFossil Fuels?

MAJOR GLOBAL COAL RESERVES (90%)

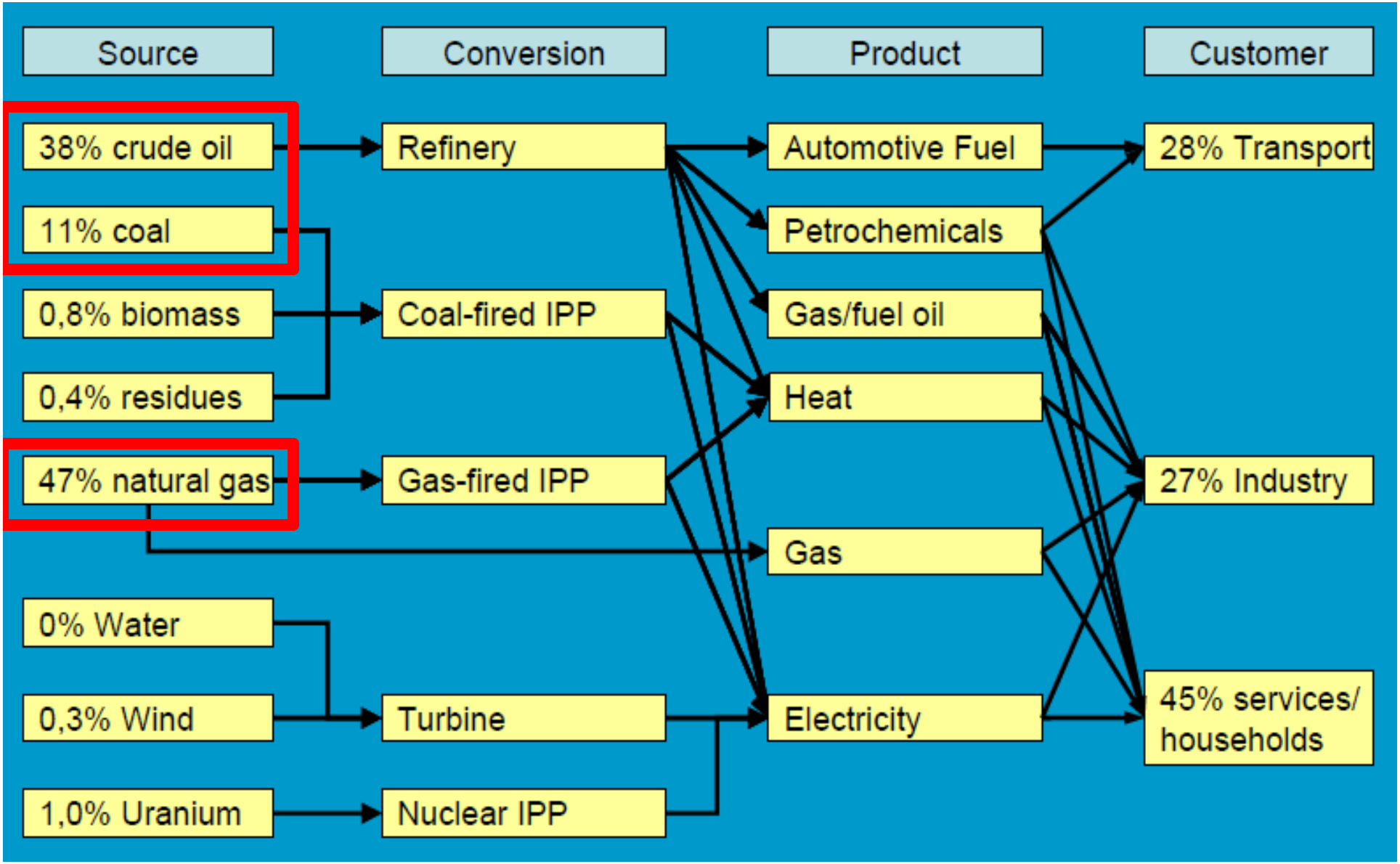
	Bituminous Anthracite	Sub-Bituminous Lignite	TOTAL Million Tonnes	% Share
United States	111,338	135,305	246,643	**22.6**
Pakistan	0	185,000	185,000	**17.0**
Russia	49,088	107,922	157,010	**14.4**
China	62,200	52,300	114,500	**12.6**
India	90,085	2,360	92,445	**10.2**
Australia	38,600	39,900	78,500	**8.6**
South Africa	48,750	0	48,750	**5.4**

BP & Wikipedia

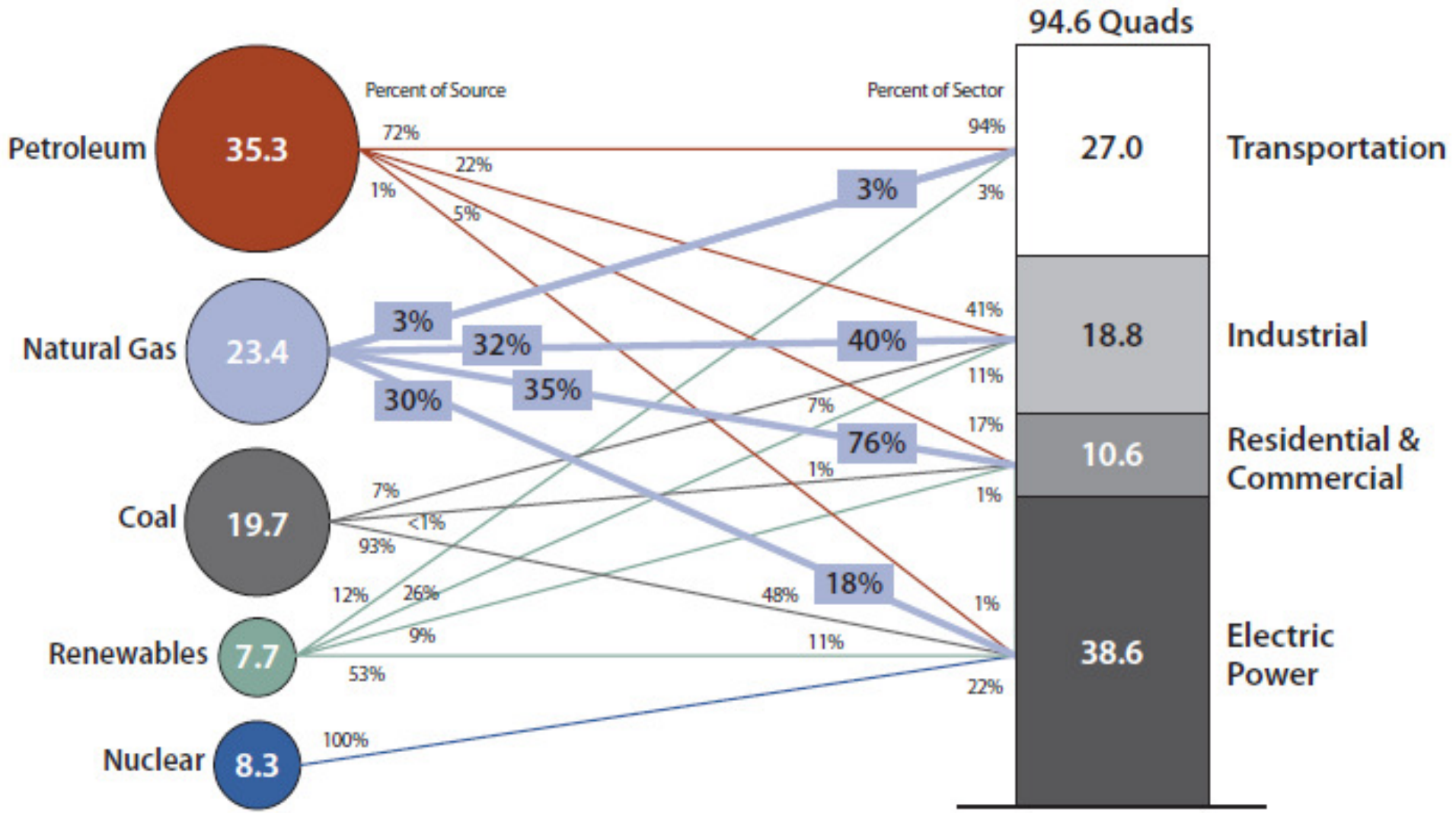


MIT Study on the Future of Natural Gas

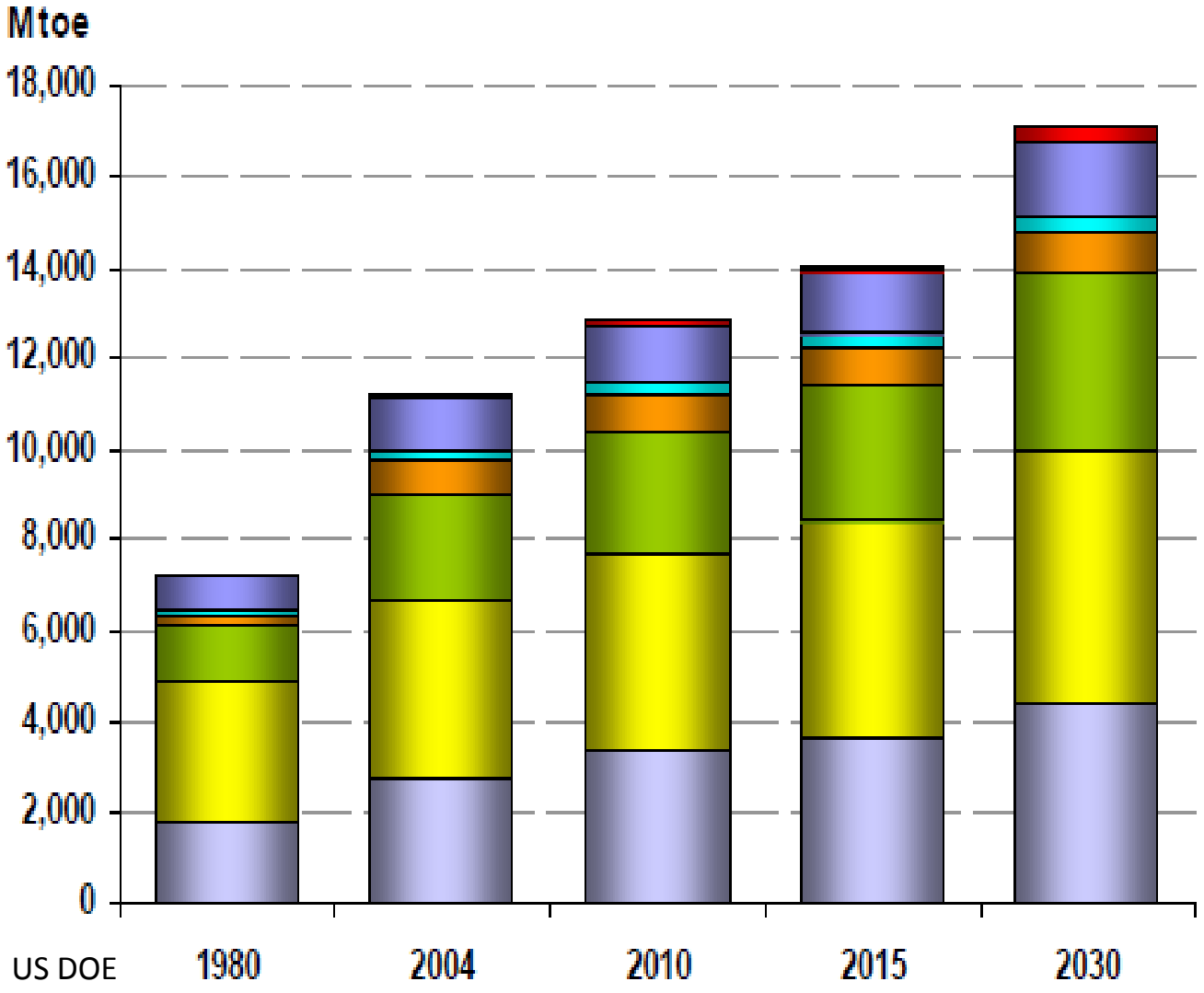
The Current Energy Infrastructure



US EIA 2009 – Energy Supply and Demand



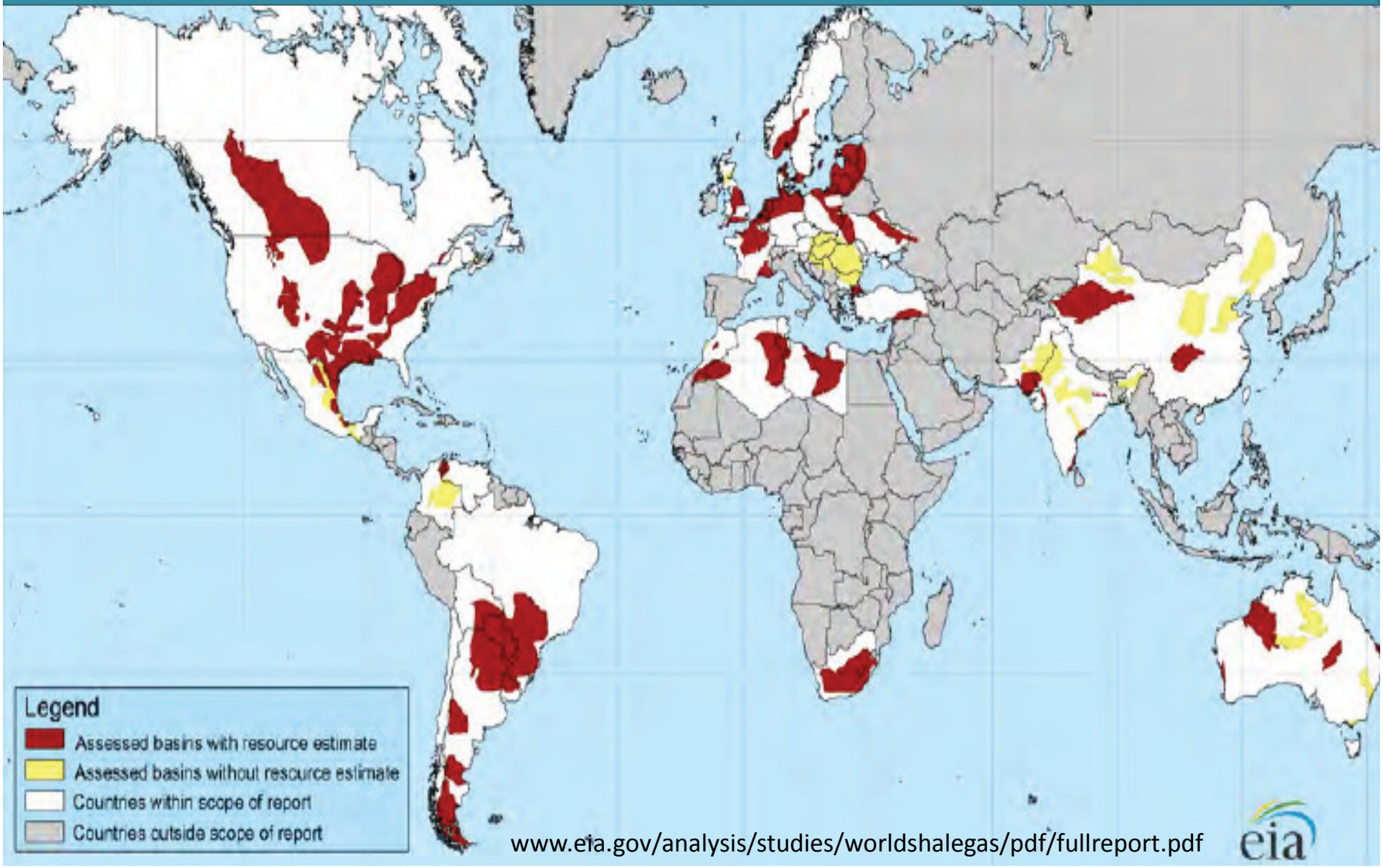
Projected Energy Sources – Coal, Oil and Gas



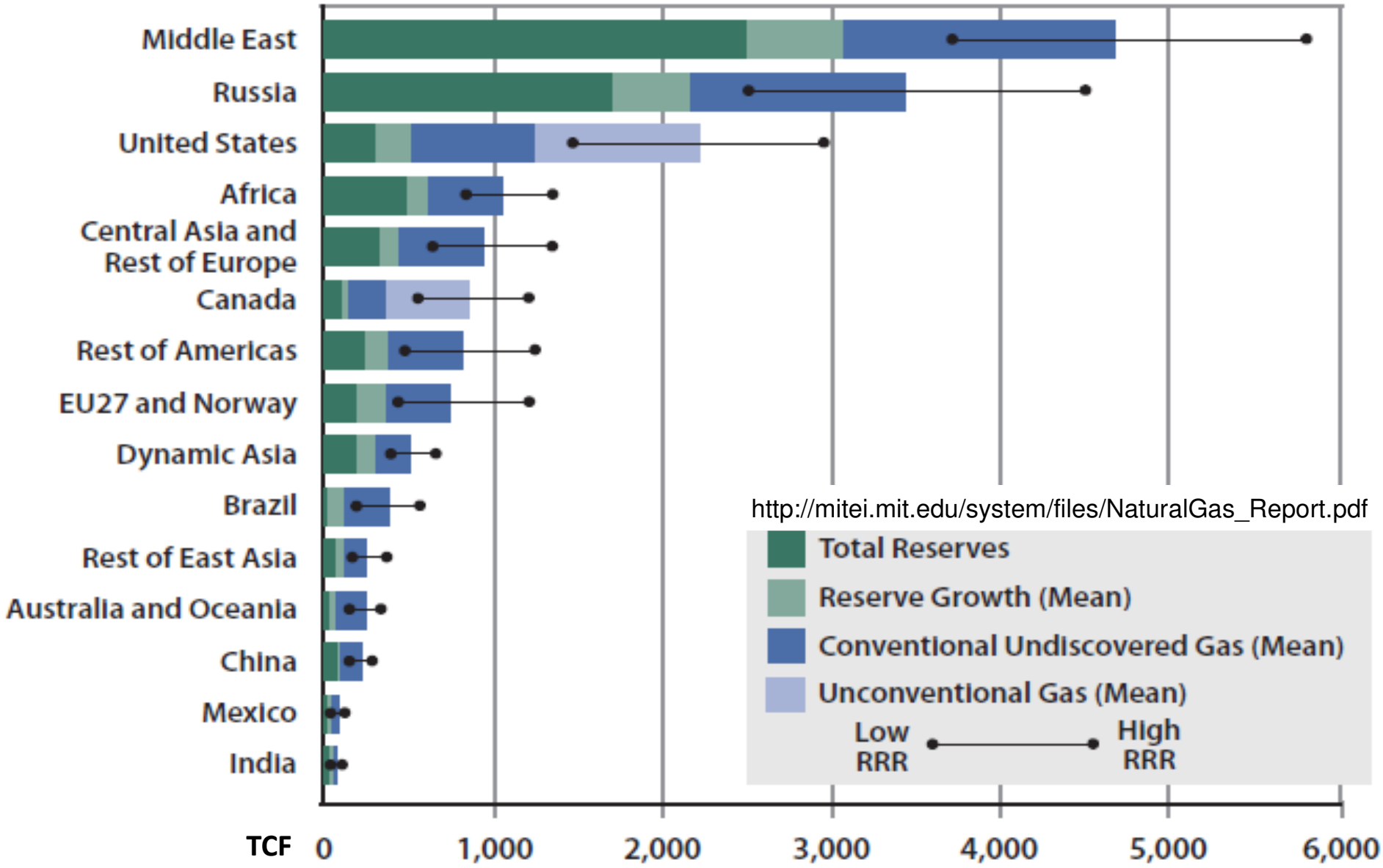
US DOE

	'04 – '30 Annual Growth Rate (%)
Other Renewables	6.5
Biomass & waste	1.3
Hydro	2.0
Nuclear	0.7
Gas	2.0
Oil	1.3
Coal	1.8
Total	**1.6**

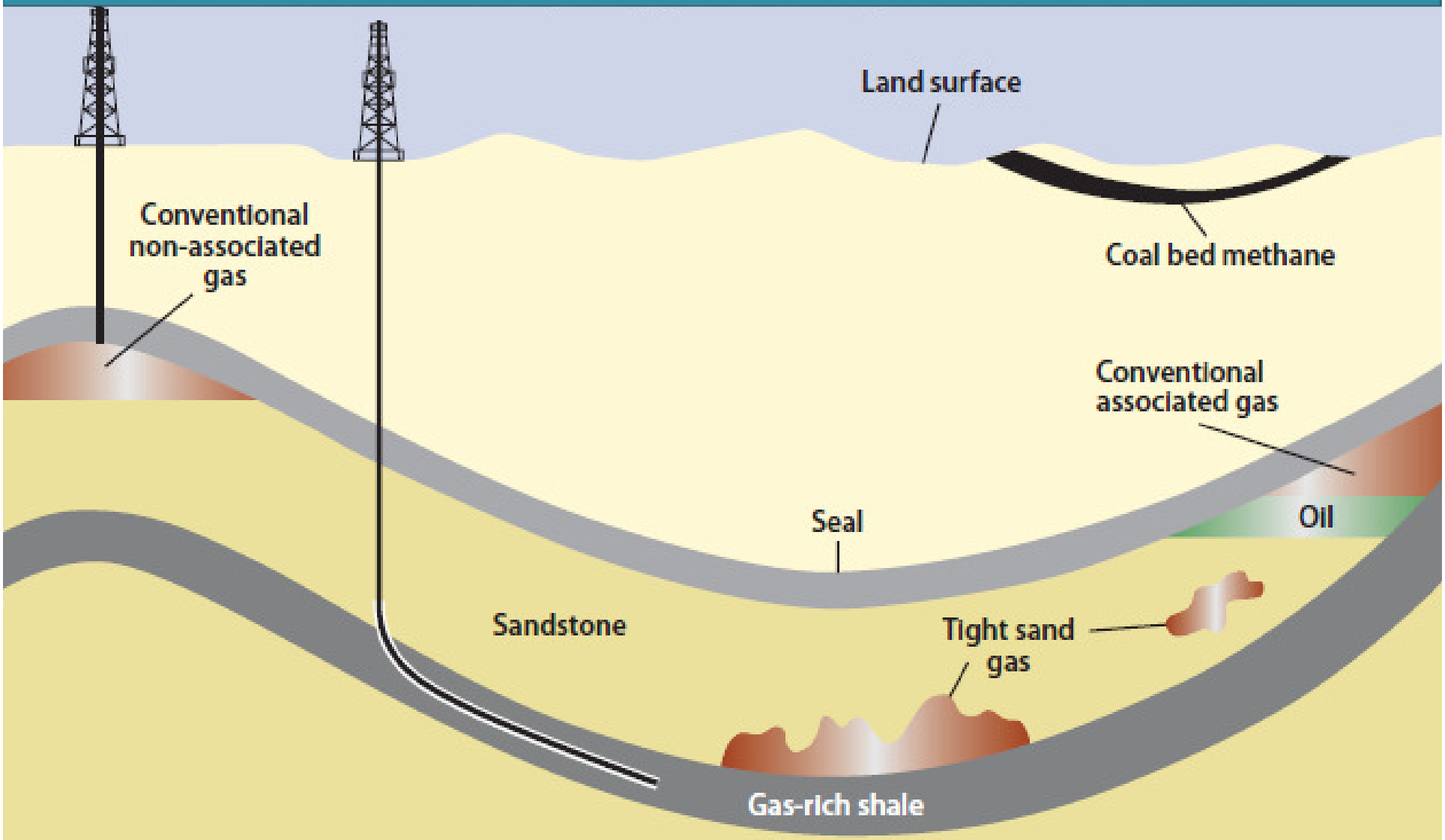
GHG Explosion – Global Shale Gas Basins



Recovery of Shale Gas (including uncertainty)



Geology Driven Economics of Shale Gas Extraction – The Environmental Justification

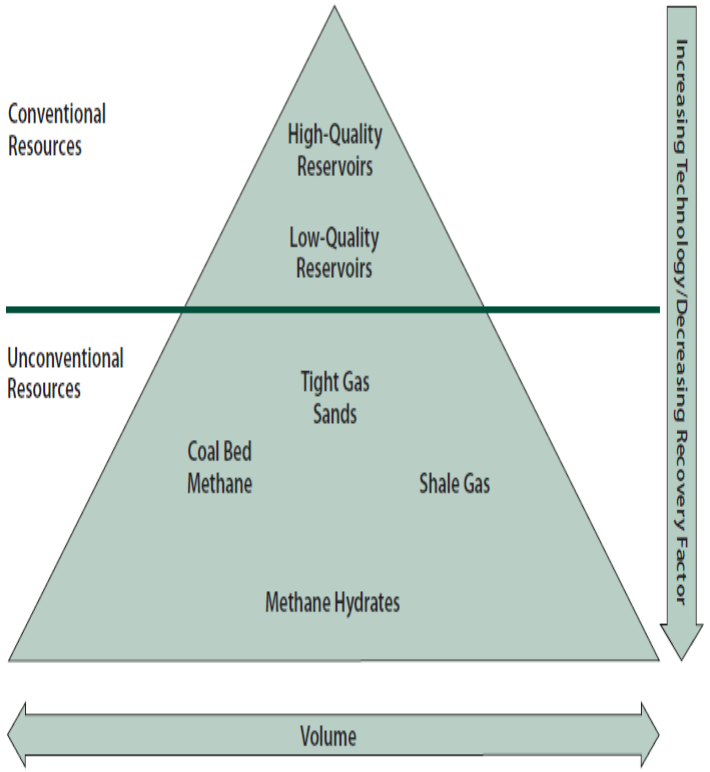


Per unit energy, natural gas offers 43% fewer carbon emissions than coal and 30% less than oil.

