

Applied Data Science, Big Data and The PI System

Teaching the Next Generation of Engineers the Skills of Today

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University of Utah

10/5/2016



Presentation Outline

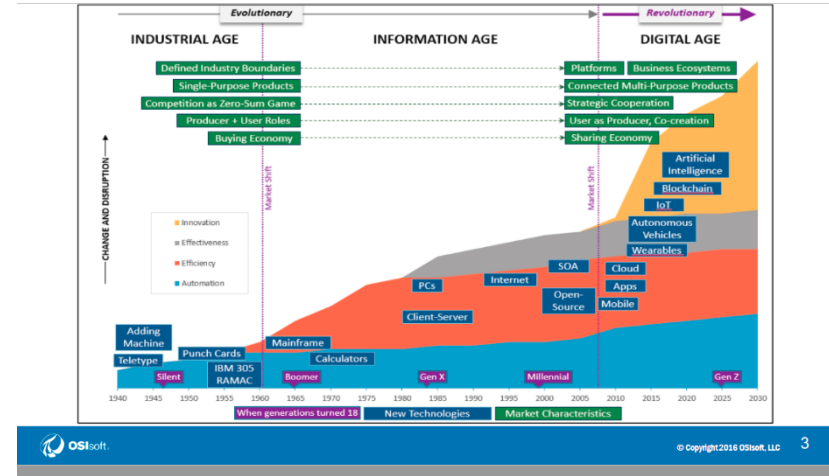
- Introduction
- Digital and data intellectual divide
- Role of academia in bridging the digital divide

Starting thought....

“The key to good decision making is not knowledge. It is understanding. We are swimming in the former. We are desperately lacking in the latter...

...I have sensed the enormous frustration with the unexpected costs of knowing too much, of being inundated with information. We have come to confuse information with understanding”

“Thinking Fast and Slow”
Malcom Gladwell



College of Mines and Earth Sciences





Atmospheric Sciences



Geology & Geophysics



Metallurgical Engineering



Mining Engineering



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Celebrating our 125th Anniversary

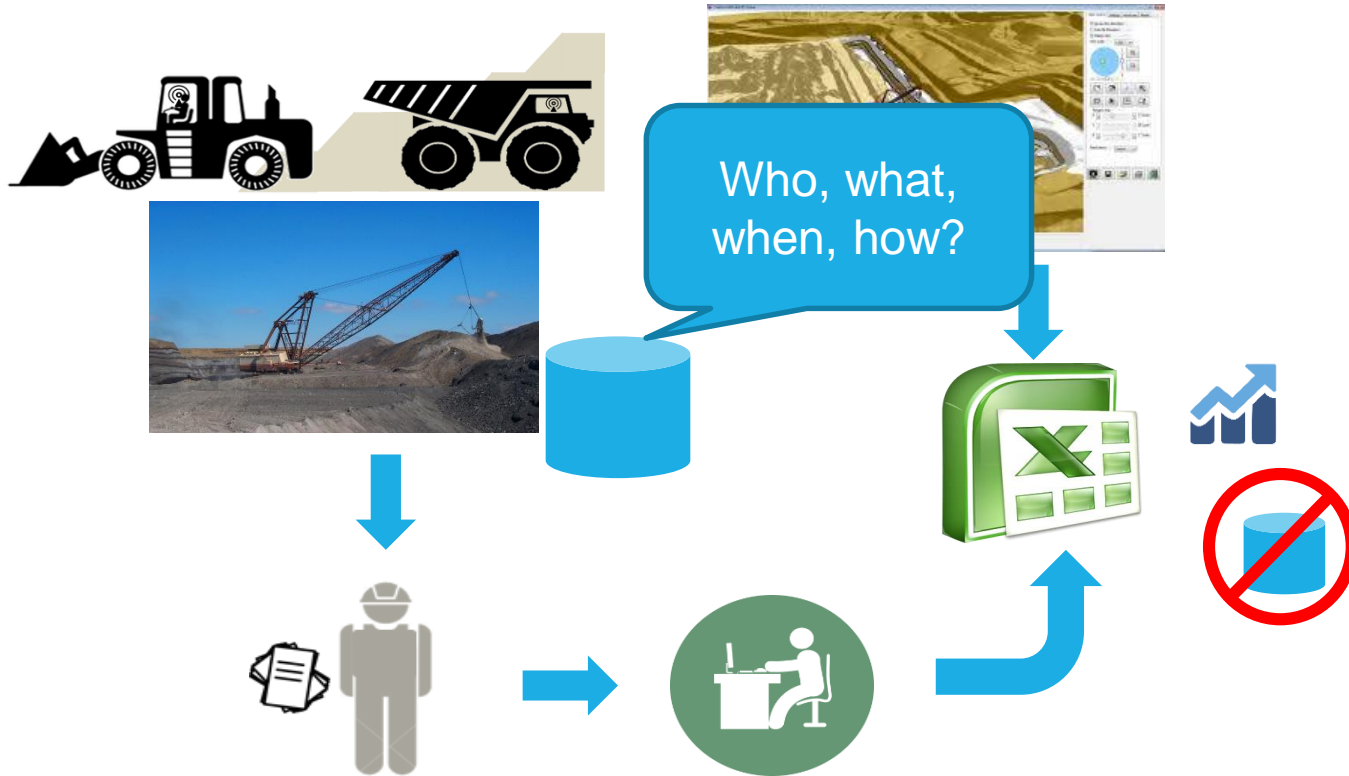


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First job out of school



New hire engineer...

Performance
management
initiative

Glorified data clerk!



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How to make data more effective...

