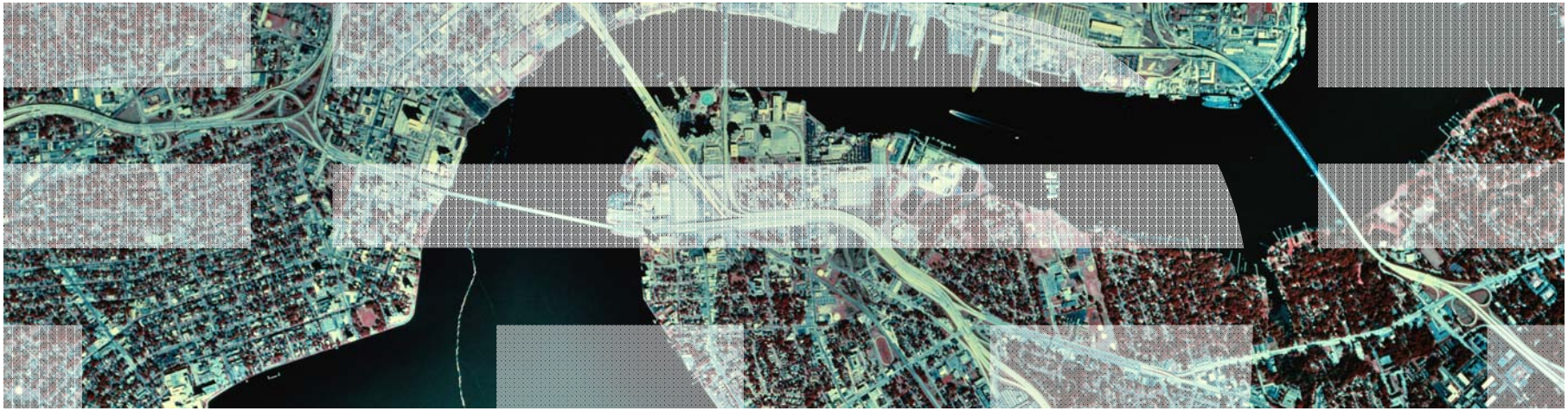
# STEM Professional Masters Degrees

## Building a Smarter Planet -- a more