Multiplying the Benefits of Information-Based Technology through Creativity

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On behalf of
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www.imr.arizona.edu

Largest interdisciplinary mineral resources research program in US
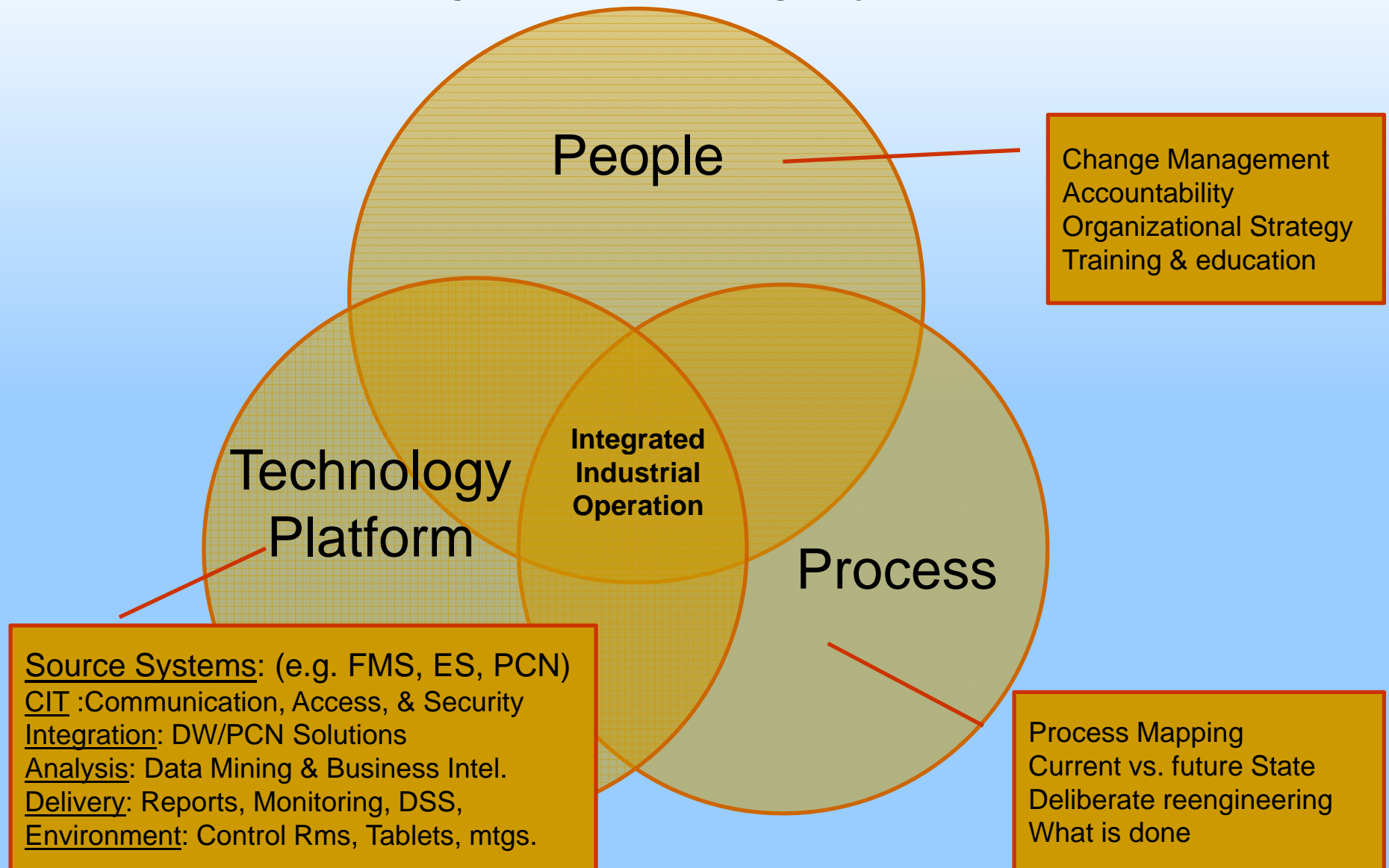

- Project Portfolio
  - Water (3)
  - Energy (4)
  - Technology (9)
  - Geology (36)
  - Health & safety (9)
  - Environmental (7)
  - Social license (3)

- 500 participants in 2011 in IMR research and education activities

- Training and outreach to >8,500 people per year

- Transferring knowledge and technology world wide

Mine Intelligence Research Group (MIRG)