Areas of work

Data Warehouses

Digital Audits

Continuous Improvement
consulting

PI AF modeling and event
frames

... like any **asset**, it should create **value**

Commodity

Type

Coal Surface, Underground

Metals Surface, UG, Mill

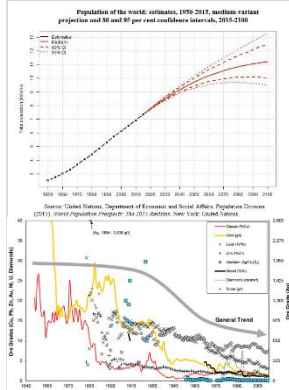
Industrial (salt,
aggregates) Greenfield Surface, surface,
UG,

Data → Action



Why? – Sustainable development

Macroeconomics: Population growth & Ore Grades



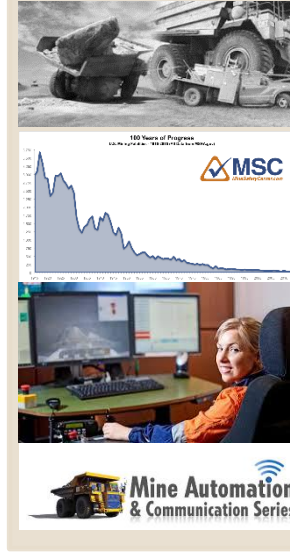
Natural Capital: Water & Energy



Financial Capital: Operational costs - \$per



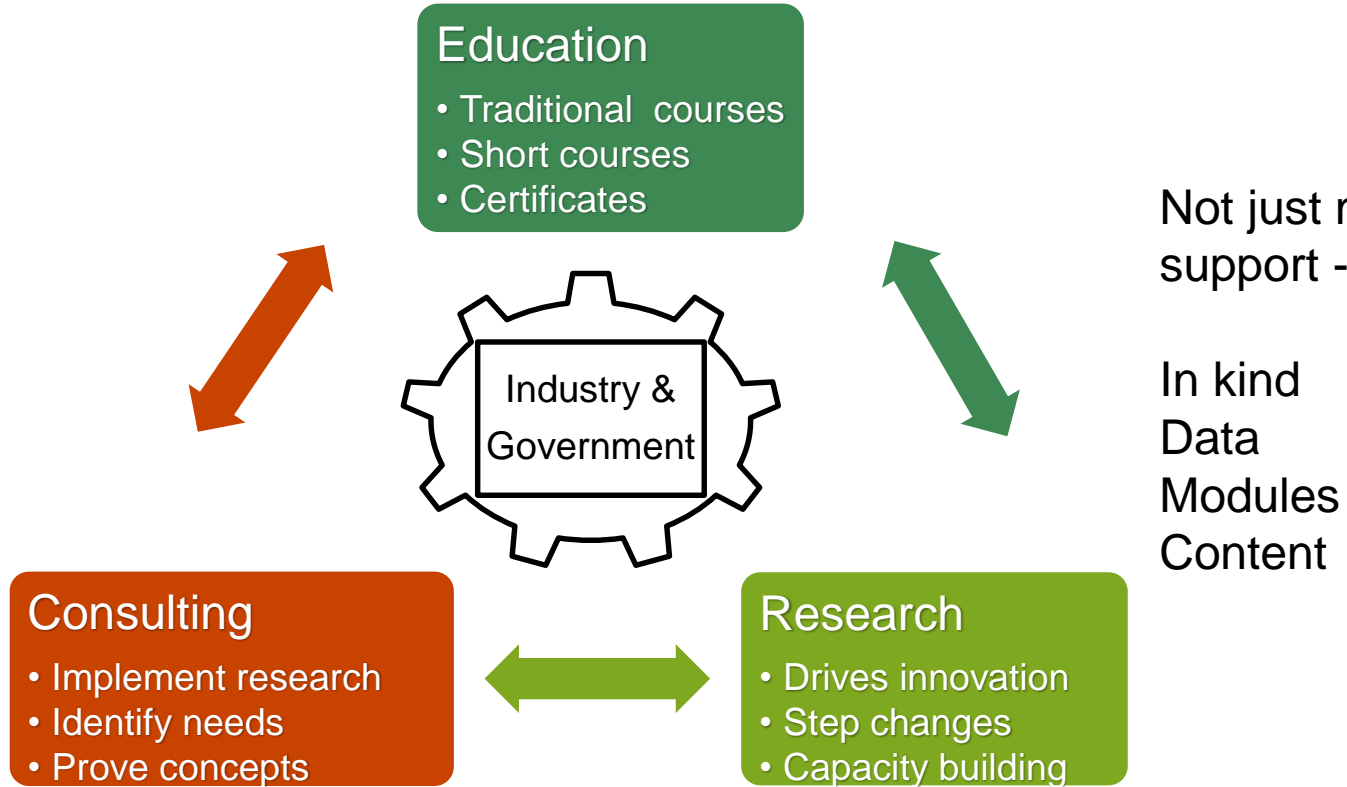
Human Capital: Safety & Health Automation



