IBM Analytics

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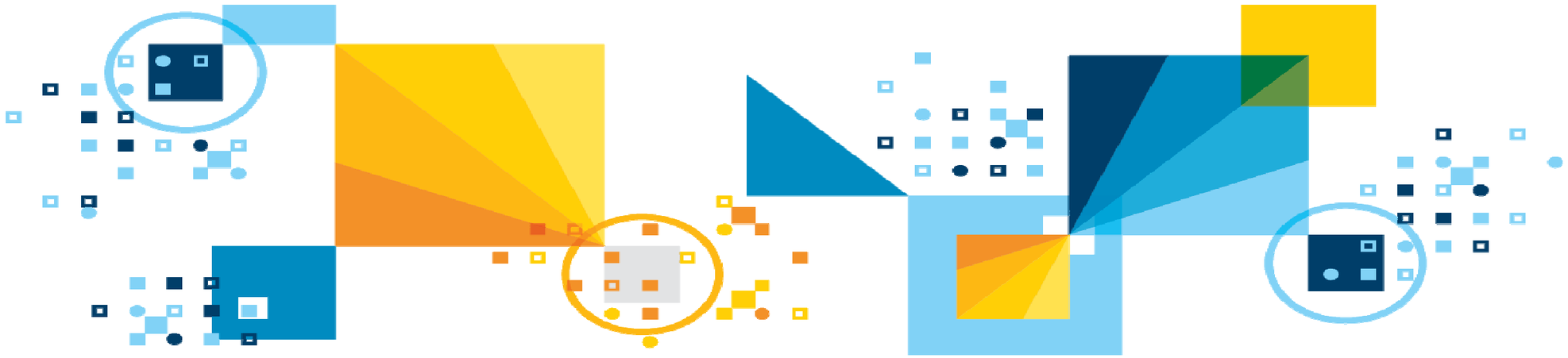
WATSON Ambassador

La nostra visione della Smarter Agricolture



Examples of IBM Research capabilities in Agriculture

Pre-planting

Genomic Research
- *Genomic sequencing*
- *Seed development using genomic analytics*
- *Disease monitoring and analysis*

Crop Planning
- *Multi objectives decision making*
- *Yield optimization*
- *Weather modeling for optimized crop planning*
- *Sustainability*

Planting & growing

Smart Farming
- *Sensor based physical analytics*
- *Precision irrigation*
- *Precision agriculture algorithms (fertilizers, spraying, pesticides)*
- *Remote sensing*

Coupled Modeling
- *Deep Thunder*
- *Hydrology simulation*

Farmer Services
- *Spatio temporal insights*
- *Sustainability*

Harvesting & Store

Logistics
- *Smart agri-logistics including intelligent transport and real-time logistics of crop products*
- *Predictive asset management*

Farmer Services
- *Spatio temporal insights*

Storage efficiency
- *Optimized storage planning*
- *Spoilage reduction*

Distribution & Process

Logistics
- *Smart agri-logistics and integrated supply chain across farm-to-fork processes*
- *Predictive farm asset management*

Traceability
- *Food traceability to consumers*

Food safety
- *Food safety consortium*

Finance
- *Financial services, insurance*

Mobile Services Platform for Agribusiness Ecosystem (IoT)

Massive Scale Analytics (Cloud, Big Data, Analytics)

Cenni storici

Cognitive computing refers to systems that learn at scale, reason with purpose and interact with humans naturally. Rather than being explicitly programmed, they learn and reason from their interactions with us and from their experiences with their environment.

