The Power of IT: Accounting for the Benefits

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With Open Data, Infrastructure and City Performance Can Become a Managed Service

Energy
- Smart meters; consumers track consumption
- Local energy generation (rooftops) integrated with the grid

Water
- Smart meters, consumers track consumption
- Support for localized water treatment and recycling (remote quality assurance)

Public Safety
- Community crime mapping and reporting

Environment
- Detection and alerts of air and water pollution
- “Whistle-blowing” on damage to the environment

Maintenance
- Phone apps - Fixmystreet.com, Seeclickfix.com, also several homegrown alternatives created by local governments

Mass Transit
- Bus timings and locations
- On-line travel bookings

All
- Spending data, even citizen budgeting
- League tables of performance, citizen satisfaction

Roads
- Traffic data, journey times, road-vehicle interactions
- Road pricing - static and dynamic
- Dynamic parking pricing, parking space search
- Plugshare - electric car recharging points

Precision Agriculture via Data & Analytics Is Smarter Agriculture

Precision Agriculture

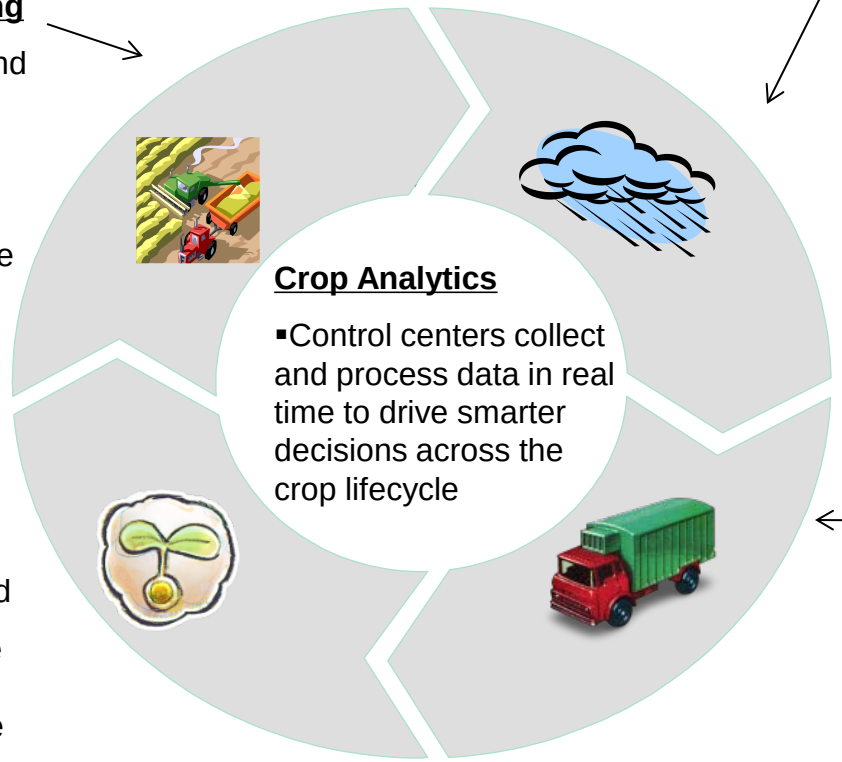
- The traditional approach requires following a set schedule for planting, fertilizing, watering, and harvesting.
- Precision Agriculture changes the traditional approach by using data and predictive analytics to make smarter decisions.
- Data for Precision Agriculture is collected in real-time from sensors in the soil, air, and crops and augmented with weather forecasts.

Crop Maintenance & Fertilizing

- Decisions are time sensitive and weather dependent
- Rain = Bad time to fertilize as rain washes away fertilizer
- No Rain = Good time to fertilize and irrigate

Watering

- 70% of fresh water consumption worldwide is driven by agriculture.
- Smarter decisions about watering = big impact
- Pictures of fields taken from satellites can be coupled with predictive weather modeling (IBM Deep Thunder) to pinpoint conditions 48 hours in advance and make smarter decisions about watering crops



Planting & Sensing

- Seeds are placed in the ground
- Sensors placed throughout the fields are used to measure temperature and humidity of the soil and surrounding air.

Transportation & Distribution

- The logistics of transporting harvested food to distribution centers are crucial to avoid waste
- Goods must be transported at right temperature and kept only as long as needed
- Enhance with track & trace

EXAMPLE PROJECT: SMARTER BUILDINGS

- Results for a Group of over 50 Buildings over 2+ years:
  - $2.9 M (33,720 MWH) in energy savings.
  - 50% improvement in operational productivity
    - Increased number of maintenance work orders – better early intervention
    - Maintenance hours expended per work order: reduced by 64%
    - Total work order hours: reduced by 54%
  - Comfort calls:
    - Total number of work orders: reduced by 19%
    - Hours per work order: increased 5%
    - Total number of work order hours: reduced 15%

EXAMPLES OF INDIVIDUAL BUILDING PROJECTS

Rule Number Description	Investigation	Solution	Location Annual Savings
Cooling Valve Open when Cold Outside. System in Economizer Mode	Packaging cardboard was blocking 80% of an outside air duct. Causing the system to command the damper to 100% open for an excessive amount of time.	Remove the cardboard.	453 MWH
Setpoint Attainment AHU - Cooling Valve Full Open for an Excessive Amount of Time	A bee's nest was found in an Air Handling Unit (AHUs) on the Roof, causing the hot water valve for the unit to be stuck open at 5%; dampers were stuck at 50% return air and the chilled water valve was stuck at 20% open.	Removed the nest and recalibrated all the actuators for full range of motion.	38 MWH
AHU - Detected Operating Outside of Office Hour Schedule	The low temperature freeze protection for a group of AHUs spotted in a location whose temperature profile changed because of energy conservation efforts. In the winter, the Low Temperature Override (LTO) was turning on AHUs to prevent freezing because the space temp dropped below 10ºC.	The Building Controls supplier has now reprogrammed the LTO to work on the average of the space temperature sensors in the spaces served.	457 MWH

CONSIDERATIONS ON ASSESSING ENERGY SAVINGS IN LARGE SYSTEMS

- System savings are an aggregation of individual project results.
  - Under a given system, individual activities are made more efficient through the management and monitoring system.
    - Better logistics routing for an individual delivery vehicle.
    - Improved energy use for a building.
    - More efficient seed planting and crop yield
    - And so on;
  - Savings generated through the application of IT to large systems likely involve thousands of individual projects, occurring over some defined time frame:
    - Typically can be combined into a defined number of project groupings.
    - Need to set standard boundaries in time and “space” or “operations”

- Data Collection and Savings Tracking requires a balance between the cost and effort of collecting the data and the accuracy and integrity of the savings estimates.
  - At some point prior to the theoretical benefits, instrumentation becomes uneconomical
  - It is possible to construct reasonable assumptions to give a reasonable estimate of savings.

CONCLUSIONS:

- Internet based monitoring and management of “macro” systems offers significant opportunities for efficiency savings.
- Instrumentation, data collection and data analysis offers a significant opportunity to “unlayer the onion”, analyze a system, and drive efficiency savings.
- The process of measuring the benefits cannot let “perfect” become the “enemy of the good”.