Permitting: Social license



Successful academic approach



Common data at mine sites

Time series



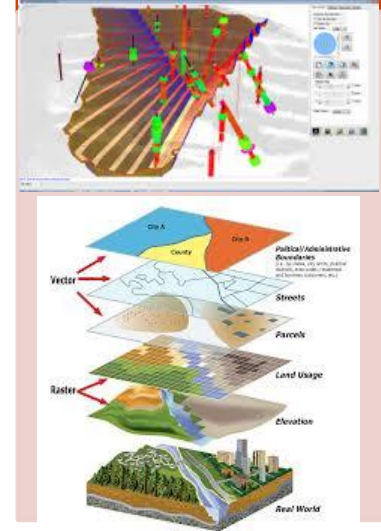
Relational



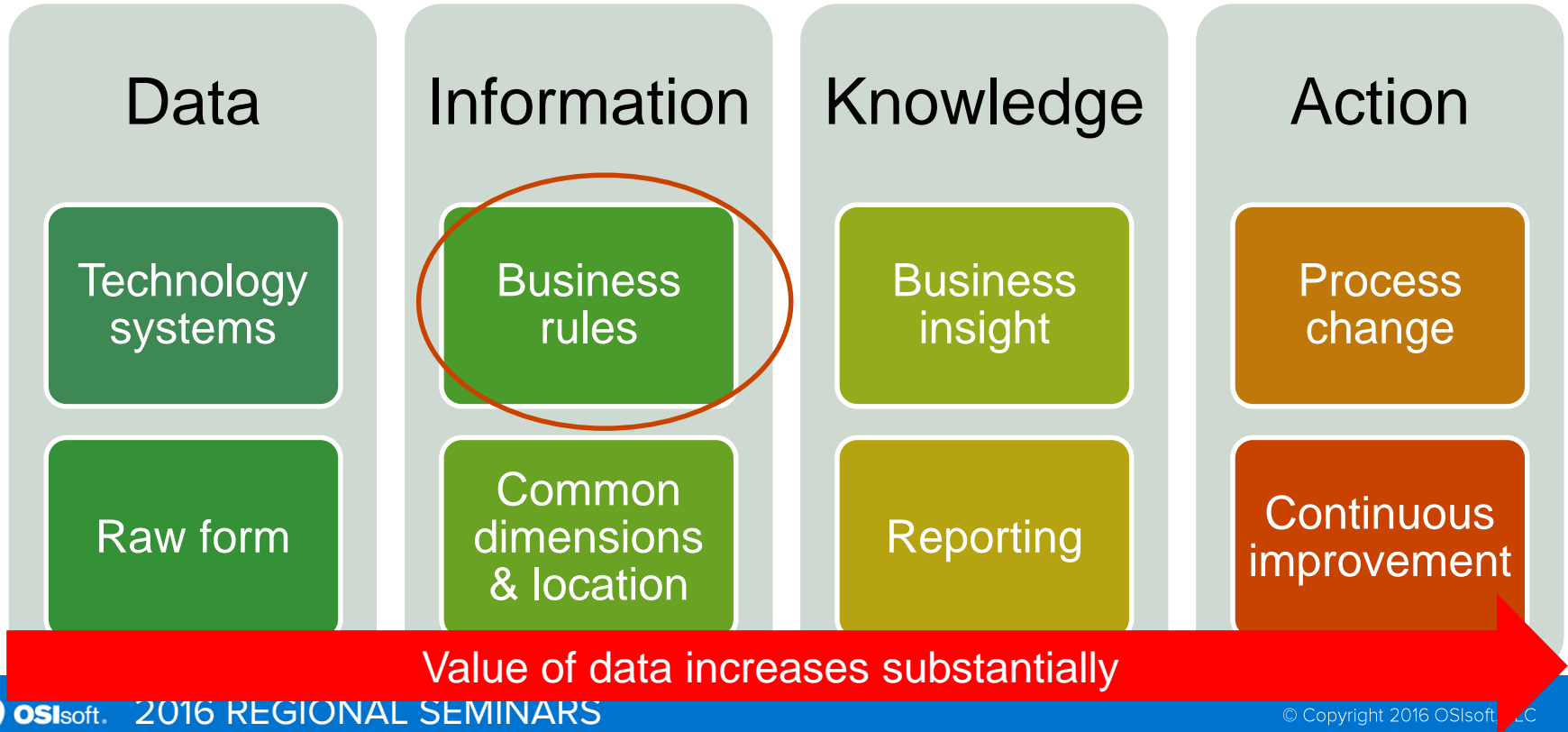
Unstructured



Spatial

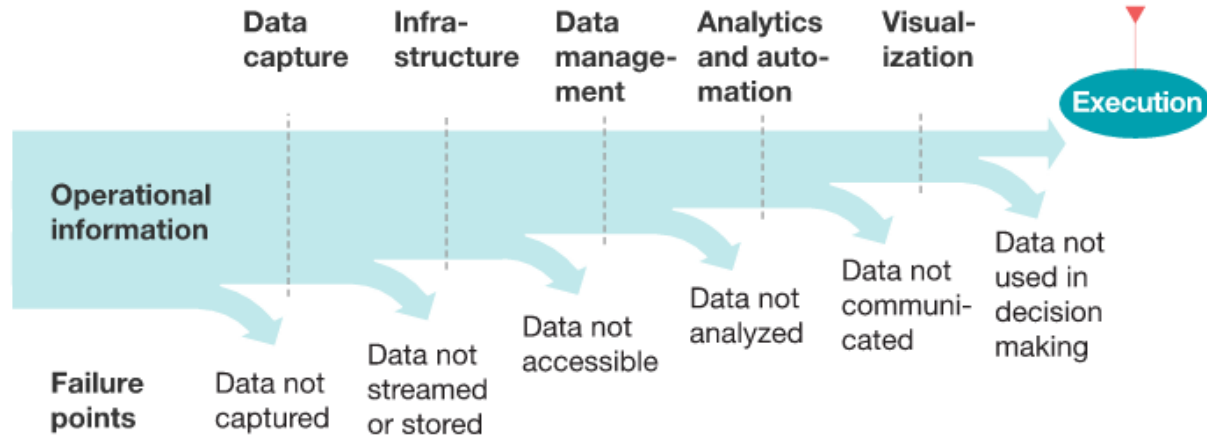


Business intelligence process approach



Data problem statement

Mining companies use only a fraction of their data.



McKinsey&Company

~\$370
billion/year

Asset Optimization

Root Cause Analysis

Predictive
Maintenance

Performance
Management

.

