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The Future of Mining and Agriculture

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28 Nov 2017

Mining and Agriculture in Australia

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MINING

6.9% of GDP (2016-17)

Contributed to **14%** of GDP growth over the past decade

Mining Reserves: Australia's Global Ranking		
1	2	5
Iron Ore, Gold, Zinc, Nickel, Uranium	Bauxite, Copper, Brown Coal	Black Coal

AGRICULTURE

2.6% of GDP (2016-17)

Australia in World Top-10 Largest Producers of:
Wheat, Barley, Almonds, Sugar Cane, Cotton, Wool, Beef, Lamb

Source: Dept of Industry Innovation and Science, ABARES, Frost & Sullivan

The Future of Mining

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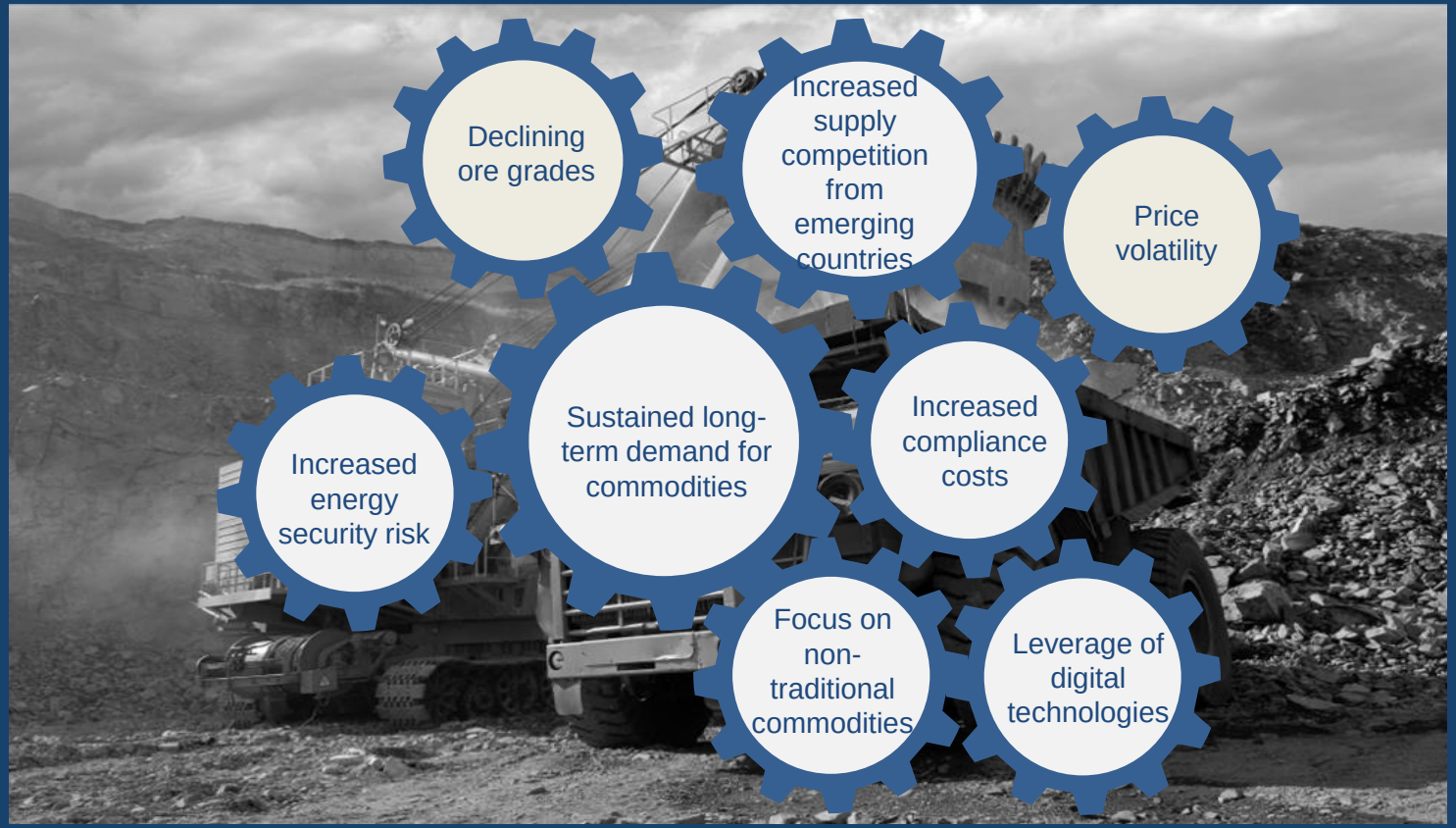
Sector Trends Impacting Opportunities