Short-sighted Solution?

	2009 Natural Gas Market[1] (trillion cubic feet, dry basis)			Proved Natural Gas Reserves[2] (trillion cubic feet)	Technically Recoverable Shale Gas Resources (trillion cubic feet)
	Production	Consumption	Imports (Exports)		
Europe					
France	0.03	1.73	98%	0.2	180
Germany	0.51	3.27	84%	6.2	8
Netherlands	2.79	1.72	(62%)	49.0	17
Norway	3.65	0.16	(2,156%)	72.0	83
U.K.	2.09	3.11	33%	9.0	20
Denmark	0.30	0.16	(91%)	2.1	23
Sweden	-	0.04	100%		41
Poland	0.21	0.58	64%	5.8	187
Turkey	0.03	1.24	98%	0.2	15
Ukraine	0.72	1.56	54%	39.0	42
Lithuania	-	0.10	100%		4
Others[3]	0.48	0.95	50%	2.71	19
North America					
United States[4]	20.6	22.8	10%	272.5	862
Canada	5.63	3.01	(87%)	62.0	388
Mexico	1.77	2.15	18%	12.0	681
Asia					
China	2.93	3.08	5%	107.0	1,275
India	1.43	1.87	24%	37.9	63
Pakistan	1.36	1.36	-	29.7	51
Australia	1.67	1.09	(52%)	110.0	396
Africa					
South Africa	0.07	0.19	63%	-	485
Libya	0.56	0.21	(165%)	54.7	290
Tunisia	0.13	0.17	26%	2.3	18
Algeria	2.88	1.02	(183%)	159.0	231
Morocco	0.00	0.02	90%	0.1	11
Western Sahara	-	-		-	7
Mauritania	-	-		1.0	0
South America					
Venezuela	0.65	0.71	9%	178.9	11
Colombia	0.37	0.31	(21%)	4.0	19
Argentina	1.46	1.52	4%	13.4	774
Brazil	0.36	0.66	45%	12.9	226
Chile	0.05	0.10	52%	3.5	64
Uruguay	-	0.00	100%		21
Paraguay	-	-			62
Bolivia	0.45	0.10	(346%)	26.5	48
Total of above areas	**53.1**	**55.0**	**(3%)**	**1,274**	**6,622**
Total world	**106.5**	**106.7**	**0%**	**6,609**	

Perhaps a 20 year supply based on current global usage of 55 tcf (proven reserves = 1,274 tcf and potential reserves are uncertain.

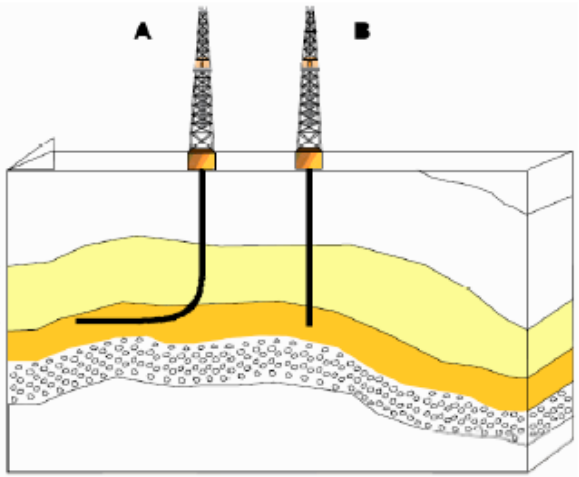


US Shale Gas - Estimated Proven Resource 245 TCF (Annual use in 2009 approx 23 TCF)

	(2003)	(Various Years)	(2006)	(2008)	(2009)
L48					
Conventional	691	928	966	869	693
Tight	175	190			174
Shale	35	85		616	631
CBM	58	71	108	99	65
Total L48	**959**	**1,274**	**1,074**	**1,584**	**1,563**
Alaska					
Conventional	237	357	194	194	237
Tight	–	–			
Shale	–	–		–	–
CBM	57	18	57	57	57
Total Alaska	**294**	**375**	**251**	**251**	**294**
U.S.					
Conventional	929	1,284	1,160	1,063	930
Tight	175	190			174
Shale	35	85		616	631
CBM	115	89	165	156	122
Total U.S.	**1,254**	**1,648**	**1,325**	**1,835**	**1,857**
Proved Reserves	**184**	**245**	**204**	**245**	**245**
Total (Tcf)	**1,438**	**1,893**	**1,529**	**2,080**	**2,102**

Unleashing GHG – Shale Gas in China

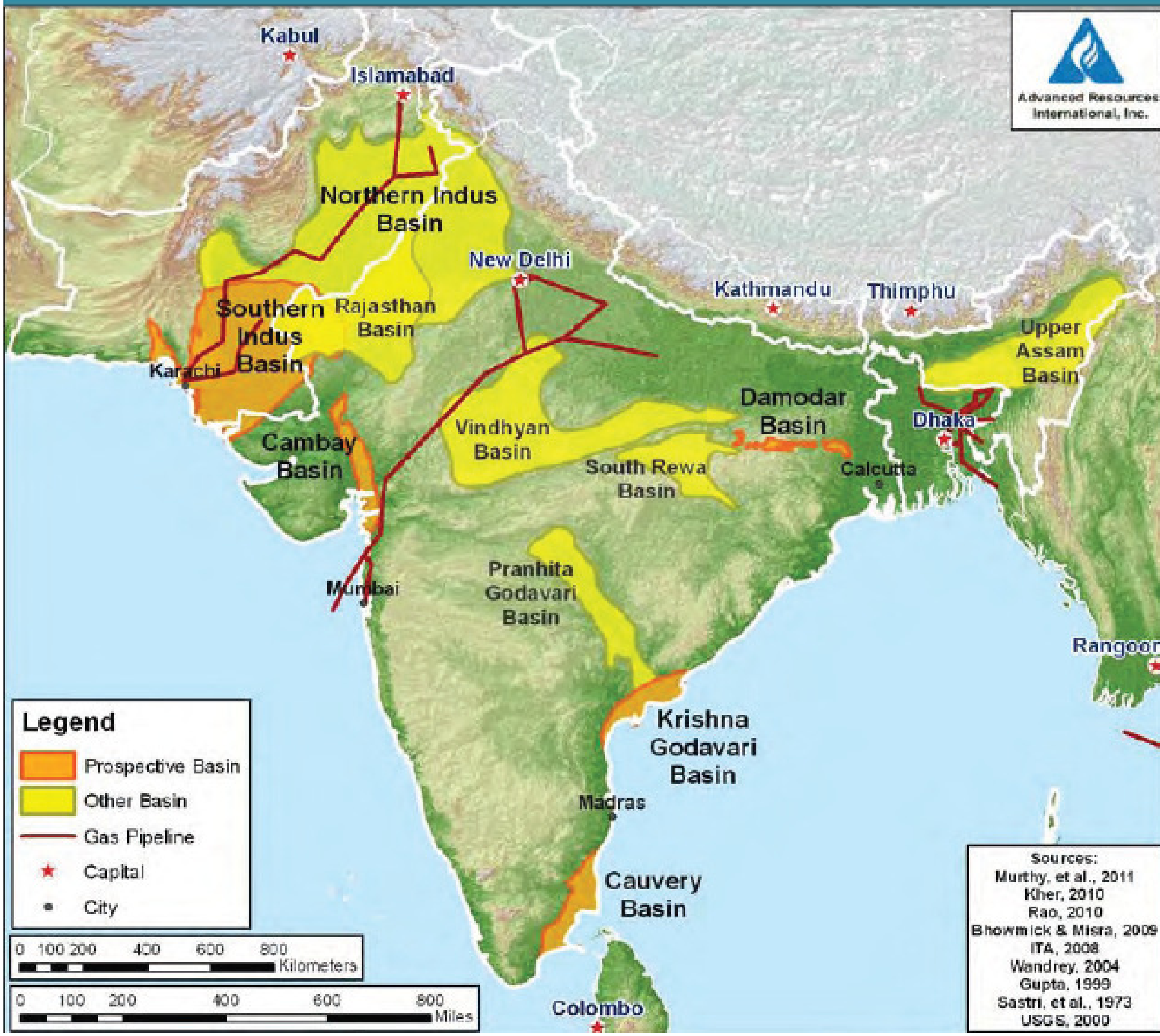
Horizontal Well (A) vs. Vertical Well (B)



Shale Gas Piloting Production Zone

Shale Gas Bearing Area

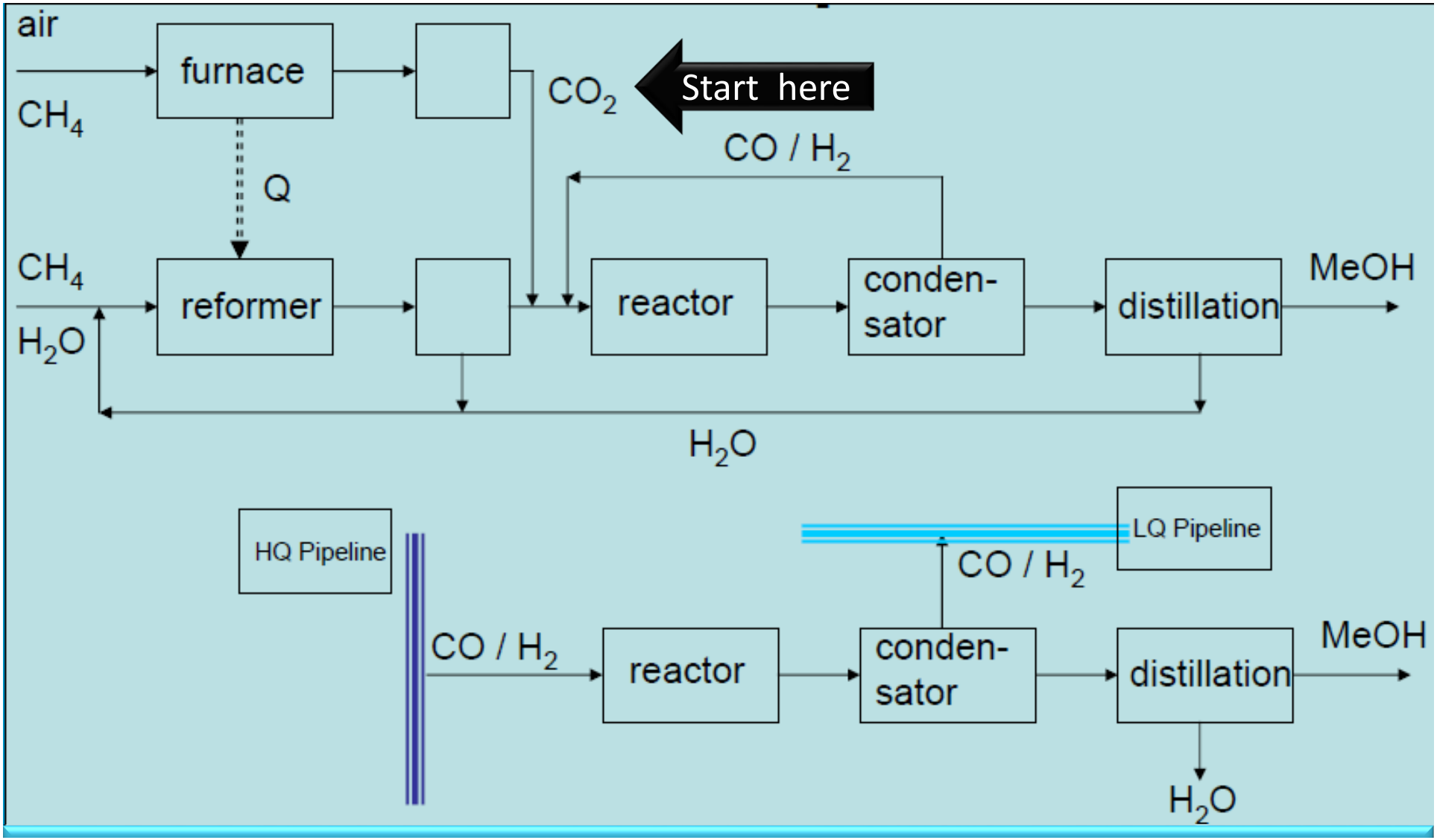
Gas Explosion in the sub-continent of India



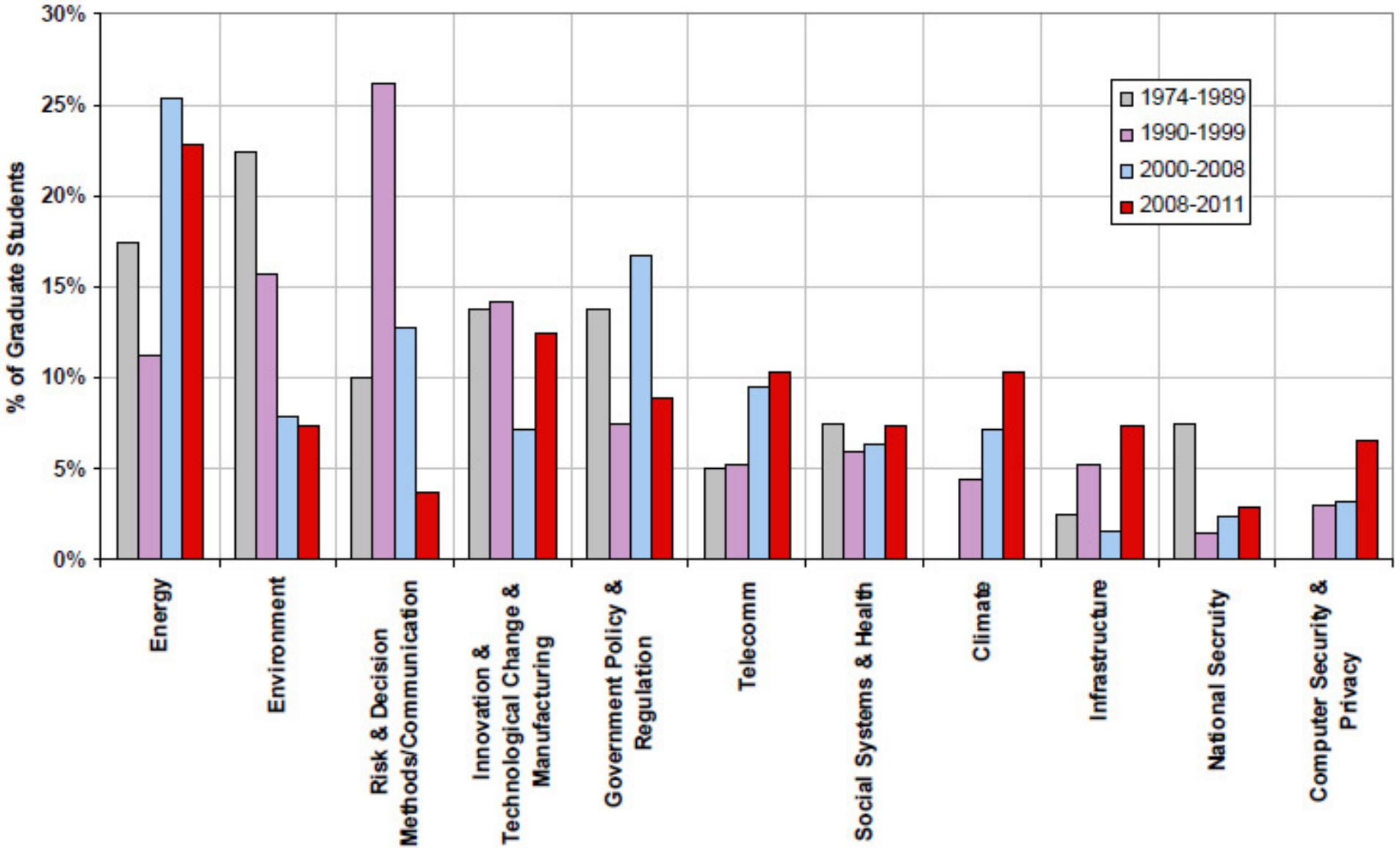
Basic Data	Basin/Gross Area		Cambay Basin (20,000 mi²)	Damodar Valley Basin (1,410 mi²)	Krishna-Godavari Basin (7,800 mi²)	Cauvery Basin (9,100 mi²)	Southern Indus Basin (67,000 mi²)	
	Shale Formation		Cambay Shale	Barren Measure	Kommugudem Shale	Andimadam Formation	Sembar Formation	Ranikot Formation
	Geologic Age		Upper Cretaceous/Tertiary	Permian-Triassic	Permian	Cretaceous	Early Cretaceous	Paleocene
Physical Extent	Prospective Area (mi²)		940	1,080	4,340	1,005	4,000	4,000
	Thickness (ft)	Interval	1,600 - 4,900	0 - 2,100	3,100 - 3,500	600 - 1,200	1,500 - 2,500	2,000 - 4,000
		Organically Rich	1,500	1,050	1,000	800	1,000	1,500
		Net	500	368	300	400	300	450
	Depth (ft)	Interval	11,500 - 16,400	3,280 - 6,560	6,200 - 13,900	7,000 - 13,000	13,000 - 15,000	10,000 - 13,000
		Average	13,000	4,920	11,500	10,000	14,000	11,500
Reservoir Properties	Reservoir Pressure		Moderately Overpressured	Moderately Overpressured	Normal	Normal	Normal	Normal
	Average TOC (wt. %)		3.0%	4.5%	6.0%	2.0%	2.0%	2.0%
	Thermal Maturity (%Ro)		1.10%	1.20%	1.60%	1.15%	1.25%	1.15%
	Clay Content		Medium	High	High	High	Low	Low
Resource	GIP Concentration (Bcf/mi²)		231	123	156	143	100	157
	Risked GIP (Tcf)		78	33	136	43	80	126
	Risked Recoverable (Tcf)		20	7	27	9	20	31

George Olah & the Methanol Economy - what to do with the excess CO_2 from shale gas

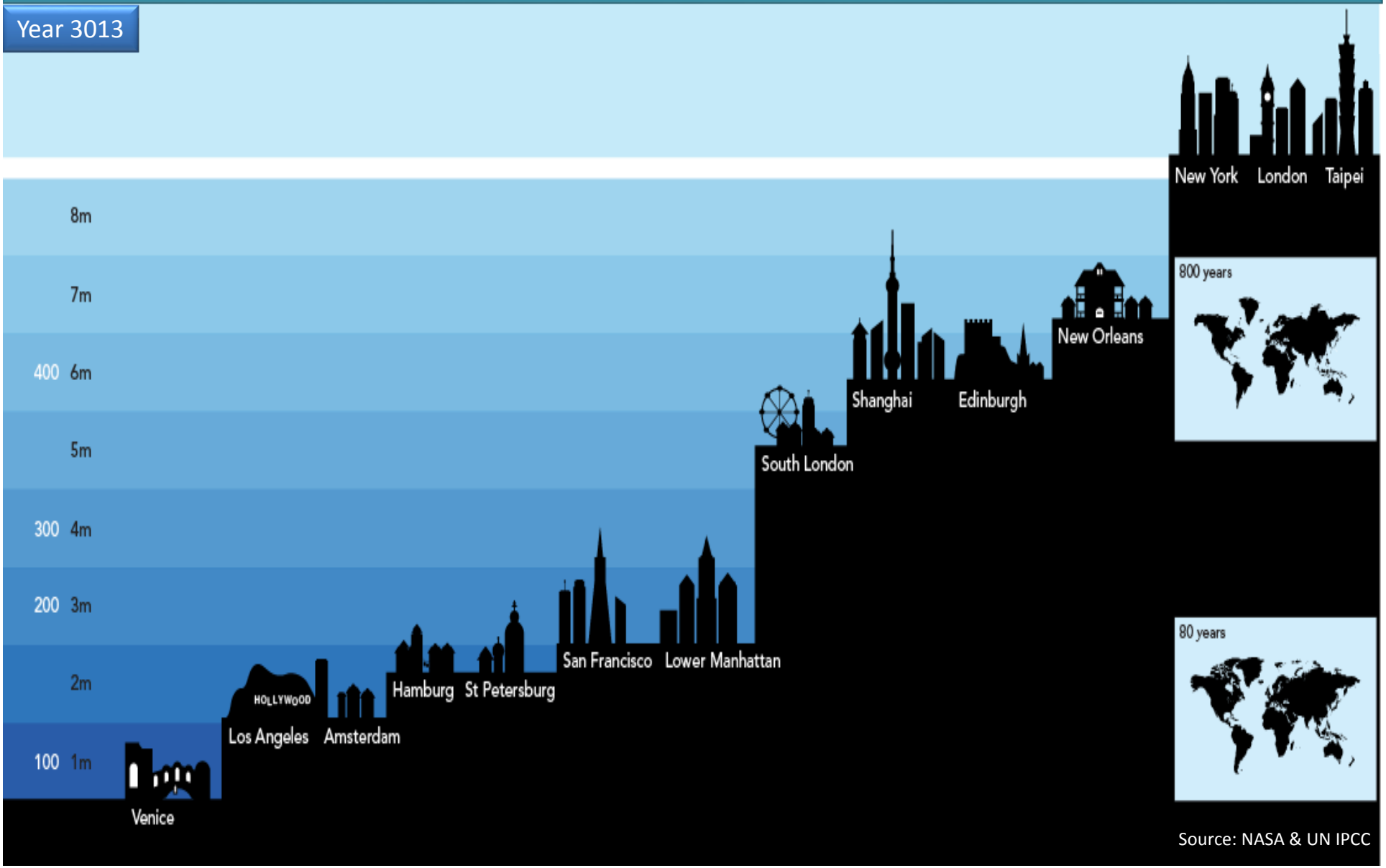
One trillion cubic feet (TCF) of shale gas may release 6 million tonnes carbon dioxide equivalent

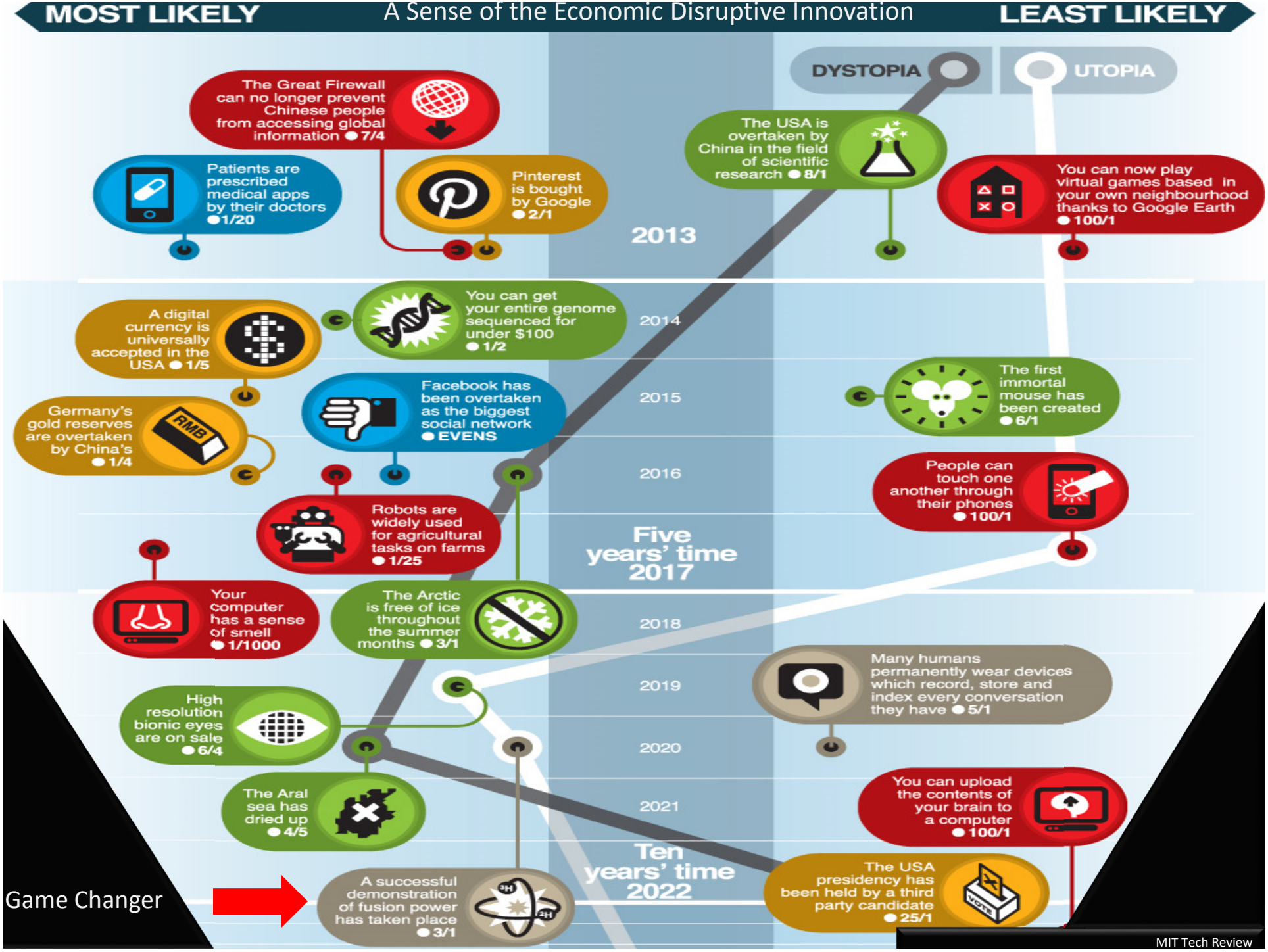


Think Energy – Trends in Graduate Research (PhD Students)