Lost Digital
Opportunities



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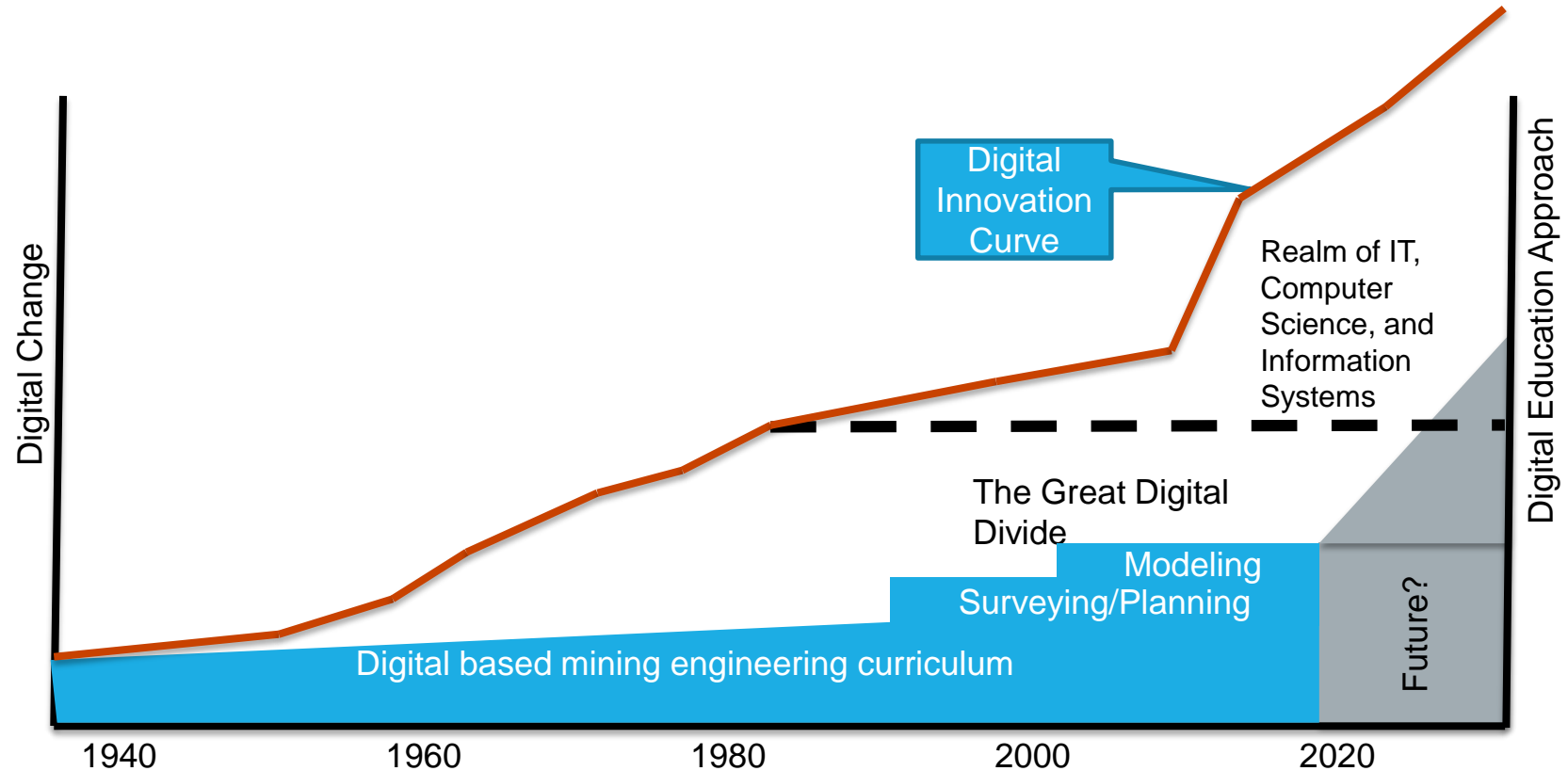
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Exploring the digital divide

Mining Perspective

Why the lost digital opportunity?



Implications of “digital divide”