Source: Frost & Sullivan

Expanding the Mining Footprint

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Emerging Markets with Top 15 Reserves by Size in at Least One Commodity, Global

Source: Corporate Exploration Strategies; Frost & Sullivan

Digital Transformation in Mining

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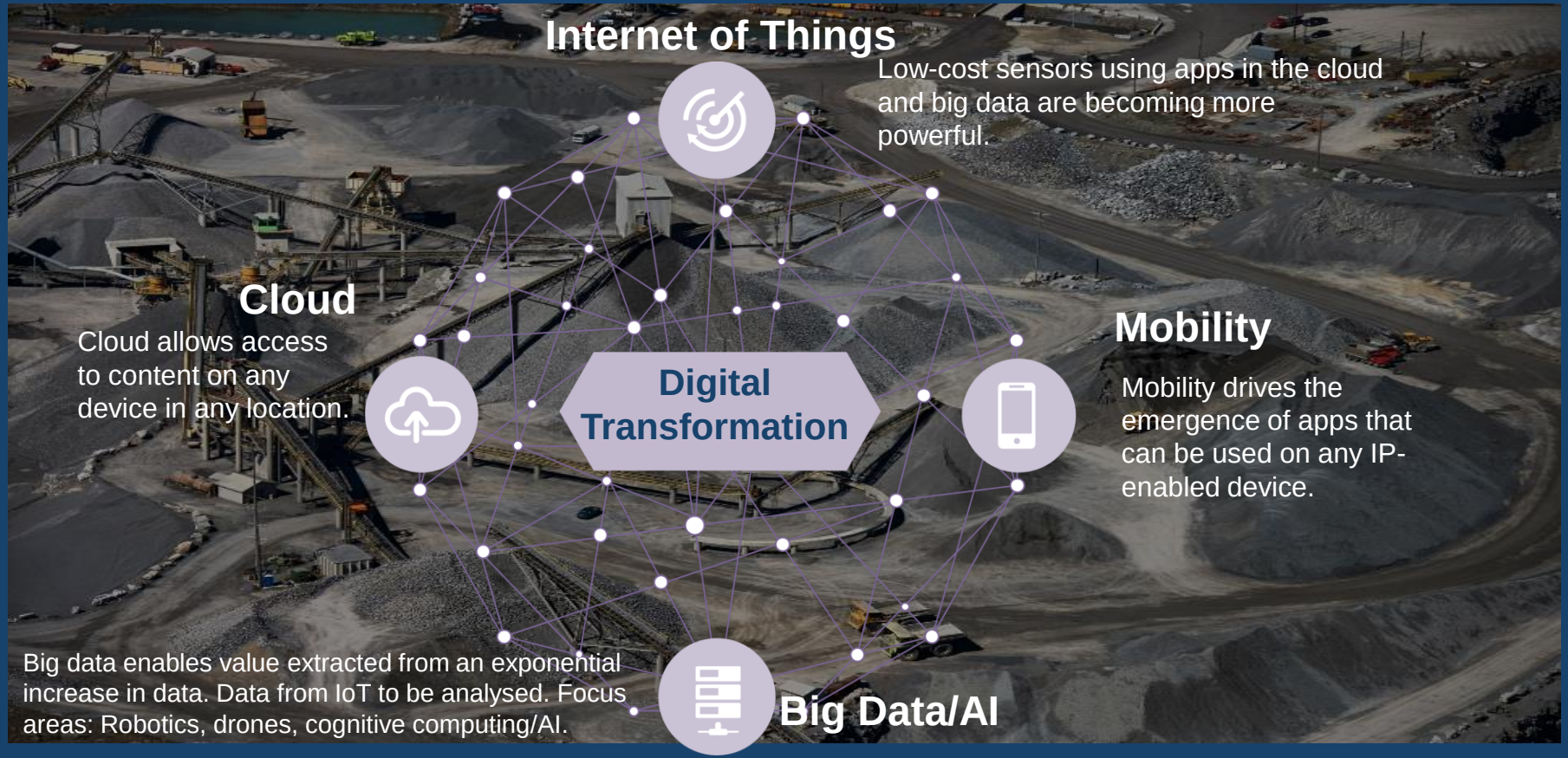

Source: Frost & Sullivan

Drivers and Restraints

Inadequate budget reduces market penetration and weakens overall revenue growth

Inadequate understanding and appreciation of digital transformation benefits continue to hamper market development