- Resources
  - 25 researchers
  - Operations center & programming center
  - DWs from 26 different mines & live streams
- Cutting-edge systems integration
  - Real-time Apps
  - Decision support systems
  - Control room design and training
  - Dynamic simulation
  - Re-engineering frontline supervision
  - Sustainable development risk analysis
  - Metal/NonMetal, coal, underground & surface

Integrated Mining Systems

People

Technology Platform

Integrated Industrial Operation

Process

Change Management
Accountability
Organizational Strategy
Training & education

Source Systems: (e.g. FMS, ES, PCN)
CIT :Communication, Access, & Security
Integration: DW/PCN Solutions
Analysis: Data Mining & Business Intel.
Delivery: Reports, Monitoring, DSS,
Environment: Control Rms, Tablets, mtgs.

Process Mapping
Current vs. future State
Deliberate reengineering
What is done

The University of Arizona, Tucson
IMR
Lowell Institute for Mineral Resources

Breaking Down Data Silos (Knowledge Isolation)

- We know that people should interact across the operations

- But we do not let all our data interact across the operations
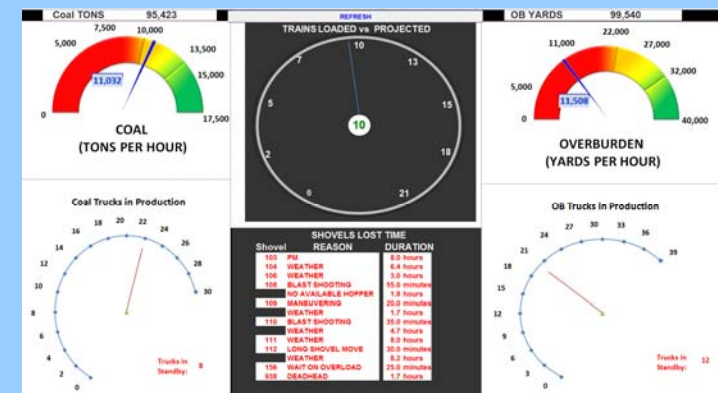
- We connect people but isolate data

The "Connection Age"

- We are moving from the "Information Age" to the "Connection Age"