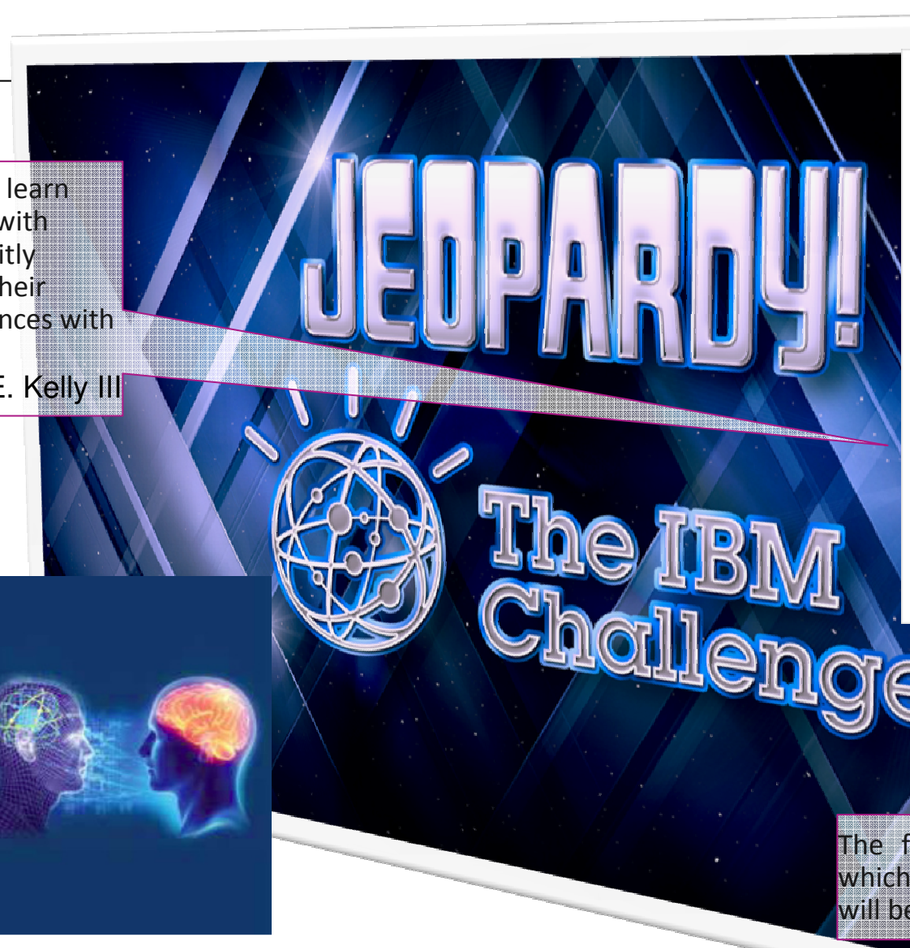
Dr. John E. Kelly III

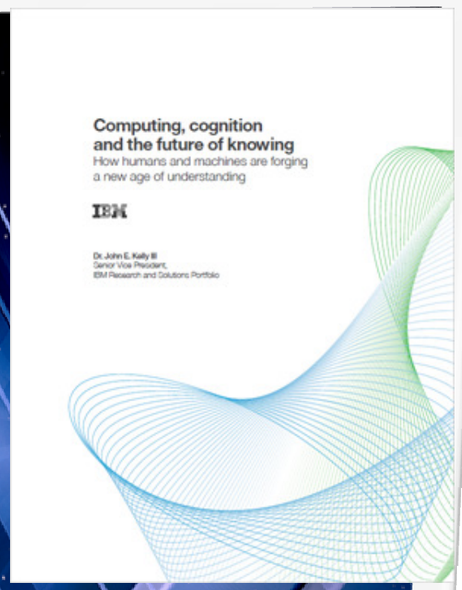
Image 1

The Tabulating Era (1900s – 1940s)

The Programming Era (1950s – present)

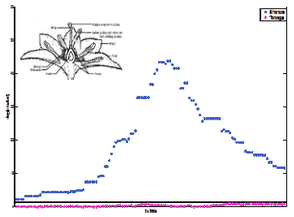
The Cognitive Era (2011 –)





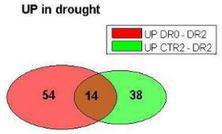
The future of such technology - which we believe will be cognitive, not "artificial" - ...

Agriculture Genomics - Methods

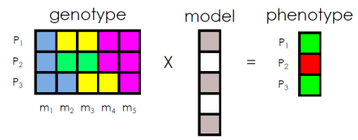


Trait Mapping

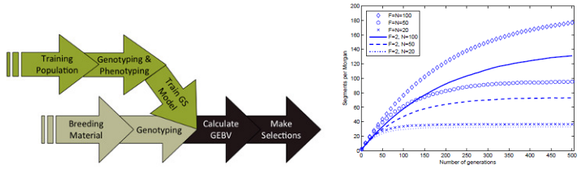
Improving quality of cultivated plants
- → *Deciphering genotypic and phenotypic variation*
- → *Adaptation to changing environments*
- → *Marker Assisted Selection and breeding strategies*



