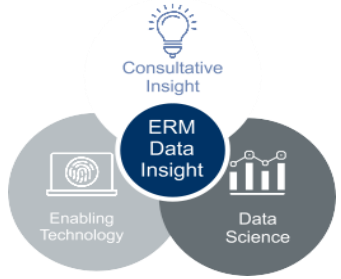


Data Science:

Gaining true insights from your data – making the most of your investment

Presented by:
Simon Gibbons, Technical Director
Simon Tillotson, Partner

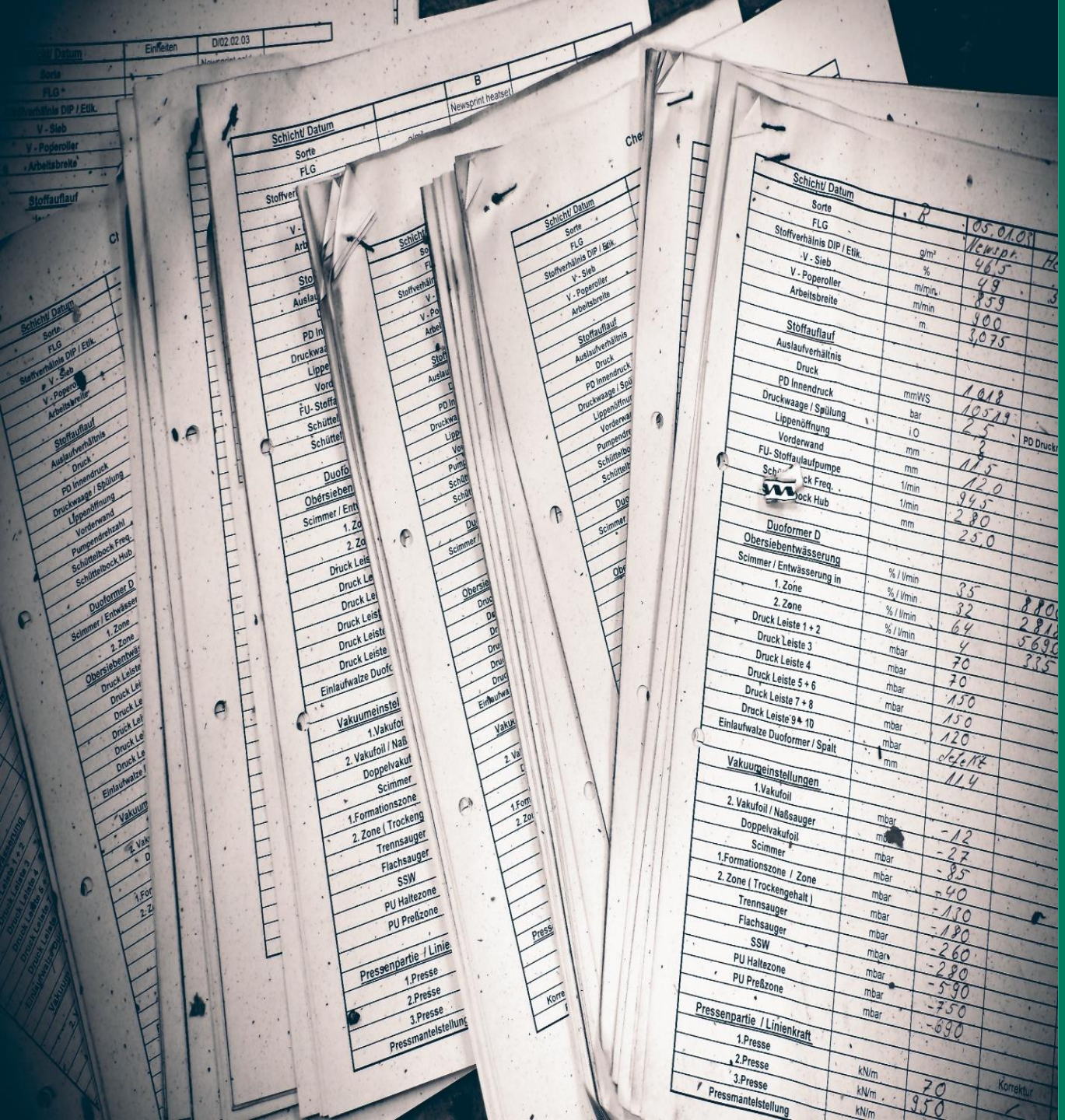
November 1, 2018

The business of sustainability

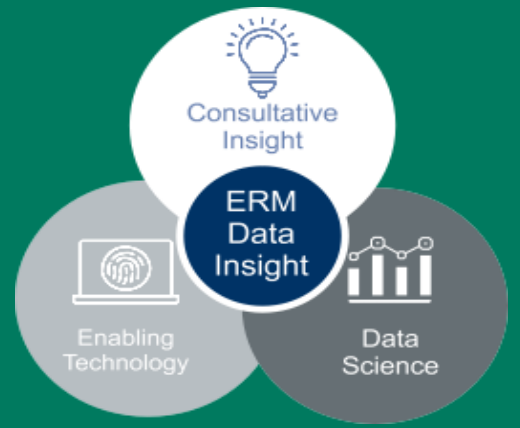
ERM

Health and Safety Moment: Insight through Visualization

- Spill modelling work has identified practical H&S risks for the workforce



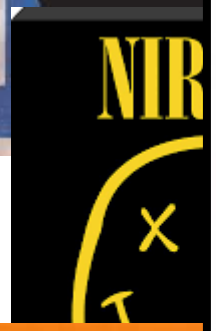
Data Science Introduction

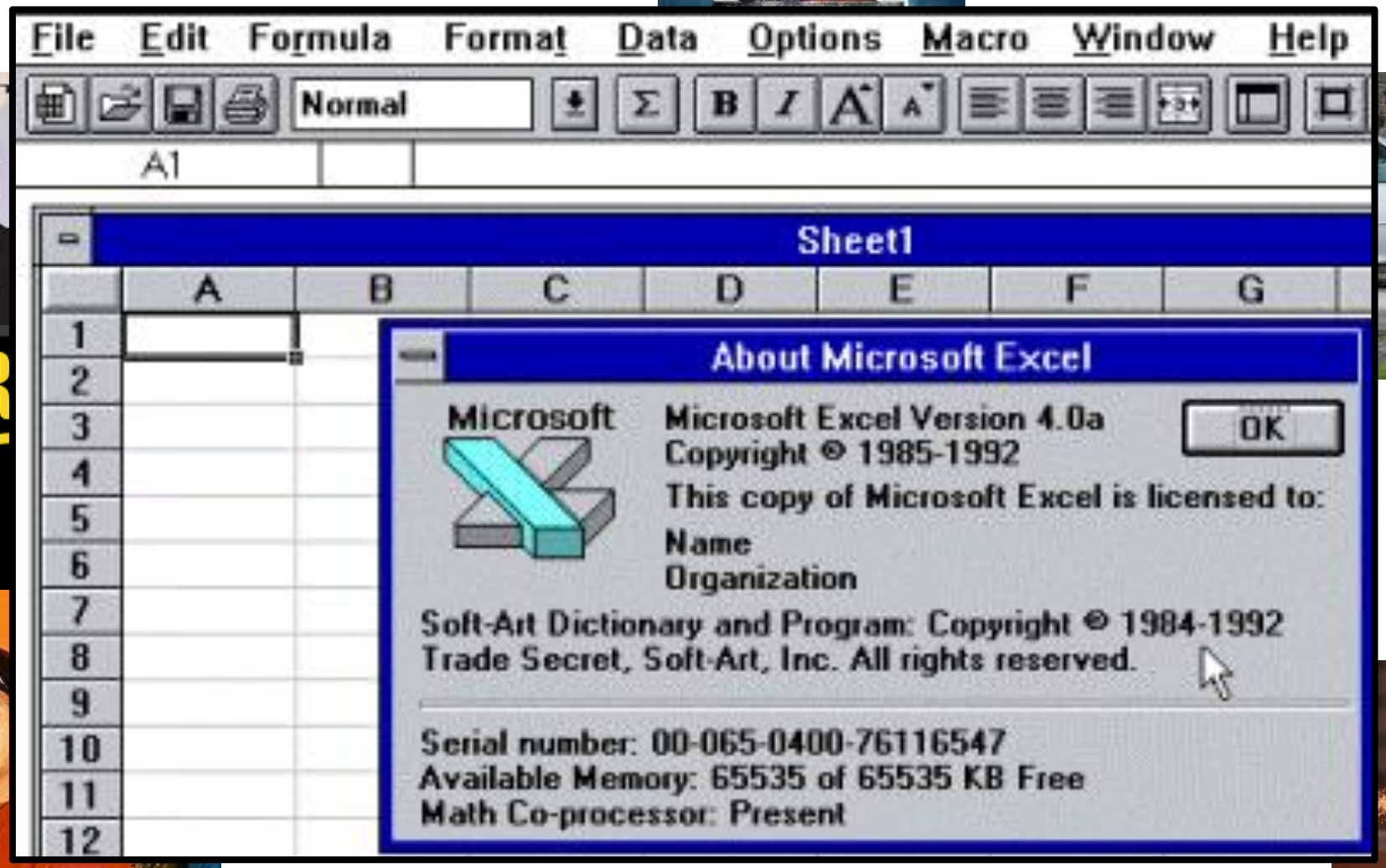


What We'll Learn About

1. The importance of Individual and organisational maturity
2. Definition of problem statements/hypotheses and workflows are essential to construct robust/reusable systems
3. Don't under-estimate the value in good data and data management
4. Big data ≠ Big reports
5. Data is a journey