- New creative ways to connect
  - sensors
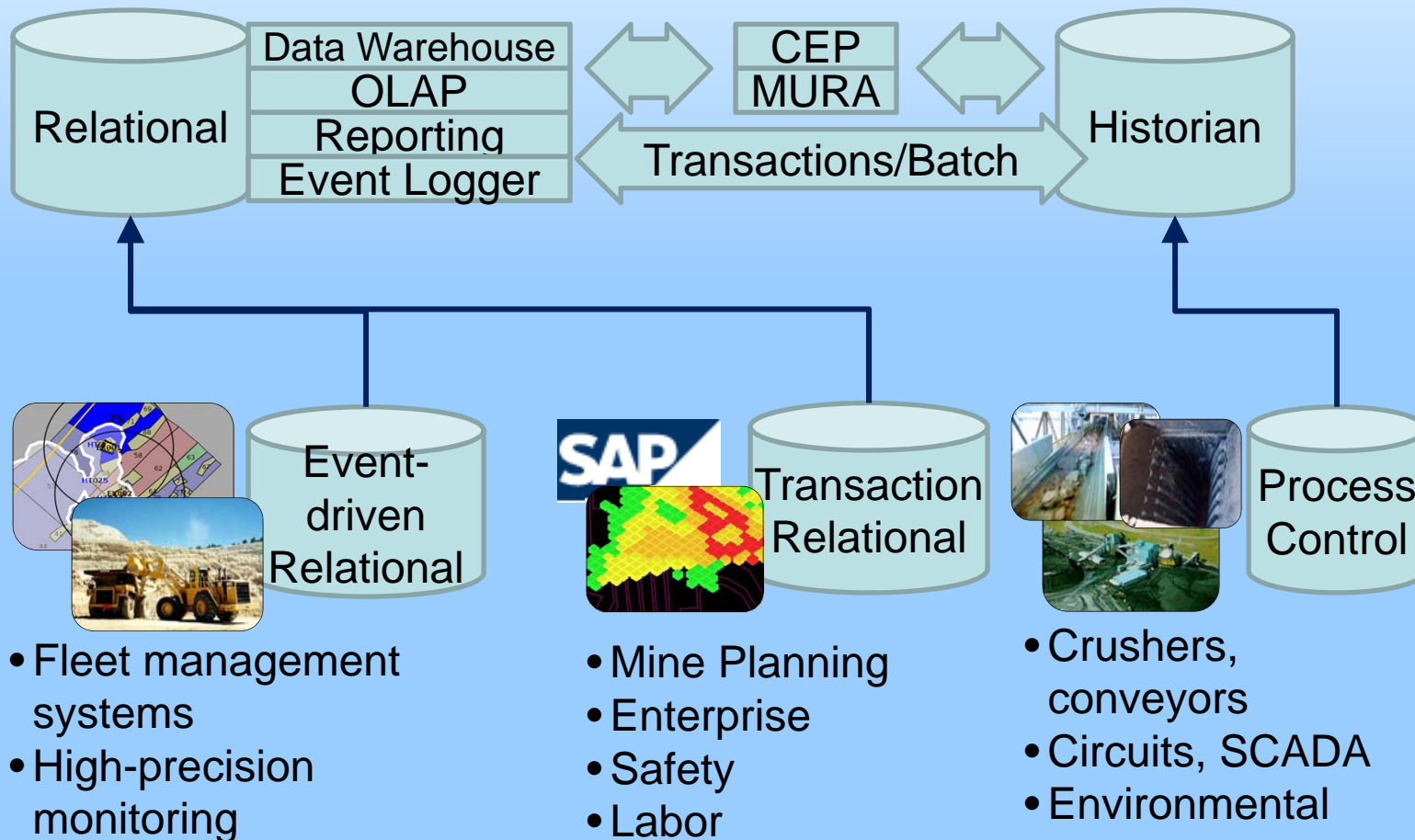 - data
  - information