Need to reduce costs prompting exploration of digital solutions

Need for increased operational agility and efficiency

Need to mitigate risks and ensure compliance

Source: Frost & Sullivan

Industrial IoT's Role in Resolving Challenges

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- Flexibility to adapt to market needs
- Quick access to knowledge experts and documents
- Integrated value chain
- Building customer relationships
- Environmental standards
- Global footprint – Better control
- Track and trace
- Equipment failure and maintenance
- Easy access to data
- Economic uncertainty
- Focus on customisation
- Production efficiency
- Product innovation – Remain competitive

Solution

IIoT Technologies (IT and OT convergence)

- Smart Sensors
  - Well over 1 million IoT sensors and devices in fixed plant in Australia's mining sector
- Drone Technologies
- Autonomous Vehicles
- Process Simulation
- Robotics
- Cloud Computing
- Big Data & Analytics
- Predictive Maintenance

Source: The University of Sydney and Frost & Sullivan

Digital Transformation across the Chain

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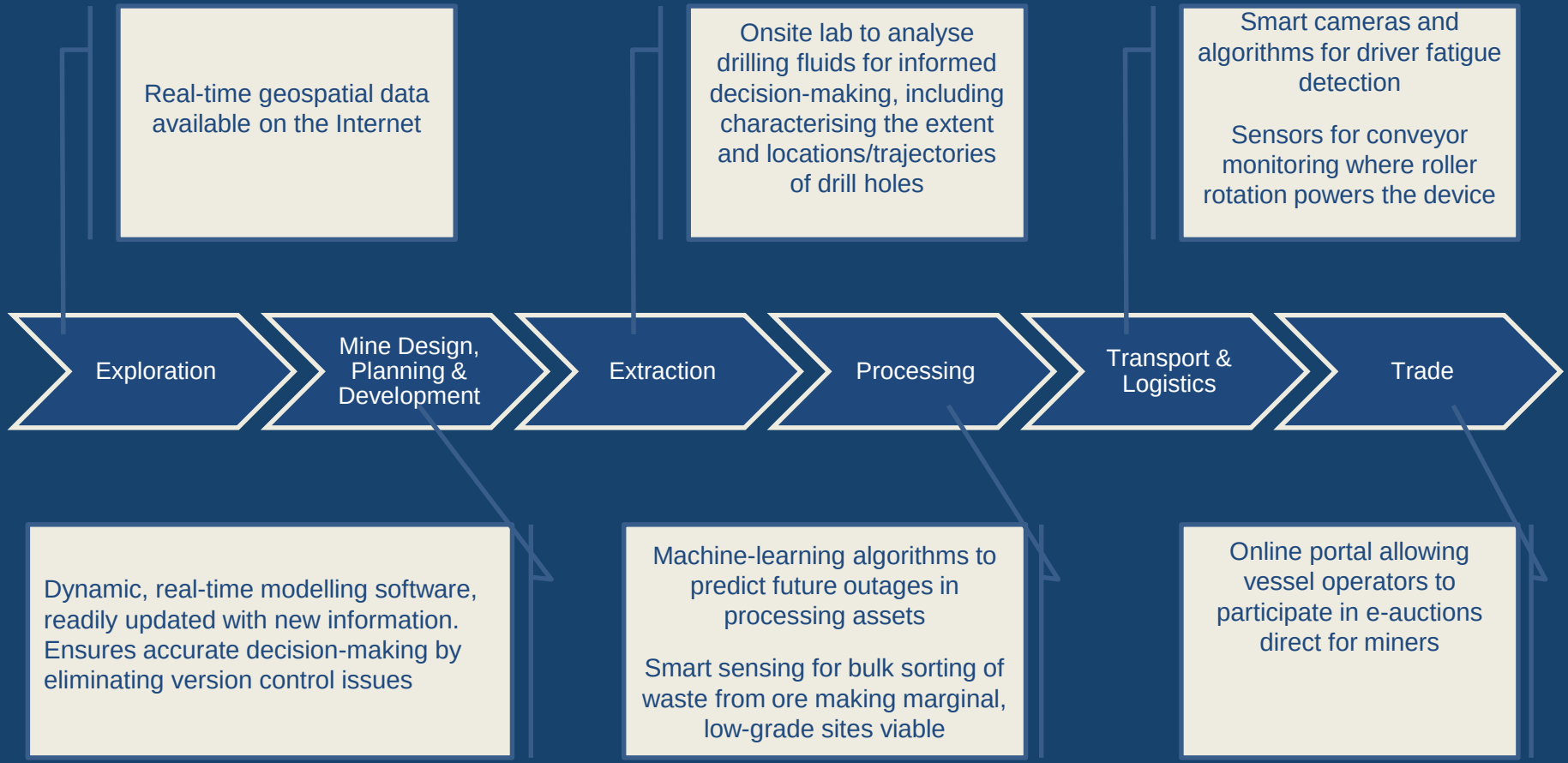