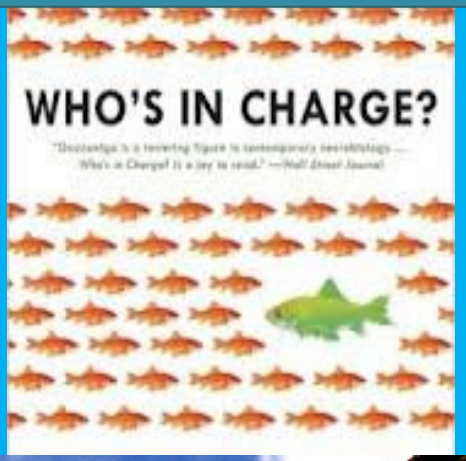


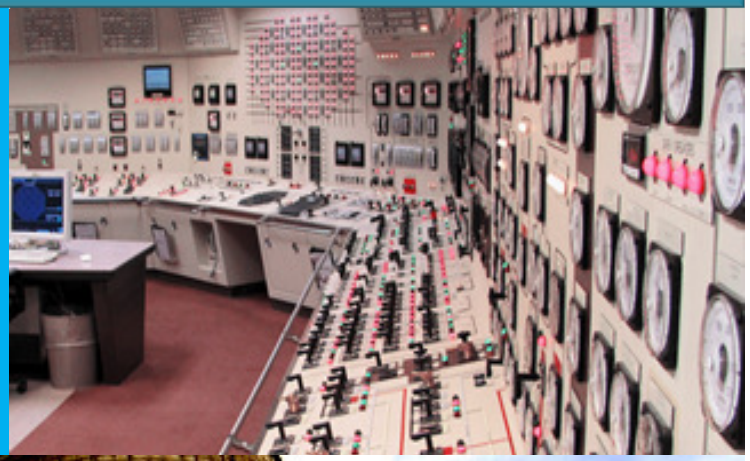
Think Energy - Expansion of water 1 m / 100 years → Accelerated Visit Venice Program




MOST LIKELY
A Sense of the Economic Disruptive Innovation
LEAST LIKELY
DYSTOPIA
UTOPIA
The Great Firewall can no longer prevent Chinese people from accessing global information ● 7/4
Patients are prescribed medical apps by their doctors ●1/20
Pinterest is bought by Google ●2/1
The USA is overtaken by China in the field of scientific research ● 8/1
You can now play virtual games based in your own neighbourhood thanks to Google Earth ● 100/1
2013
A digital currency is universally accepted in the USA ● 1/5
You can get your entire genome sequenced for under $100 ● 1/2
2014
Germany's gold reserves are overtaken by China's ● 1/4
RMB
Facebook has been overtaken as the biggest social network ● EVENS
2015
The first immortal mouse has been created ● 6/1
2016
People can touch one another through their phones ● 100/1
Robots are widely used for agricultural tasks on farms ● 1/25
Five years' time 2017
Your computer has a sense of smell ● 1/1000
The Arctic is free of ice throughout the summer months ● 3/1
2018
Many humans permanently wear devices which record, store and index every conversation they have ● 5/1
2019
High resolution bionic eyes are on sale ● 6/4
2020
The Aral sea has dried up ● 4/5
2021
You can upload the contents of your brain to a computer ● 100/1
Ten years' time 2022
The USA presidency has been held by a third party candidate ● 25/1
VOTE
A successful demonstration of fusion power has taken place ● 3/1
2H
2H
Game Changer
MIT Tech Review

Can we enjoy the fruits of safe nuclear fusion energy?





War – What is it good for?

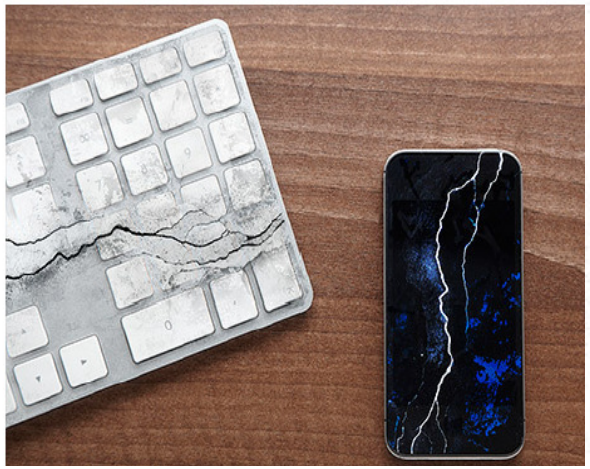
In 2012, **large-scale cyberattacks targeted at the Iranian government** were uncovered, and in return, Iran is believed to have launched **massive attacks aimed at U.S. banks** and Saudi oil companies. At least 12 of the world's 15 largest military powers are currently building cyberwarfare programs, according to James Lewis, a cybersecurity expert at the Center for Strategic and International Studies.

ASIA BUSINESS | May 29, 2012, 8:55 p.m. ET

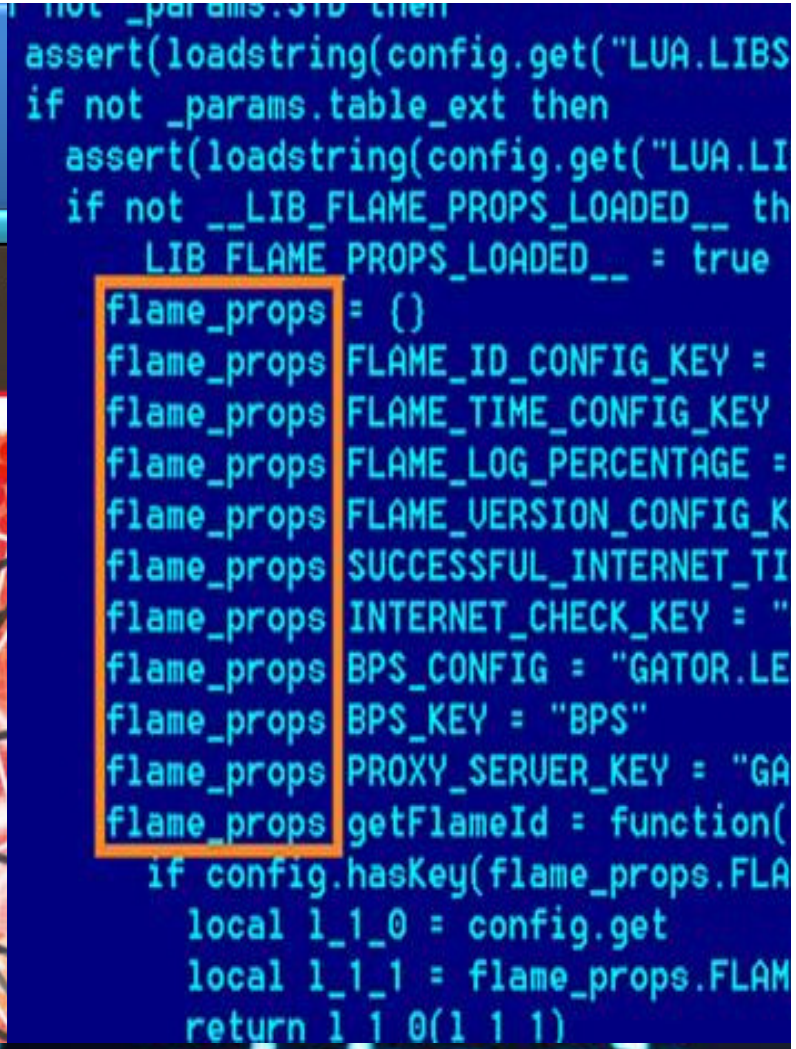
Sophisticated Virus Infects Computers in Iran, Mideast

Nations prepare for cyber war

By David Goldman@CNNMoneyTechJanuary 7, 2013: 5:40 AM ET



Rogue State Sponsored Death by Digital Annihilation?



Terminator RIP -Tomorrow's Soldier – Hacker Force aka Geek Squad

Geek Squad

Florence Colgate
PhD, Computer Science

Geek Squad

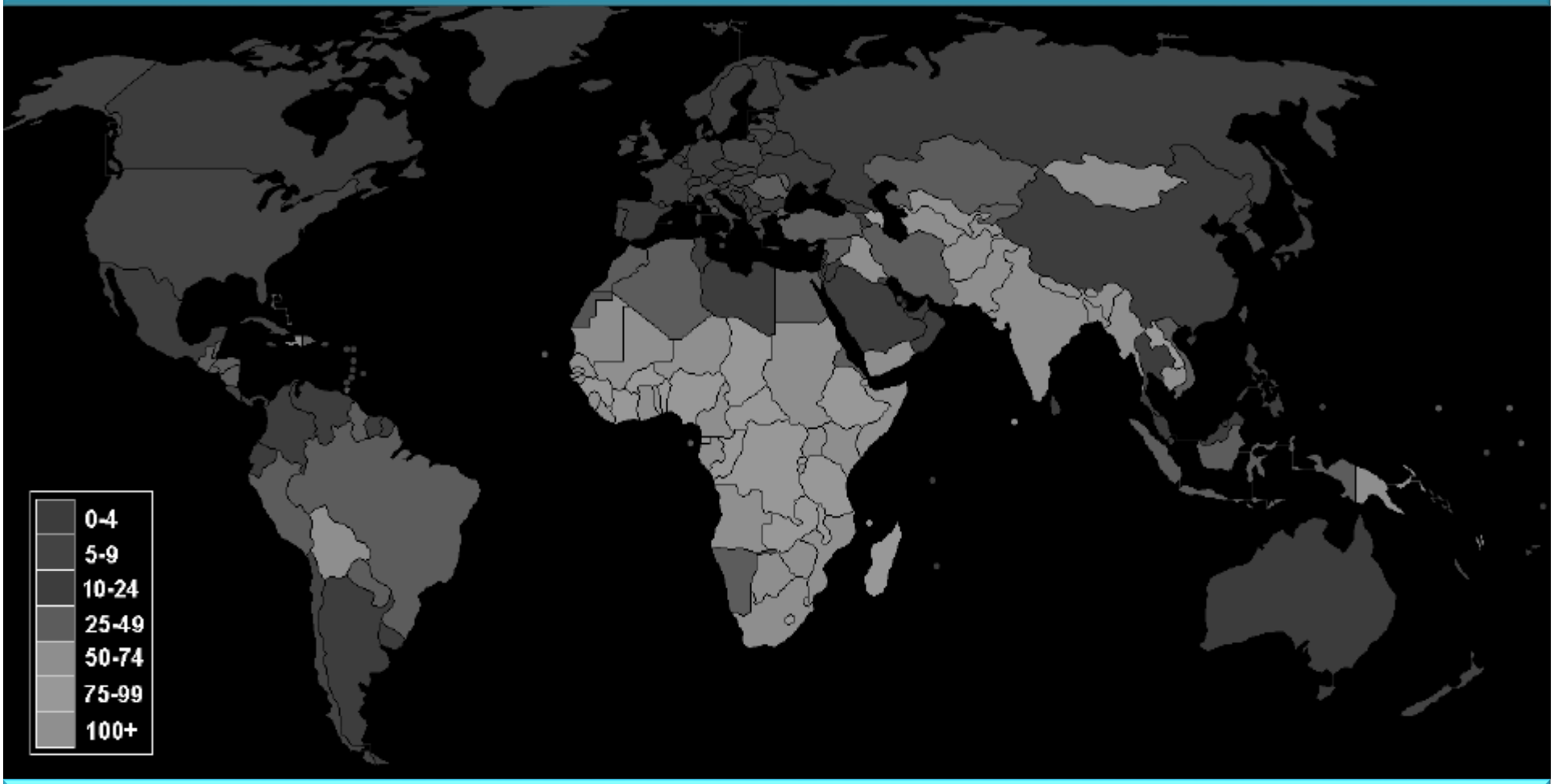
Chuck Norris
PhD, Software Engineering

Survivors Will Create New Markets … The Geeks Shall Inherit the Earth

Imagining new lines of future business is easy but creating markets and realizing business growth is a test of vision and tenacity. We must pursue the arduous task of economic development which can be painfully slow. Creating educated consumers who can afford to pay for a better life style and improved standard of living is rooted in education. It requires almost quarter century of investment before one can even begin to think of reaping the harvest. Rampant pleonexia, existing social inequality and gender injustice makes it difficult to inculcate these principles to lift the bottom billion and transform them from welfare recipients to economic contributors, customers and consumers of goods and services.

http://www.guardian.co.uk/books/2012/jul/13/price-inequality-joseph-stiglitz-review

The War on Poverty <> Life Style Technologies vs The Bottom Billion's Chance at Life



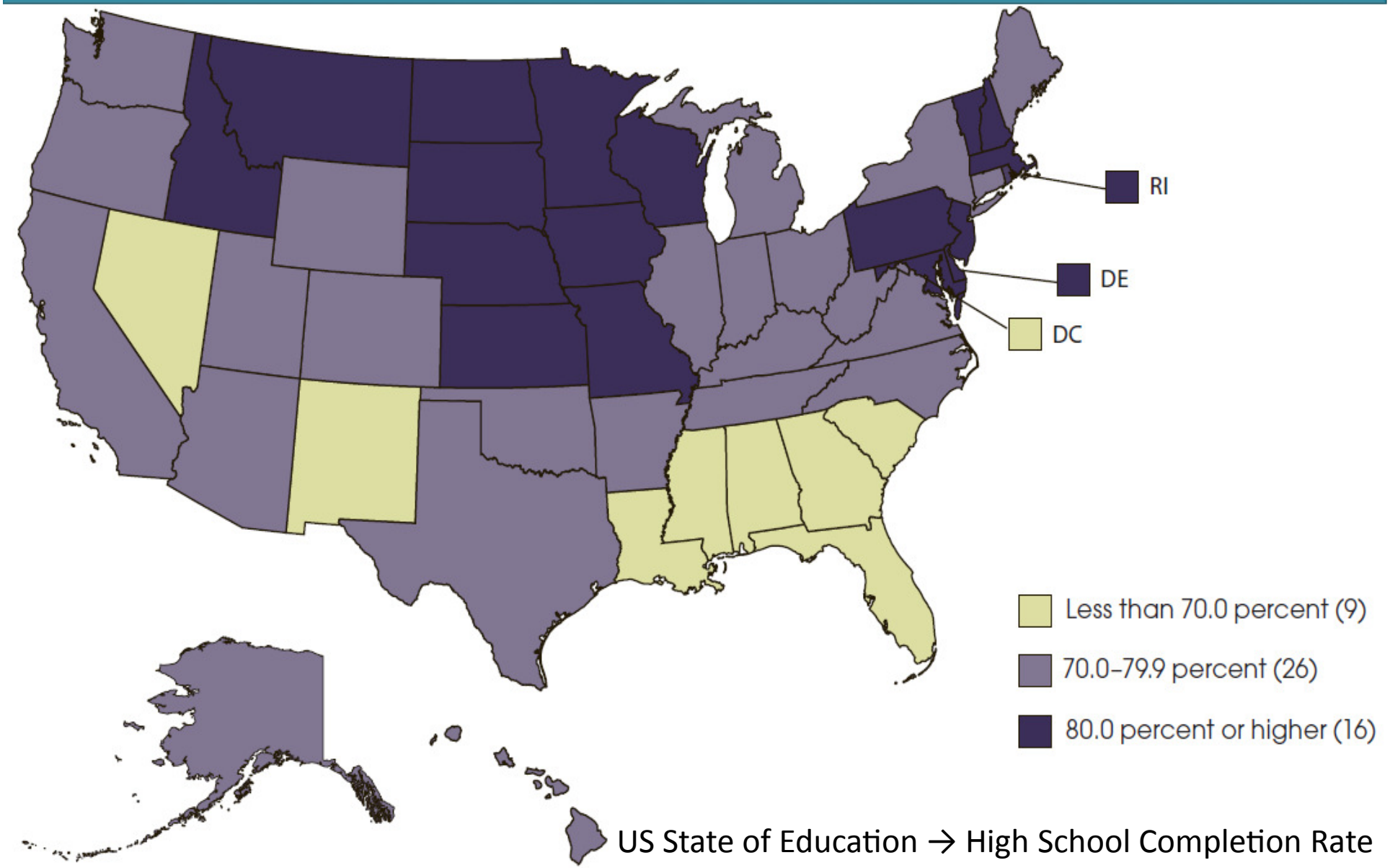
Reality Check ☑ Infant Mortality Rates Around The Globe

Reality Check ☑ Water

884 million	people lack access to safe water supplies — approximately one in eight people
6 kilometres	is the average distance African and Asian women walk to fetch water
3.6 million	people die each year from water-related diseases
98 per cent	of water-related deaths occur in the developing world
84 per cent	of water-related deaths are in children ages 0–14
43 per cent	of water-related deaths are due to diarrhoea
65 million	People are at risk of arsenic poisoning in the Bangladesh, India and Nepal area

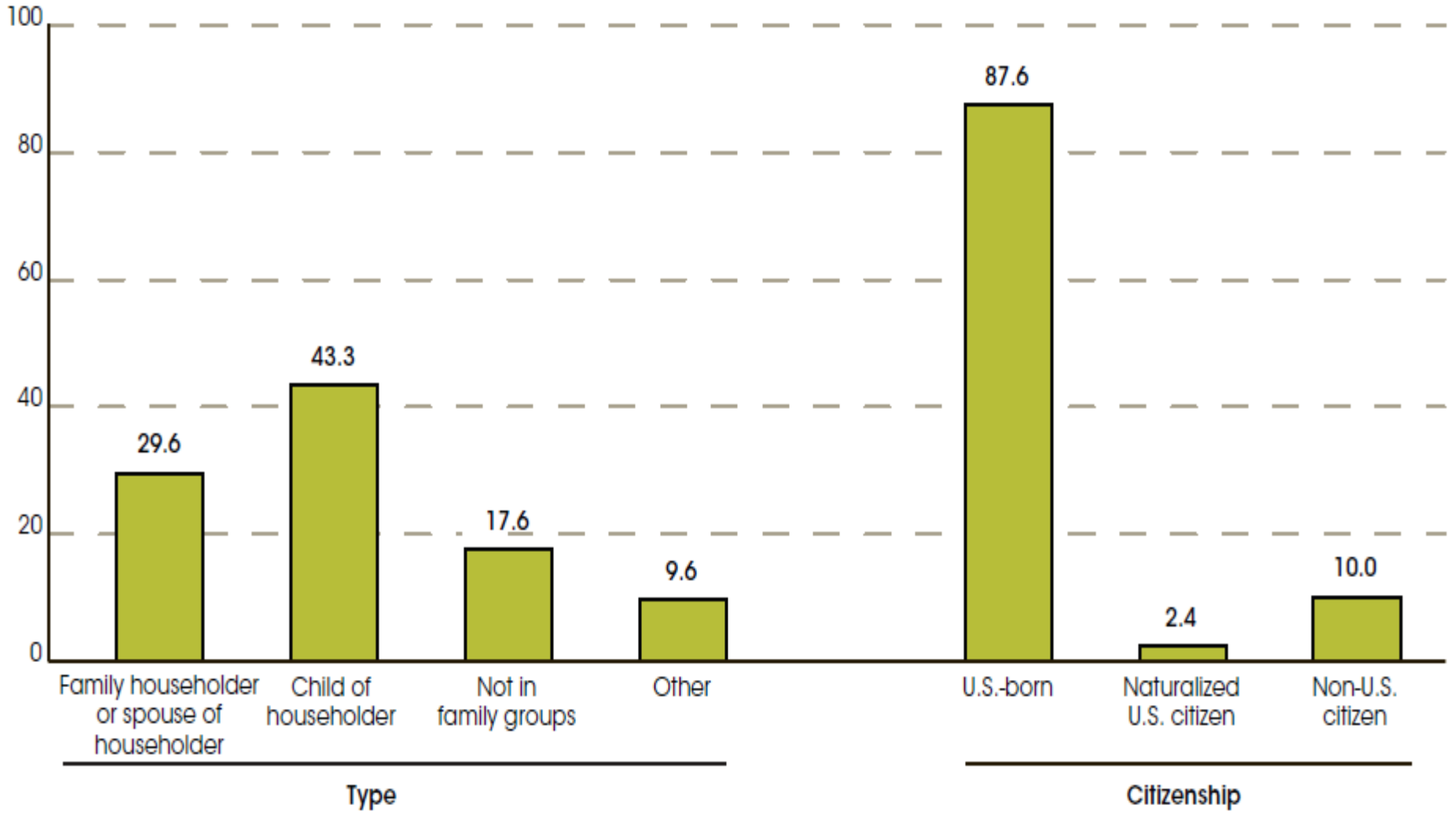
www.scidev.net/en/features/nanotechnology-for-clean-water-facts-and-figures.html

Reality Check ☑ Education



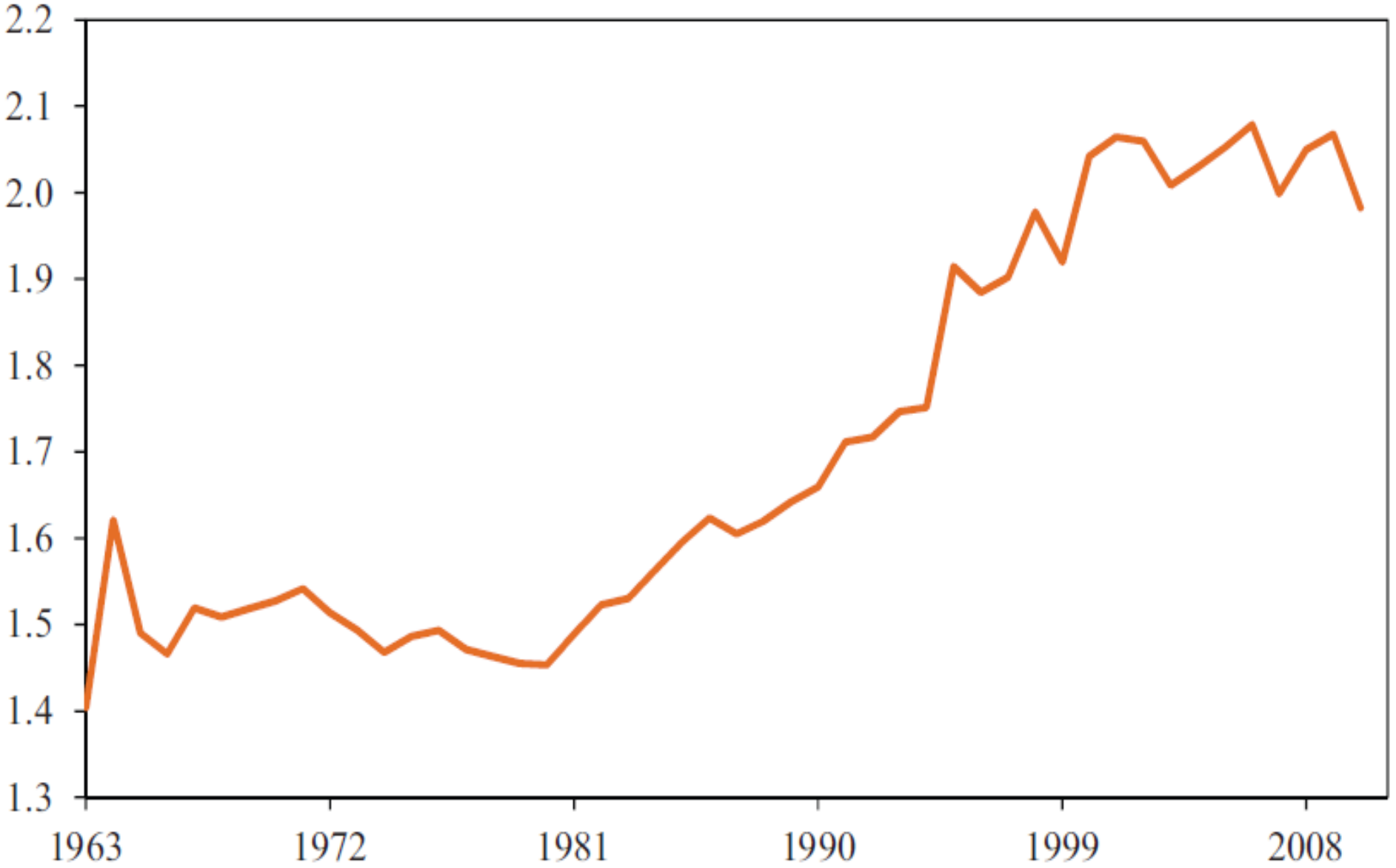
US State of Education → High School Completion Rate