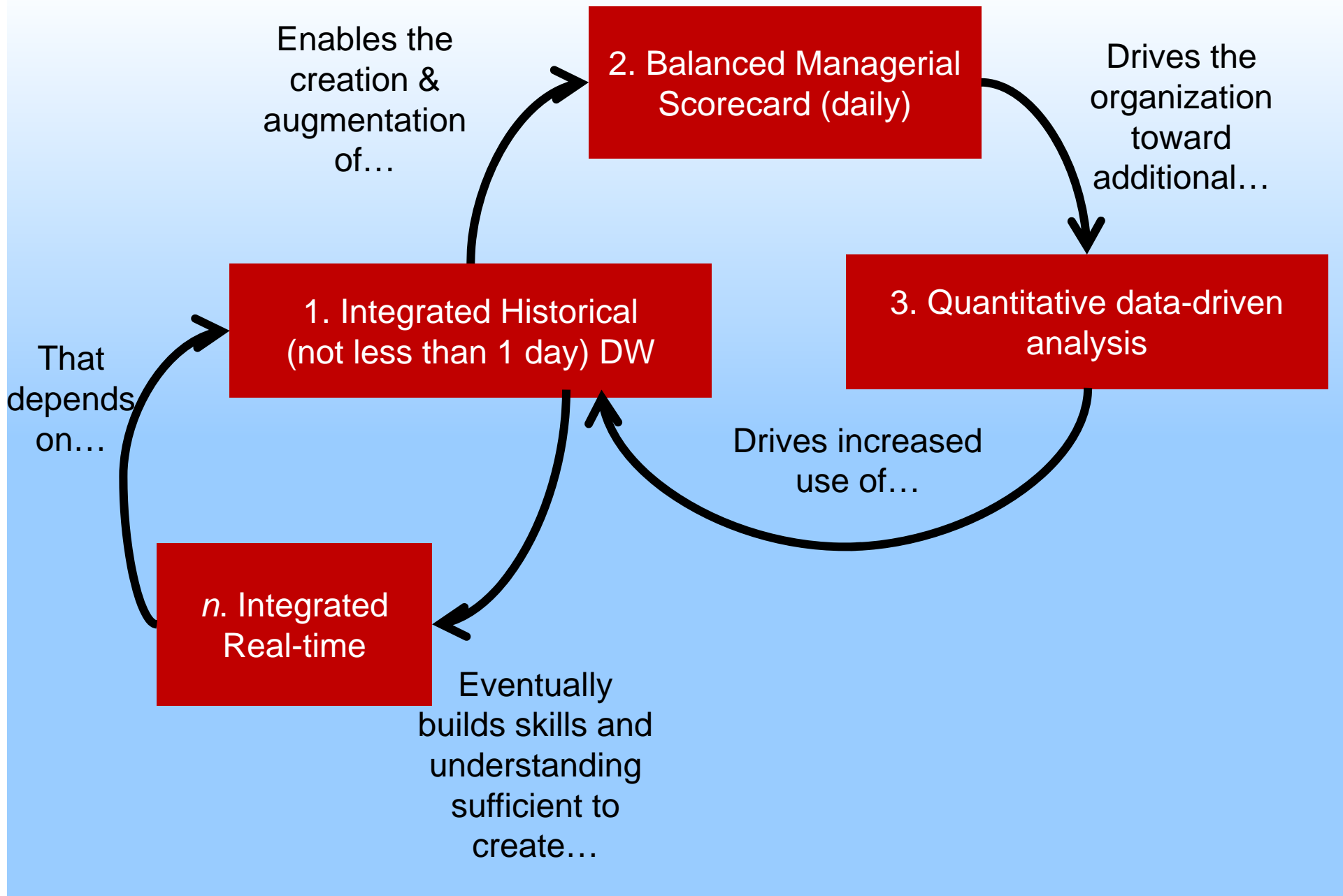 - knowledge
  - people
  - action
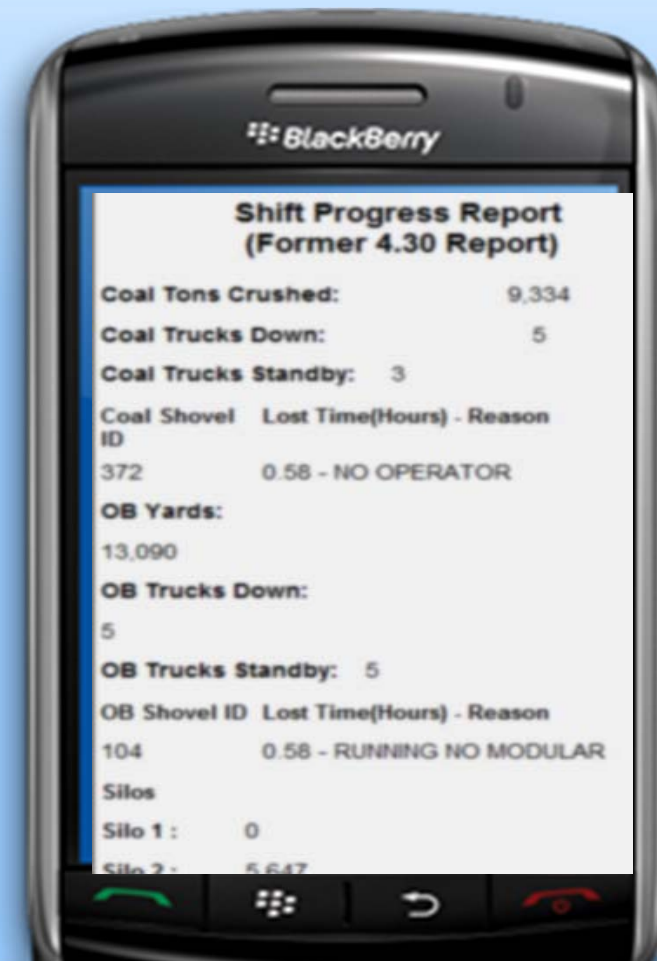
Our Approach