intelligent, interconnected, instrumented world:

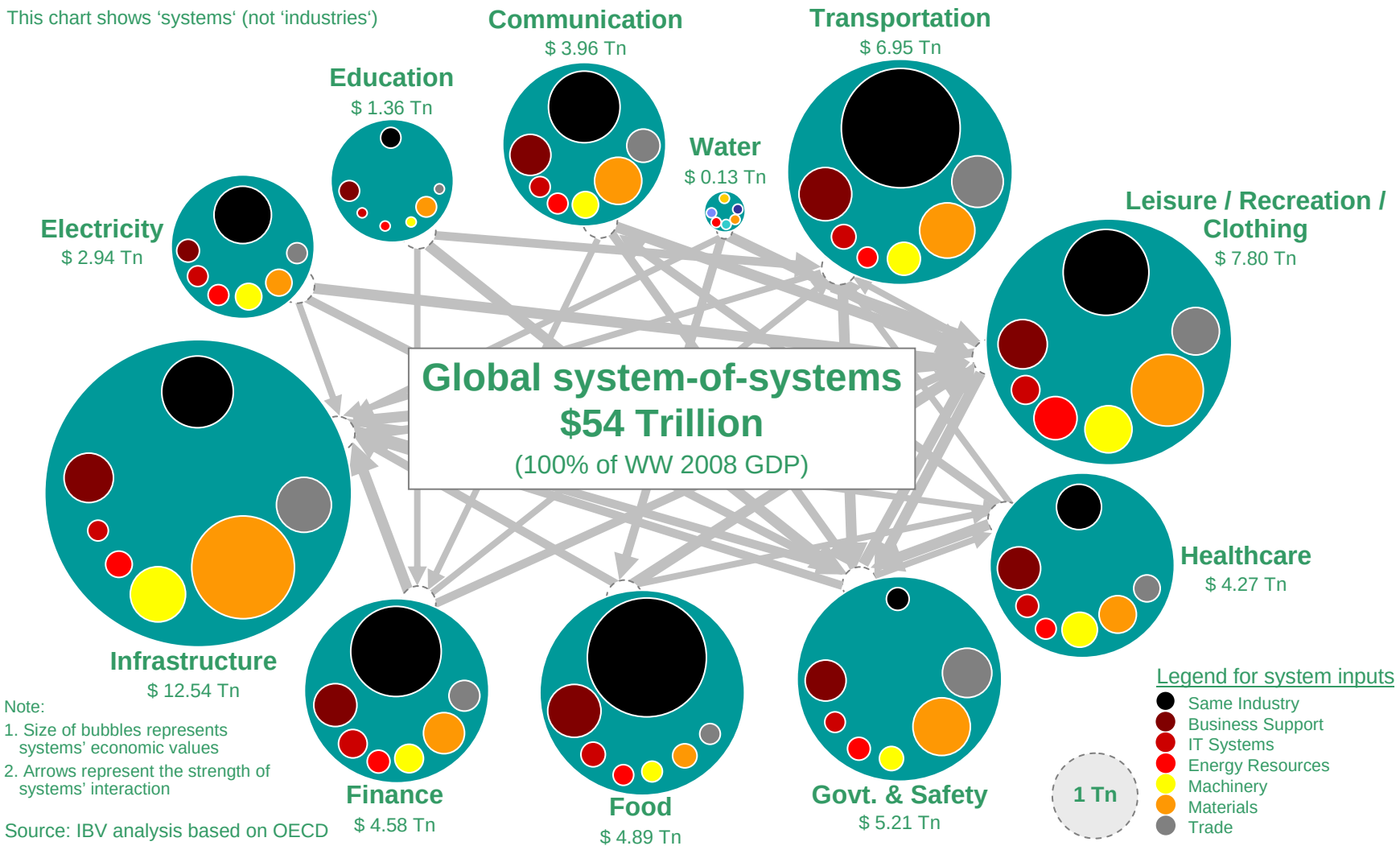
University – Industry – Government – Non-profits