Moving on from the 1990's

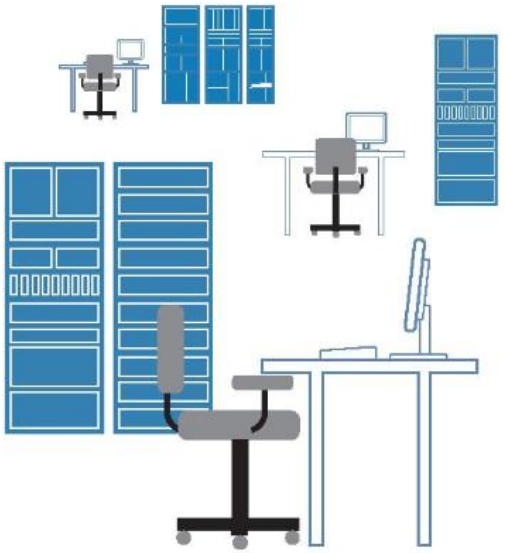




The Role of Data and the Data Manager

Data waster

Collects data but severely underuse them



Data collector

Collects data but do not consistently maximize their value

Aspiring data manager

Understands value of data and marshals resources to take better advantage

Strategic data manager

Has well-defined data-management strategies that focus on collecting and analyzing the most valuable data

The Economist Intelligence Unit

Digital Maturity – a Corporate View

Digital Maturity Level 1
Moving from Analog

L1 Characteristics

- Isolated Data Sets
- Pen & Paper → Excel
- Bespoke Reports
- Reports On Hard Copies/Hard Drives
- Lack Of Transparency

INCONSISTENT AND INEFFICIENT

Digital Maturity Level 2
Making the Digital Leap

L2 Characteristics

- Digital Data Collection
- Single Source Of Truth
- Speed Up Decision Making Process (Real Time)
- Consistent And Efficient Reporting

RELIABLE AND EFFICIENT

Digital Maturity Level 3
Integrating on Digital

L3 Characteristics

- Connecting Business Data Sources
- Data Insights Leading To Optimization
- Better Visualization (3D) → Stakeholders
- Efficient Decision Making Process

INTEGRATED AND INSIGHTFUL

Digital Maturity Level 4
Into Data Mining

L4 Characteristics

- Predictive Analytics
- Machine Learning For Data Analysis
- Automated Decision Making

To Artificial Intelligence, Virtual Reality And Beyond

FORWARD-LOOKING AND PROGRESSIVE

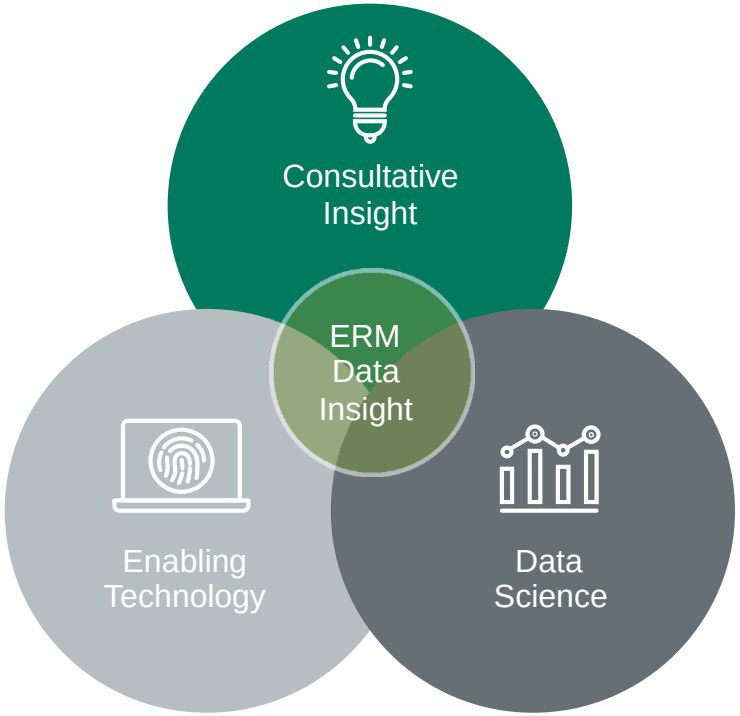
Data + Data Science + SME = Data Insights

Companies acquire complex and significant amounts of data over the operational lifetime of a site. ERM's experience suggests data is rarely stored in a centralised, organised place, can be difficult to locate, is inconsistent, its purpose unclear and the true value of the data in managing risks lost.

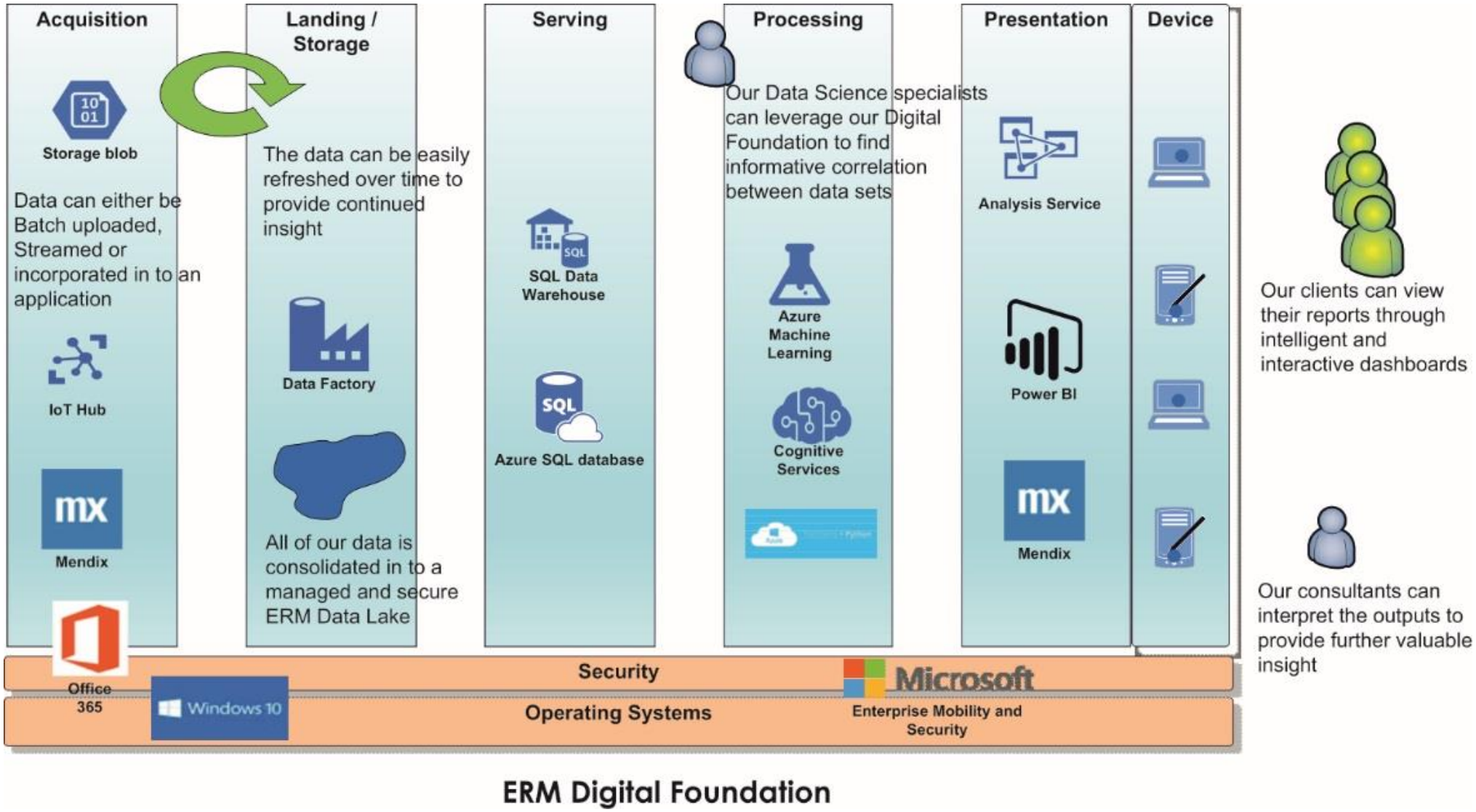
1. **Collection of Good Data**: Acquire, transform, and persist data appropriately

2. **Is it Right?** Apply data science techniques to find correlations within data

3. **What does it tell us?** Apply consultative insight to determine the "so what" in context of the problem that you the client are trying to solve and deliver value