Reality Check ☑ US State of Education → Drop-out Demographics

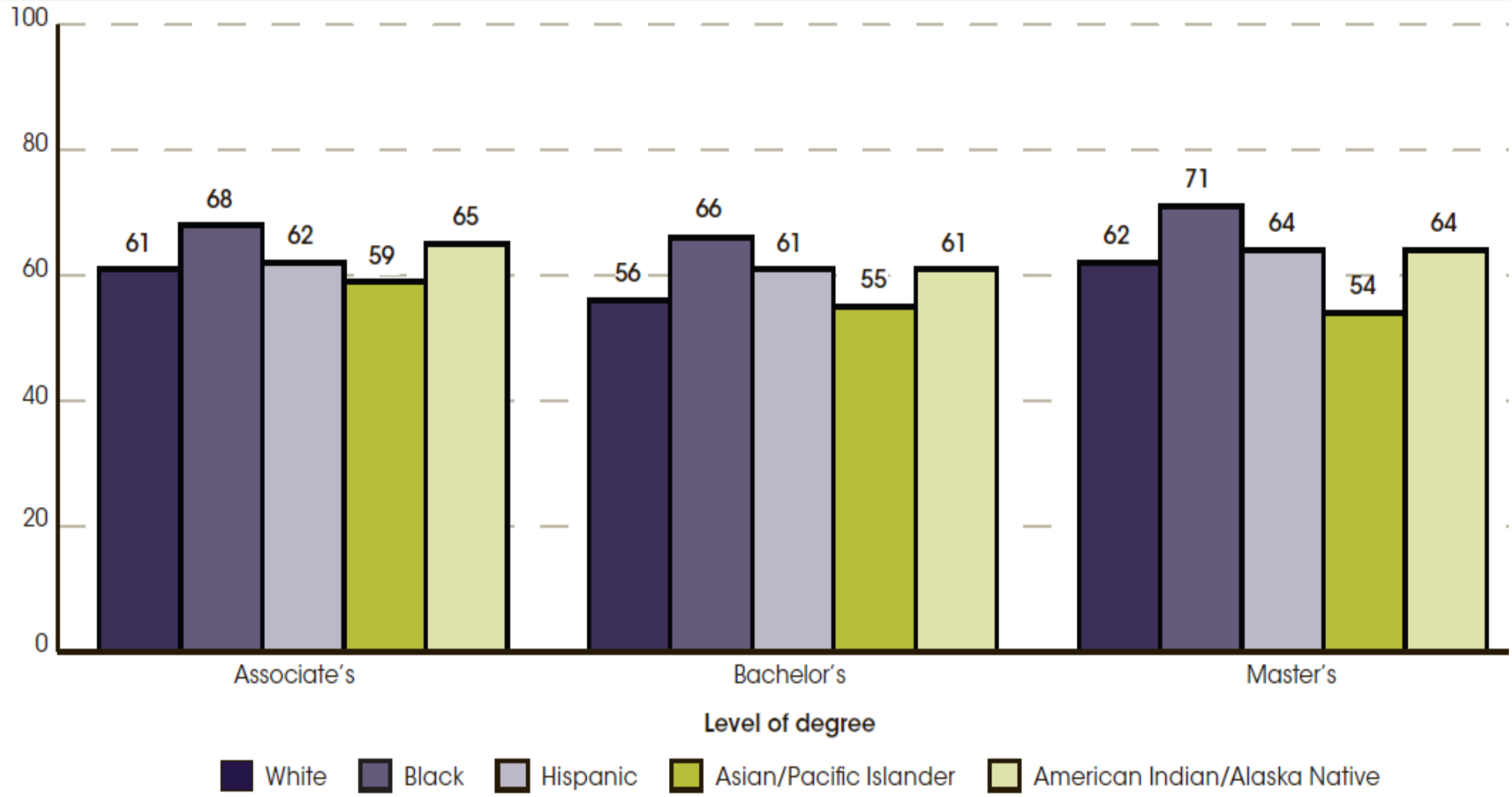


Percentage distribution of 16-24 year olds neither in school nor working

Earnings Ratio ☑ College Degree to High School Graduation

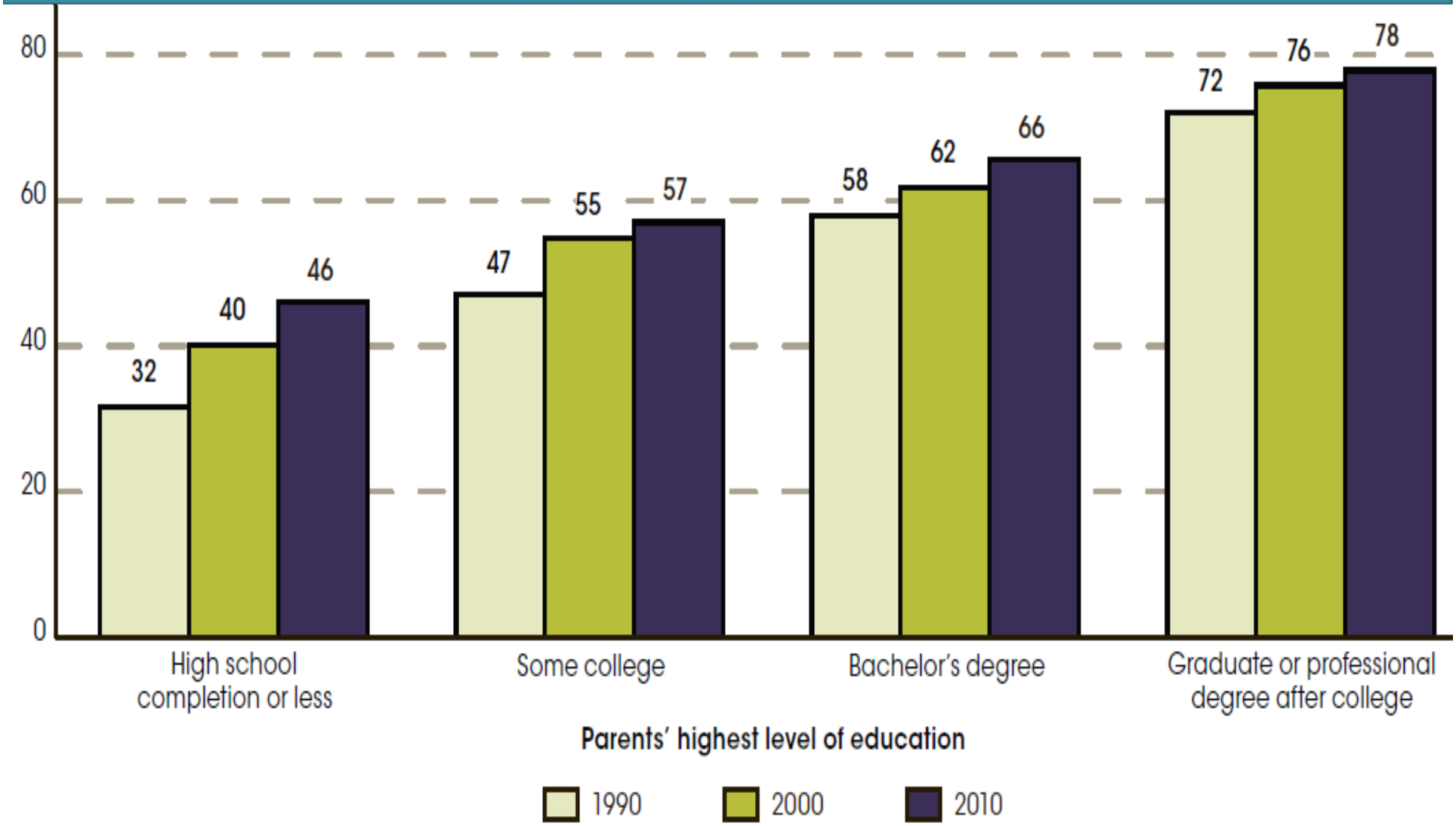


Good News ☑ Percentage of degrees conferred to US-resident females



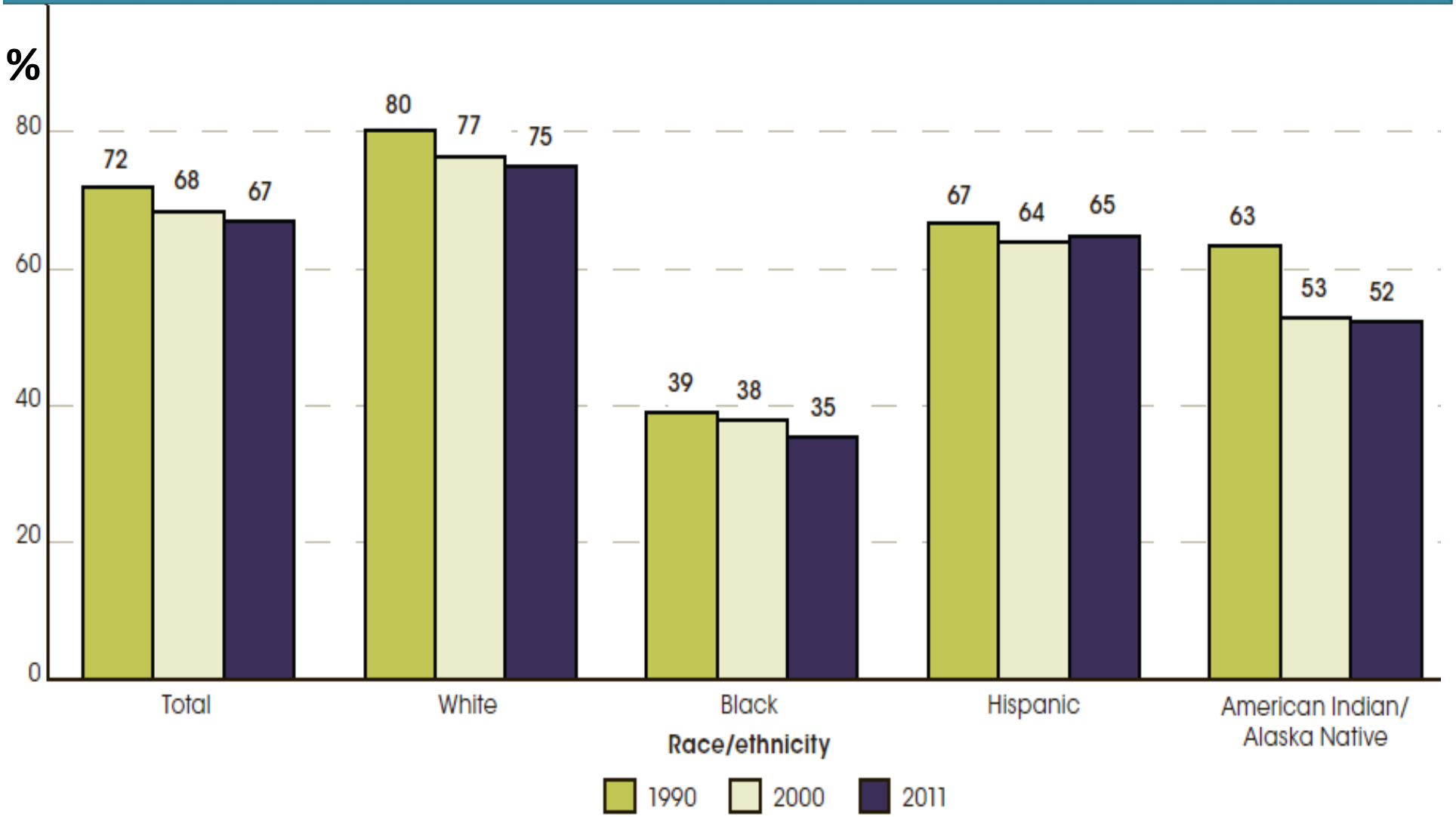
The education of a boy influences the fate of a man. The education of a girl changes the destiny of a nation.

US Education → *Destiny's Child ?*



12th grade students with definite plans to graduate from 4-year college

US Education → *The Writing On The Wall ?*

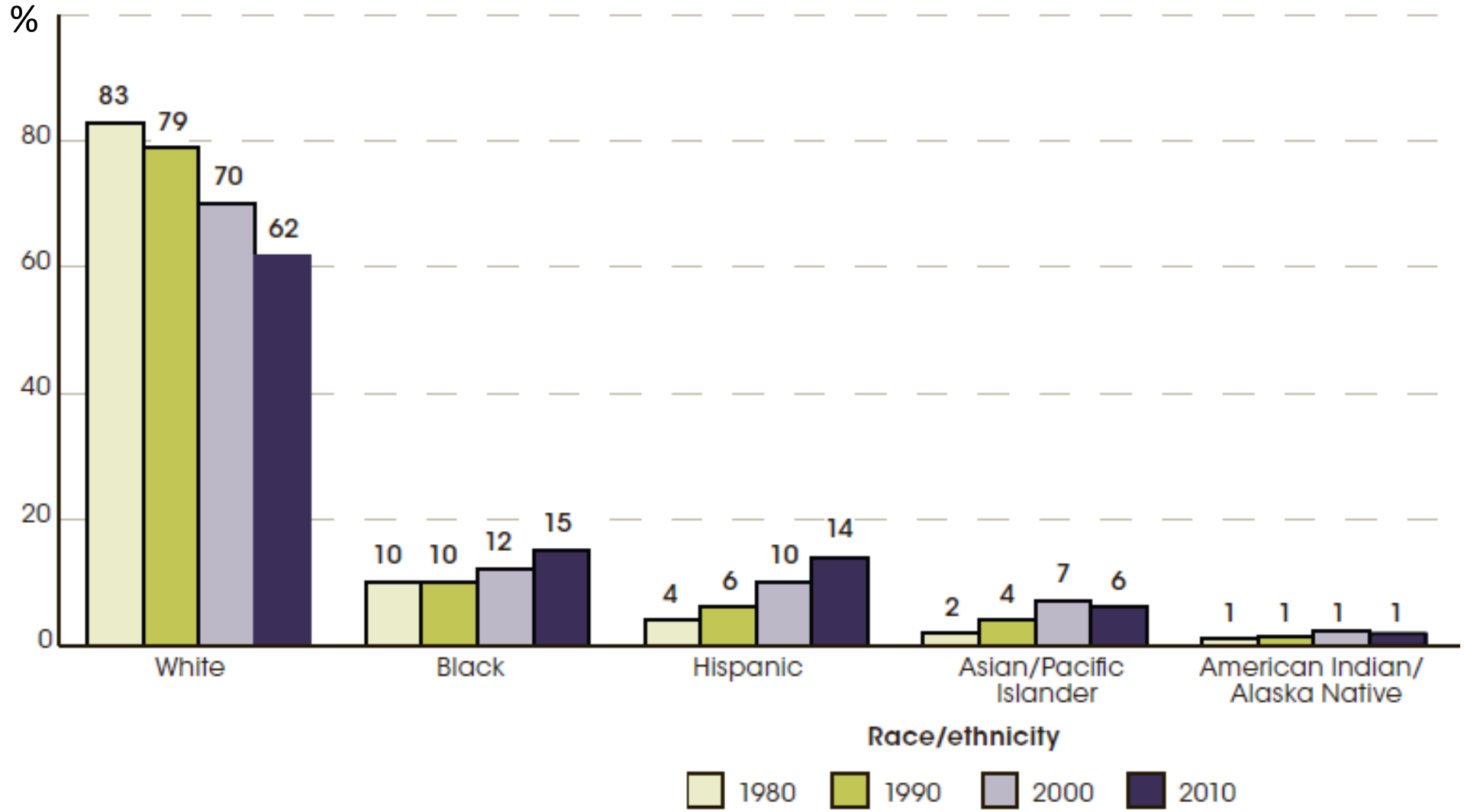


Distribution of students (5 to 17 years) living in two-parent households

US Education → *Fait accompli ?*

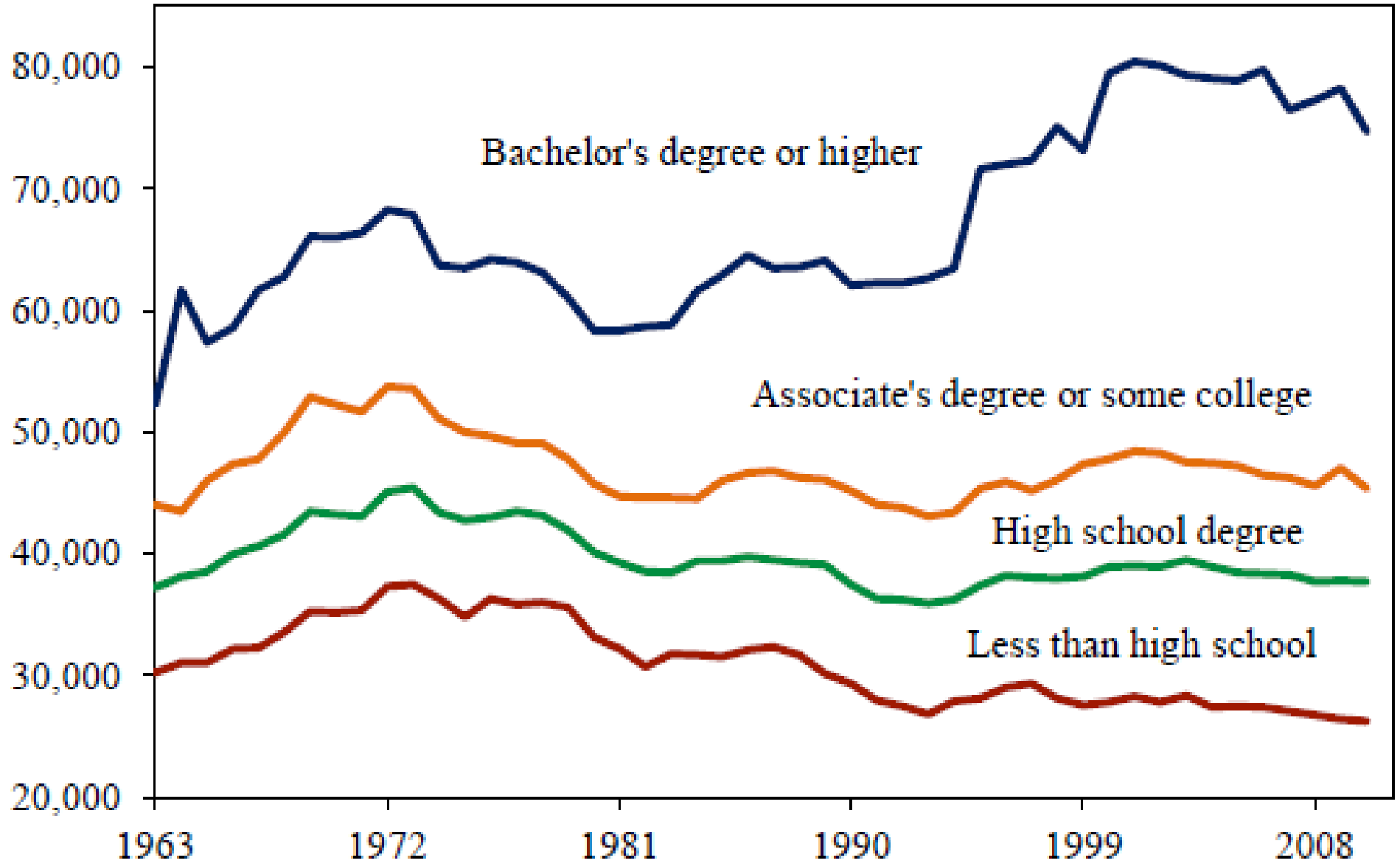
Distribution of students enrolled in elementary & secondary education

US Education → *Quod erat demonstrandum (QED)*



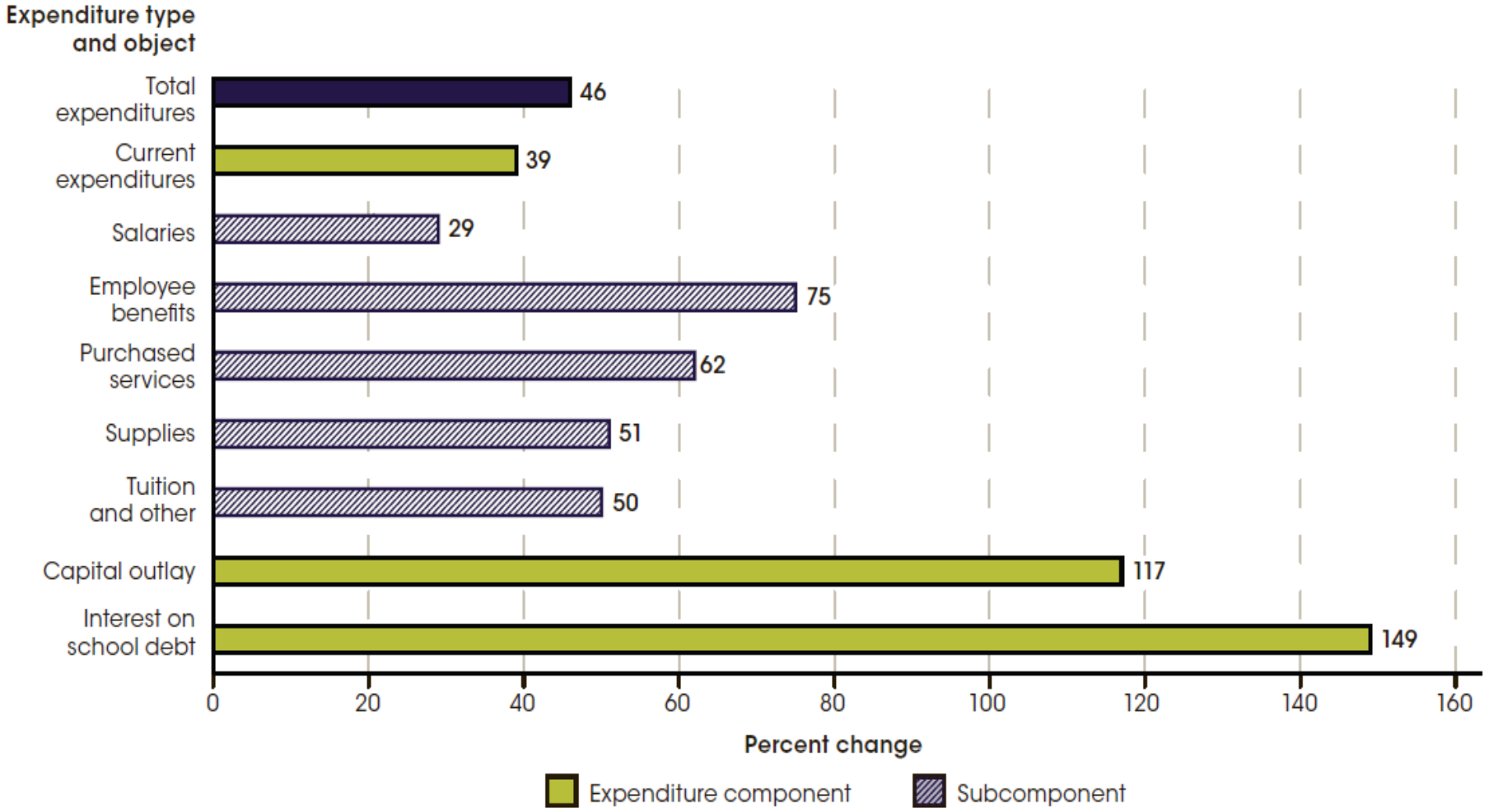
Undergraduate enrollment of US-residents in post-secondary education

US Education Level → Average Annual Earnings (2010 Dollars)