Lilian Wu

CGS/NSF workshop, May 18, 2010

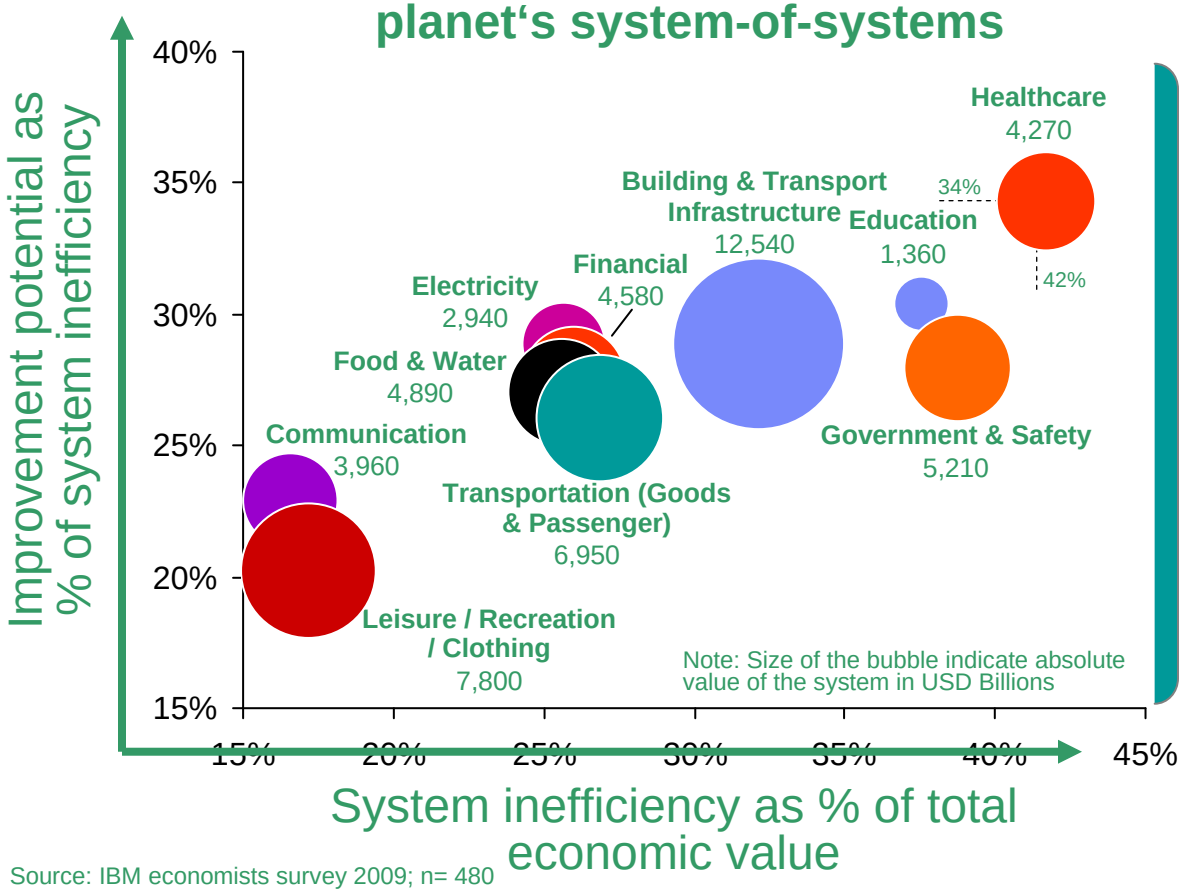
# Our planet is a complex, dynamic, highly interconnected $54 Trillion system-of-systems (OECD-based analysis)