Role of a Strong Digital Foundation



Problem Statements, Hypotheses and Workflow

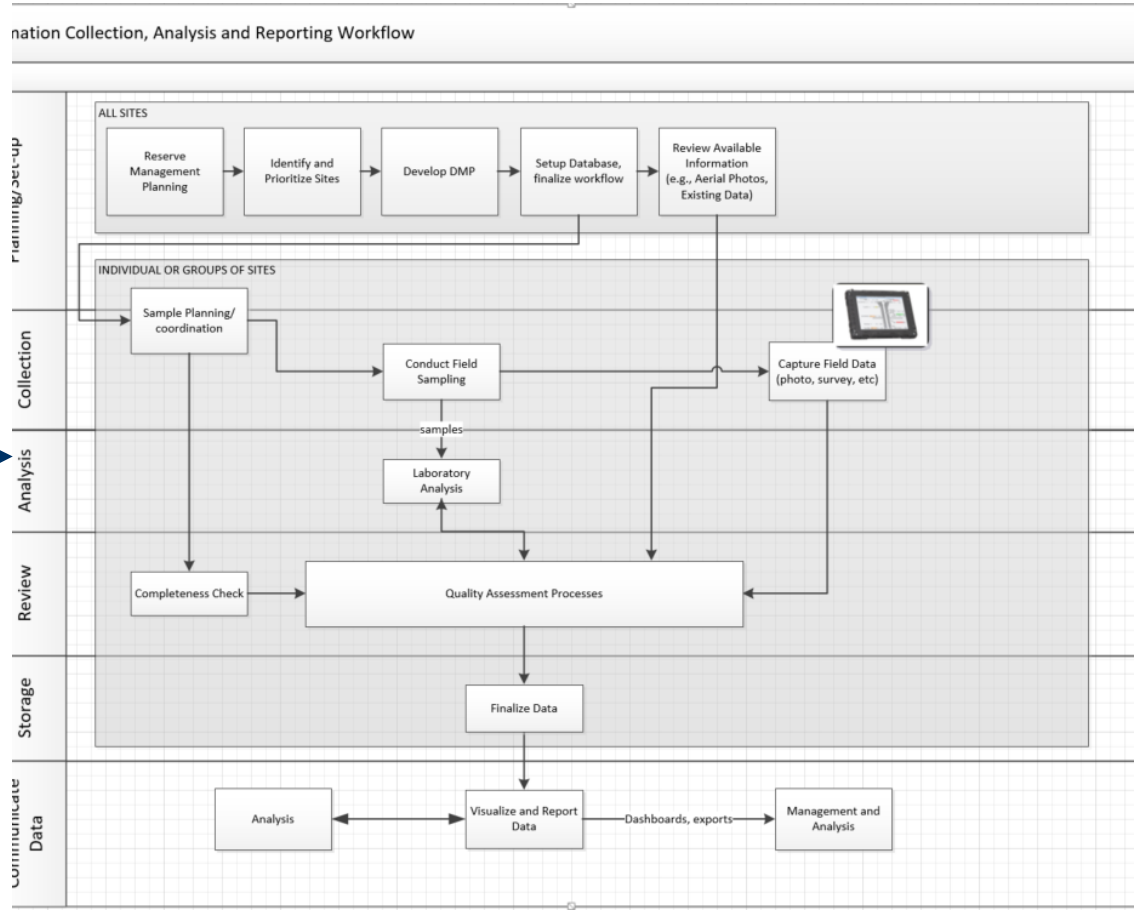
How close is the revolution to our factory doors? Where should I make investments in infrastructure, cybersecurity, and partnerships?

Where is the value for my company, and how can we maximize it?

What should we pilot now to start capturing this value?

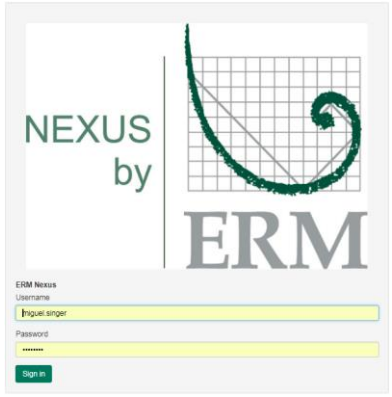
How will digital disrupt my industry in the next 5-10 years? What new ecosystems will emerge?

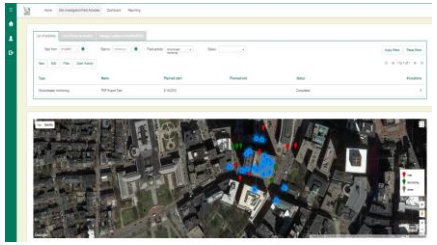
What new capabilities, skills, and mind-sets will we need in our organization? How will we identify, recruit, and retain the right new talent?

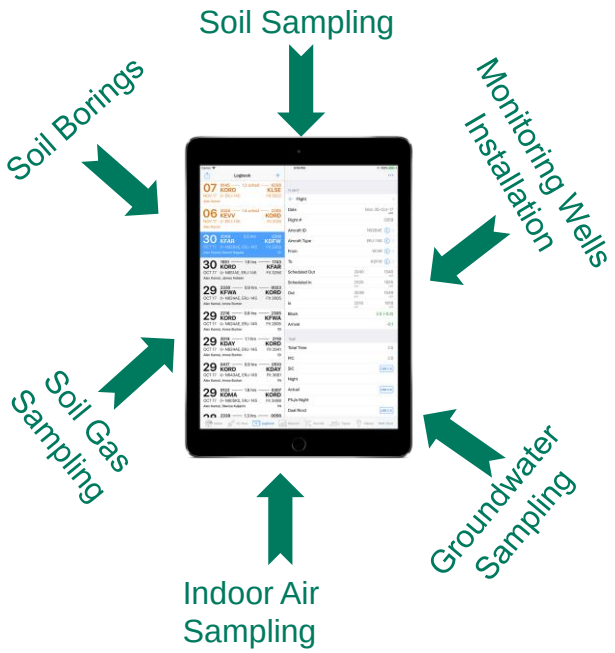


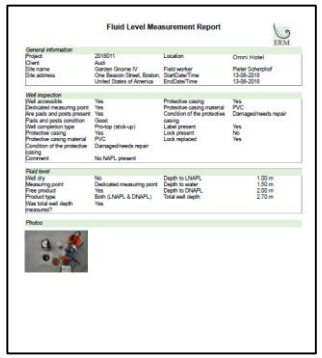
Example Data Workflow

Field Planning → Field Data Collection → Data Management → Data Assessment → Data Reporting