Differential gene expression

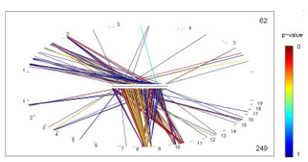


Genomic selection & prediction

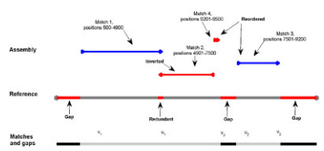


Breeding strategies & simulations

Cultivar demographics



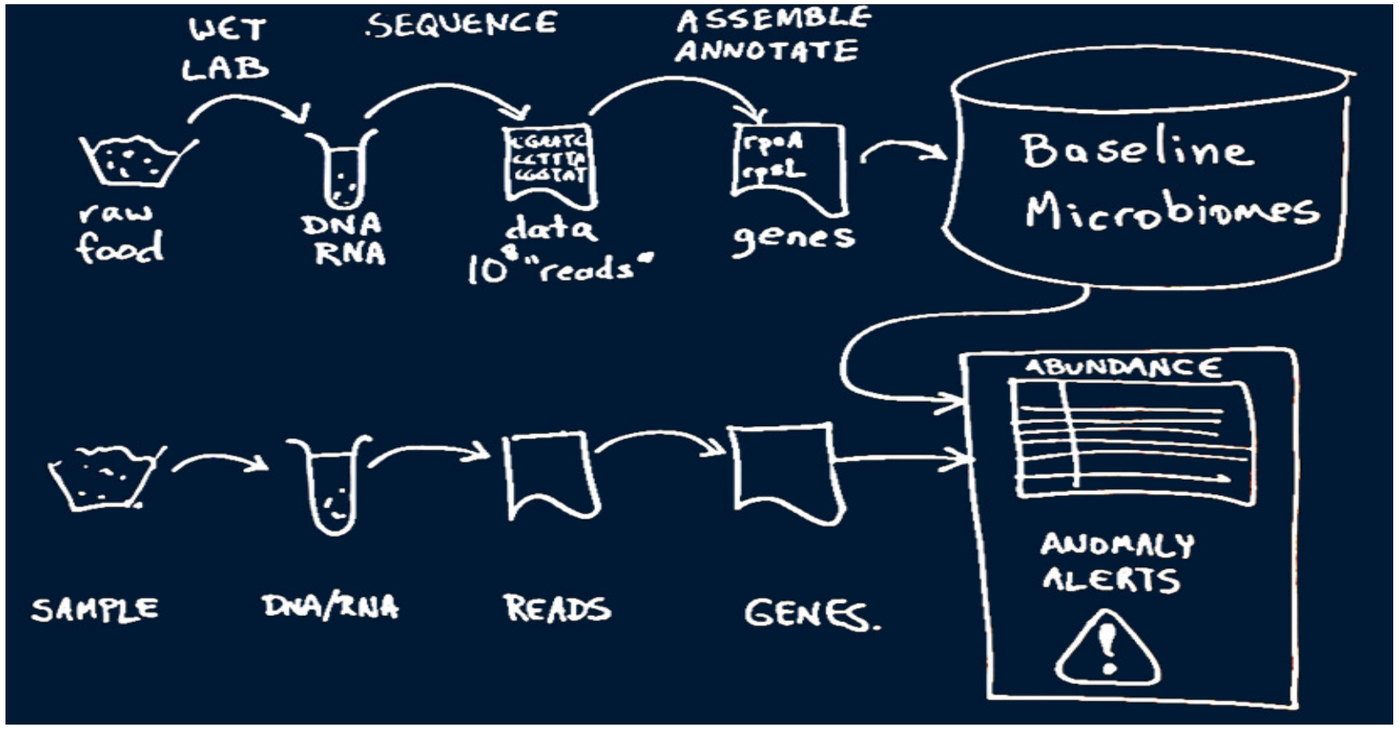
Comparative genomics



Genome assembly

Agriculture Genomics - Analytics Process

Step 1: What is the Baseline **Step 2:** Sampling detecting anomalies



Data collected at the source, along the supply chain → **Samples sequenced, assembled & annotated** → **Comparison to baseline microbiome information** → **Report of anomalies created**

What is the Food Safety Consortium?