# Economists estimate, that all systems carry inefficiencies of up to $15 Tn, of which $4 Tn could be eliminated

This chart shows ‘systems‘ (not ‘industries‘)

## Analysis of inefficiencies in the planet‘s system-of-systems




Source: IBM economists survey 2009; n= 480

**Global economic value of**

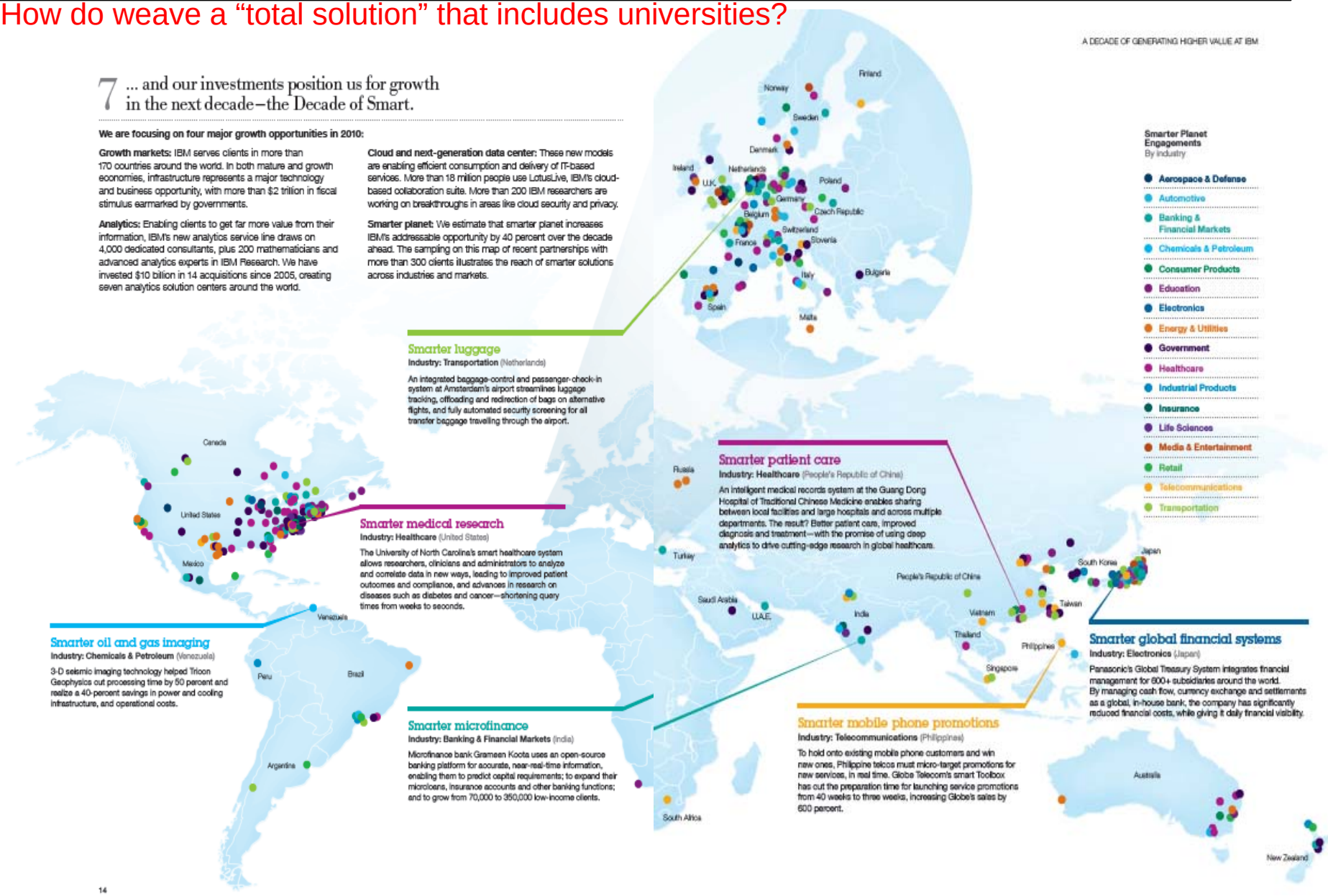
| | |
|---|---|
| System-of-systems | **$54 Trillion** 100% of WW 2008 GDP |
| Inefficiencies | **$15 Trillion** 28% of WW 2008 GDP |
| Improvement potential | **$4 Trillion** 7% of WW 2008 GDP |