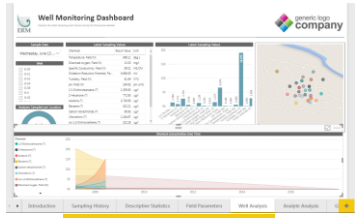


earthsoft EQuIS

Microsoft Azure

earthsoft EQuIS

esri ArcGIS Online



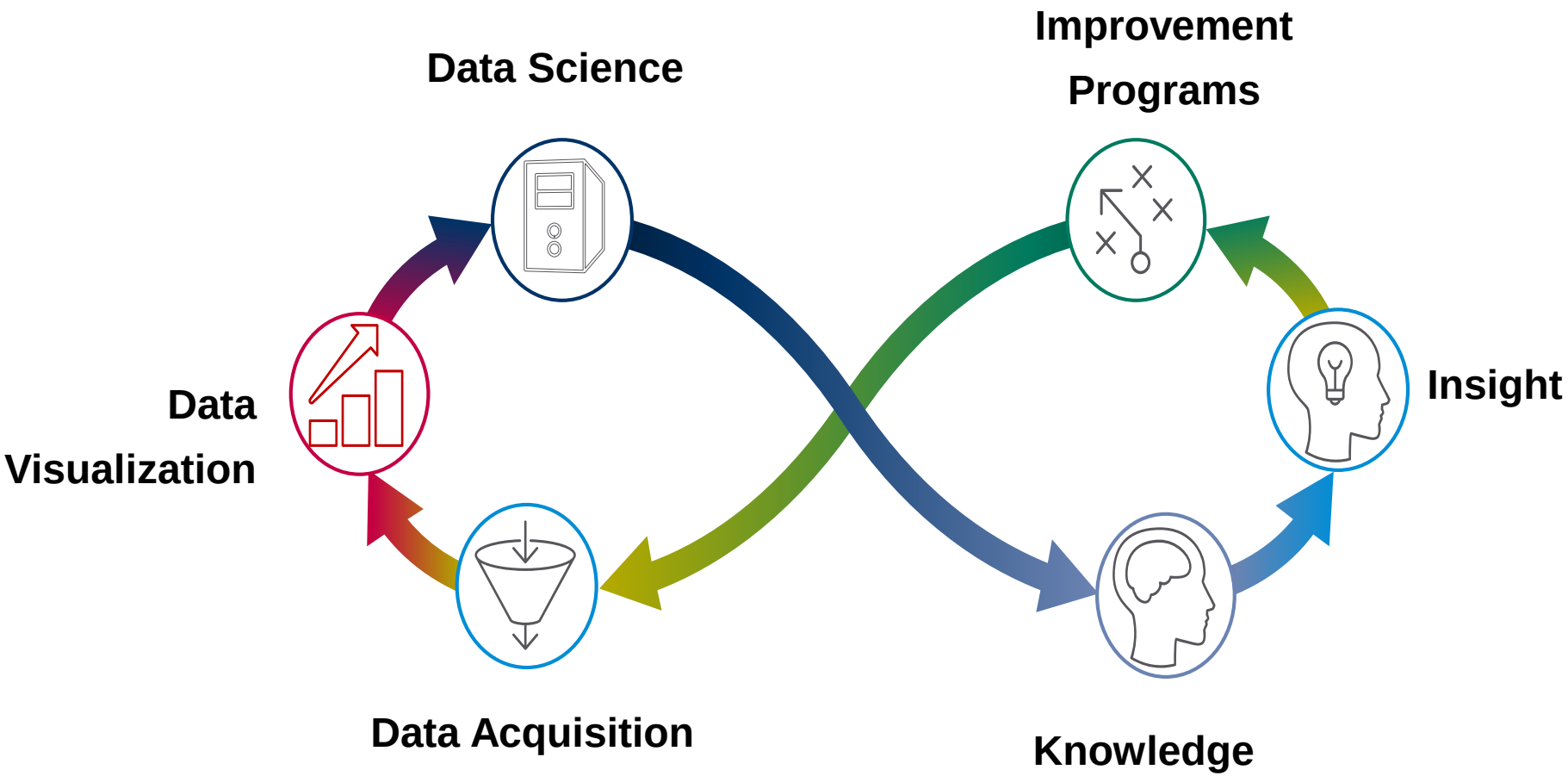
Power BI

Story Map ArcGIS

Power BI

Office ← Field → Office

Virtuous cycle of analytics

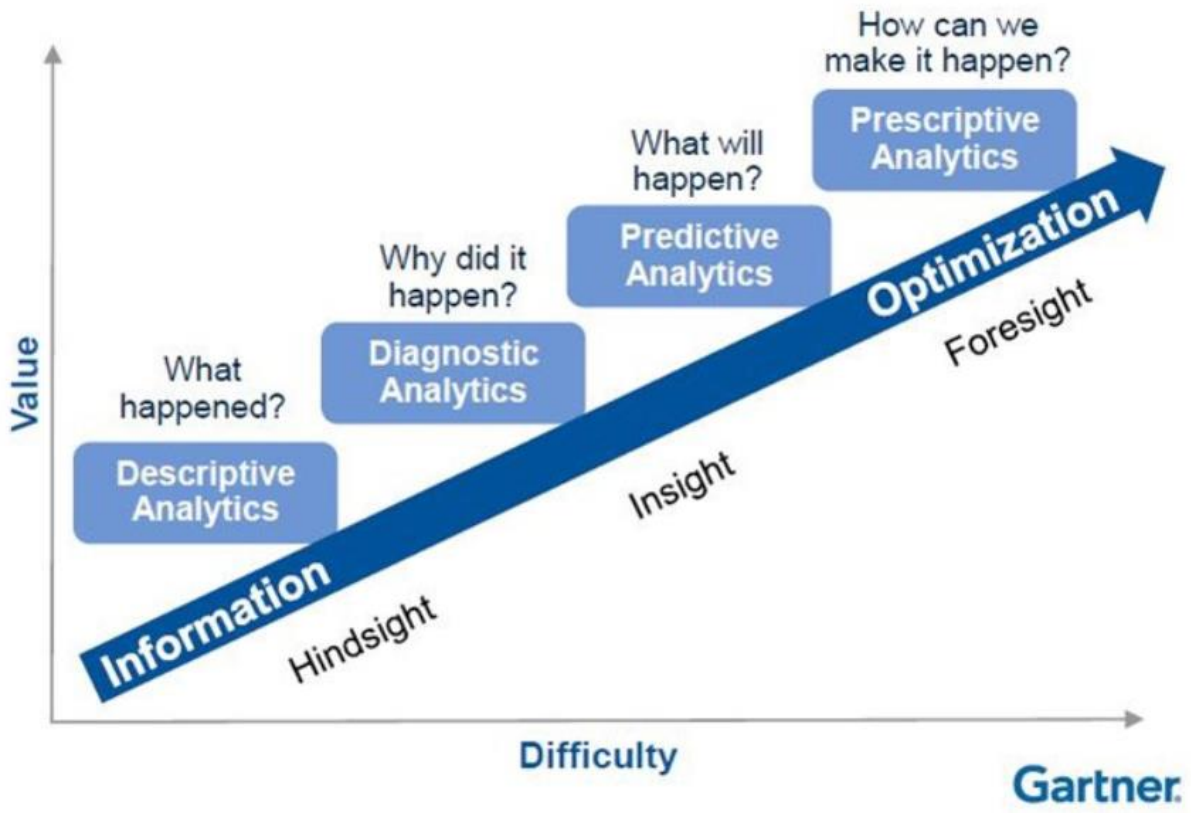


Levels of Insight

Analytics: *Visualising data – showing trends and indicators – is it performing as it should?*

Machine Learning: *Identifying patterns and probably outcomes – what could happen?*

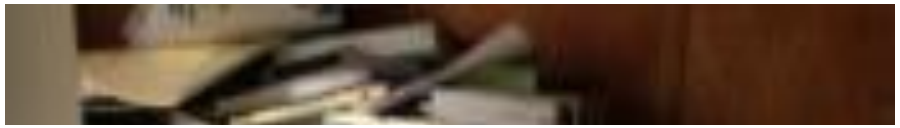
AI: *Predicting what is going to happen - making decisions on probable outcomes*



Examples:
Maturity Stage 2
Reliability & Efficiency

Accessing Data to Make Decisions

Data management

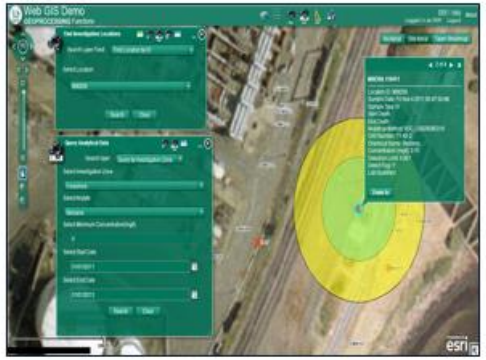


Opportunity

- Improve data quality
- Accessible by internal stakeholders globally
- Enable mobile applications
- Improve data access & consistency

- Develop project dashboards
- Improve communication of risks & liabilities
- Promote collaboration with consultants
- Improve decision making

- Allow transition between Consultancies
- Collate legacy data
- Quick response to regulator requests & bespoke regulator views
- Ensure long term access to project data

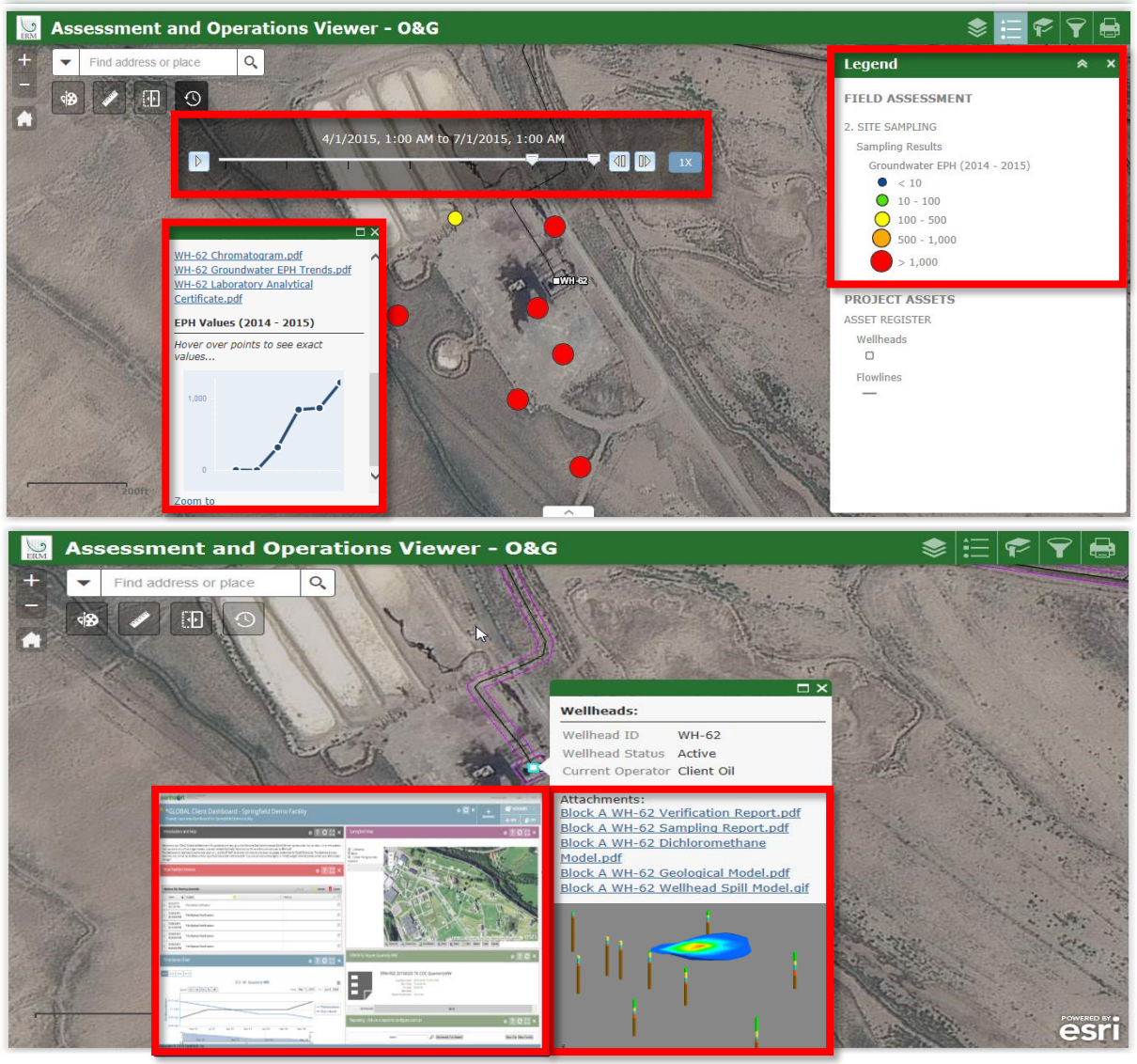


Case Study: Improving insights and transparency

Situation: *Client needed to quickly and efficiently analyze and visualize environmental data.*

Approach: Develop a centralized repository and visualization tools and create an analysis framework to analyze all environmental data for the organization.