A collaborative effort of stake holders using genomics-enabled diagnostics with molecular tools for:
Surveillance

- Risk assessment
- Diagnosis of food borne pathogens

…through the global food chain — from farms, slaughterhouses, the transportation chain, processing facilities, to supermarkets

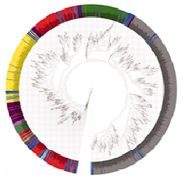
Food Safety Consortium Components

Data

Genomic and microbiome data gathered from areas of the food delivery chain as cataloged microbiome information

Genomics

Reference Data



Expertise

Collaboration of expertise from industry, research and academia with experience and capabilities focused on the challenge

IBM Research

UC DAVIS UNIVERSITY OF CALIFORNIA

MARS incorporated

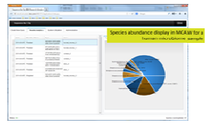
Industry

Academia

Analytics

Prototype system access that is secure and scalable for defined projects, output reports and on-going increased insight with new data sets

Web Based Tools



Accelerated Discovery Lab

Weather modeling and data analytics empower an island nation to save its natural resources

- Goal: Improve food security for its citizens by improving local agriculture.
- Only 3% of Brunei's rice is grown in the country today
- Brunei hopes to increase domestic rice production by 60% by 2015.
- Apply deep expertise in using data analytics and weather modeling to improve agriculture and energy development.
- Using Blue Gene-P system, show specific conditions in an area as small as 1.5 x 1.5 square kil ect changes over 10 minute increments for a 48 hour period.

BRUNEI

Reference: http://www.research.ibm.com/articles/brunei.shtml

Crop Modeling

- Crop Models – DSSAT(US – Netherlands), APSIM+ (Australia), Aquacrop (FAO), InfoCrop (India) etc.

- DSSAT

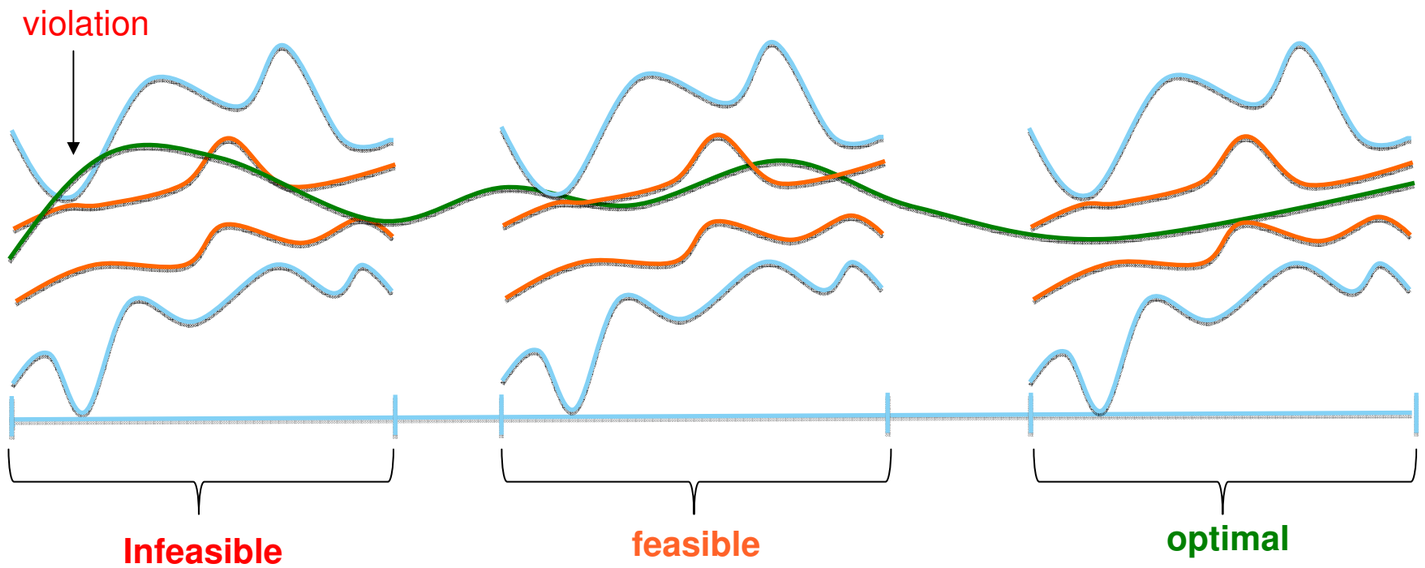
- Developed over 30 years.
- Florida State University, Georgia State Univ, Washington State Univ, …
- > 2500 trainer users.
- Has models for
    - Cereals – rice, maize, wheat, barley, millets, sorghum.
    - Legumes – chickpeas, lentils, peanut, soyabean.
    - Root crops – cassava, potato.
    - Oil crops – canola, sunflower.
    - Veggies – pepper, cabbage, corn, beans, tomato,
    - Fiber – cotton.
    - Other – sugarcane, pineapple.
- Can be used for farm management process development including irrigation, fertilizer scheduling, cultivar development, rotational analysis.