**How to read the chart:**

For example, the Healthcare system‘s value is $4,270B. It carries an estimated inefficiency of 42%. From that level of 42% inefficiency, economists estimate that ~34% can be eliminated (= 34% x 42%).

# How do we involve universities?

## How do weave a “total solution” that includes universities?



# Holistic Modeling & Analytics
# Example: FIU's Terrafly

Naphtali David Rishe
Director, High Performance Database Research Center
Director, NSF Industry-University Cooperative Research Center
http://HPDRC.FIU.edu http://TerraFly.FIU.edu

FIU
Florida International University
Miami's public research university

## Indexing Geospatial Data with MapReduce

Naphtali Rishe+, Vagelis Hristidis+, Raju Rangaswami+,
Ouri Wolfson*, Howard Ho**, Ariel Cary+, Zhengguo Sun+, Lester Melendes+

+School of Computing and Information Sciences, Florida International University
*University of Illinois at Chicago **IBM Almaden Research Center

Sponsored by: NSF Cluster Exploratory (CluE)

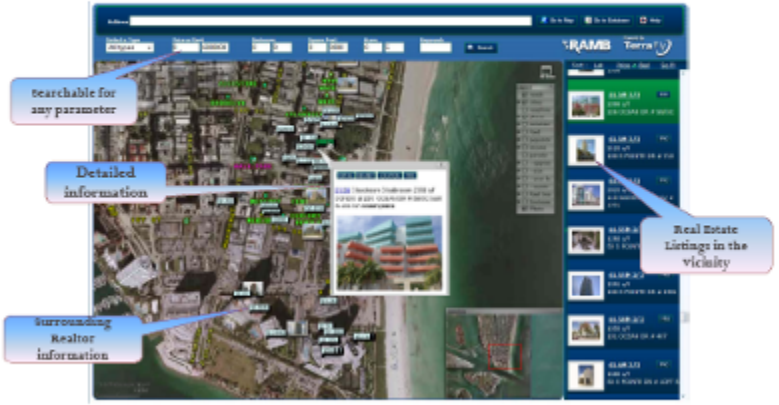
TerraFly

## Hydrology Application

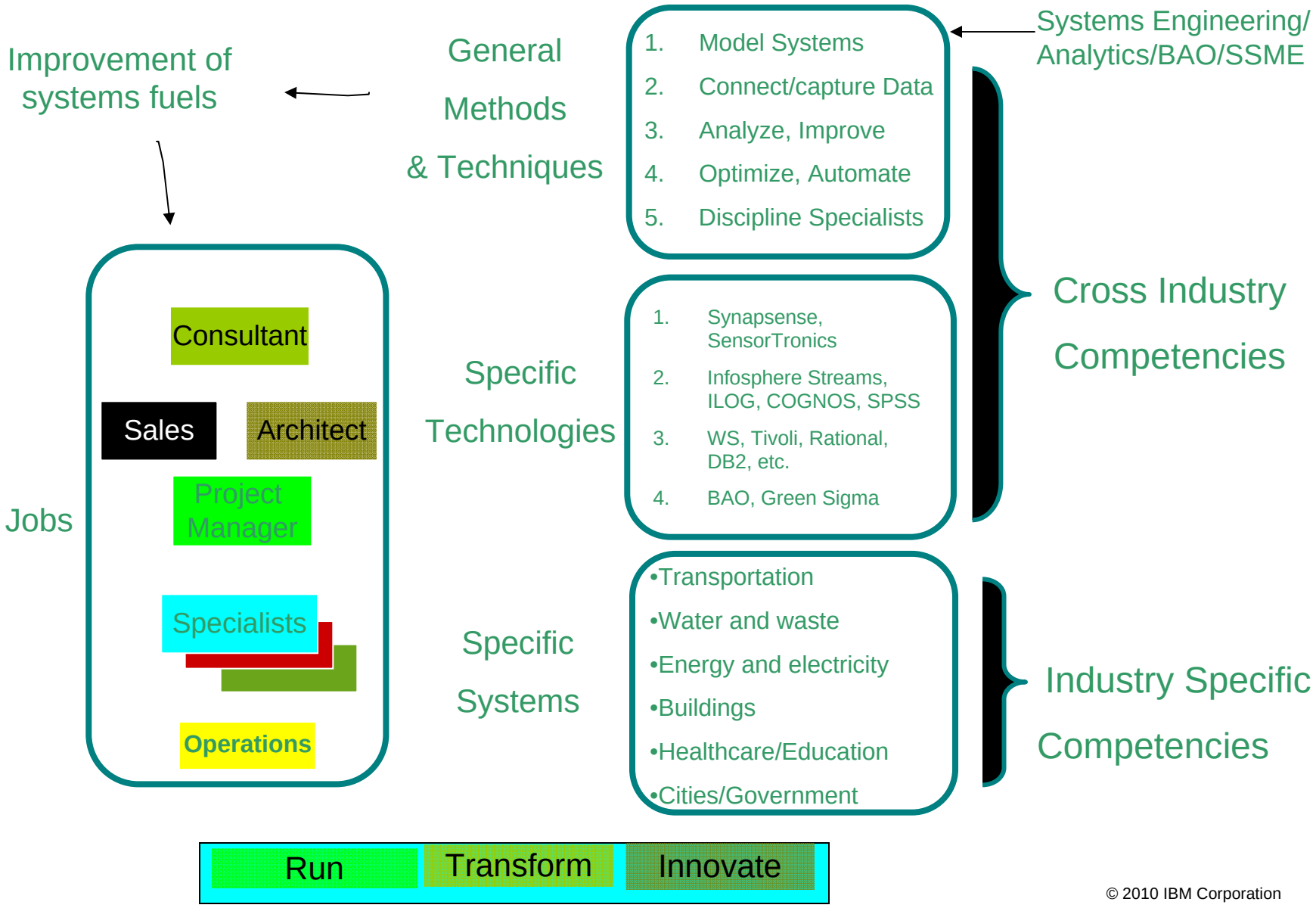
**Average of Surrounding Stations' Mean Daily Stage for Selected Water Body.**