- Integrated, distributed data backbone across vendor databases => "Cloud"

- Customer focused "Apps" delivered to portable devices

- Integrated operations centers

- Real time simulation of complex operations

- Information when and where you need it

- Manage social license

- Change management and education

Mine Information Research Group
Integrated Operations Center Laboratory

BI Tools

BI Purpose

1. Dashboards (Status)

Do I need to look more into something or make a decision??

2. Real Time Analysis & Decision Support (IOC SCREENS)

Help make a prediction / trend of shift to take corrective action or optimize. Most often in Integrated Operations Centers (IOC).

3. Integrated shift-to-date reports (gen.)

Mid-game (shift) score for management – do I need to intercede?

4. Balanced Managerial Scorecard (daily)

Manager meeting to identify areas in need of attention through performance reports

5. Balanced Operator Scorecard (d/w/m)

Feedback to operators on their individual / crew performance

- Ad-hoc Analysis (OLAP as-needed)

To understand more details or create models for improvement options.

- Advanced Historical Analysis

To investigate root-causes or implement "KNOWLEDGE" programs, i.e. M2M

- Data Mining

Increasing Time Scale

Immediate

After-action

**Advanced Business Intelligence
Real-time Data**

- Mine Plan Integration
- Re-engineering frontline management

- Advanced business intelligence
  - Early warning measures
  - Real time fleet costing
  - Fragmentation
  - Blending
  - Dynamic simulator
  - Decision support system
  - Adherence to mine plan
  - Fatigue management
  - Assignment of personnel

- Mine to Leach Data Integration
- Waste to ore management
- Block caving analysis, planning, and management

Advanced Business Intelligence Historical Data

Economic Evaluation (NPV, IRR)
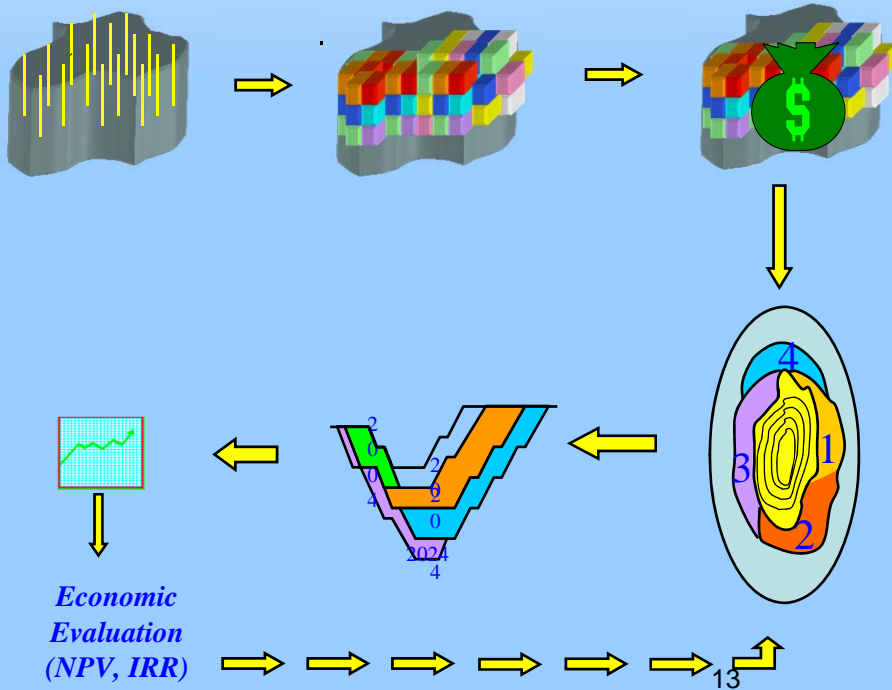
- Automated reports from OLAP cubes
- Activity based costing
  - Equipment replacement analysis
- Data-rich truck fleet management
- Tire management
- Fuel management
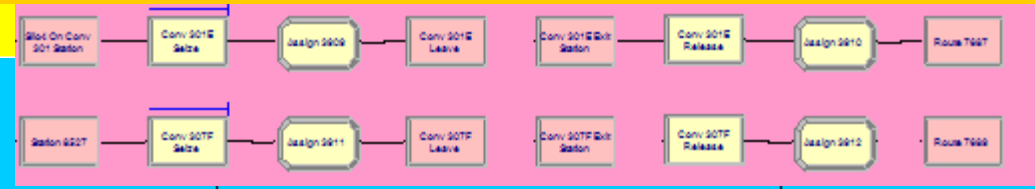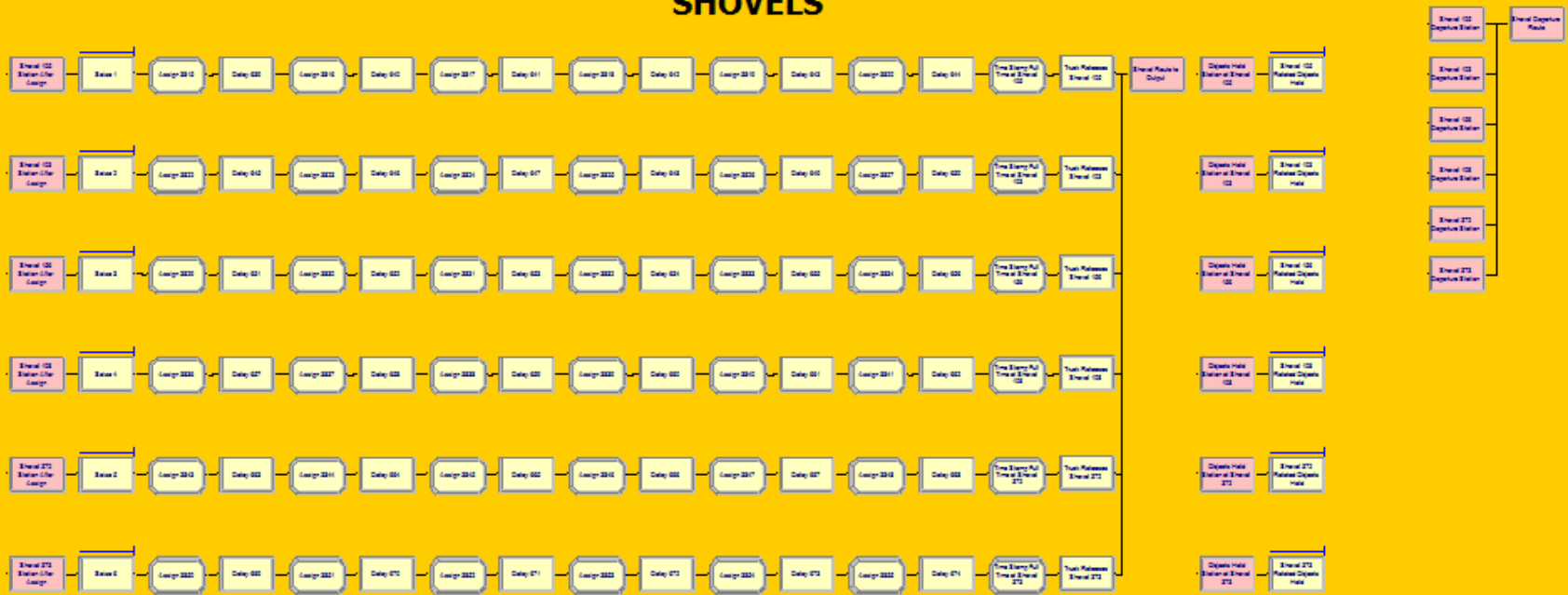
Simulator: A shovel goes down