- Substantial knowledge acquired in DSSAT.

- Ongoing and Future Work

- Develop model for Laila variety rice (Brunei).
- Recommend farm management steps (Brunei)
- Integrate model with weather forecasting model for farm operations (Brunei).
- Find optimal conditions (weather, soil) for Laila under irrigated and non-irrigated scenario. (Brunei)

Crop Modeling – Optimal transplantation Date (Optra)

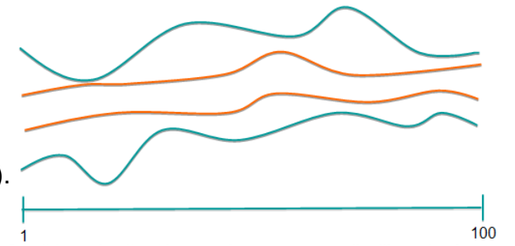


Optra

- Transplantation date optimization software. Developed at IRL.
- Uses 6 month weather forecast and optimal weather conditions for crop.

Ongoing and Future Work

- Use opTra for analysis using past 5 years observed weather data (Brunei).
- Determine optimal conditions for Laila. (Brunei)
- Introduce uncertainty in the model.
- Field application. (Brunei)



Feasible and optimal temperature ranges over the lifecycle of a crop

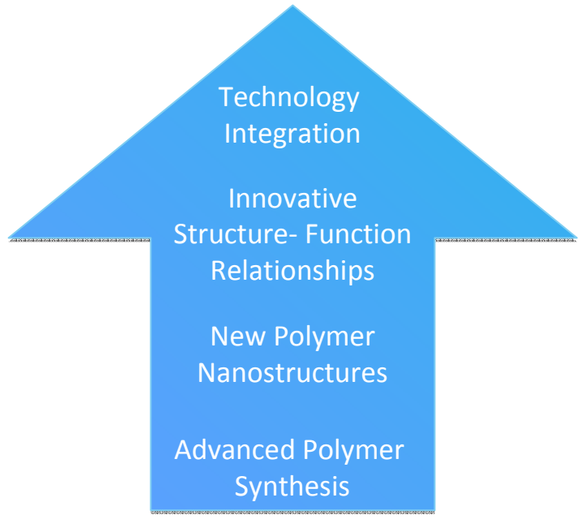
Materials Innovation for Smarter Agriculture (ARC)

Opportunity

- Advanced Polymer Materials are increasingly used in agricultural innovations to enhance cultivation of crops in adverse weather and soil conditions for crop protection and for improving the yield and quality of crops in shorter time at lower cost.

Innovation

- ARC has the potential for providing polymer materials innovations in smarter agriculture *via* it's ongoing activities in adjacent research spaces:
  - e.g. Controlled Release Polymers (CRP) for the precision deployment and performance of moisture control agents and site-localized release of chemical actives (currently with various Pharmaceutical companies).
  - e.g. Antimicrobial polymers which are currently being evaluated for use in combating citrus greening of orange orchards in Florida (with COKE)
  - e.g. Existing block co-polymers and hydrogels (multiple engagements) that are potentially adaptable towards soil reclamation research