Drones in Mining

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Current Use Cases

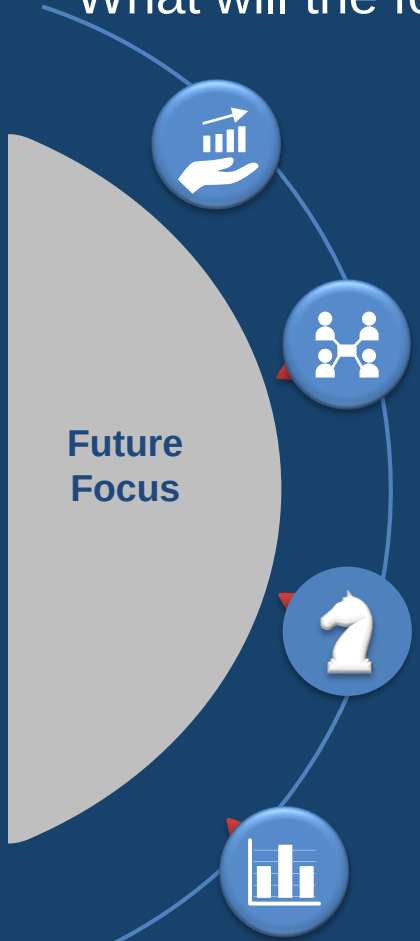
- Aerial 3D mapping for volumetric measurement of aggregates
- Slope inspection and characterisation, highwall mapping
- Infrastructure and equipment inspection (Smelter stacks, Railroads, railcars, Pipelines, Overhead power lines and substations)
- Blast monitoring and post blast surveys
- Incident investigations and emergency response

Future Direction

- Increased flight times
- Use underground and in confined spaces
- Real-time video and data streaming
- Use of machine learning

Source: Frost & Sullivan

What will the focus areas be in the future?



Significant opportunity to widen the application of **sensors** across the mining value chain.

Significant potential for **drone-as-a-service** business models for the mining sector.

Untapped opportunities to transform the rich data sets generated from mines into actionable insight using **AI**.

Cybersecurity will become increasingly important as connectivity expands the attack surface.

Source: Frost & Sullivan

The Future of Agriculture

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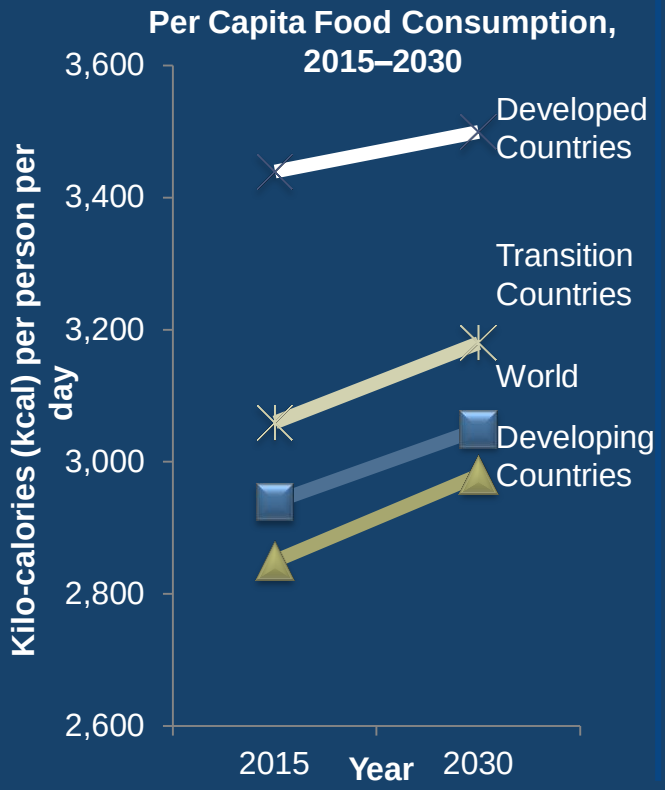
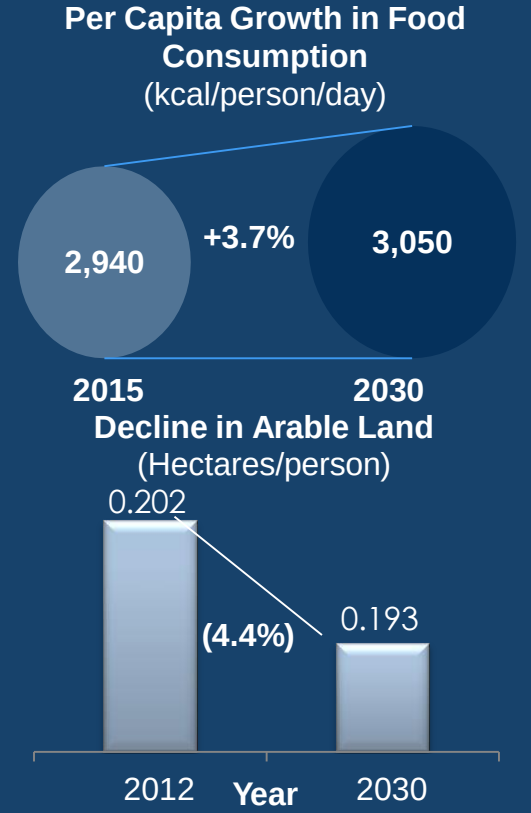
The Challenge Ahead