TerraFly

## Real Estate



# Intrapreneurship & Job Creation



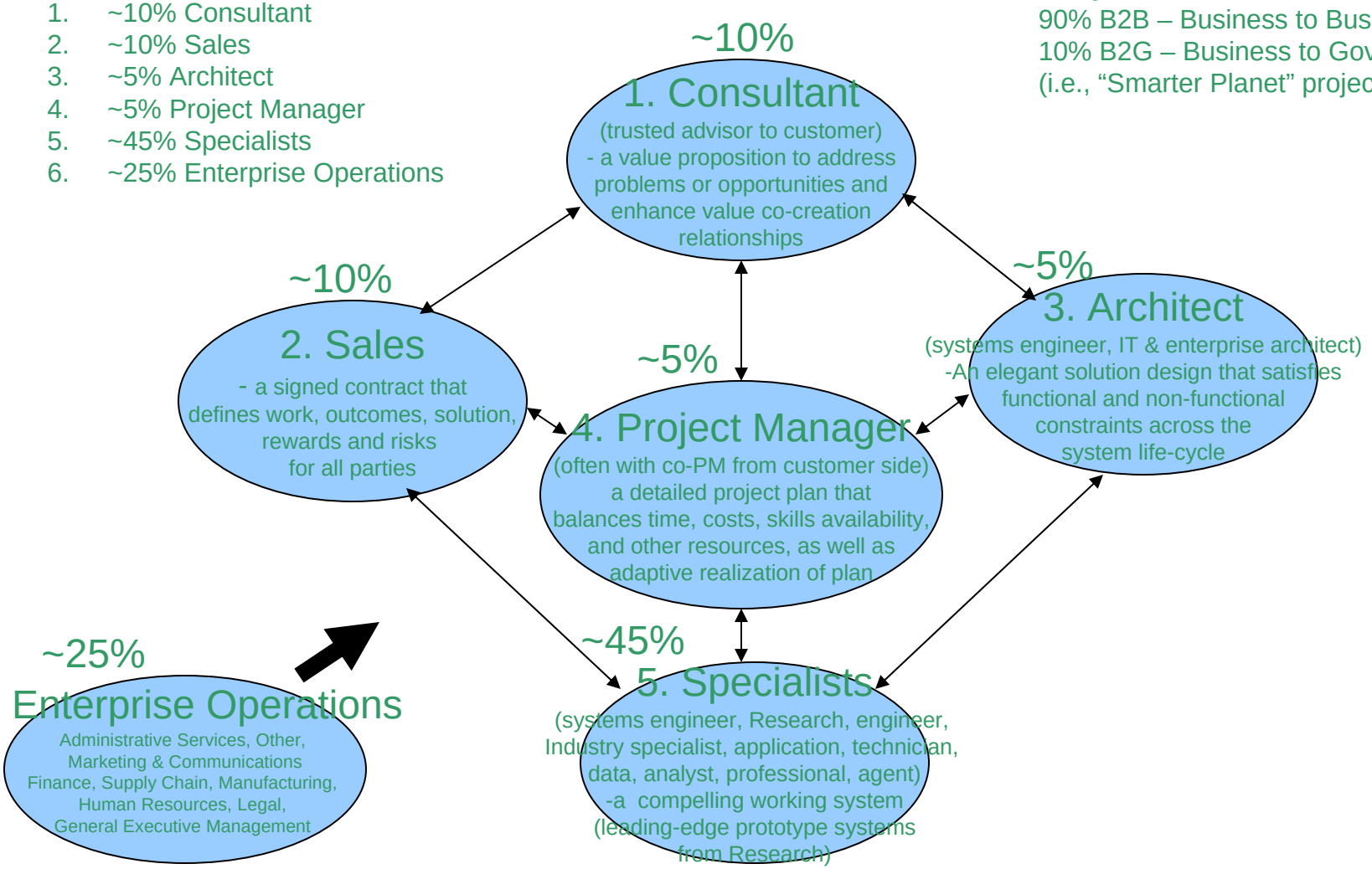
# IBM Jobs: Project teams focus on customer needs

## IBM Employees

1. ~10% Consultant
2. ~10% Sales
3. ~5% Architect
4. ~5% Project Manager
5. ~45% Specialists
6. ~25% Enterprise Operations

## Project Work:

90% B2B – Business to Business
10% B2G – Business to Government
(i.e., “Smarter Planet” projects)



# Grand Challenges in Business & Society

## Improve Quality of Life = Quality of Service from systems + Quality of Opportunities in systems

### Systems that focus on basic things people need

1. Transportation & supply chain
2. Water & waste recycling
3. Food & products manufacturing
4. Energy & electricity grid
5. Buildings & construction (Smarter Buildings)
6. Information and Communication Technologies

Systems that move, store, harvest, process

### Systems that focus on people's activities and development

7. Retail & hospitality/Media & entertainment
8. Banking & finance (wealthy)
9. Healthcare & family (healthy)
10. Education & professions (wise)

Systems that enable healthy, wealthy, and wise people

let's build a smarter planet

### Systems that focus on governing security, opportunities, and rights

11. Cities & family and professional life/security (property tax)
12. States/regions & development opportunities & investments (sales tax)
13. Nations/NGOs & rights/rules/incentives/policies/laws (income tax)