Technology implementation confusion

- Installation \neq Implementation
- Site capabilities



Lack of strategic plan

- Corporate or site driven
- Process changes

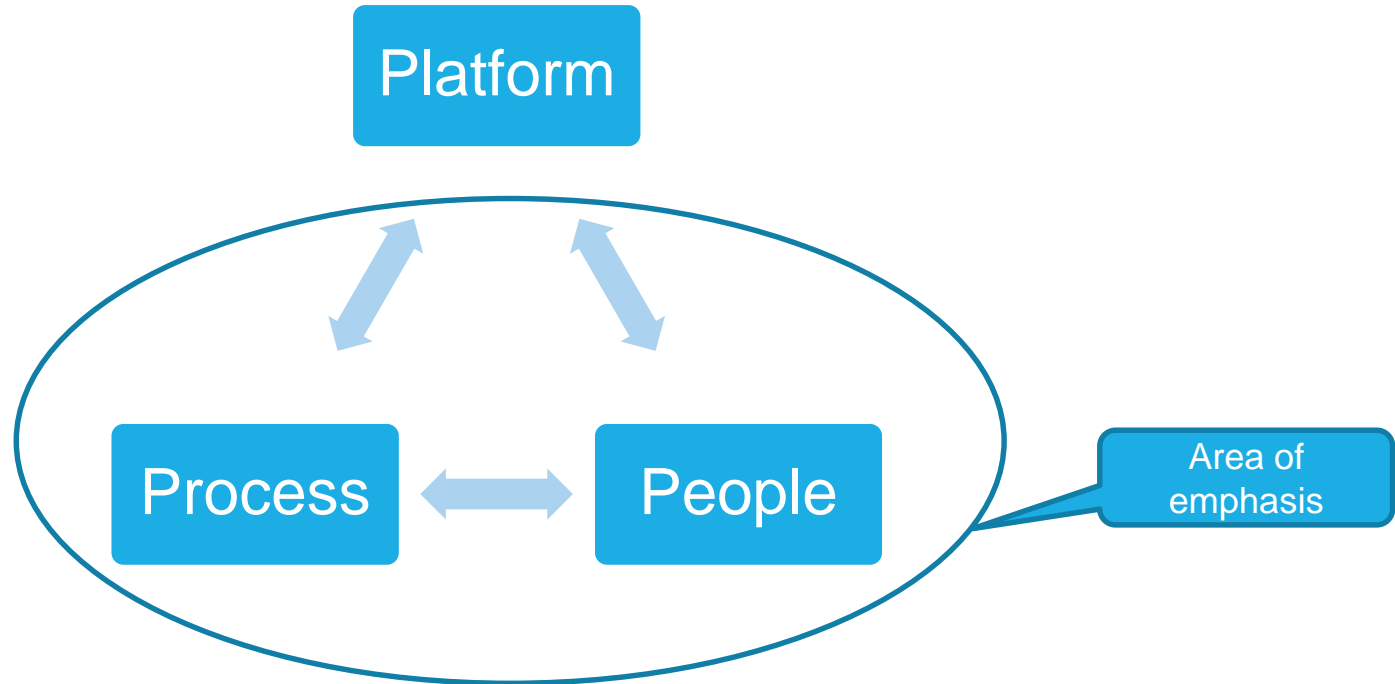


Collaboration pains

- Context
- Business rules & operational standards



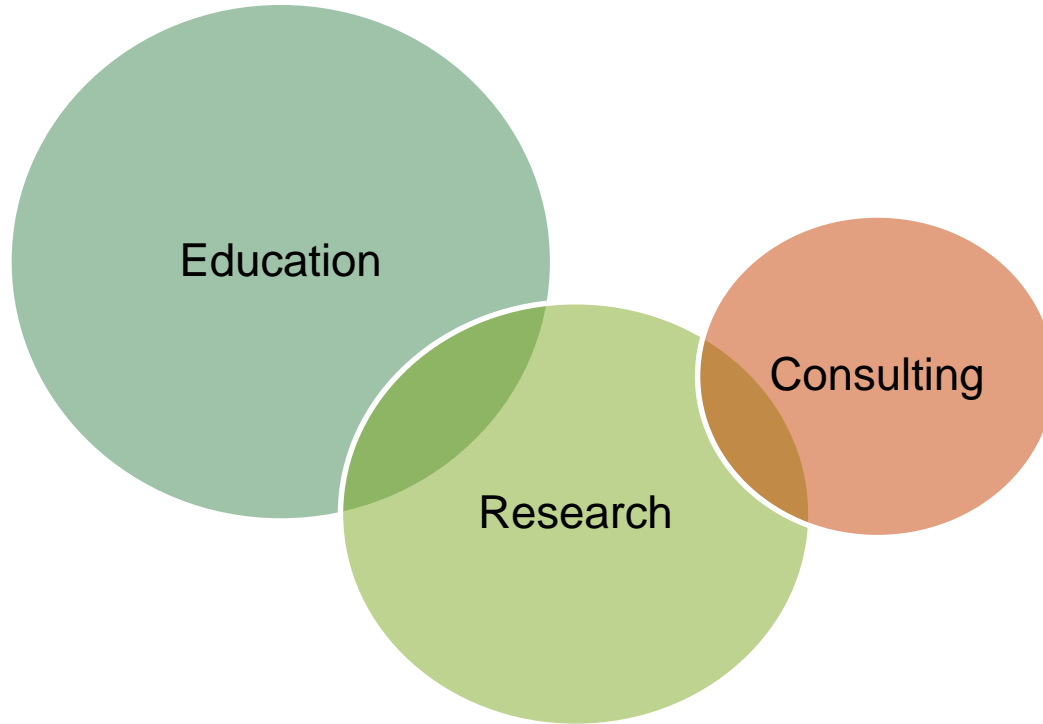
Technology Implementation



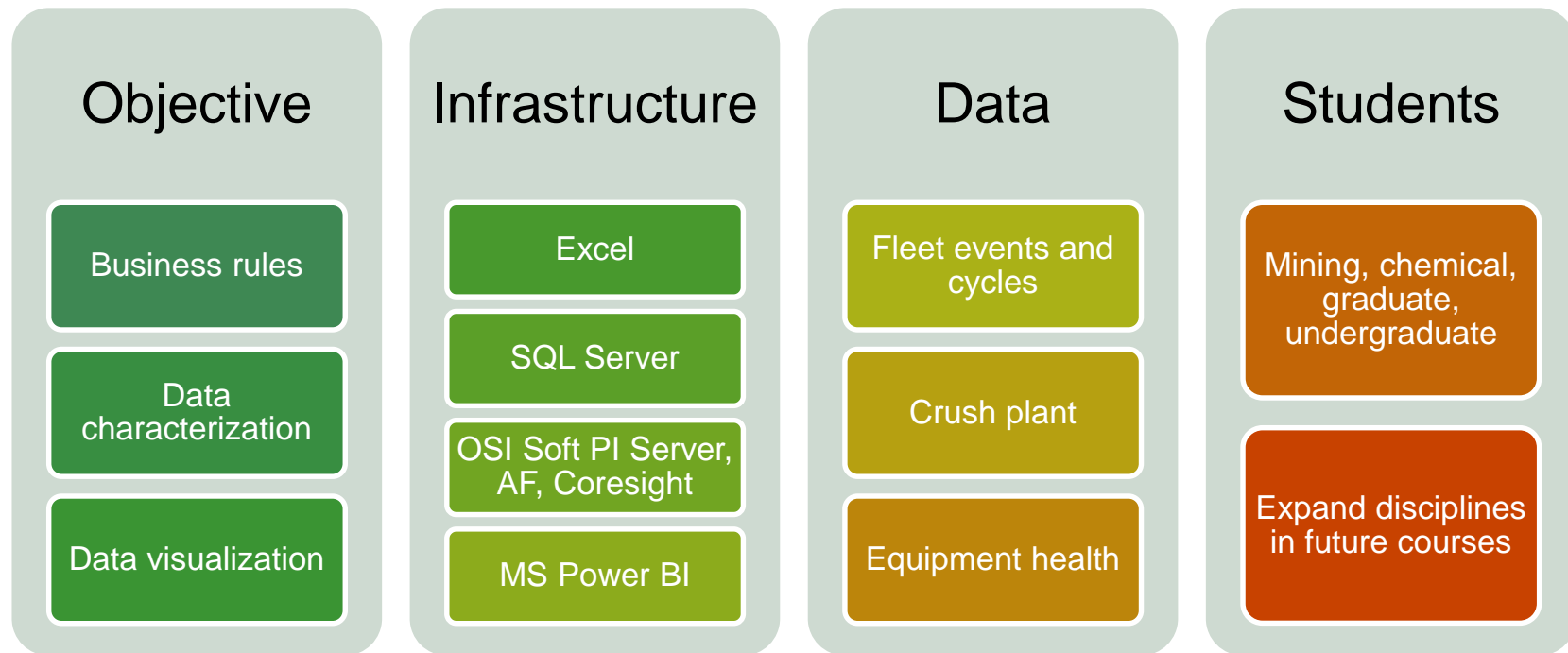
What can be done?



