Big Data and The Future of Agriculture

Sonny Ramaswamy
Interstellar, The Movie

• "The world doesn’t need any more engineers. We didn’t run out of planes and television sets... we ran out of food."

• Starring: Matthew McConaughey and Anne Hathaway
Nutritional Security
An Existential Threat
Malthusian Necessities of Life

Food, Shelter, Fiber, Fuel > 9 billion

- CLIMATE CHANGE
- LAND & WATER CONSTRAINTS
- INCREASING URBANIZATION
- ENVIRONMENTAL DEGRADATION
- MINIMAL ECOLOGICAL FOOTPRINT
- CHANGING INCOME & DIETS
- POSITIVE HEALTH OUTCOMES
Hurricane Katrina
28 August 2005
1445 GMT
GOES-12 visible

Population
Climate
Hunger
Changing Incomes & Diet
Funding
Anti-Science

Extreme Weather
Land & Water Resources
Health
Poverty
Pipeline
Anti-Intellectualism
Path Forward

- Transformative discoveries
  - Internet of Agricultural Things
  - Big Data
- 21st Century Extension
- Farming systems
- Education
- Policies, regulation, marketing
- Human dimensions
- Communications
#InternetOfAgThings
21st Century Farm
Supply Chain

- On Farm Production
- Soil Health, Water, Nutrients
- Pests/Control
- Energy
- Traceability and Tracking
- Supply Chain Management
- Processing
- Inspection
- Transportation
- Storage

- Retailers
- Inventory
- Access
- Smart Refrigerators
- Food Safety
- Ripeness
- Shrink Wrap
- Waste
- Smart Services
- Etc.
Food Waste and Food Loss

➢ Double food production in 40 years
➢ Cut loss/waste by half?
➢ Impact climate change
Precision Foods

- Individual genome, epigenome, microbiome
- Plant/animal genome, epigenome, microbiome
- Wearable sensors
  - FitBit, Apple Watch
  - Athos, Hexoskin, Gymi
  - Google contact lens
- Food analysis
- Lifestyle
- Behavior
Big Data: Milieu

• Analytics
• Informatics
• Evidence-Based Tools
• Meta-Analysis and Synthesis
• Complex Systems
• Computational Sciences
• Data Engineering
• Data Mining
• Cloud Computing
• Implementation and Evaluation
• Data Security and Cybersecurity
• Predictive Modeling
• Data Visualization
• Decision Analytics
• Embedded Systems
• Machine Learning
• Multidimensional Data
• Network Science
• Sensor Networks
• Spatial Analytics
• Bandwidth
• Cyberphysical Systems
Big Data: Opportunities

Cochrane Collaboration – [http://www.cochrane.org](http://www.cochrane.org)

Transparent, Collaborative, Participatory
Open Data is a powerful, evidence-based tool for long-term sustainable development by improving economic opportunities for farmers and health of consumers.

Open access to research, meta-analysis, and open publication of data are vital resources for nutritional security.
Big Data: Challenges

- Ownership
  - Open Ag Technology Systems
- Decision Support Tools
- Cost
- Bandwith
- Quality
- Curation
- Disambiguation
- Connectivity
- Cybersecurity
- Storage

http://www.lsi.com/PublishingImages/LSI_blog_Bigdata_V1.jpg
USDA Activities

USDA Open Data Initiative
● Implementation of OMB 13-13
● Implementation of OSTP directives
  – Publication of Scholarly Articles: PubAg
  – Release of Scientific Data: Ag Data Commons

Supporting Global Open Data Action
● Open Data Policy
● Access to USDA Data
● Collaboration and Cooperation
● Minimizing Duplication
GODAN Framework
Global Open Data for Agriculture and Nutrition

- Promotes global efforts for unrestricted availability, accessibility, and usability of agriculture and nutrition data
- Encourages collaboration and cooperation among existing agriculture and open data efforts to avoid duplication
- Seeks to bring together stakeholders to solve long-standing global problems
GODAN Framework
Global Open Data for Agriculture and Nutrition

A few of the successes in just over a year
• 120+ partners
• 3rd International Open Data Conference
• Publication with 14 cases studies
• Planning for Africa and Global conferences
Nutritional Security
We are drowning in information, while starving for wisdom. The world henceforth will be run by synthesizers, people able to put together the right information at the right time, think critically about it, and make important choices wisely.

E. O. Wilson, Entomologist, Author, Pulitzer Prize Winner
Humans Matter