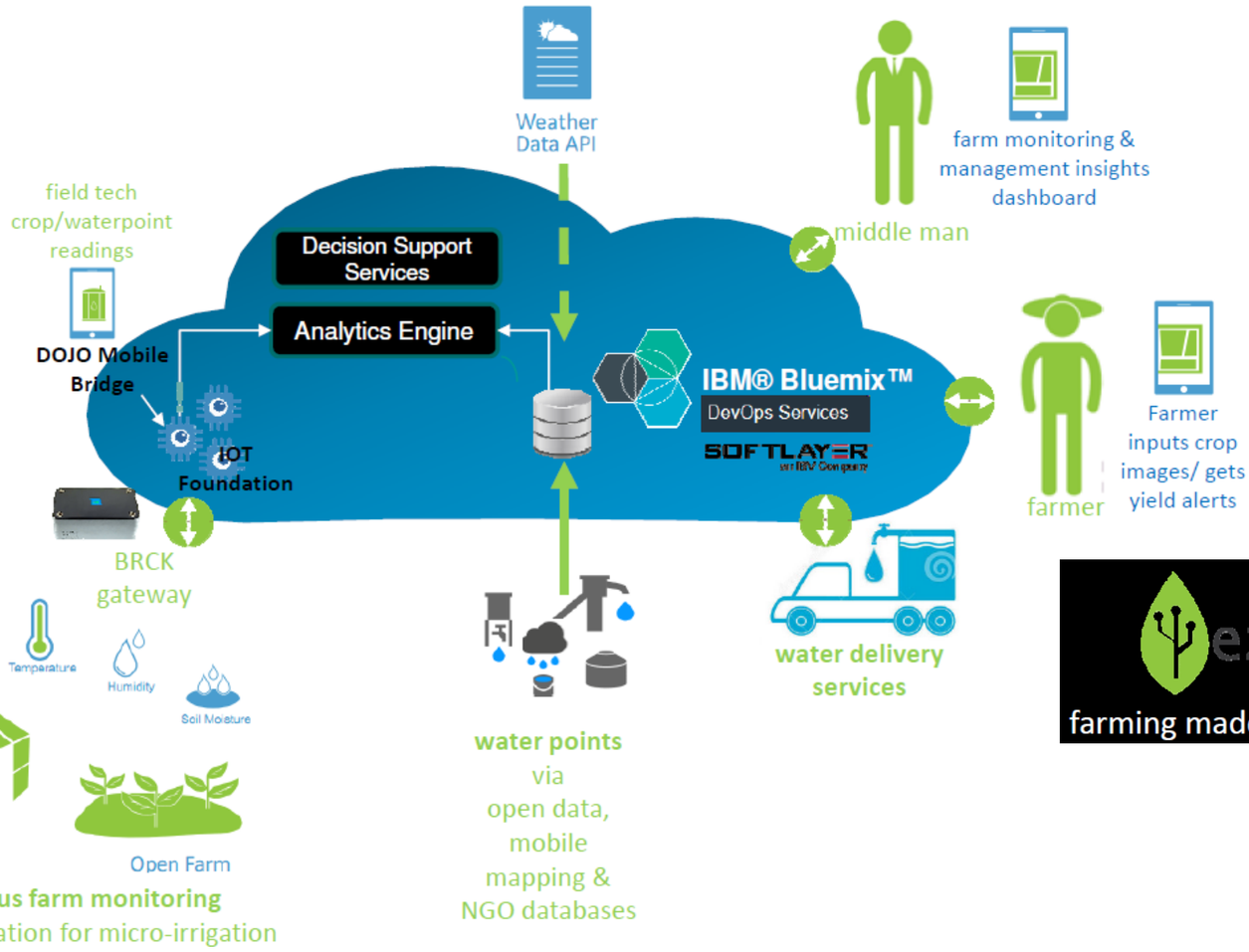


Impact

- Up to 90% of agrichemicals deployed are wasted – precision CRP agrichemicals have potential for significant financial and environmental savings
- Up to 10% of harvested grain held in long term storage is lost through pests. CRP pest repellents are a potential innovation in reducing this cost
- IBM polymers present innovative research solutions to emerging problems such as Citrus Greening which has cost the state of Florida alone $4.5B to date

Introducing

IBM Research | Africa
The world is our lab.



ezfarm
farming made easy with IBM

ezfarm Water Kit

धन्यवाद
Hindi

多謝
Traditional Chinese

ขอบคุณ
Thai

Спасибо
Russian

Gracias
Spanish

Thank You

شكرا
Arabic

Merci
French

Obrigado
Brazilian Portuguese

Bedankt
Nederlands

多谢
Simplified Chinese

Danke
German

நன்றி
Tamil

ありがとうございました
Japanese

감사합니다