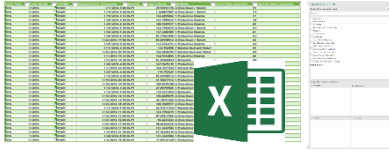
Enact change in following areas



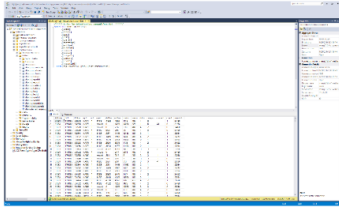
Engineering applications of big data – Fall 2016



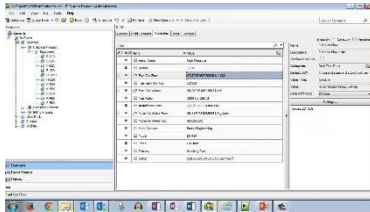
Connecting standards to business rules



Excel Tables & Pivot



SQL Tables & Views

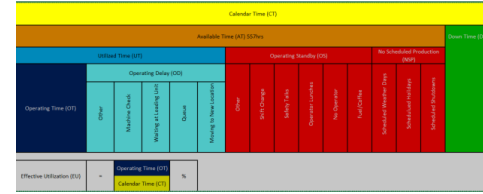


PI AF / Event Frames

Business Rules to
Engineering Standards

Business Rules to
Engineering Standards

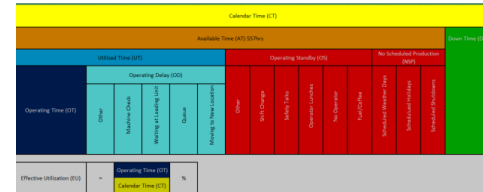
Business Rules to
Engineering & Operational
Standards



Time Usage Model

Item	Description
Material	Material is a physical entity that is used in the production process. It is a tangible asset that is consumed in the production process.
Material Type	Material Type is a classification of material based on its physical properties and chemical composition. It is used to identify the material and its characteristics.
Material Usage	Material Usage is the amount of material that is consumed in the production process. It is measured in units of material.
Material Cost	Material Cost is the cost of the material used in the production process. It is calculated based on the material usage and the material price.
Material Inventory	Material Inventory is the amount of material that is stored in the warehouse. It is used to track the material and its location.
Material Flow	Material Flow is the movement of material from the warehouse to the production process. It is used to track the material and its location.
Material Status	Material Status is the current status of the material. It can be in stock, in use, or out of stock.
Material History	Material History is the record of all material usage and inventory changes. It is used to track the material and its location.
Material Forecast	Material Forecast is the predicted future material usage and inventory. It is used to plan for future material needs.

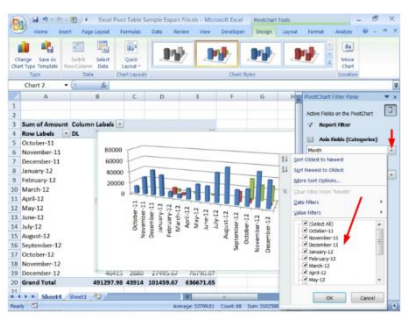
Material Hierarchy



Time Usage Model /
Operational Cycles



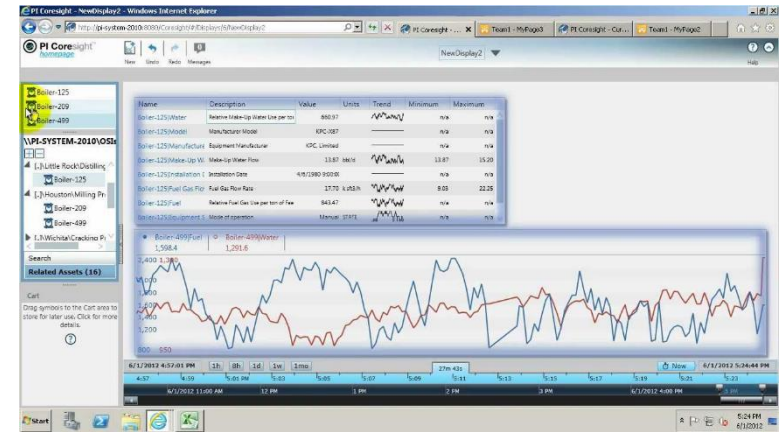
Class Example: Data Visualization



Pivot
Charts



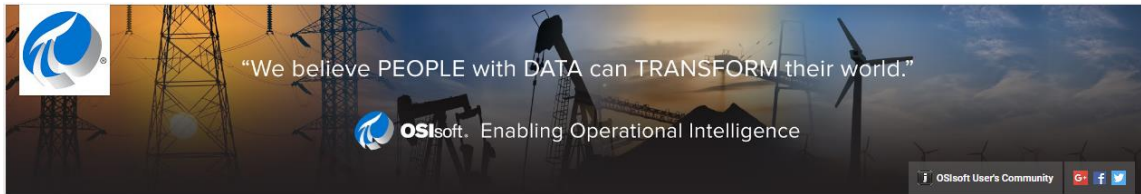
Power BI



PI
Coresight



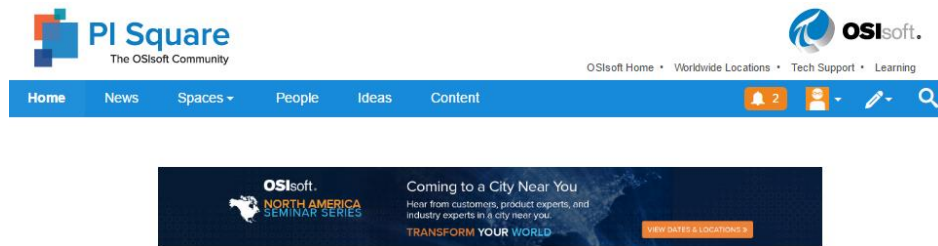
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Welcome, William Sign Out