Systems that govern

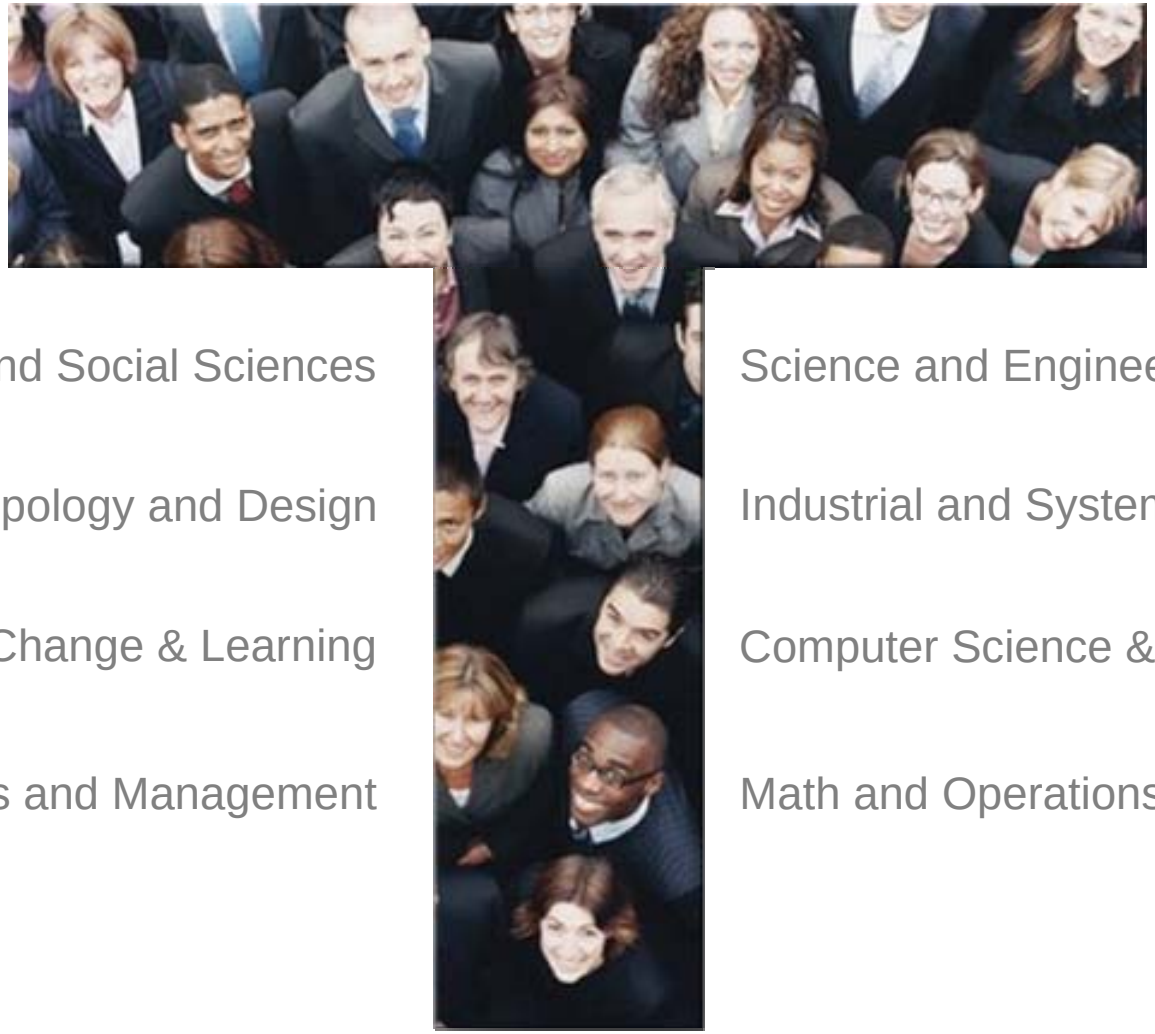
"Imagine a better system, and use STEM language to explain why it is better"

STEM = Science, Technology, Engineering, and Mathematics

See Challenge-Based Learning: http://www.nmc.org/news/nmc/nmc-study-confirms-effectiveness-challenge-based-learning

# People who are Adaptable, Forward-Looking, Knowledgeable, Innovative

T-shaped = deep and broad multi-disciplinary, multi-cultural, multi-functional/systems experiences



Economics and Social Sciences

Business Anthropology and Design

Organizational Change & Learning

Business and Management

Science and Engineering

Industrial and Systems Engineering

Computer Science & Info. Systems

Math and Operations Research

# Universities are mini-Cities: System of Systems