- Developed a framework to analyze environmental data ranging from hourly site-level sensor data to corporate level sustainability metrics; processing 150-200 million data points a year
- Incorporated visualization tools to allow environmental advisors worldwide to quickly trend and analyze performance and understand compliance across all sites, business lines and the corporation
- Developed integration points into control systems to allow operators to react to real-time warning alerts calculated by the system based on sensor data and algorithms



Automation and data analytics in reporting

Challenge:

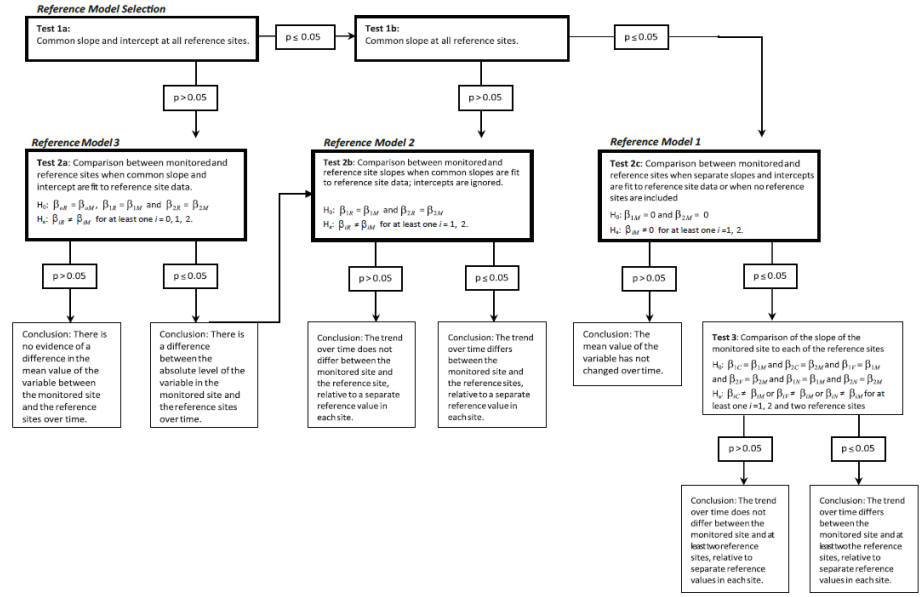
- 200 custom regulatory reports
- Must be completed annually with 4-6 weeks to complete all analyses and reports

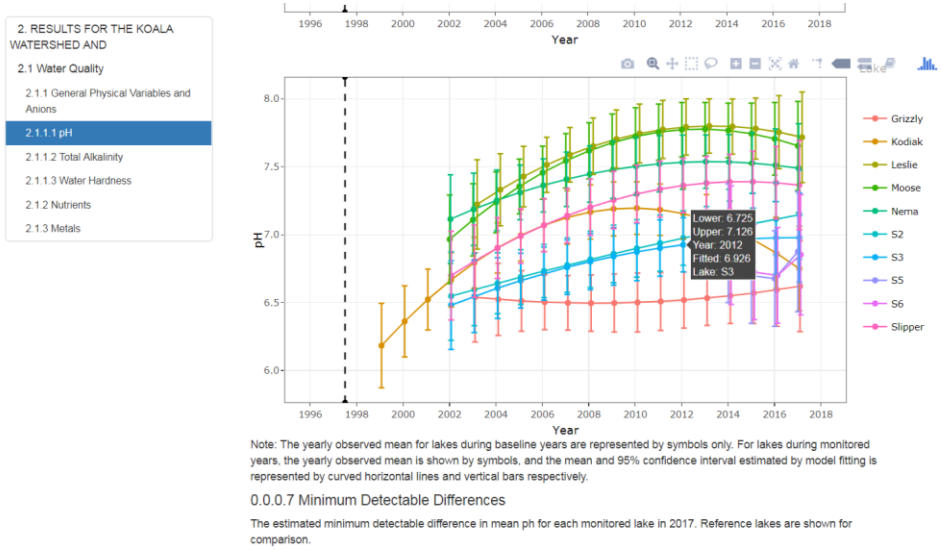
Approach:

- Leverage R and Rstudio to create a reporting template that could be automated

Benefits:

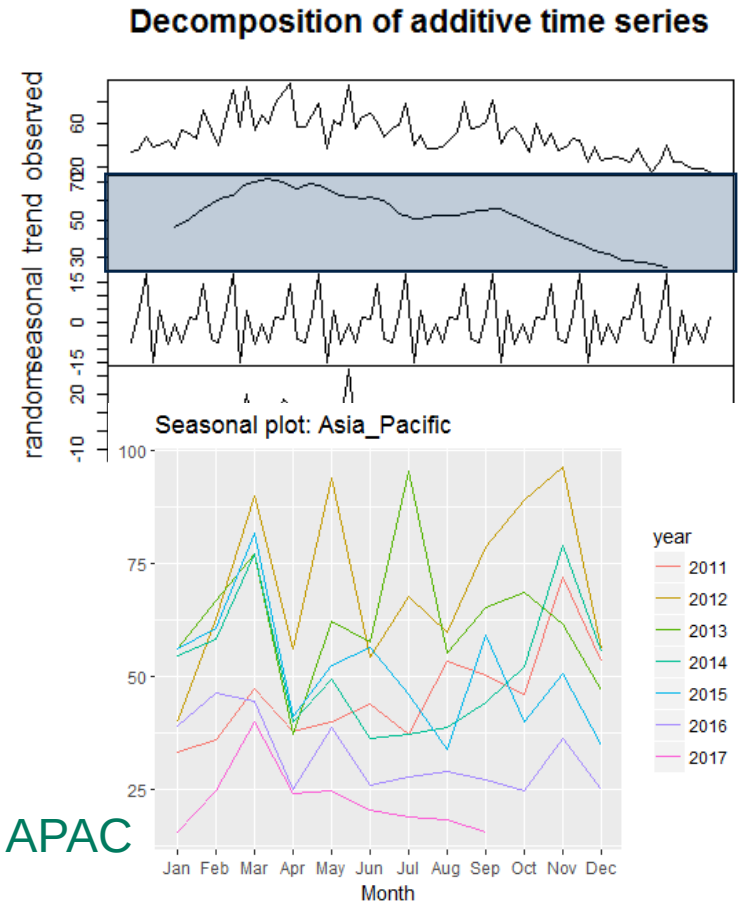
- Ability to quickly shift focus to problem sites and manage non-compliance risk.
- Higher confidence and building strong relationship with Regulator
- Overall improvement in the efficiency, accuracy, quality and timeliness of reporting.