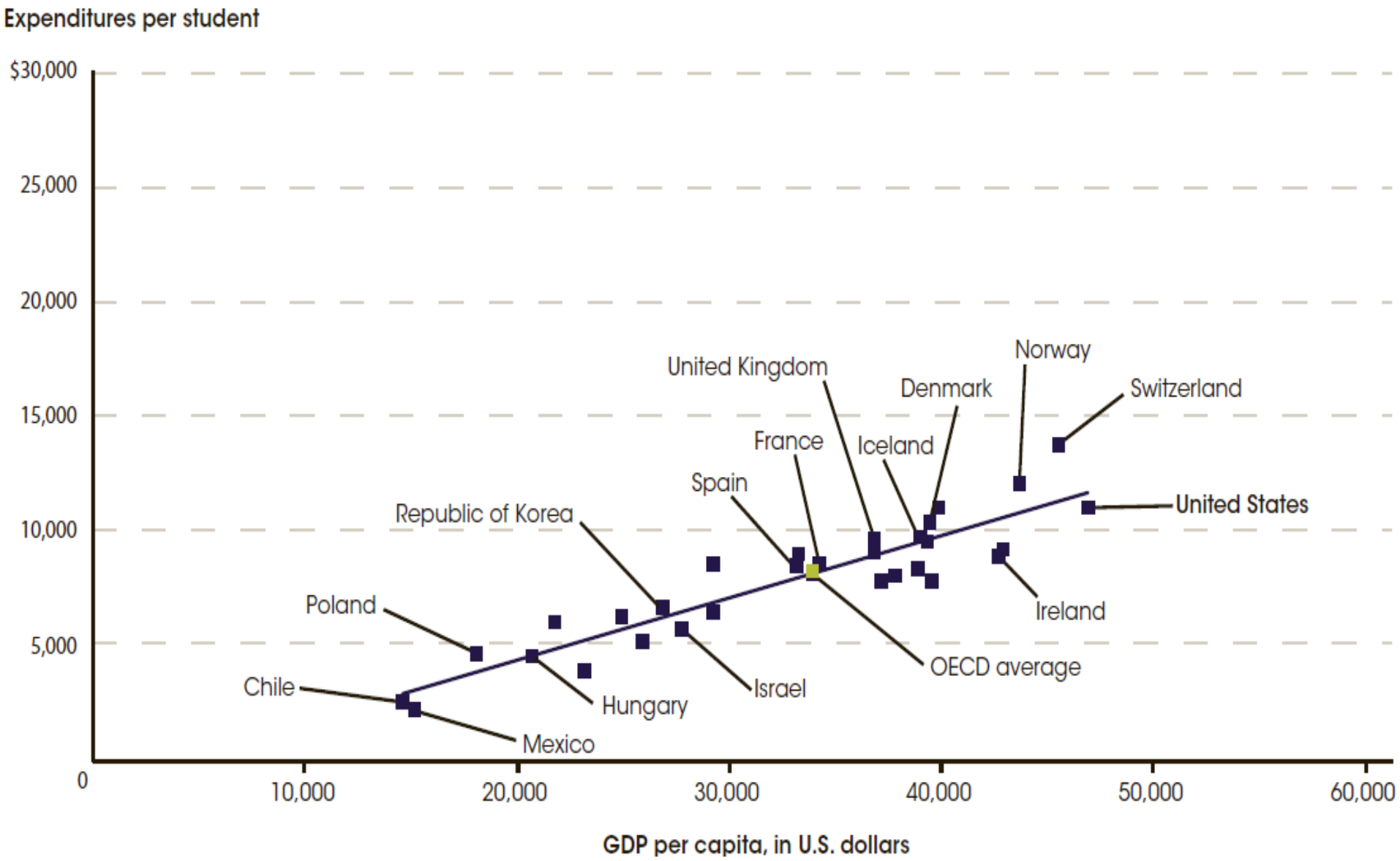


US Education → Finances

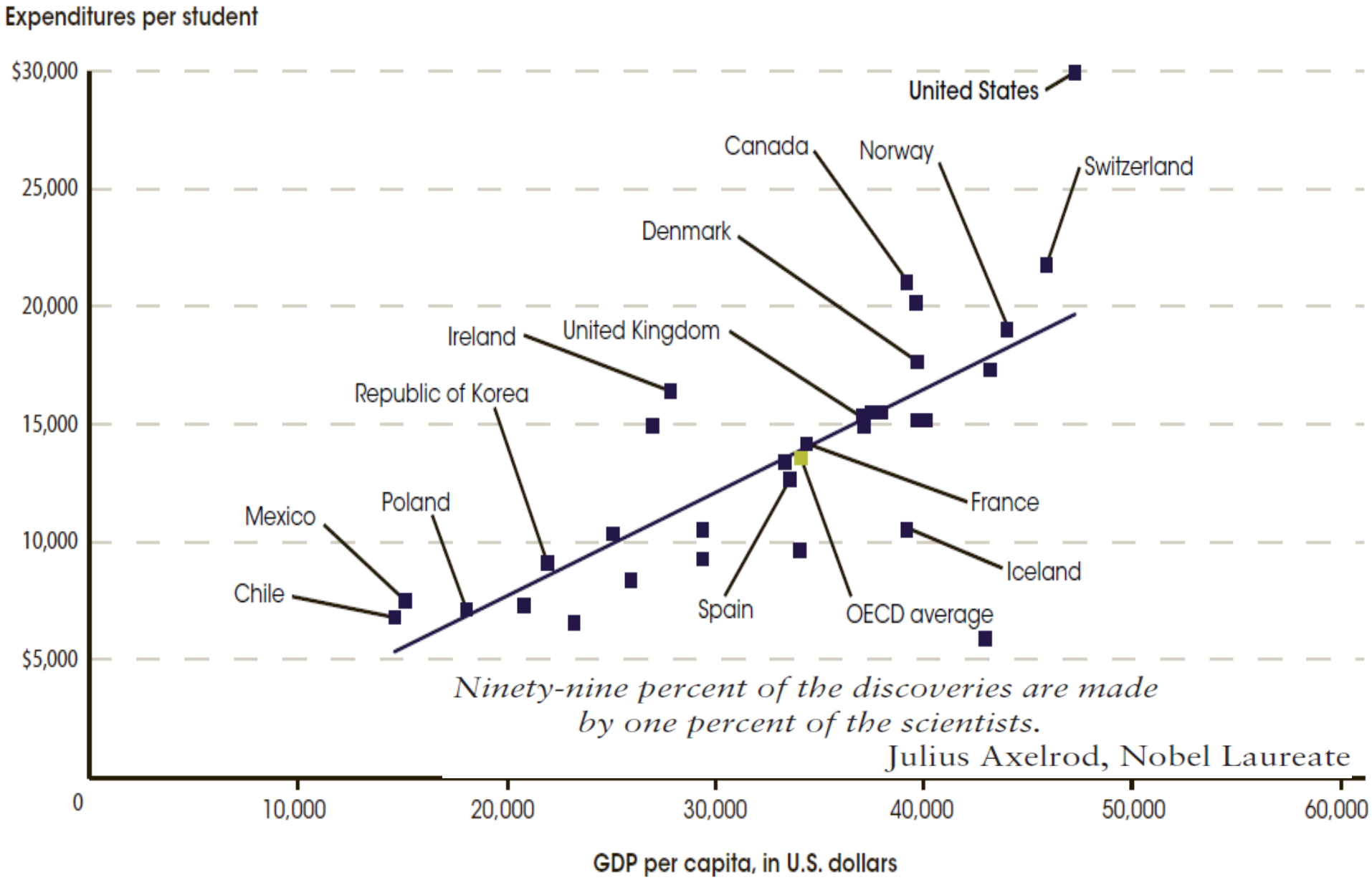
Percentage change in total expenditures per student in fall enrollment in public elementary and secondary schools, by expenditure type and objects of current expenditures, in constant 2010–11 dollars: School years 1988–89 to 2008–09



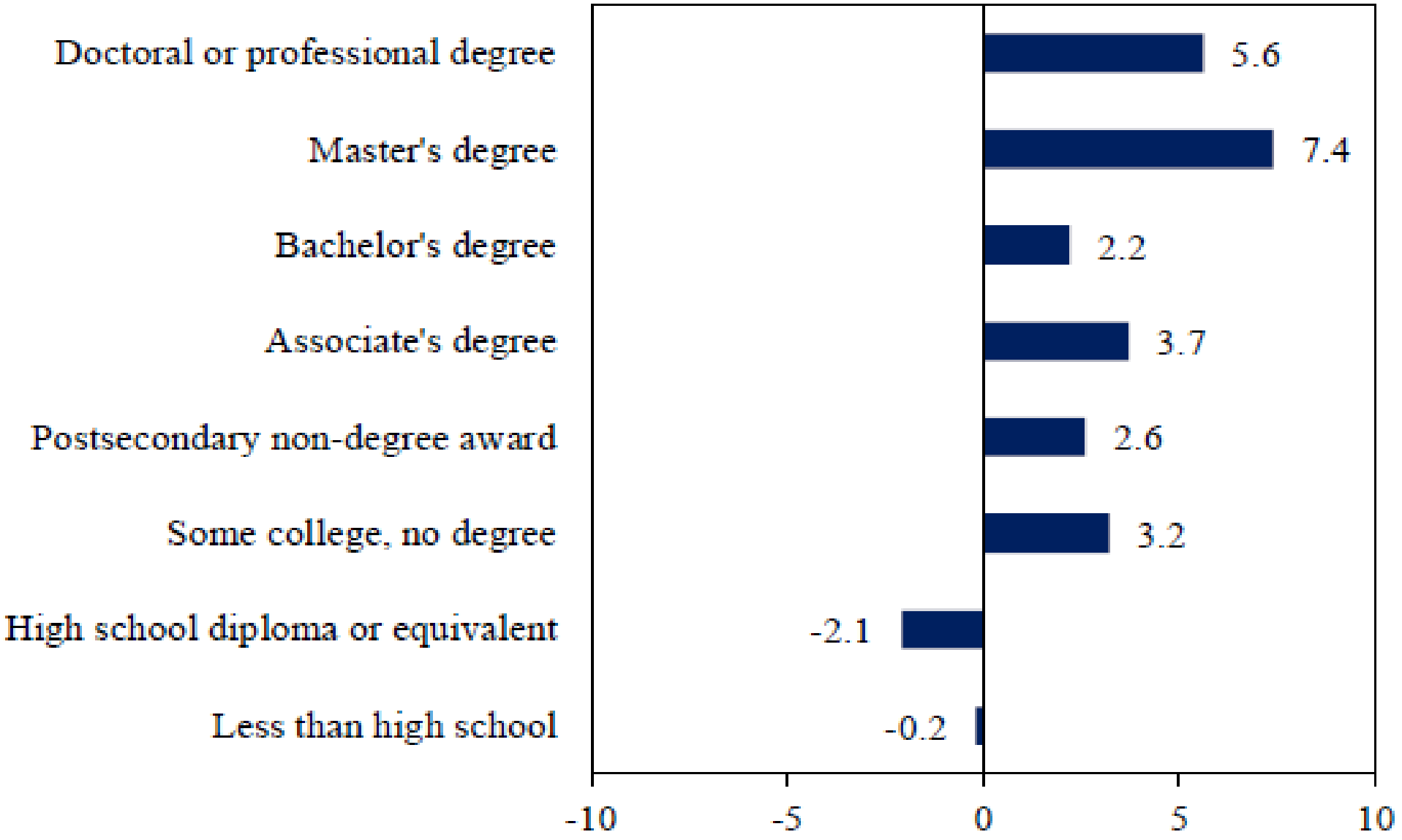
US Education → Comparative Investment in Pre-College Education



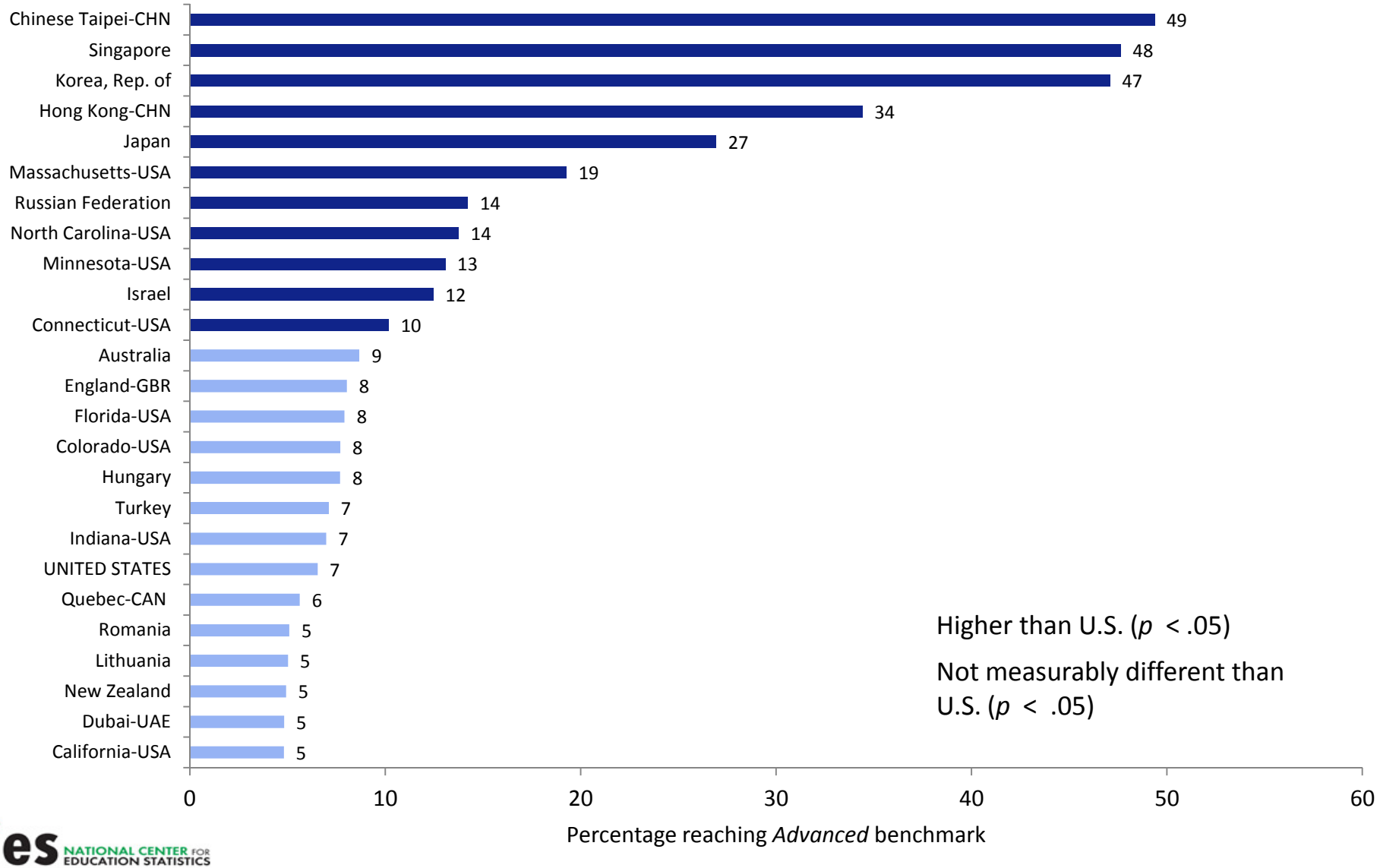
US Education → Comparative Investment in Post-Secondary Education



US Education → Projected Employment Growth 2010-2020 (% change)



US Education → Performance → Mathematics by 8th Grade Students



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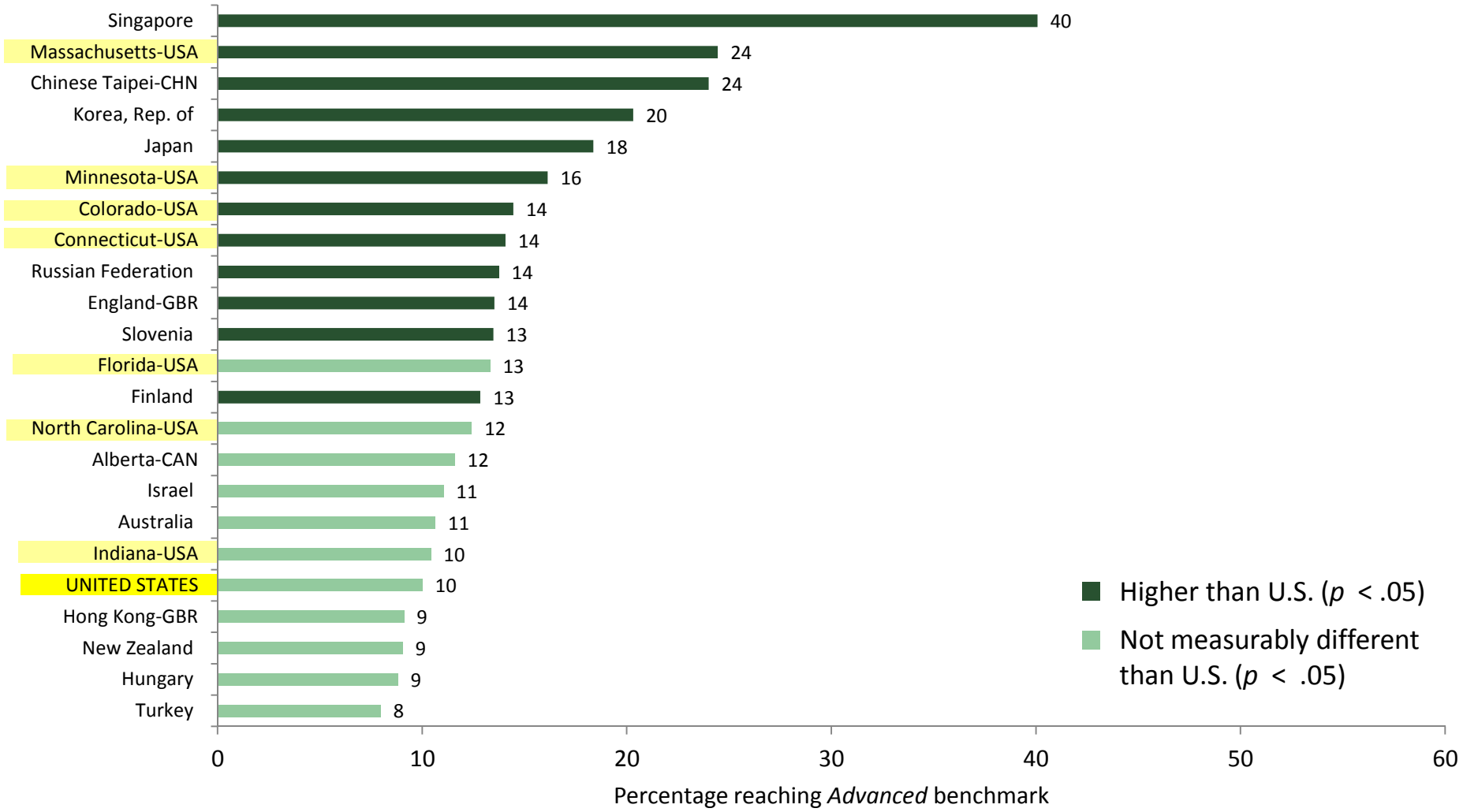
Institute of Education Sciences

US Education → Performance → Science by 8th Grade Students



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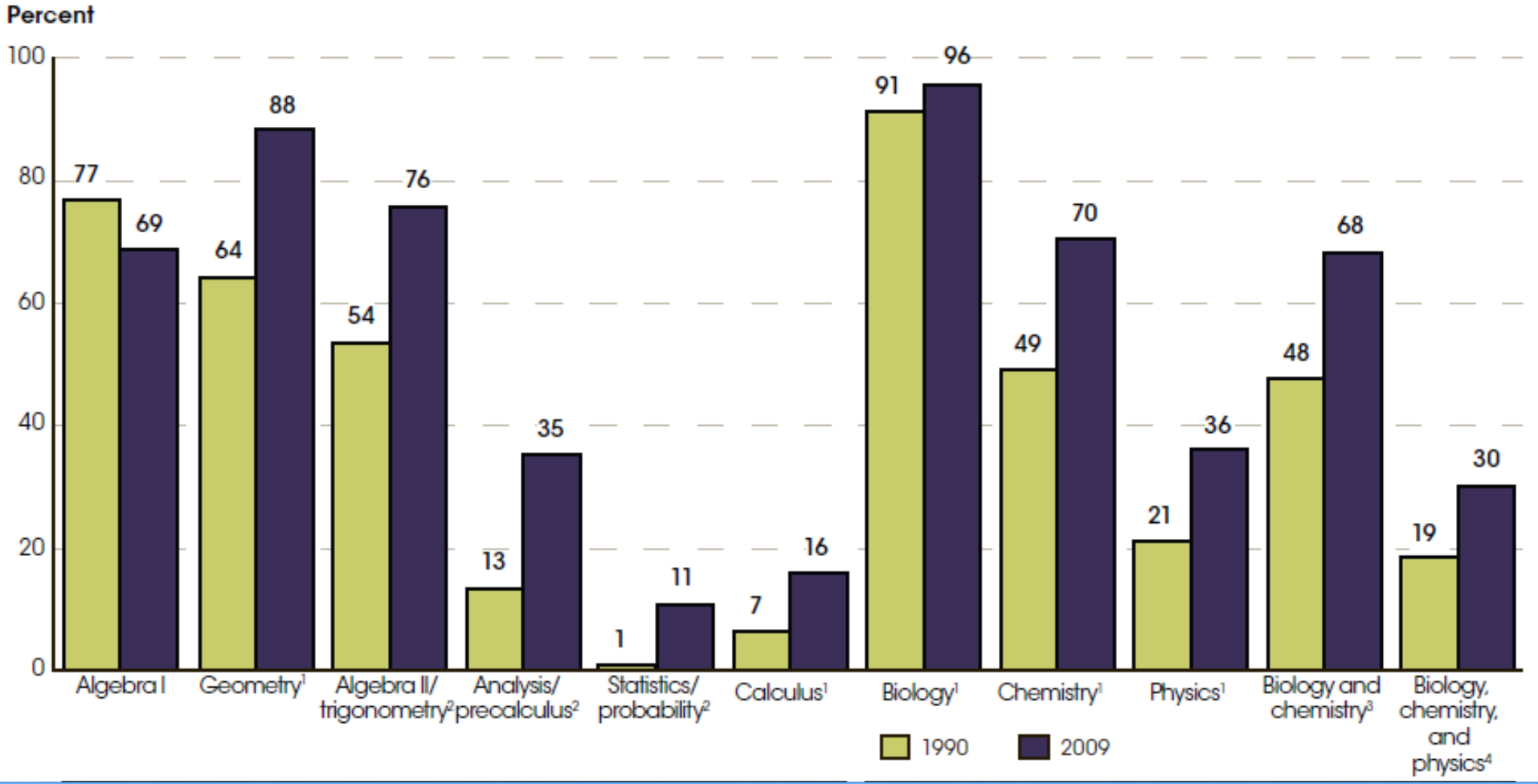
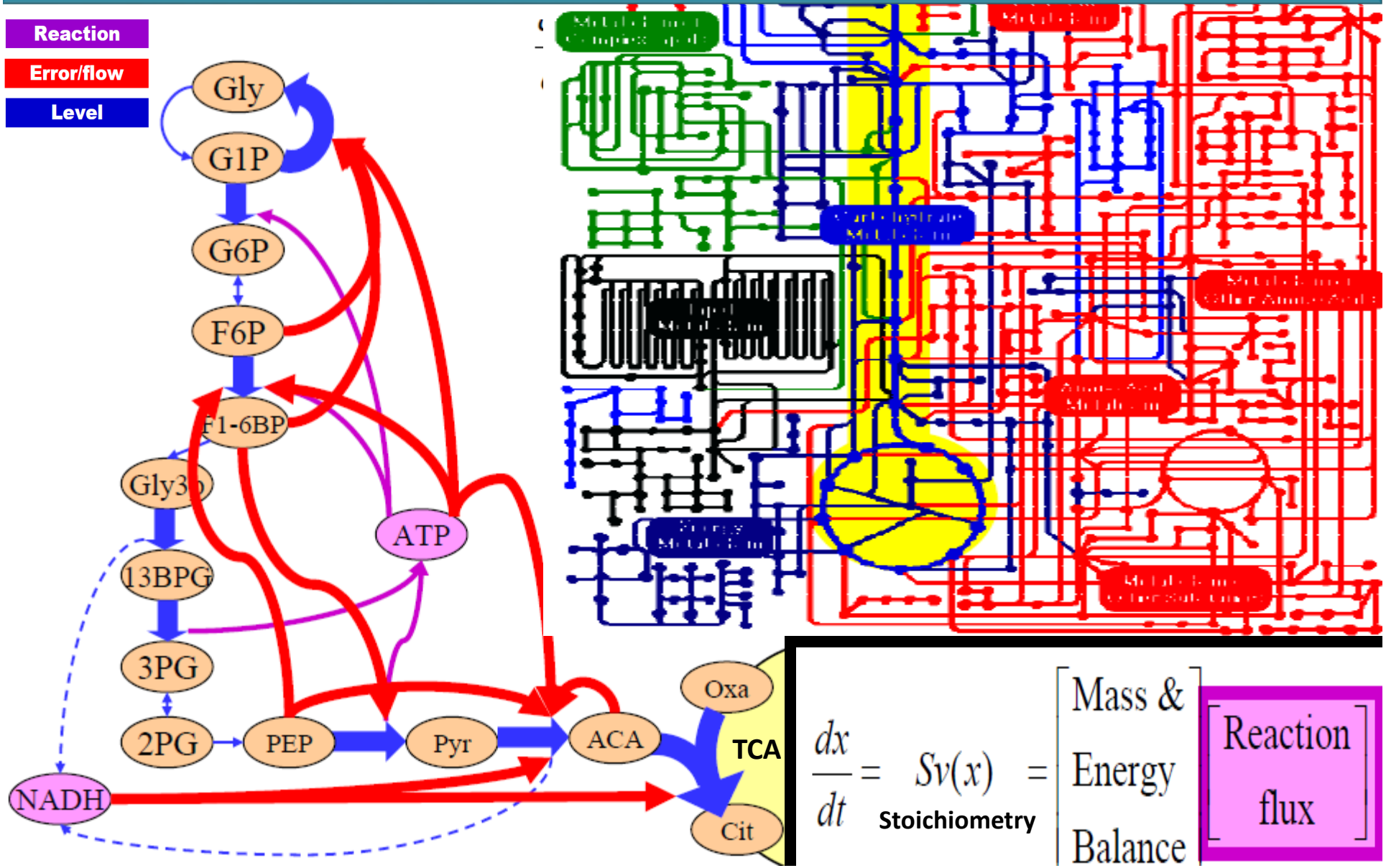
Biology void of chemistry and mathematics