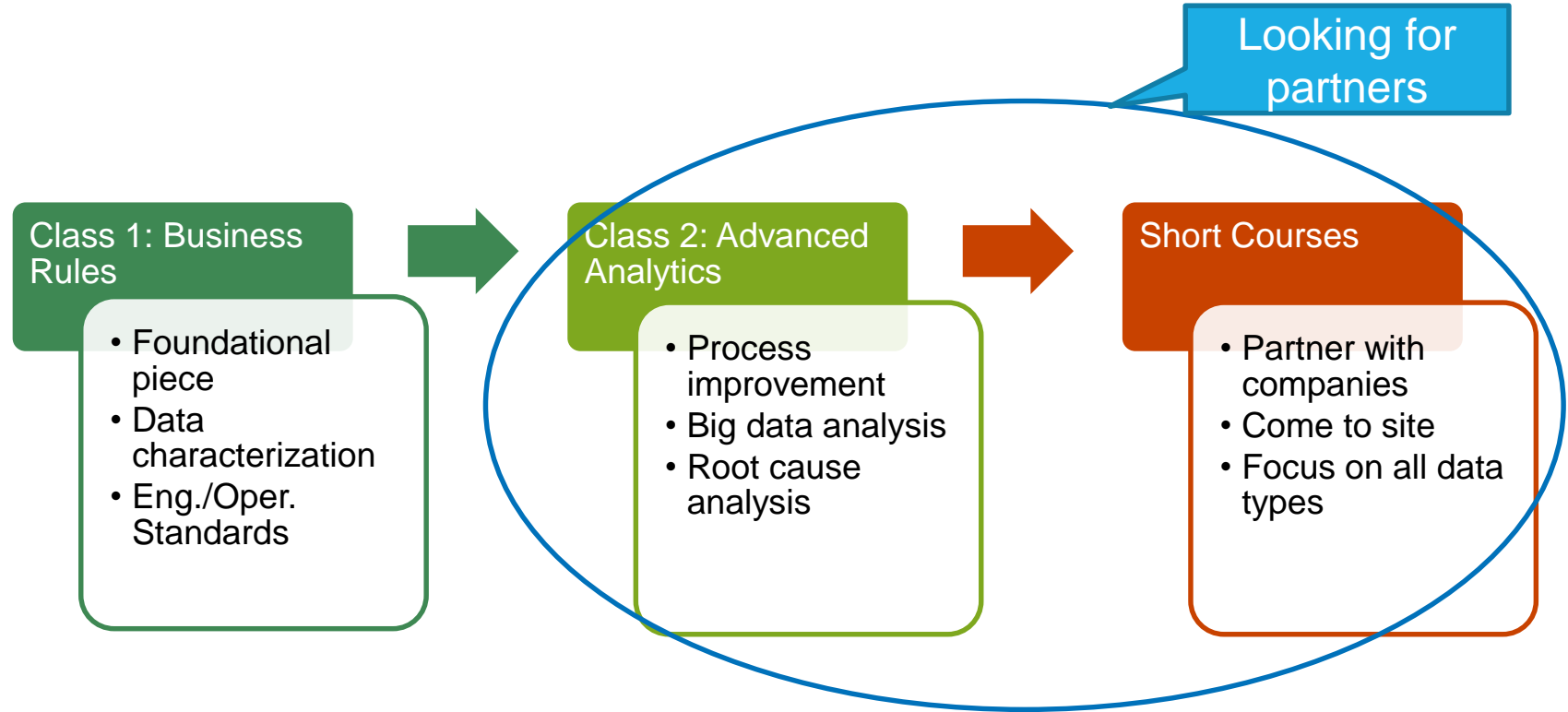


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Initial lessons learned

- Introduce concepts gradually
 - I do, we do, you do approach
- Infrastructure always a challenge
- Business rules first
 - Visualizations important business rules foundational
- Students are enjoying it!