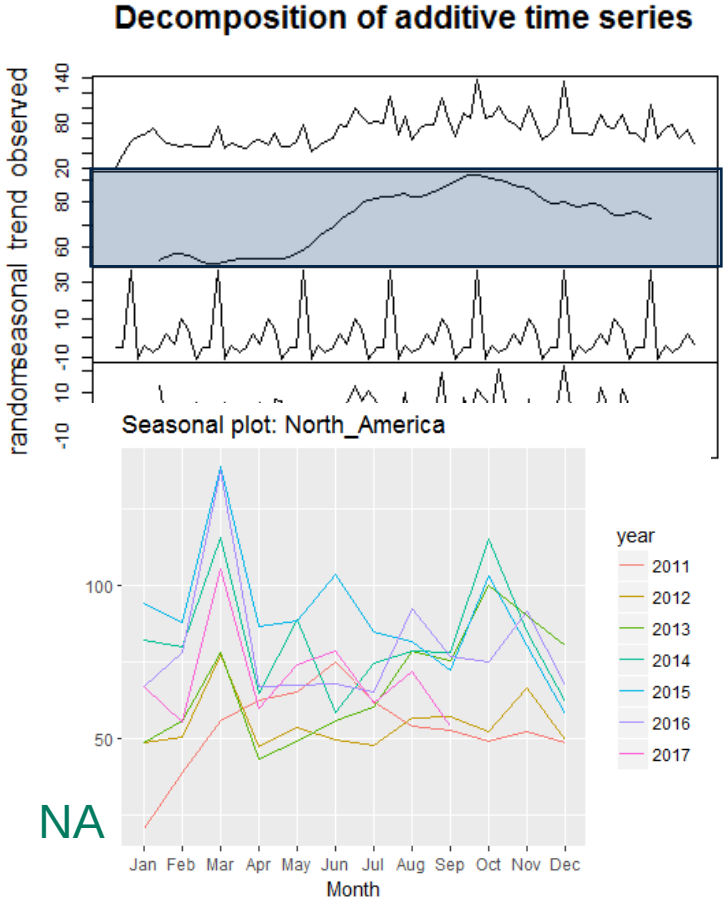


Examples:
Maturity Stage 3
Data Insights
Identifying Patterns and Reacting

Data accessibility

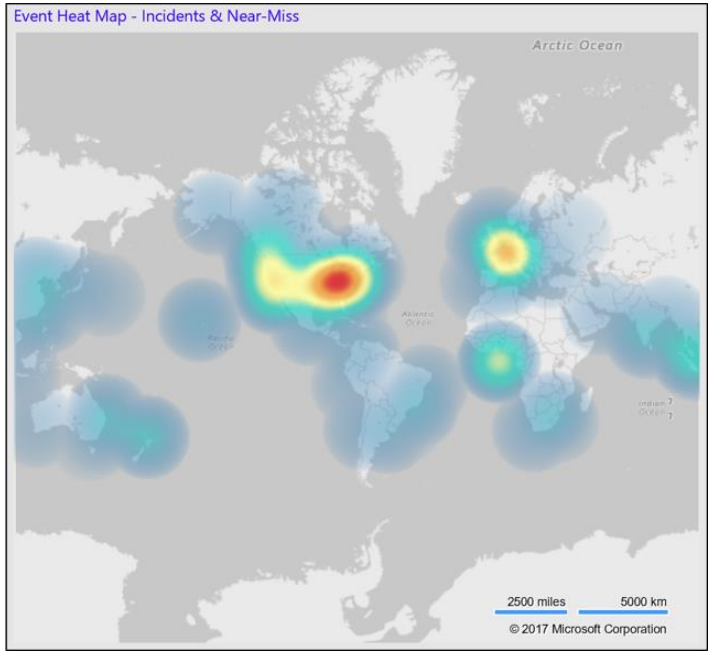


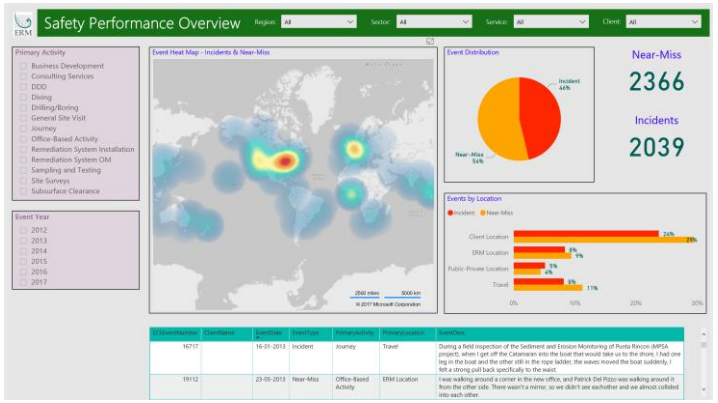
APAC



NA

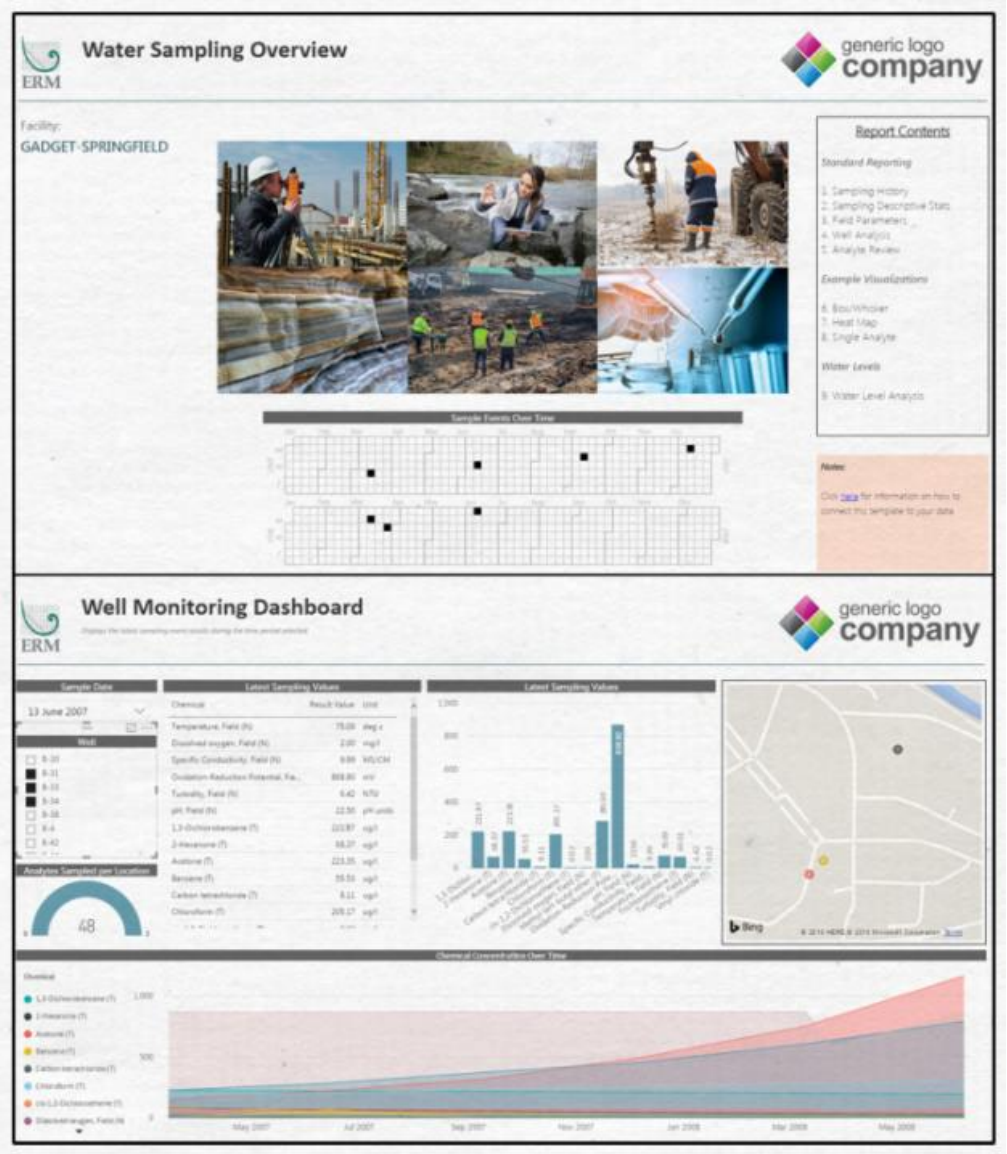
Statistical Analysis (Snapshot)