Enrollment of high school graduates in science and mathematics courses

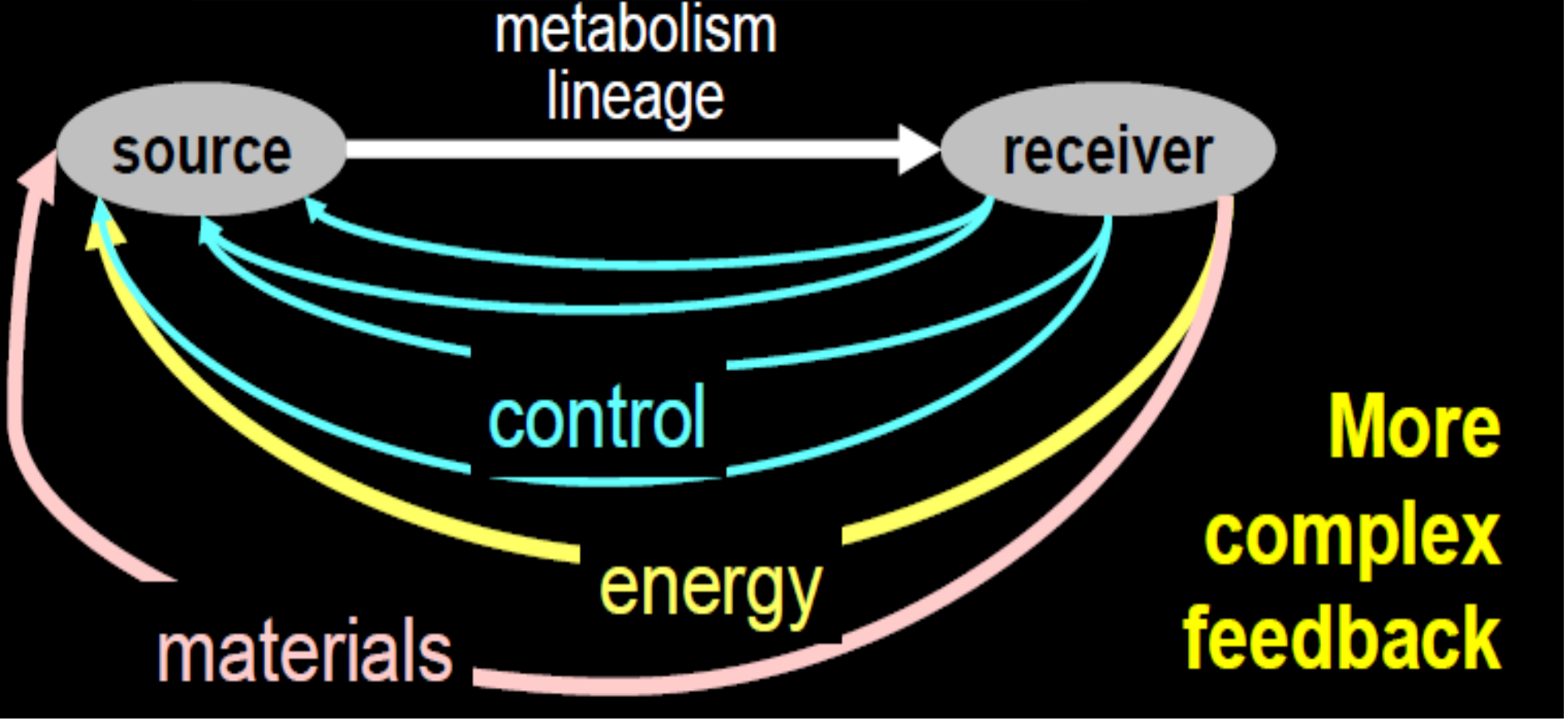
Dumbed-down descriptive biology infecting schools & general colleges

Biology void of chemistry and math cannot deliver value of bio-systems

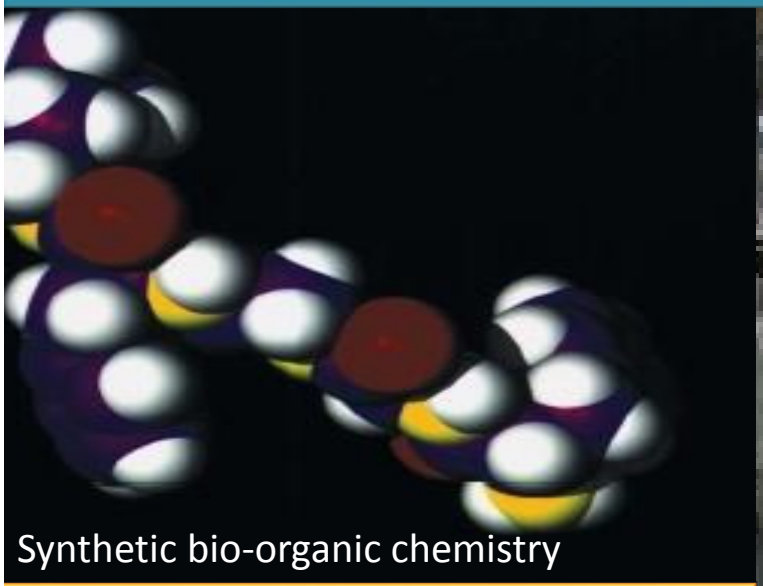


Understanding bio-systems network may help global complex problems

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

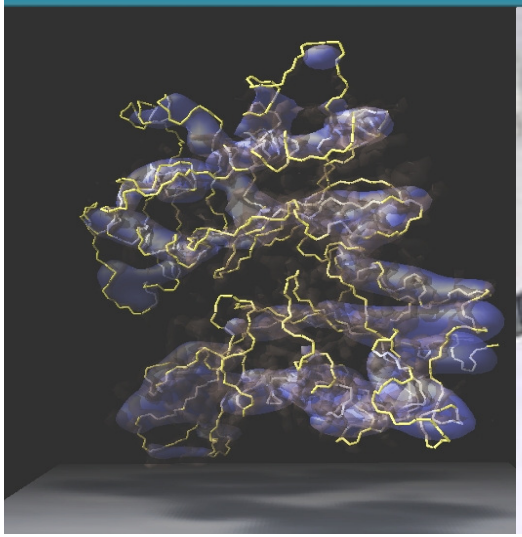


Understanding bio-systems is key to medicine, healthcare and pharmaceutical industry



Synthetic bio-organic chemistry

Metabolic Engineering - Protein RNA DNA



BIOLOGICS - MANUFACTURING

Vaccines from milk

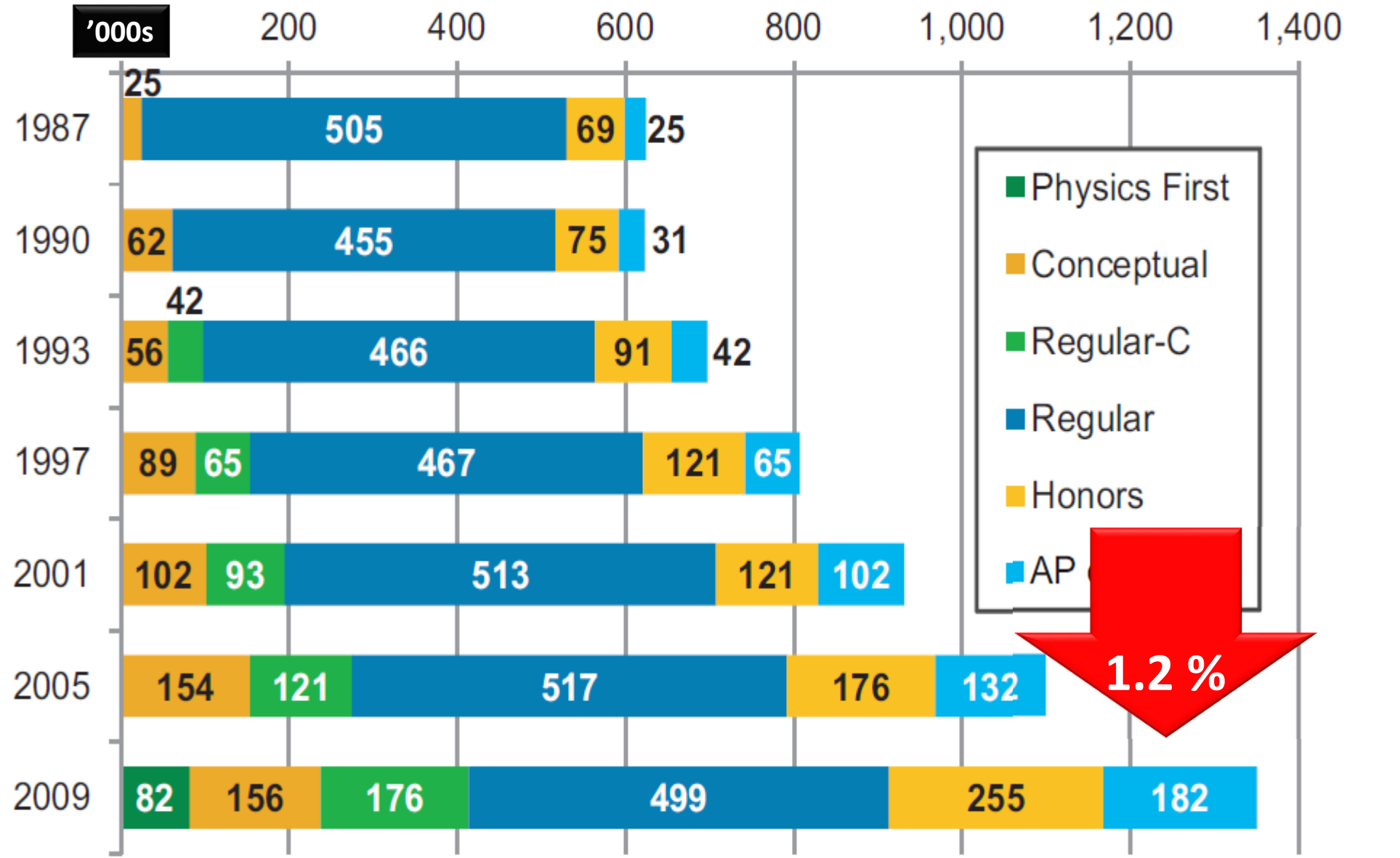
Vitamin A from rice

US Math-Science → School Teachers Lacking in Rigor in Math & Science

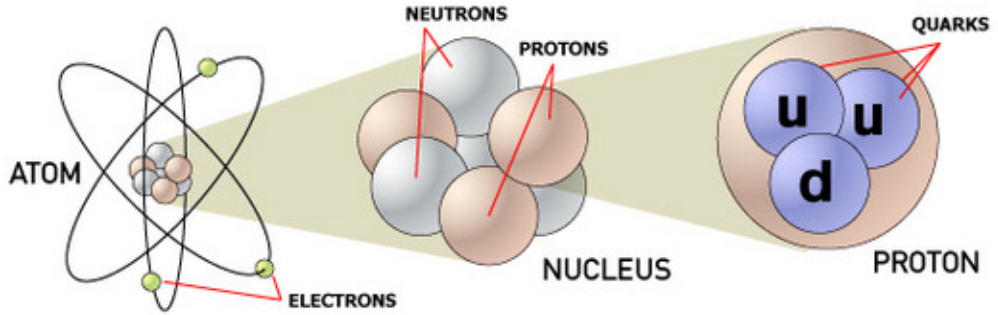
Number and percentage of grade 9–12 public school classes of various subjects taught by a teacher with a major and certification in that subject area, by selected subject areas: 2007–08

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

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



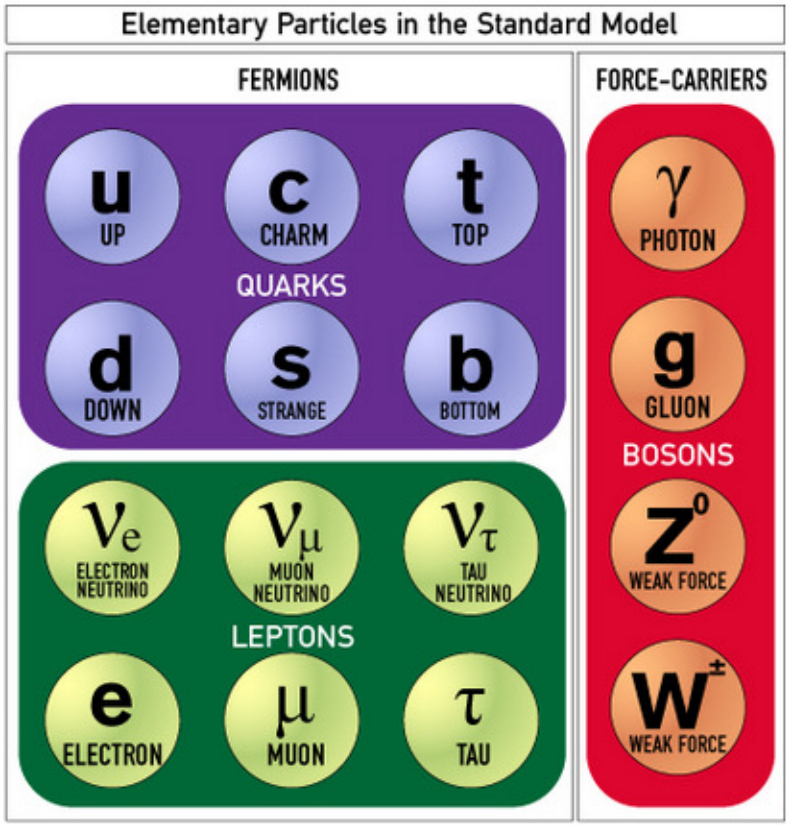
US Math-Science → Women BS Physics → 1,300 out of 1,000,000 (2011)

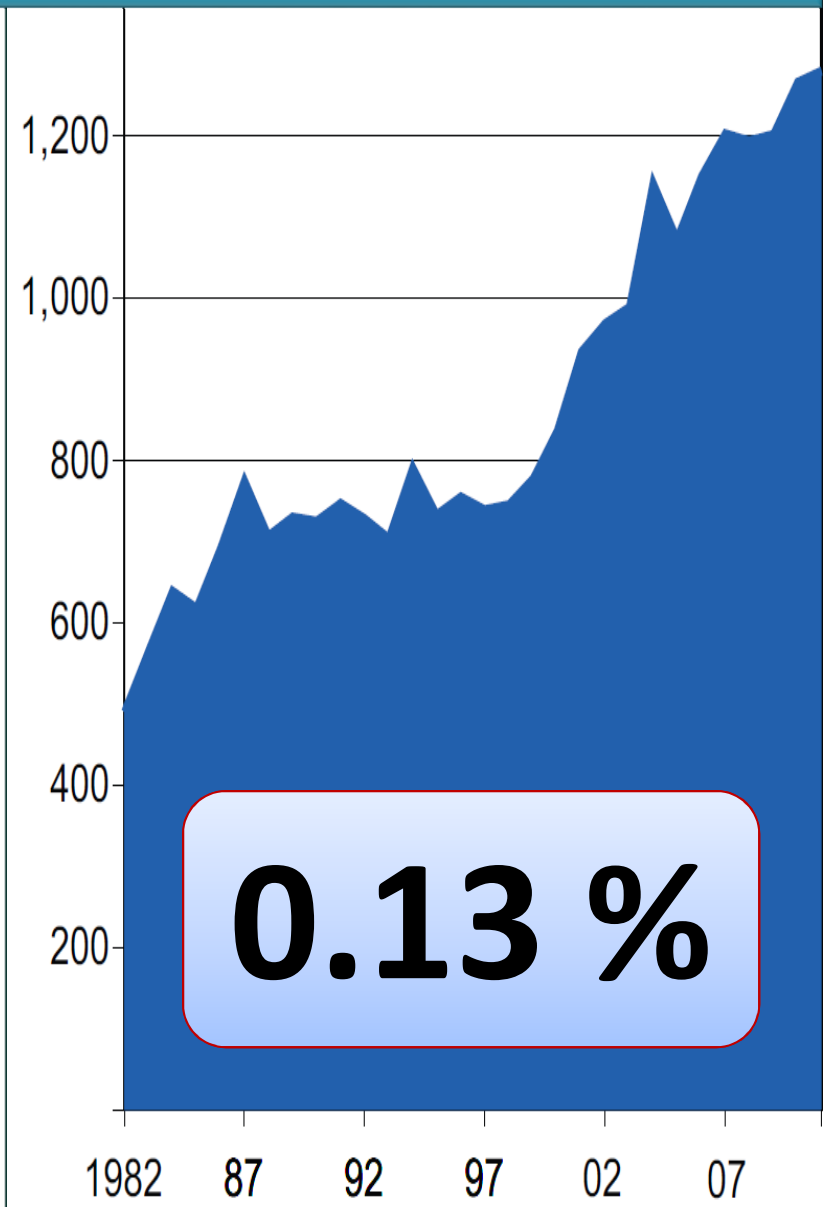


Three categories of particles form the **Standard Model**. Matter is composed of **fermions** (**quarks** and **leptons**). **Bosons** provide three forces: **electro-magnetism**, the **strong** nuclear force and the **weak** nuclear force.

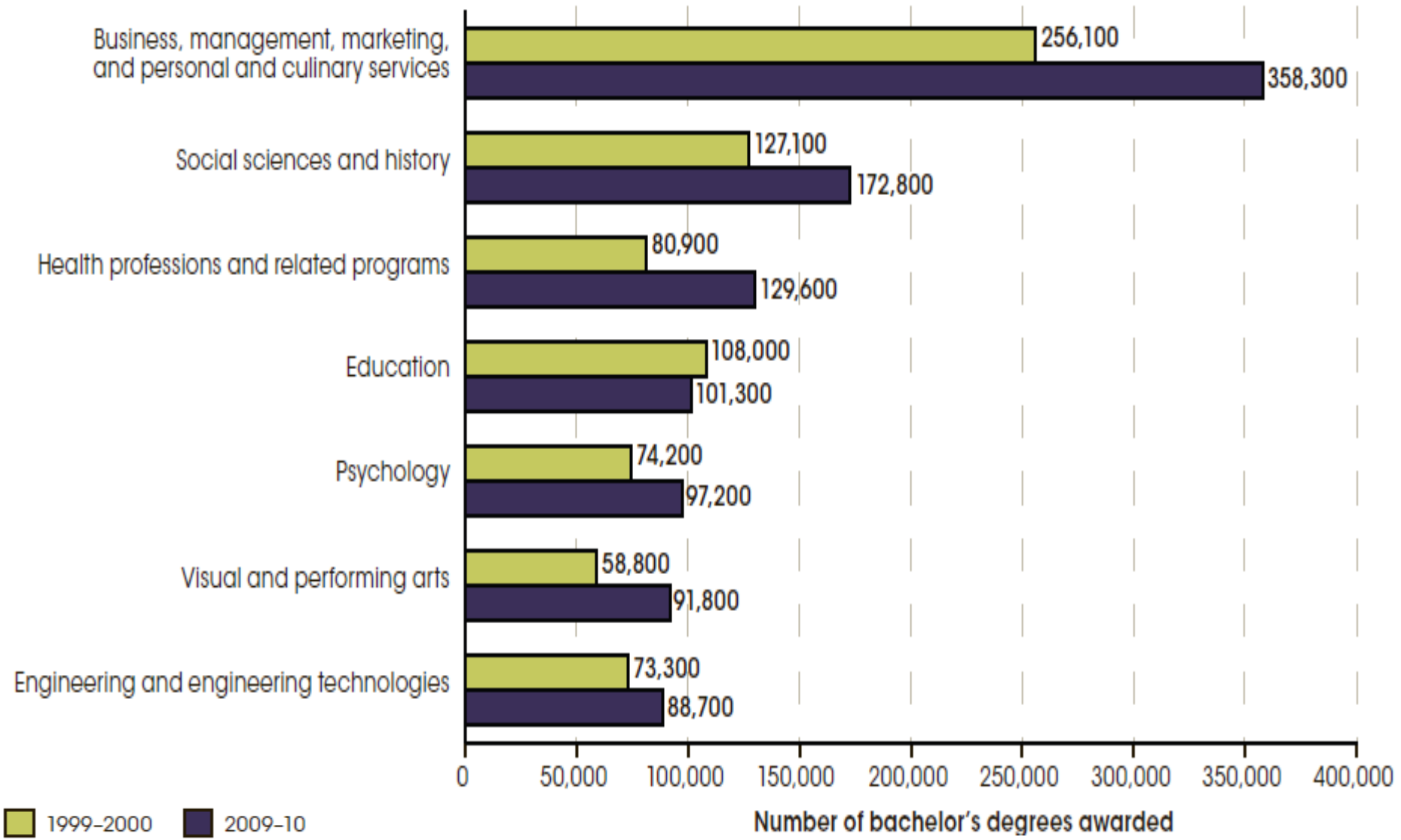
Currently the Standard Model is incomplete and does not explain many important features of the known universe, such as:

- **gravity**
- **mass**
- **dark matter** (23% of the universe)
- **dark energy** (73% of the universe)





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



Add gender gap to lack of rigor in math-science in US public education

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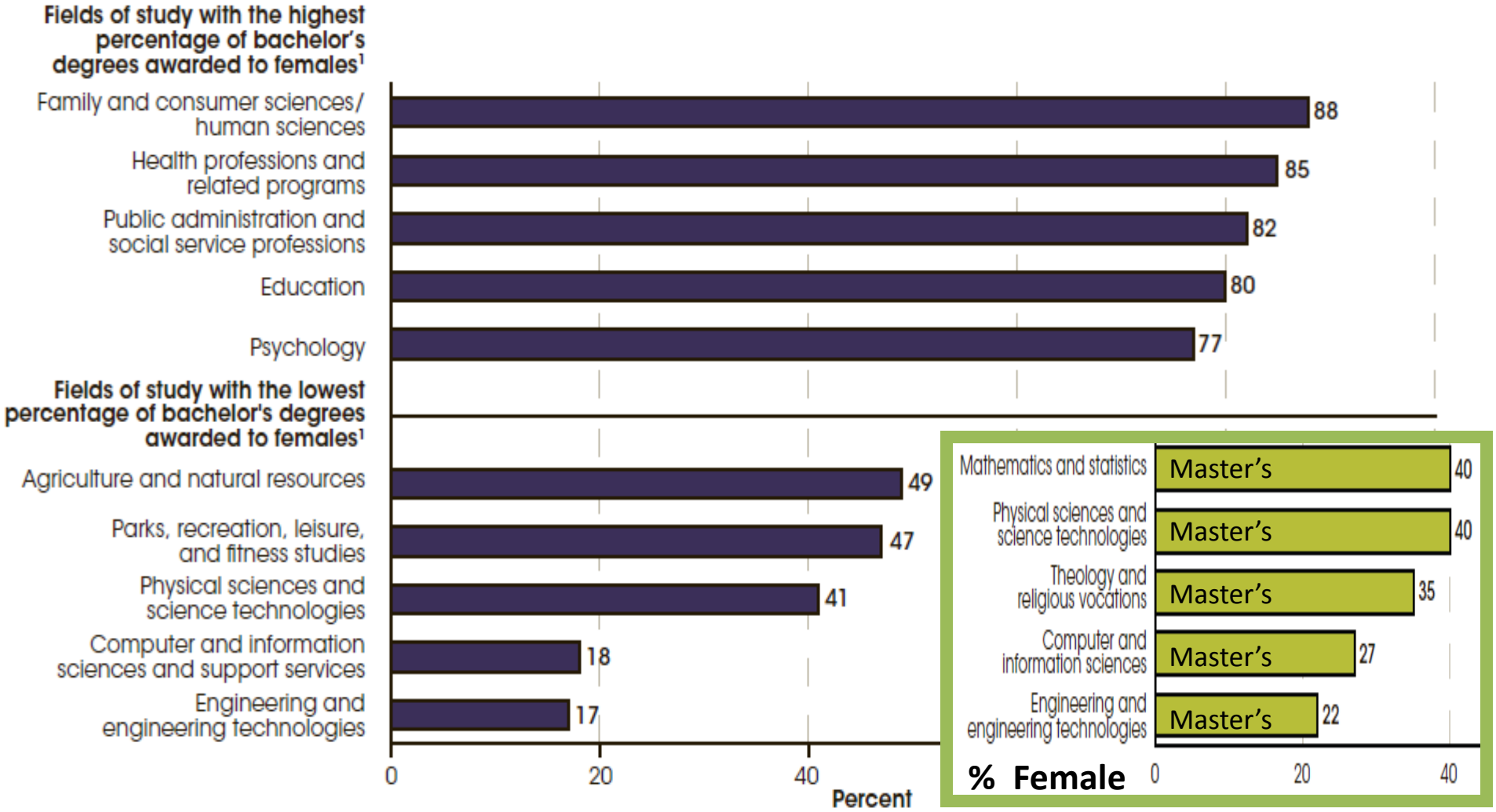
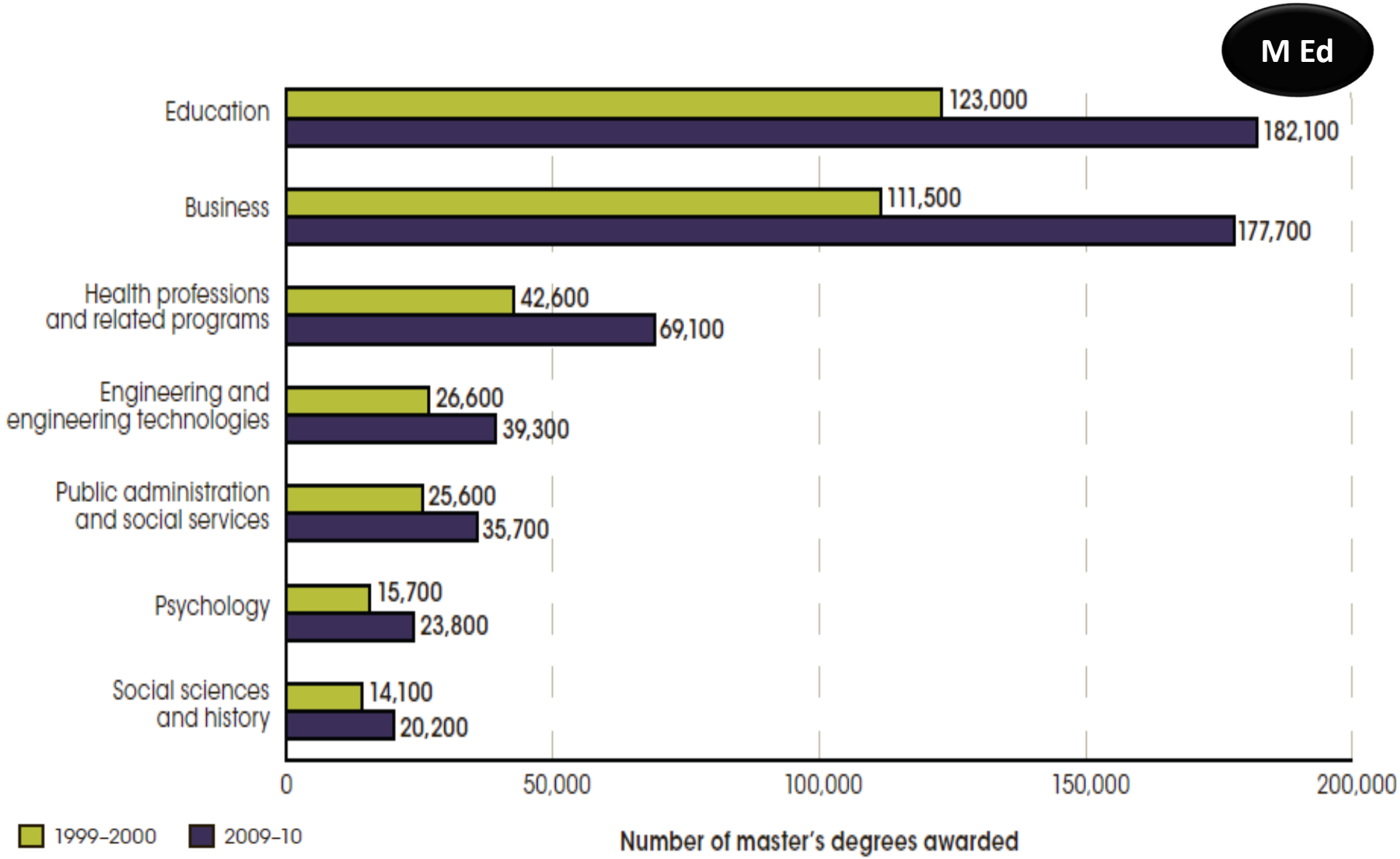
Percentage of bachelor's degrees awarded to females by degree-granting institutions in selected fields of study: Academic year 2009–10