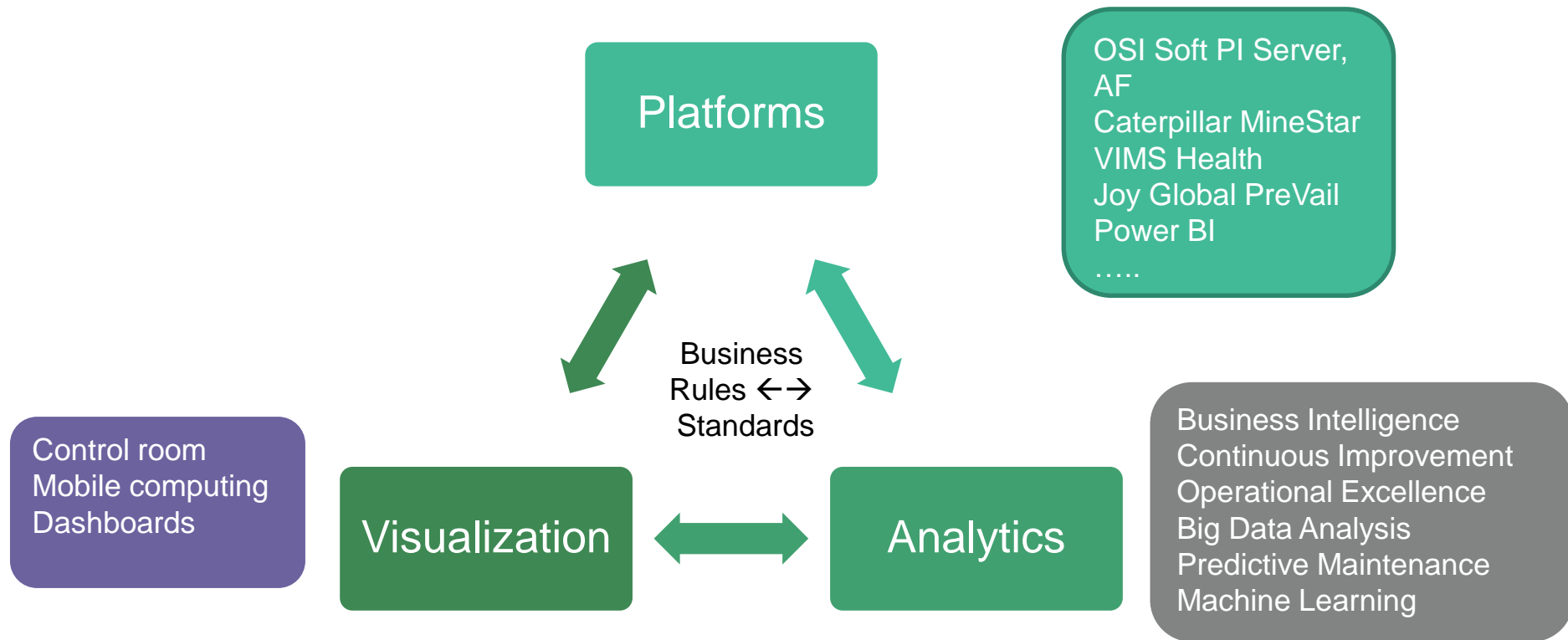
Class Progression



Utah's Digital Minescape

Mining IS/OT Research Lab

Workings of lab



Research areas

Natural Capital:
Water & Energy



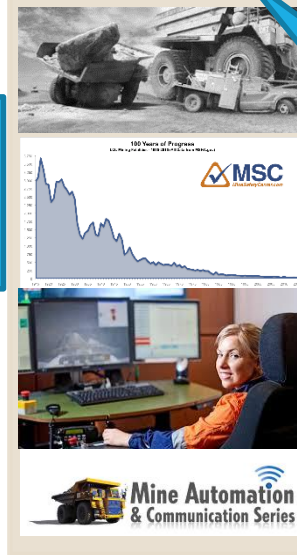
Energy
optimization:
M2M

Financial Capital:
Operational costs -
\$per



Mine
leadership in
digital age

Human Capital:
Safety & Health
Automation



Data and
Automation

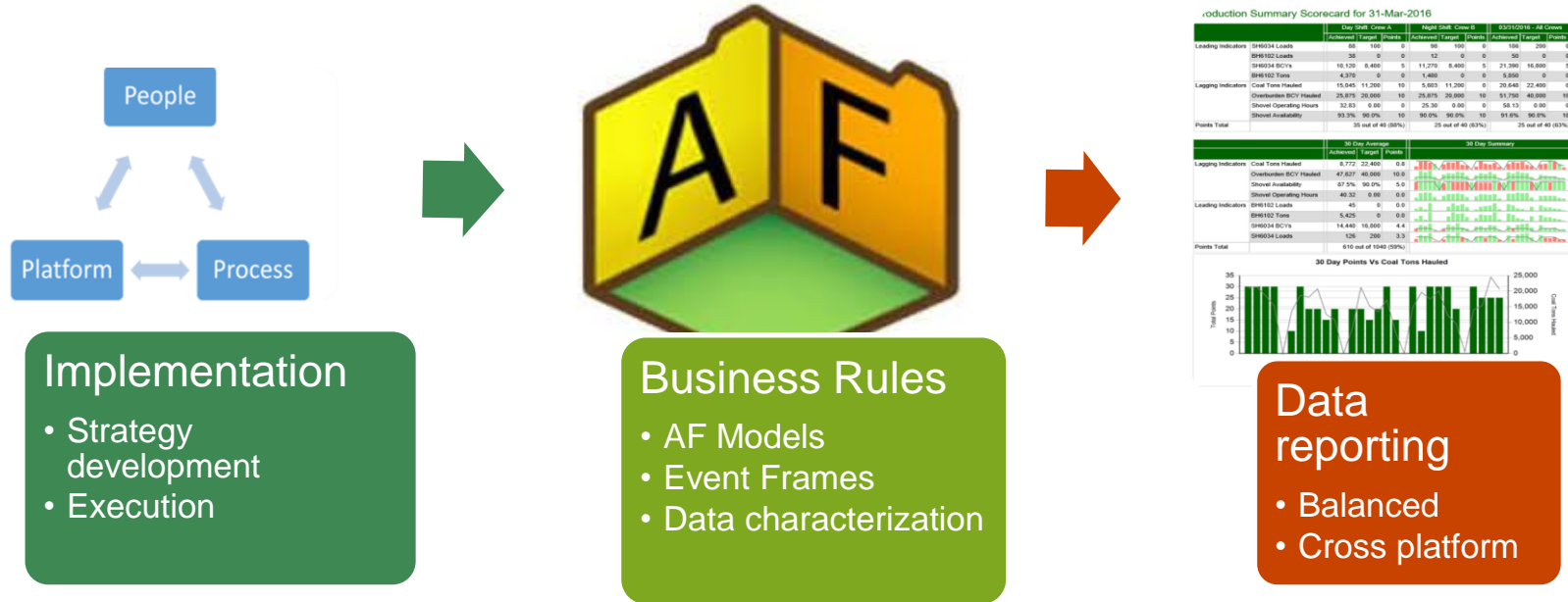


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Consulting work



Conclusions

- Large opportunity to expand mining curriculum - People
 - Short courses, certificates, etc.
- Technology collaboration is key - Process
 - Break “silos” – data, process, roles, etc.
- Looking for support: data, content, modules, etc.
 - Start small and expand
- Utah uniquely suited geographically, intellectually, to build lab



감사합니다

谢谢

Danke

Merci

Gracias

Thank You

ありがとう

Спасибо

Obrigado