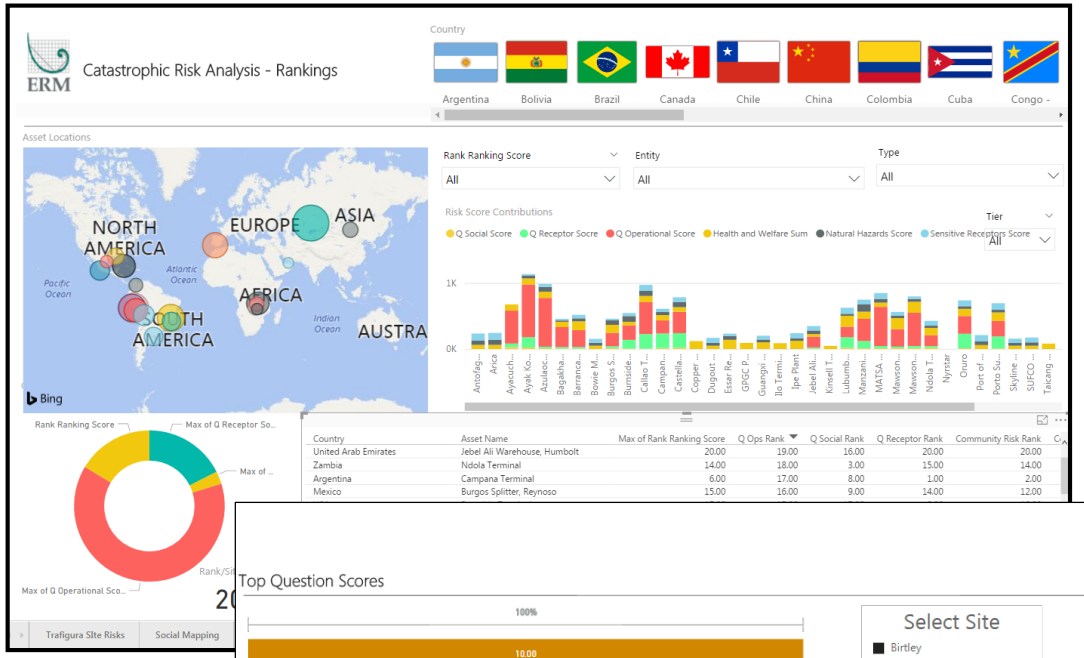


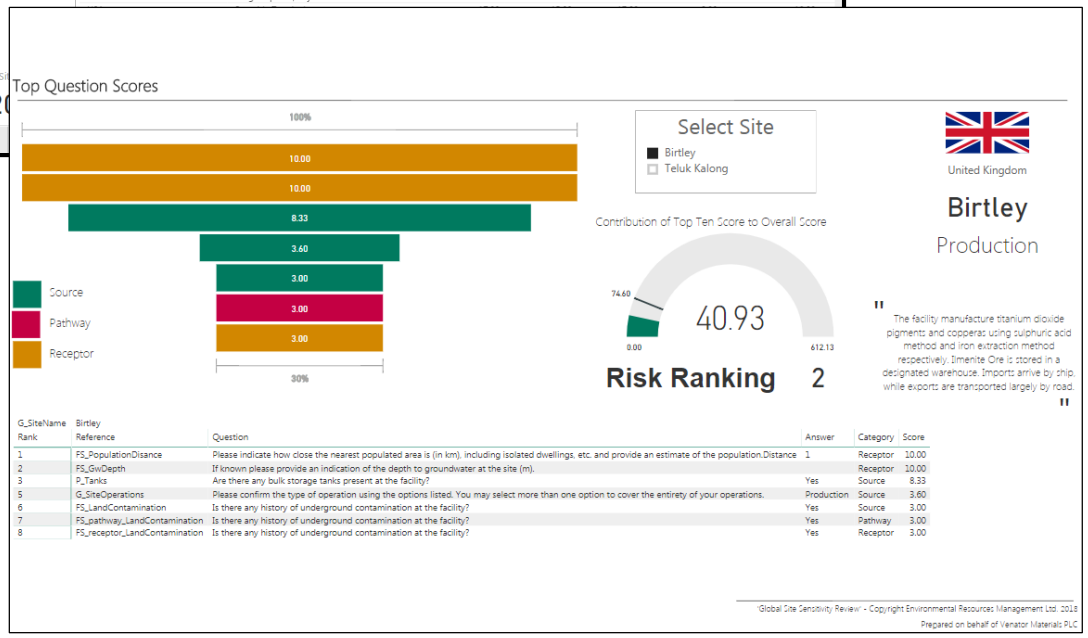


Converting to a Visual

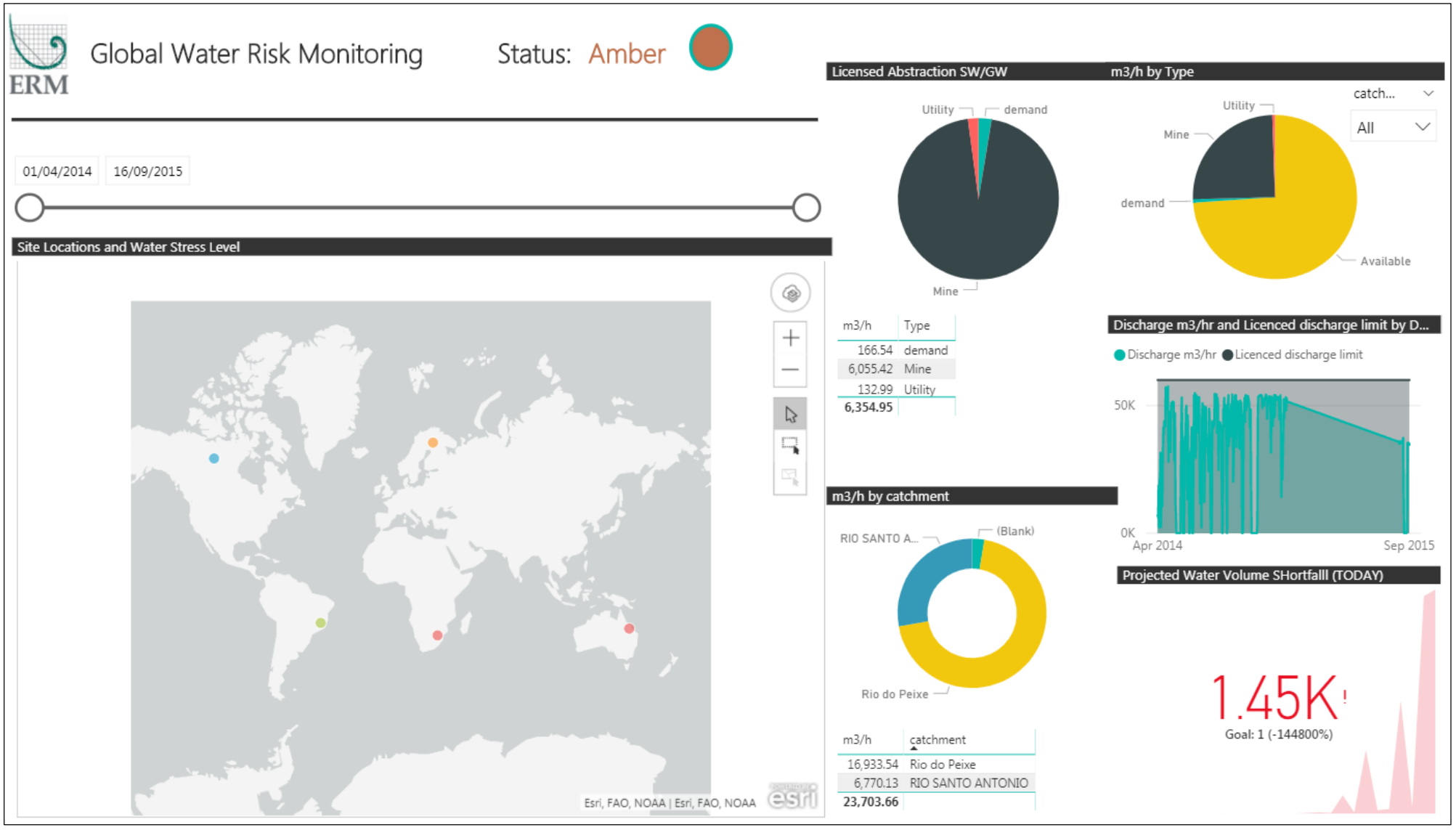
Dashboards for data presentation & corporate overviews



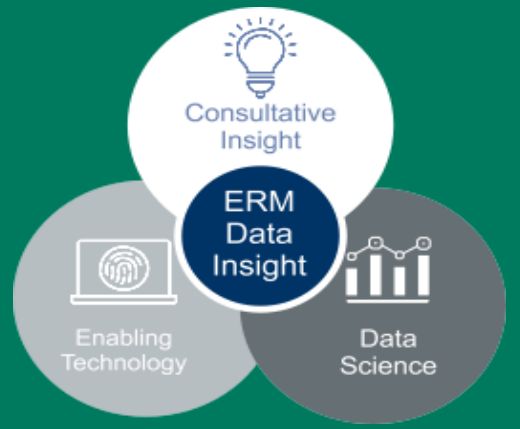




Dashboards for managing operational risk



Examples:
Maturity Stage 4
Data Mining
Creating Predictions from Data



Data Insights

- How do we get true value out of data?
- Developing a good data workflow can enable us to:

Acquire, transform, and store data

Apply data science techniques to find correlations and assess the strength of relationships

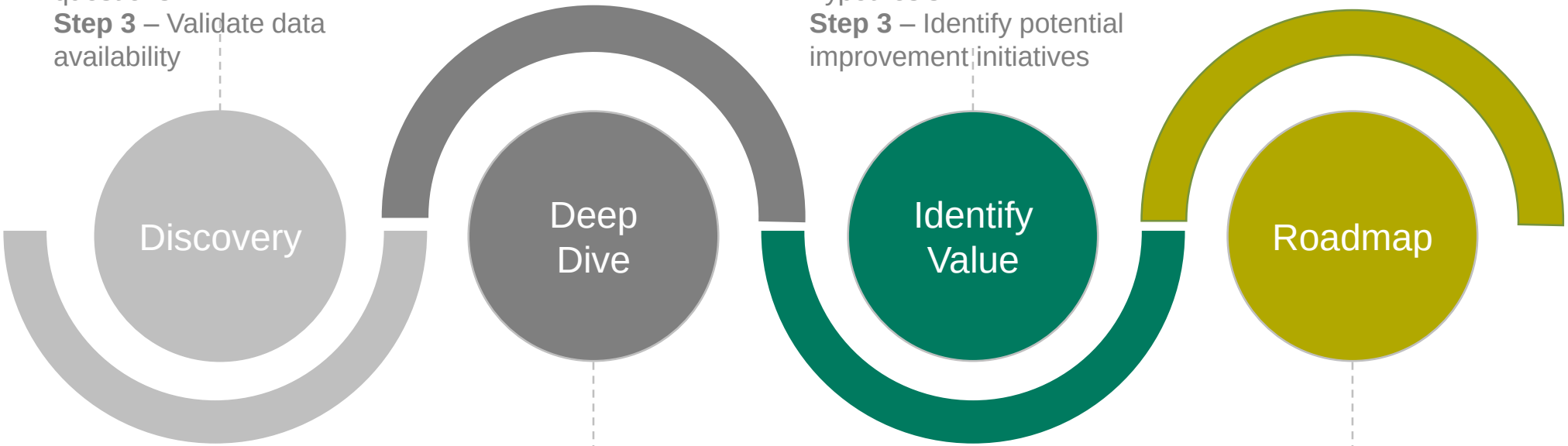
Identify the different combinations of factors driving outcomes

Detect and understand the early warnings and weak signals which point to a vulnerability, an emerging trend or a hard to predict event

Provide in-depth assessment by applying consultative insight to determine the “so what” in context of the problem that the client is trying to solve and deliver value

Data insight approach

Step 1 – Define primary hypothesis
Step 2 – Develop questions
Step 3 – Validate data availability

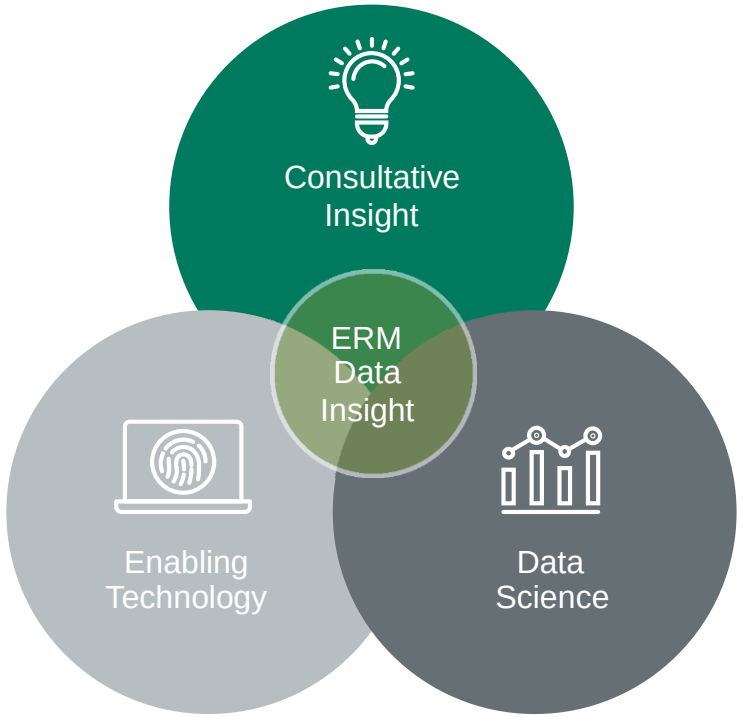


Step 1 – Perform gap remediation
Step 2 – Perform preliminary analysis and produce output
Step 3 – Validate initial findings

Step 1 – Derive data insights
Step 2 – Prove the hypothesis
Step 3 – Identify potential improvement initiatives

Step 1 – Develop roadmap for improvement
Step 2 – Perform close-out workshop

Data + Data Science + SMEs = Insights



The targeted improvement roadmap developed as a result of this approach focuses on one or more of three primary areas of concern:

- **Organisational change** – Identifying if the right data is being acquired and effectively delivered to the right areas of the organisation to affect timely decision support.
- **Functional change** – Identifying where technology and data can be more effectively utilised to improve the internal service delivery of specific functions across Health, Safety and Environment.
- **Systems change** – Identifying where system improvements could be implemented to drive out complexity and cost and/or improve performance .

Case Studies

The two case examples that follow come from one of our international mining clients. The first looking at the organisation's regional operation, the second focusing on a single operation.

These outputs were two of 20 key insights provided by ERM in a work programme delivered over 14 weeks for the Group level HSE Director.

Case study
High potential risk management

Following one HiPo event, the data revealed that likelihood of a second event happening within 30 days was greater.