Education ranks 1st in the number of Master's degree awarded in the US

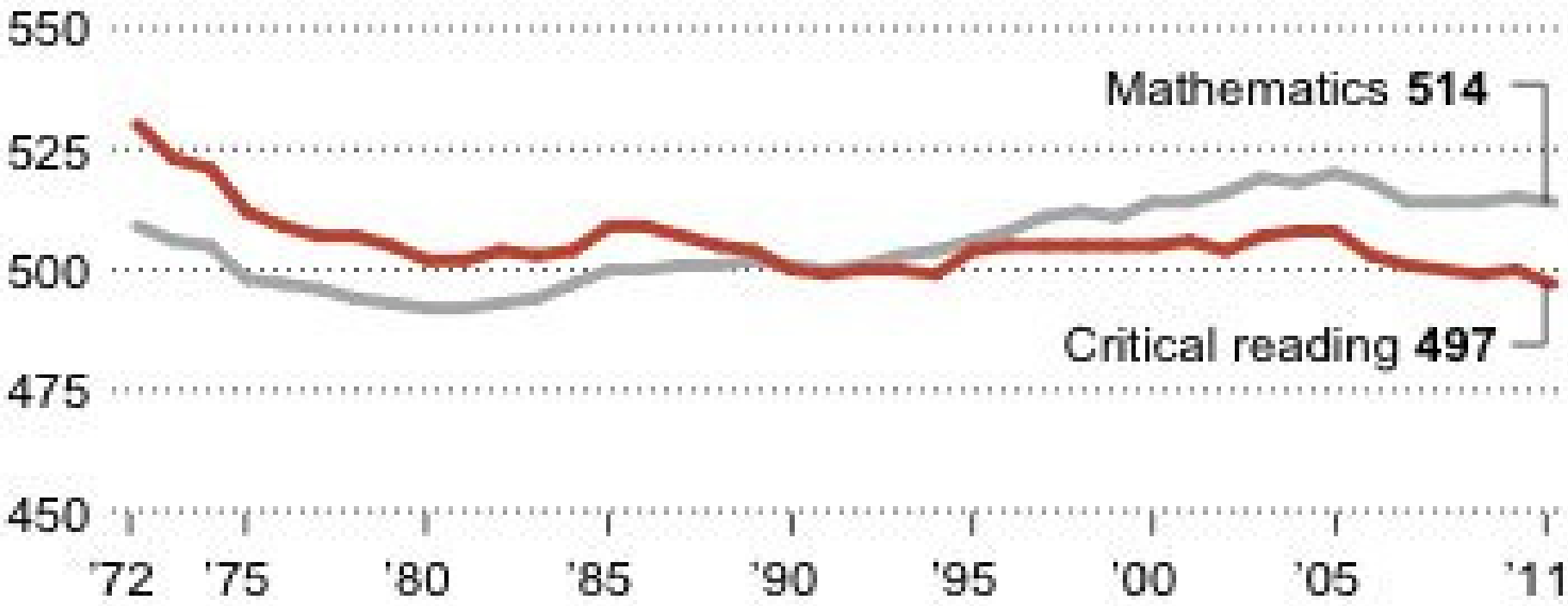
Paradox – Shoddy state of US pre-college education vs M Ed degrees awarded



182,100 Master's degree in Education awarded in US but SAT scores plunged

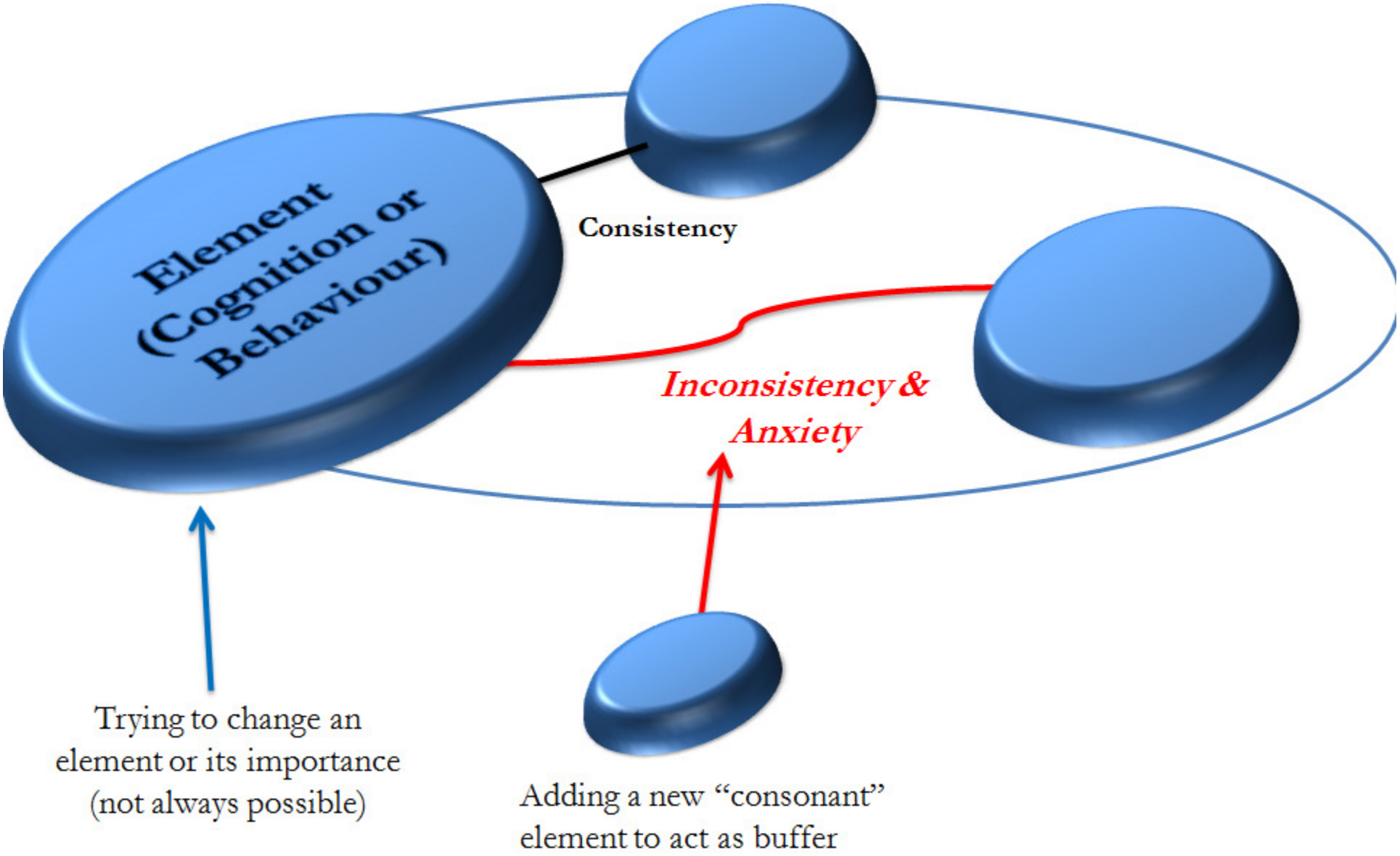
Scores on the critical reading portion of the SAT fell to their lowest level on record last year, and combined reading and math scores reached their lowest point since 1995.

Mean scores of college-bound seniors



Can this data explain why some students in 2045 cannot read the syllabus and comprehend how or what to write for their term papers, which material to review or the dates for quiz and tests?

Those who cannot read a college syllabus and comprehend suffers from Cognitive Dissonance



Those who cannot read a college syllabus and comprehend suffers from Self-infatuation

Mail Online

How college students think they are more special than EVER: Study reveals rocketing sense of entitlement on U.S. campuses

By Daily Mail Reporter

PUBLISHED:15:30 EST, 5 January 2013| **UPDATED:**14:29 EST, 7 January 2013

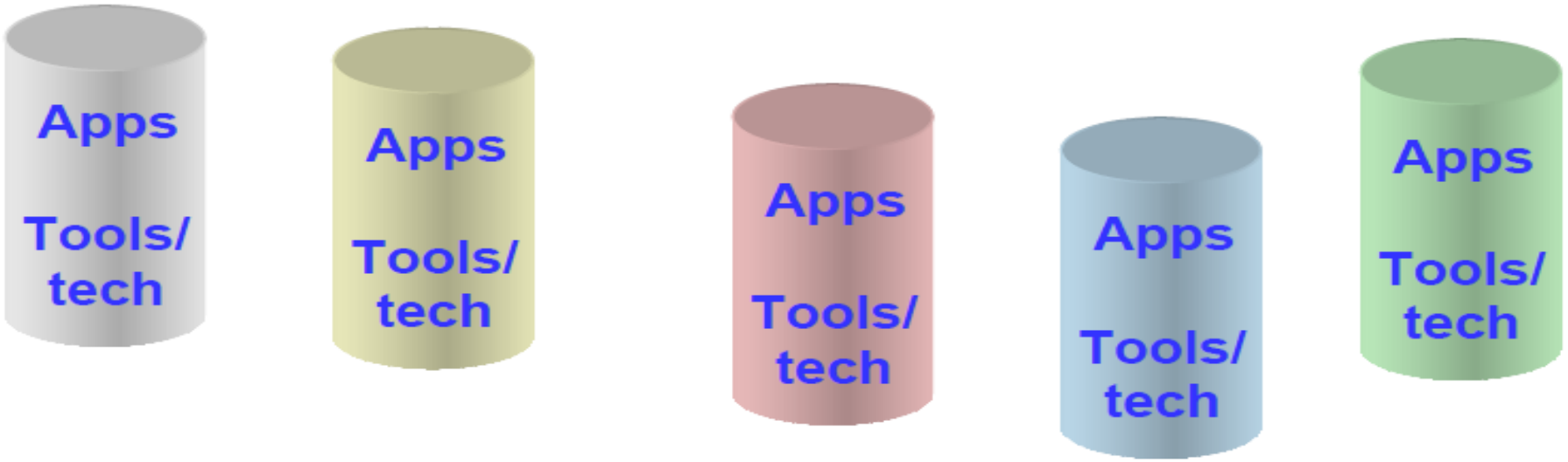
Books aside, if you asked a college freshman today who the Greatest Generation is, they might respond by pointing in a mirror.

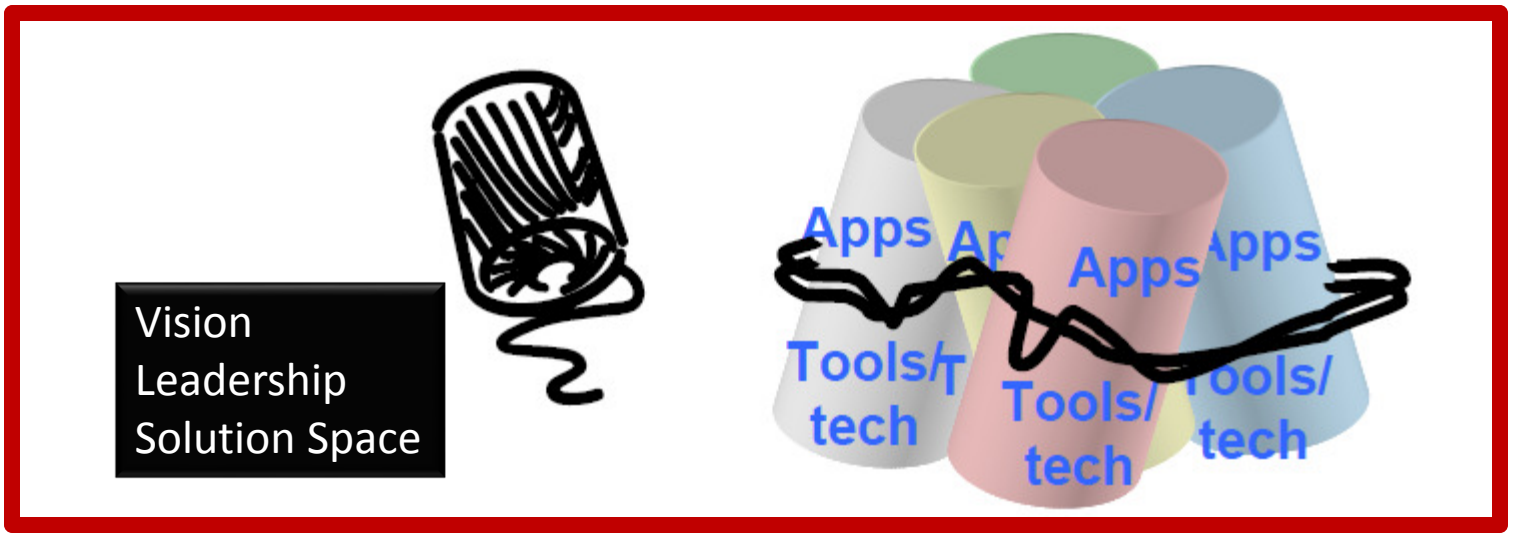
Young people's unprecedented level of self-infatuation was revealed in a new analysis of the American Freshman Survey, which has been asking students to rate themselves compared to their peers since 1966.

Roughly 9 million young people have taken the survey over the last 47 years.

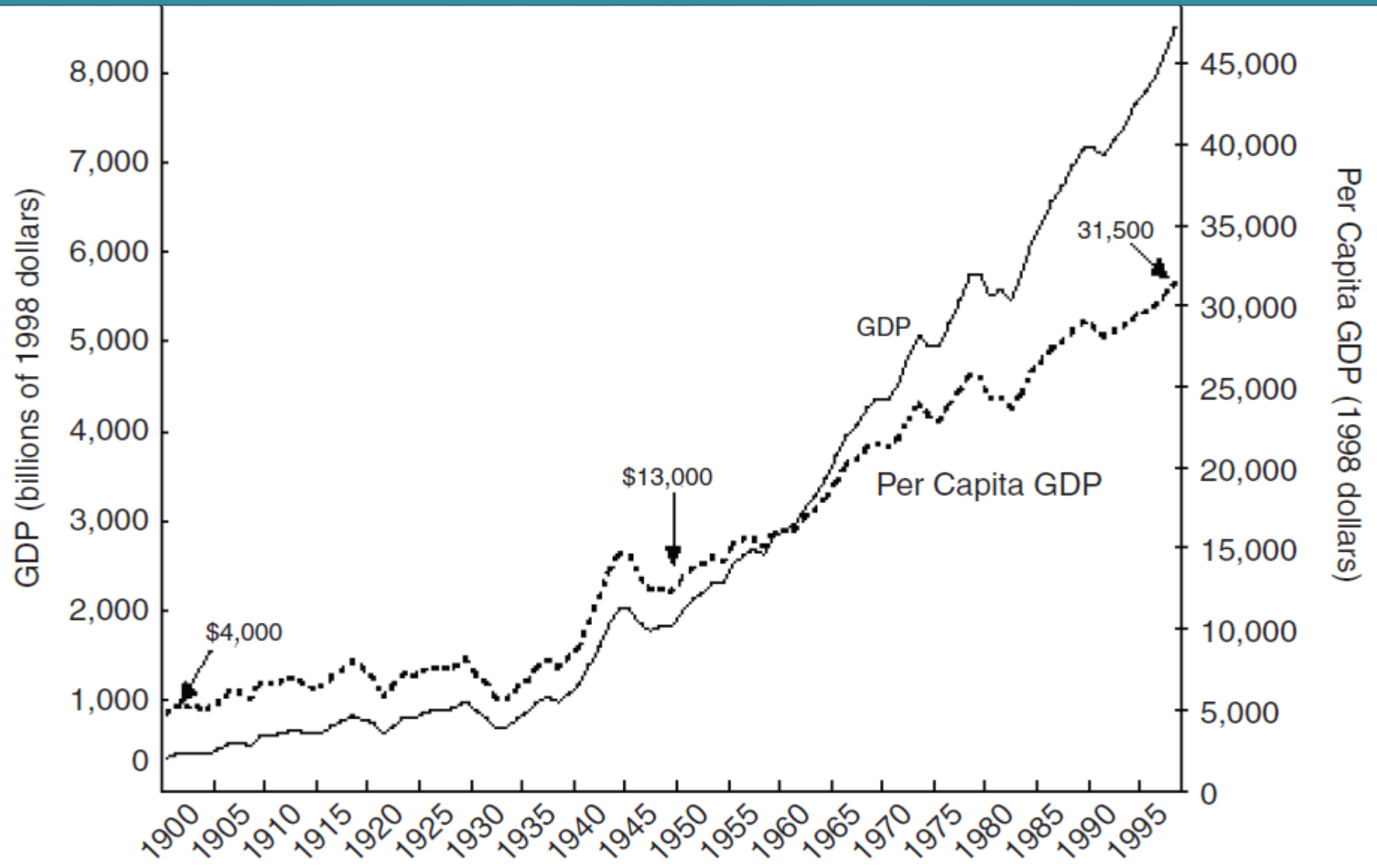
Institutional Architecture of Academic Stovepipes Inhibits Convergence

EE, CS, ME, MS, APh, ChE, Bio, Geo, Eco, …



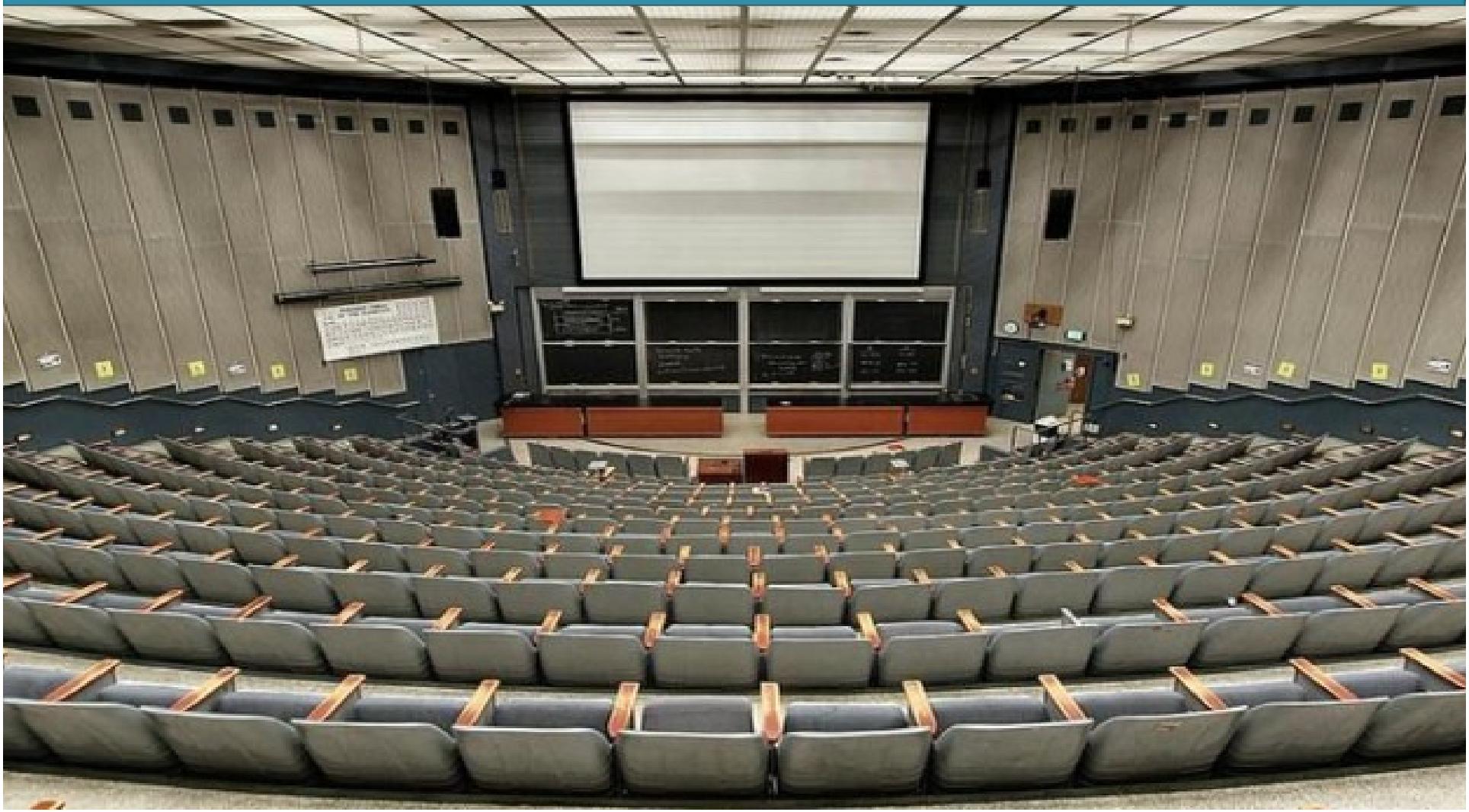


TEMPORARY CONCLUSION
Why math is key to prosperity – US GDP Growth in the 20th Century



MOOC – Is this the answer to 21st Century Global Economic Growth ?

MOOC completion rate is about 1% - is this the classroom of the future ?