Not a re-distribution problem—

"Even if we took all the food produced in 2009 and distributed it evenly amongst the global population, the world will still need to produce 974 more calories per person per day by 2050." - **World Resource Institute**

Source: Frost & Sullivan

Enabling Technologies for Future Farms

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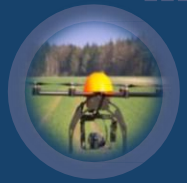
Service Requirements 3

- Installation and systems integration
- Yield monitor calibration
- UAV drone mapping

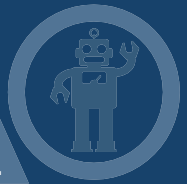
Software 2

- Farm operations Management solutions
- Predictive analytics
- Controlled traffic farming software



Communication 4

- GNSS (includes all satellite-related solutions such as tractor guidance, auto steering, and yield monitoring)
- Cellular
- LPWAN



Hardware 1

- Precision agriculture equipment
- Crop cultivation technologies
- Sensors and sensor fusion
- GNSS equipment
- Autosteering/automation technologies

Others 5

- Cloud computing
- Machine-to-machine (M2M) communication
- Artificial intelligence

Note: GNSS—Global Navigation Satellite System
LPWAN—Low-power Wide Area Network

Source: Frost & Sullivan

Disruptive Technologies - Emerging Use Cases

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Soil and Water Monitoring

Grain Silo Monitoring

Hot-house (Greenhouse) Condition Monitoring

Cattle Tracking

Nutrient Sensing Technologies

Weather and Climate Sensors

Aeroponics

Hydroponics/Aquaponics

Variable Rate Technologies

Autonomous Farming

Agriculture Drones

Robotics

Source: Frost & Sullivan

Connectivity – Creating New Business Models

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Tractor-as-a-service helping farmers shift CAPEX cost to OPEX

- Farmers are discovering the option to pool their vehicles and machinery to share the cost of ownership using a tractor-as-a-service model.
- Opportunity to go beyond tractors - platform that lets farm co-ops, equipment retailers, and dealers pay for equipment on demand and rent out their own machinery when not in use.

Source: Frost & Sullivan

IoT – Creating New Business Models

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A	**Database Backbone**	Product by environment testing makes on-farm prescriptions possible
B	**Variable-rate Fertility**	Variable rate ‘apps’ aligned with yield management zones
C	**Precision Seeding**	Planter hardware systems enabling variable rate seeding and row spacing
D	**Fertility & Disease Management**	‘Apps’ for in-season customer application of supplemental late nitrogen and fungicides
E	**Yield Monitor**	Advances in yield monitoring deliver higher resolution data
F	**Breeding**	Significant increases in data points collected per year to increase annual rate genetic gain

- **Remote sensing** maps every field in the US and superimposes climate information.
- Database contains over **150 billion soil observations and 10 trillion weather-simulation points.**
- Result is **prescriptive planting** according to the weather.
- **Model pushed up yields** by about 5% over two years.
- Monsanto is now **selling insurance** to farmers through independent agents.

Source: Monsanto; Frost & Sullivan

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Thank You