Findings

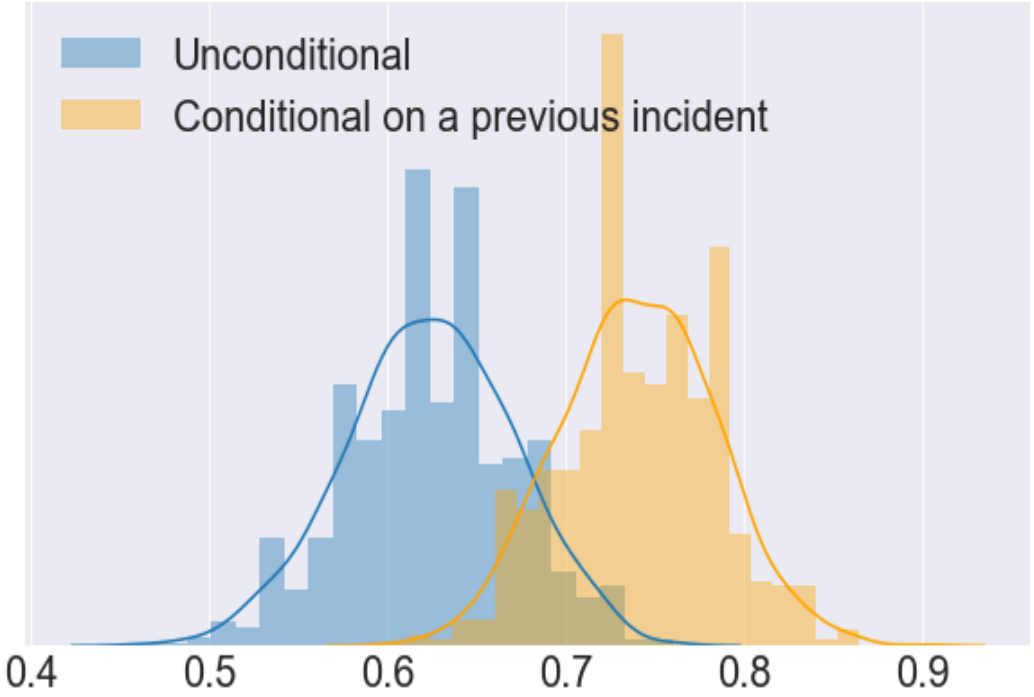
On a “typical” day (blue curve) there is a probability of about 62% that a severe incident (serious or above) will happen in the next 30 days.

However, If an incident has just happened (orange data), this probability rises to about 74%.

Value

Our analysis encouraged the organisation to revisit the processes they put in place in their global mining operations immediately following a HiPo event.

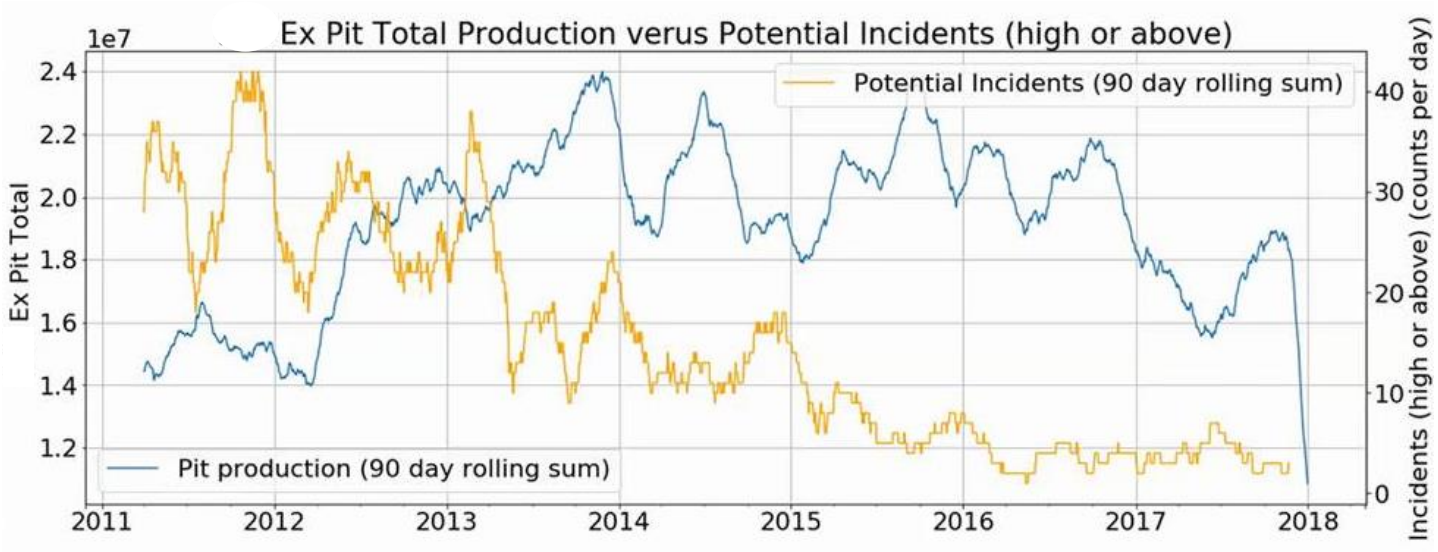
Probability of seeing at least one Actual Incident (serious or above) over the next 30 days



Case study
Production impacts on H&S performance

High level analysis of key production metrics in one asset demonstrated an inverse relationship between production and incident rates.

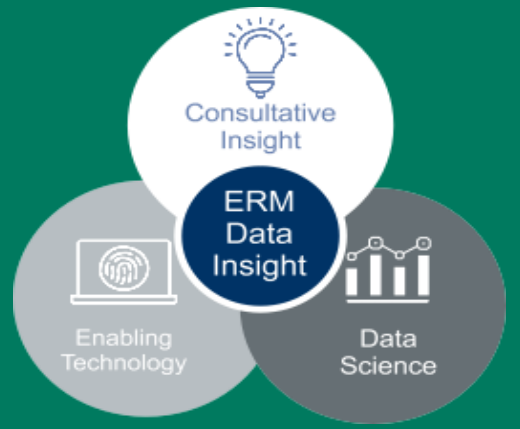
Core Trend:
Production goes up – incidents drop
Production goes down – incidents climb



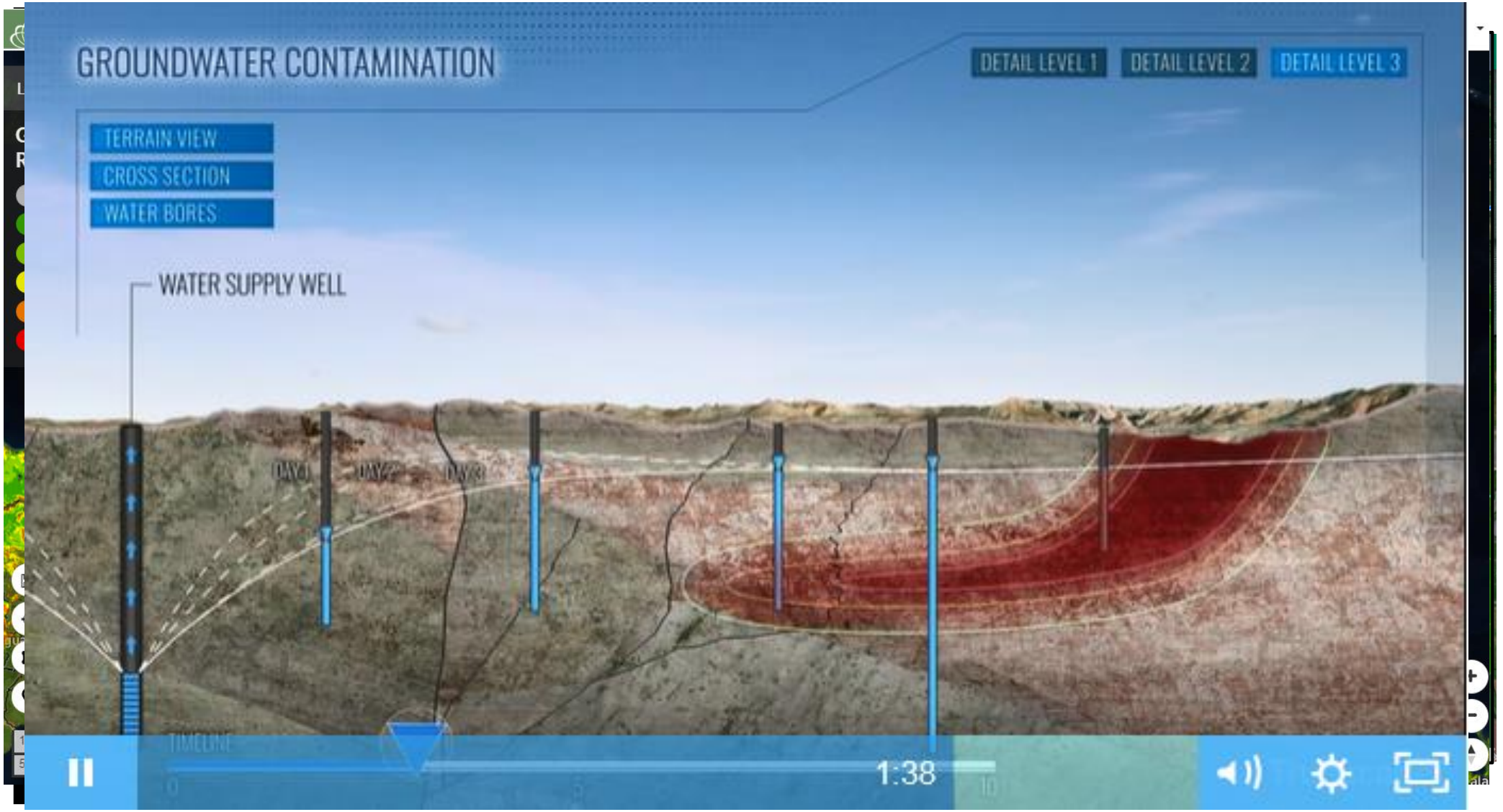
Deeper analysis investigating the following potential contributory and causal factors was also considered:

- Type of work activities
- Staff turnover rates
- Ratio of contract and new hires in workforce
- Weather/environmental conditions
- Impact of H&S campaigns.

Further Advances: Visual Communication



Better reports and communicating data



Thank you

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