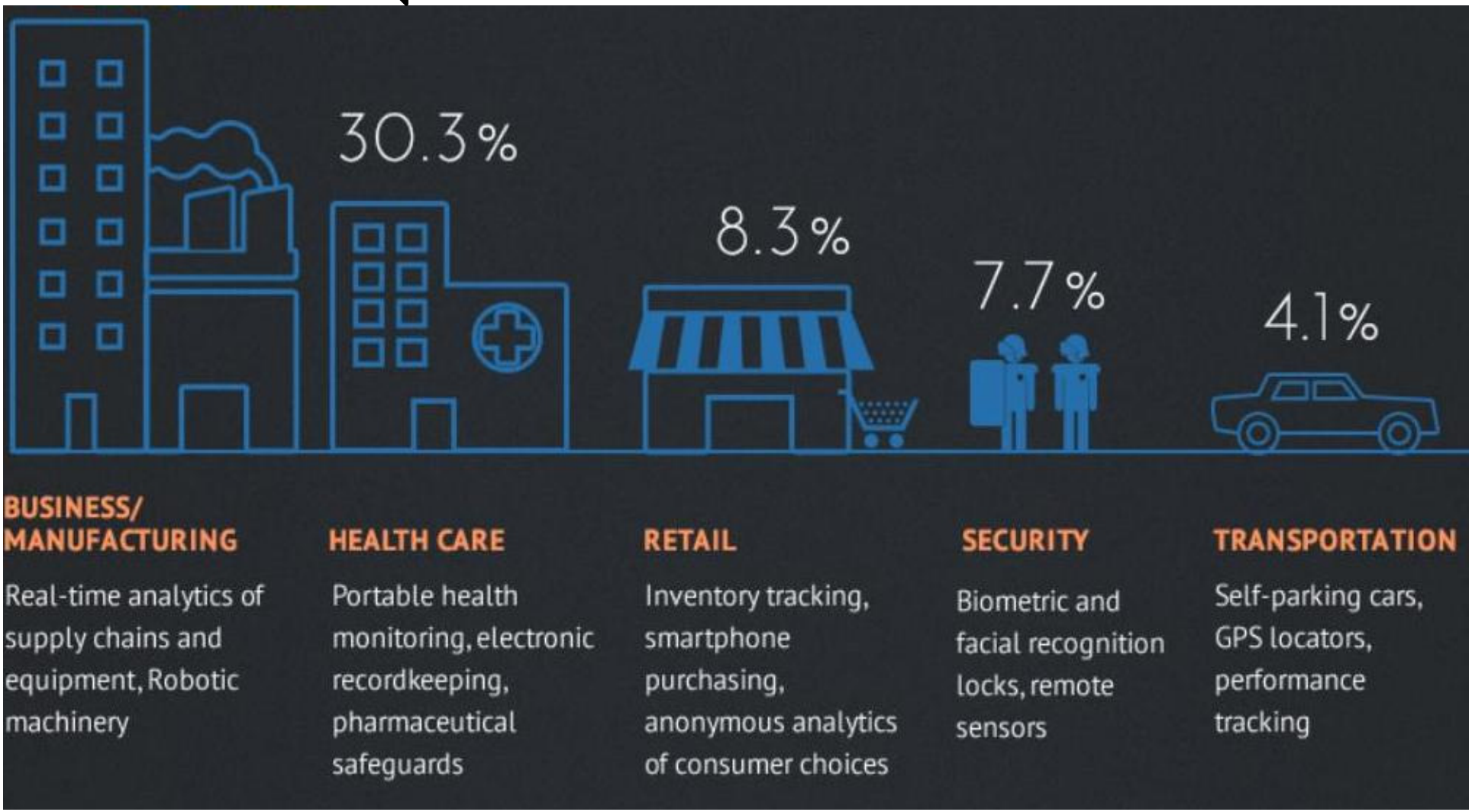


If my theory of relativity is proven successful, Germany will claim me as a German, the Swiss will call me a Swiss citizen and France will declare that I am a citizen of the world. Should my theory prove untrue, the French will call me a Swiss, the Swiss will call me a German and the Germans will call declare that I am a Jew. *Einstein (presenting his then-infant Theory of Relativity at the Sorbonne - Paris, 1921)*

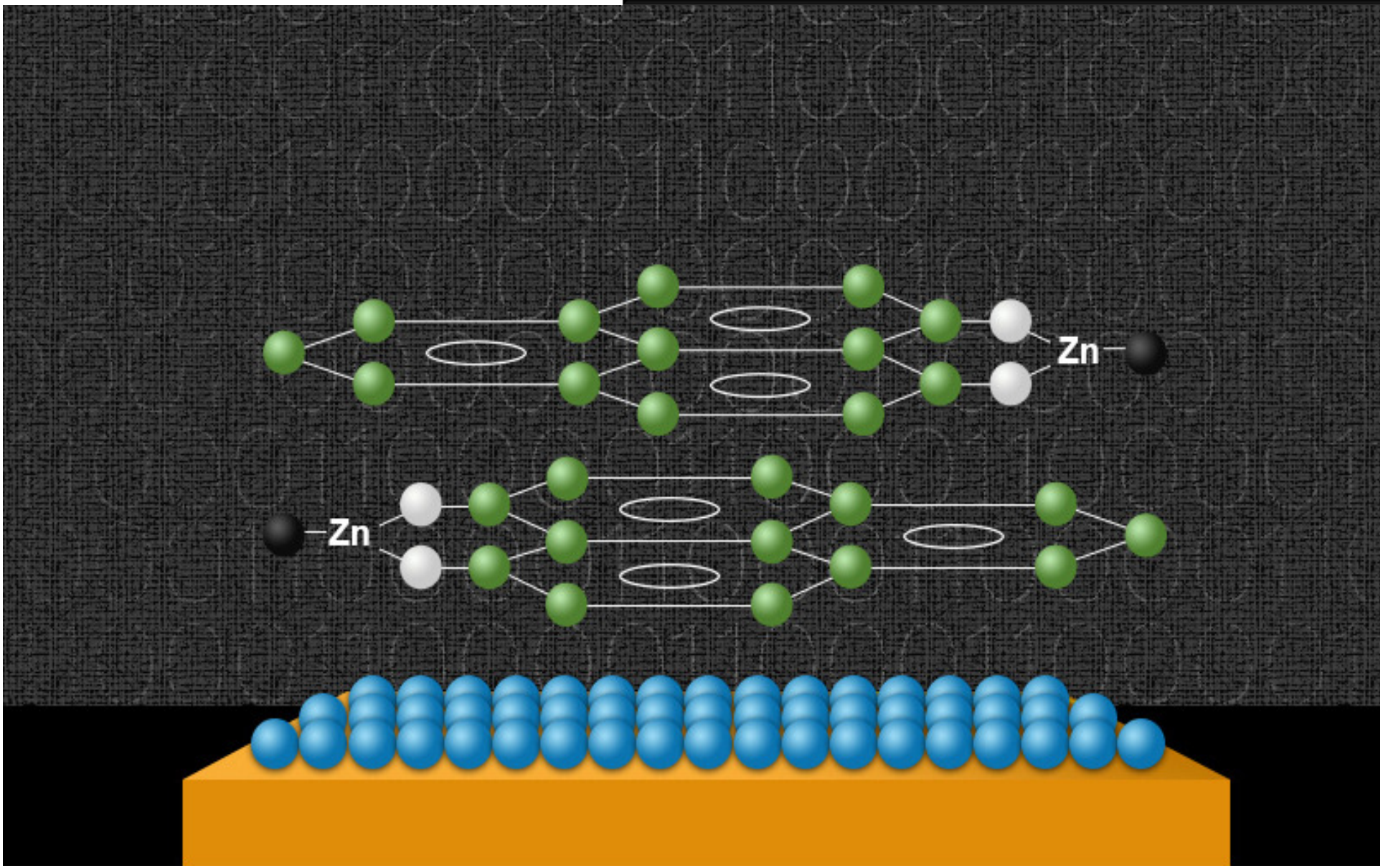
Think different.

40.2%

Think VERY BIG – Think Industrial Internet – Think adding $15 trillion to the economy

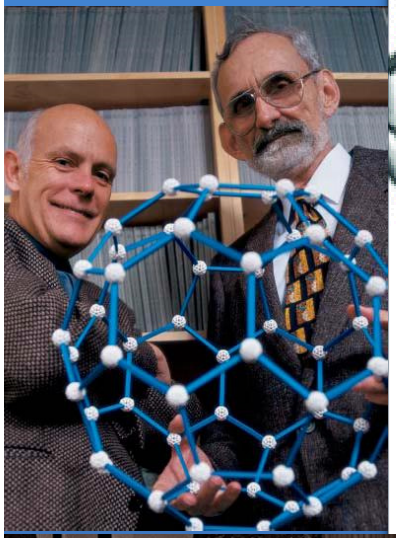


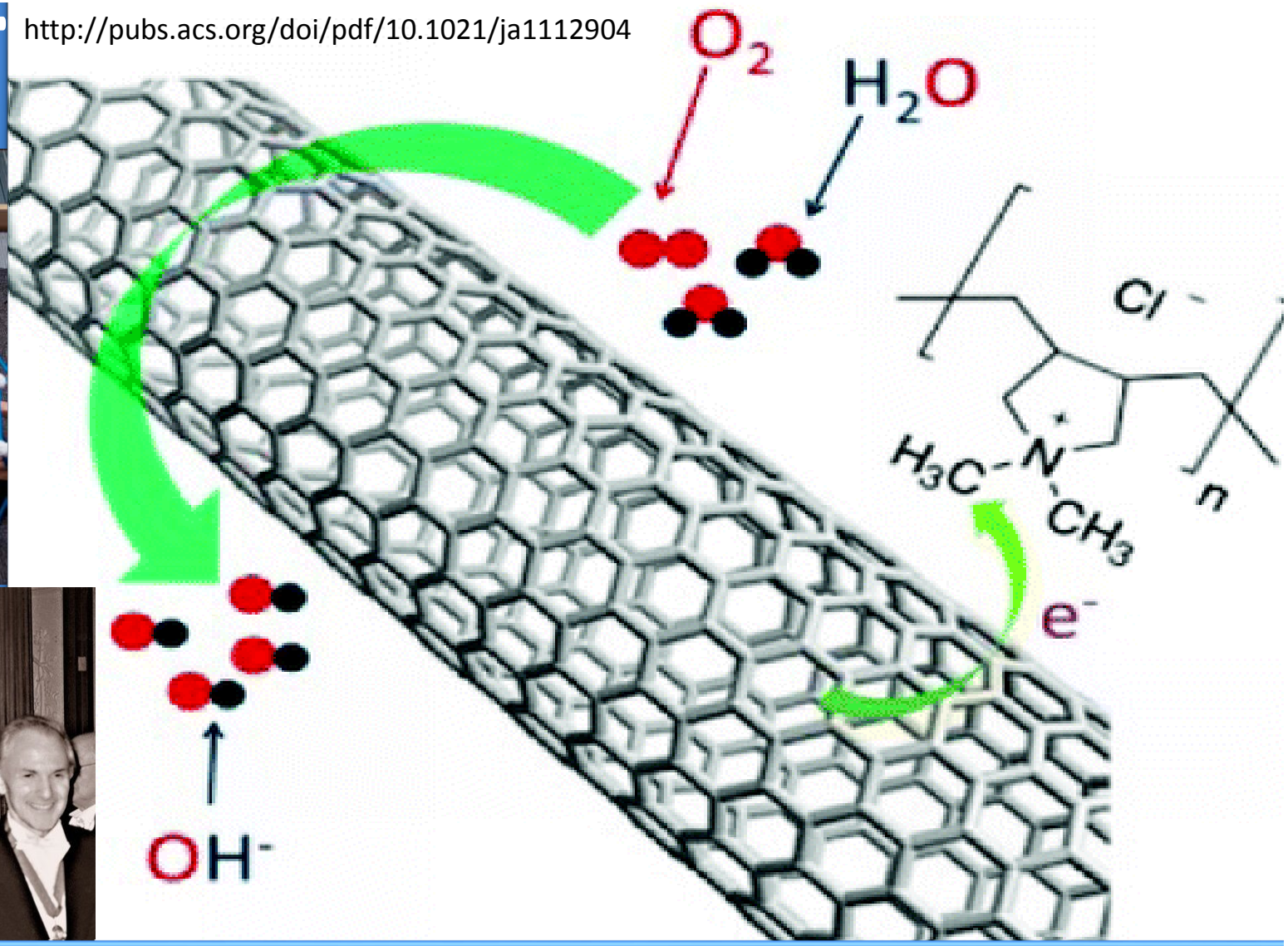
Think Graphene



CNT

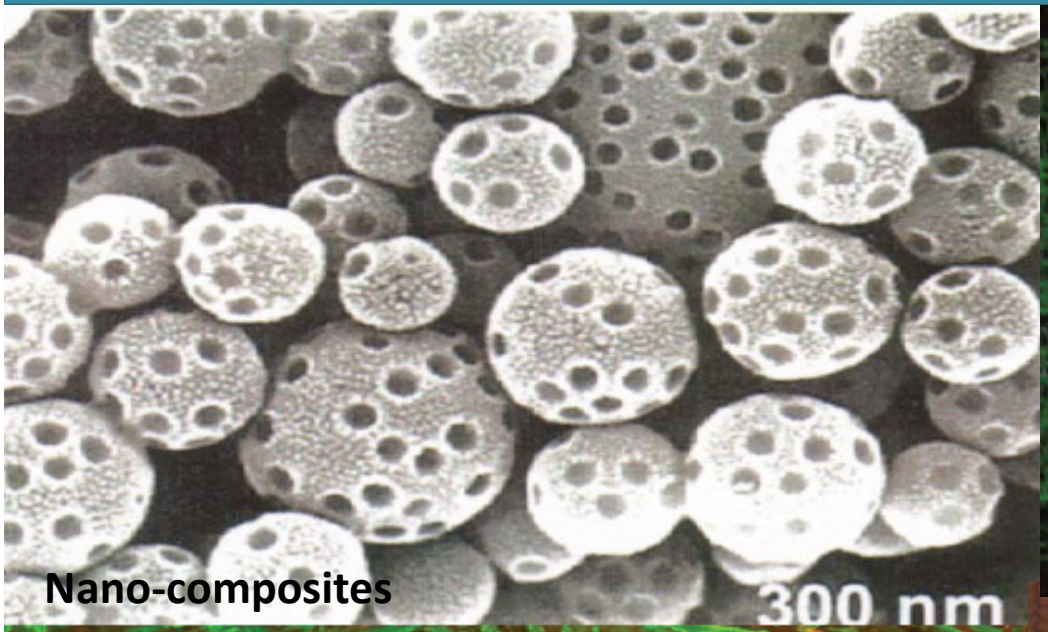
http://pubs.acs.org/doi/pdf/10.1021/ja1112904



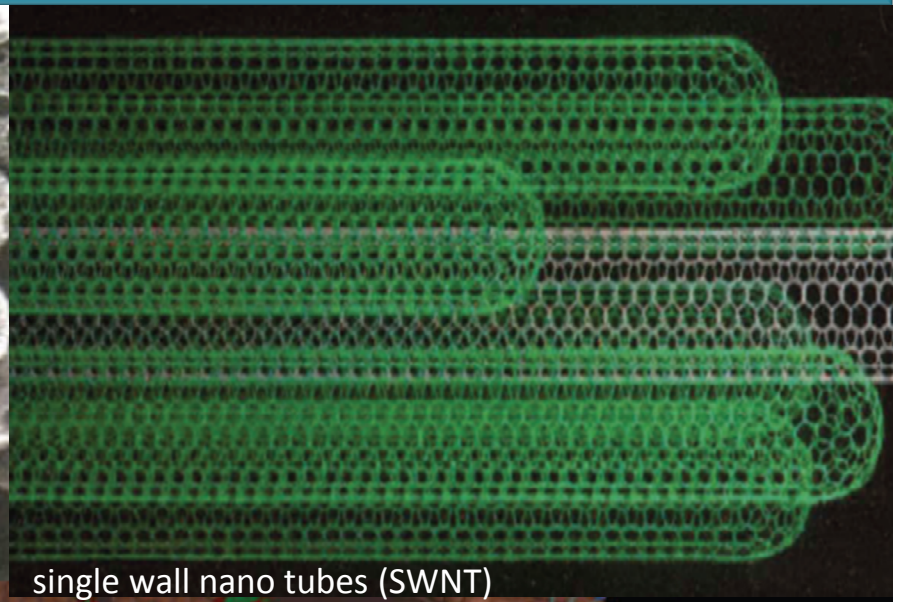


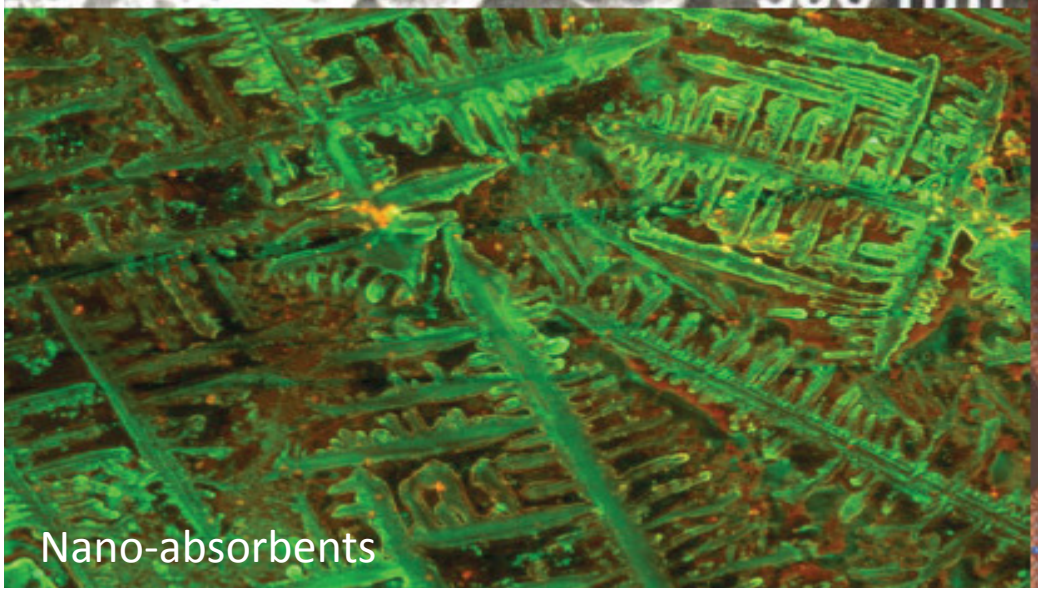
PDDA (poly-diallyldimethylammonium chloride) has a strong electron withdrawal ability. It was used to create net positive charge for carbon atoms in the nanotube carbon plane via intermolecular charge transfer. Resultant PDDA functionalized/adsorbed carbon nanotubes were demonstrated to act as metal-free catalysts for oxygen reduction reaction in fuel cells with similar performance as Platinum catalysts. (US $65,000 per kg). The adsorption-induced intermolecular charge-transfer may be a general approach to various carbon-based efficient metal-free ORR catalysts for oxygen reduction in fuel cells and even new catalytic materials for applications beyond fuel cells.

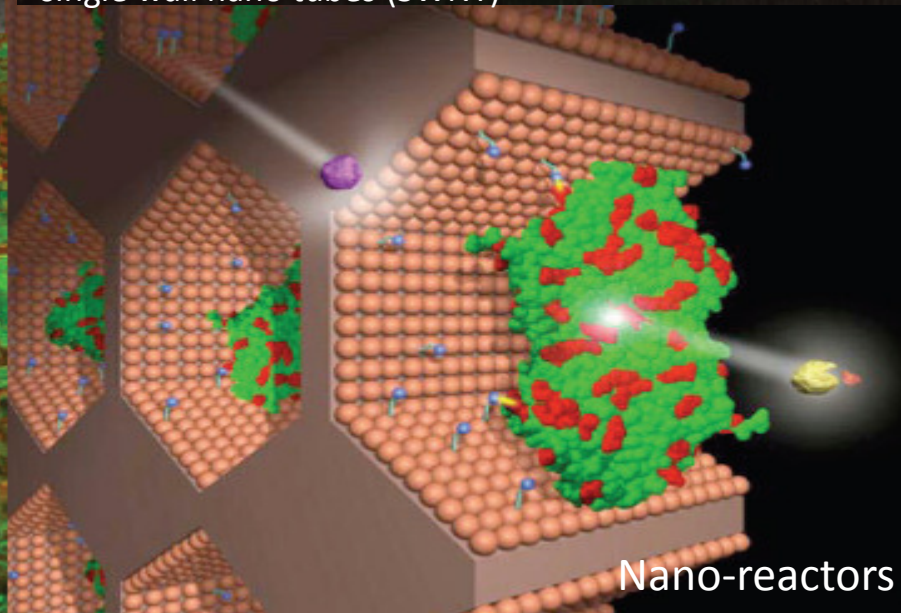
Think Water – The Next Oil – Purification, Desalination & Waste Water Management



Nano-composites


single wall nano tubes (SWNT)


Nano-absorbents


Nano-reactors

Think

micro-payments

Think

"Here is Edward Bear, coming downstairs now, bump, bump, bump, on the back of his head, behind Christopher Robin. It is, as far as he knows, the only way of coming downstairs, but sometimes he feels that there really is another way... if only he could stop bumping for a moment and think of it."

Winnie–The–Pooh
Chapter I

Key Sources and References

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- CIW
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- Business Insider
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Profile http://lnkd.in/Zb5SiT

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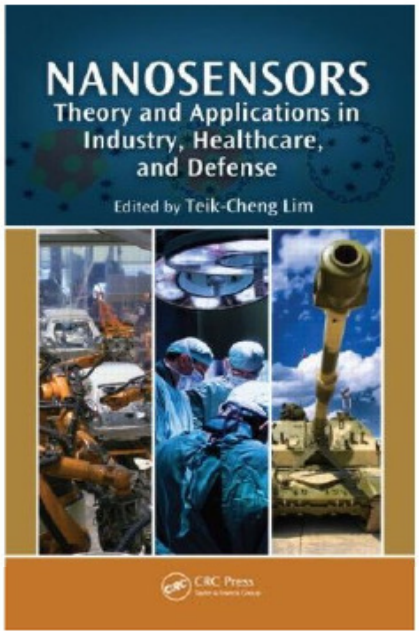

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ECONOMETRICS IN OPERATIONS MANAGEMENT

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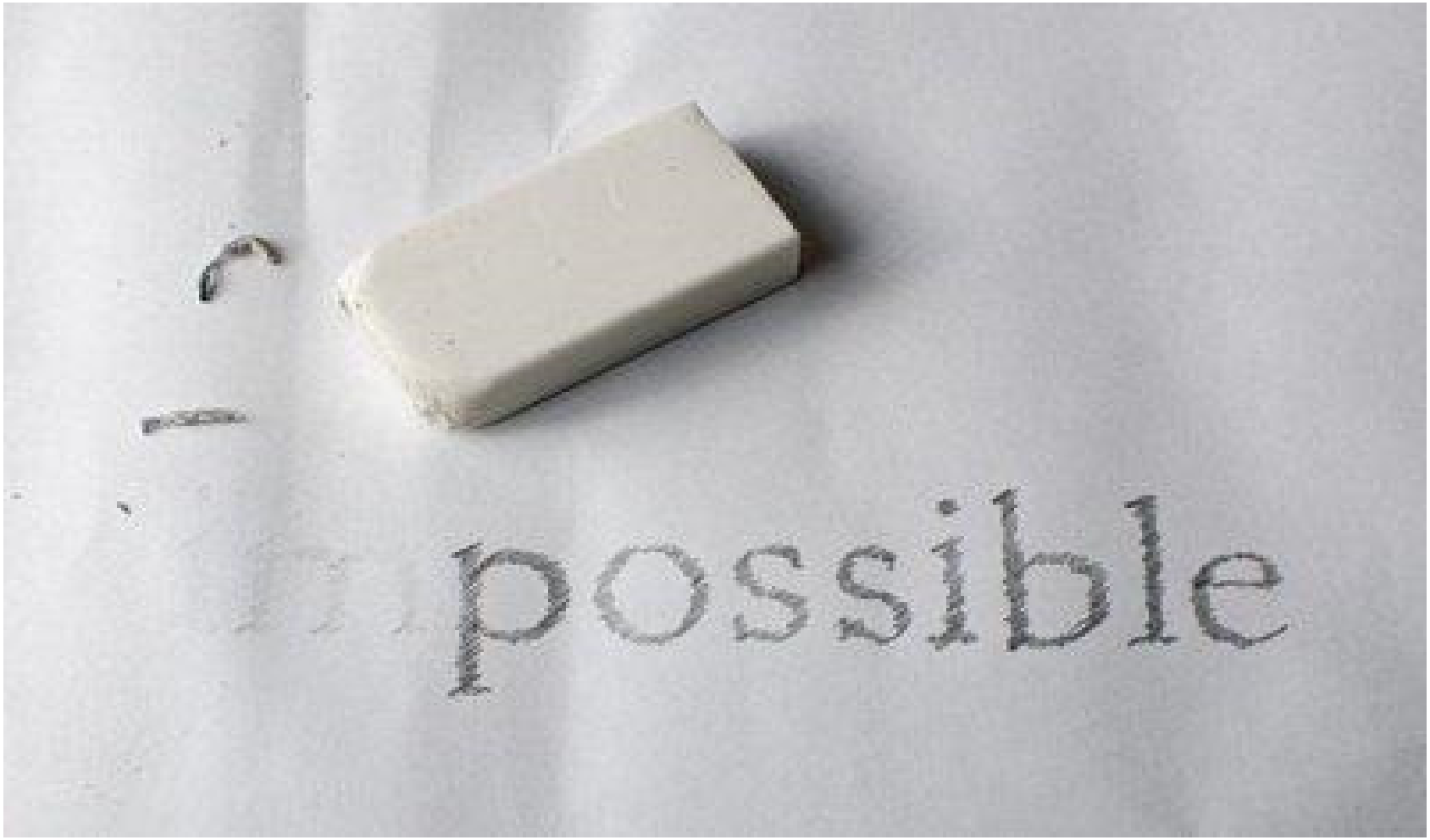
Think beyond …



This is the true joy in life, being used for a purpose you consider a mighty one, a force of nature rather than a feverish, selfish clod of ailments and grievances complaining that the world will not devote itself to making you happy. - *George Bernard Shaw*