where to assign the trucks?

Simulation Model: ARENA

NOW

HISTORICAL

Enter Historical date below

Month	Day	Year	Hour	Minute	Second
1	28	2011	7	30	0

MANUAL INPUTS

LEGEND

(Dispatch Required) Sheets mandatorily requiring options for dispatch

Place for entering Manual options (Optional)

Place mandatorily requiring options to be entered by user

NOW information

HISTORICAL information

Most recently validated manual input

List of Active Trucks and Sizes
(Dispatch Required)

Blend Set Points (NOW)
(Dispatch Required)

Silo 1 Contents

Active Pits

Blend Set Points (HISTORICAL)
(Dispatch Required)

Silo 2 Contents

Truck Full Haul Times

Train ETA
(Dispatch Required)

Silo 3 Contents

Truck Empty Haul Times

Train-Car Sequence (NOW)

Silo 4 Contents

Hopper-Silo Connections
(Dispatch Required)

Train-Car Sequence (HISTORICAL)

Silo 5 & Barn Contents

Silo Objects   **Circuit Stations**   **Circuit Features**   **Blending Conveyor Stations**   **Blending Conveyor Features**

OPEN AUTO GENERATOR

VALIDATE INPUTS (NOW)

VALIDATE INPUTS (HISTORICAL)

Truck & Dozer both Tele & Autonomous

1. Monitoring

Dashboard

Sentiment

Last 30 Days

Blogs

News

Twitter

YouTube

Search the Blogs:

Please enter the keyword: Rosemont Copper   Search Blogs

Rosemont Blog Category Sentiment

- Pro
- Anti
- Neutral

Blog Category

Tony Davis

Philip Franchine

Website Metrics

Unique visitors

- Tucson
- Rapid City
- Pelotas
- Mumbai
- Other

2011|06   2011|07   2011|08   2011|09

New counts in period

September August July June May April March February January
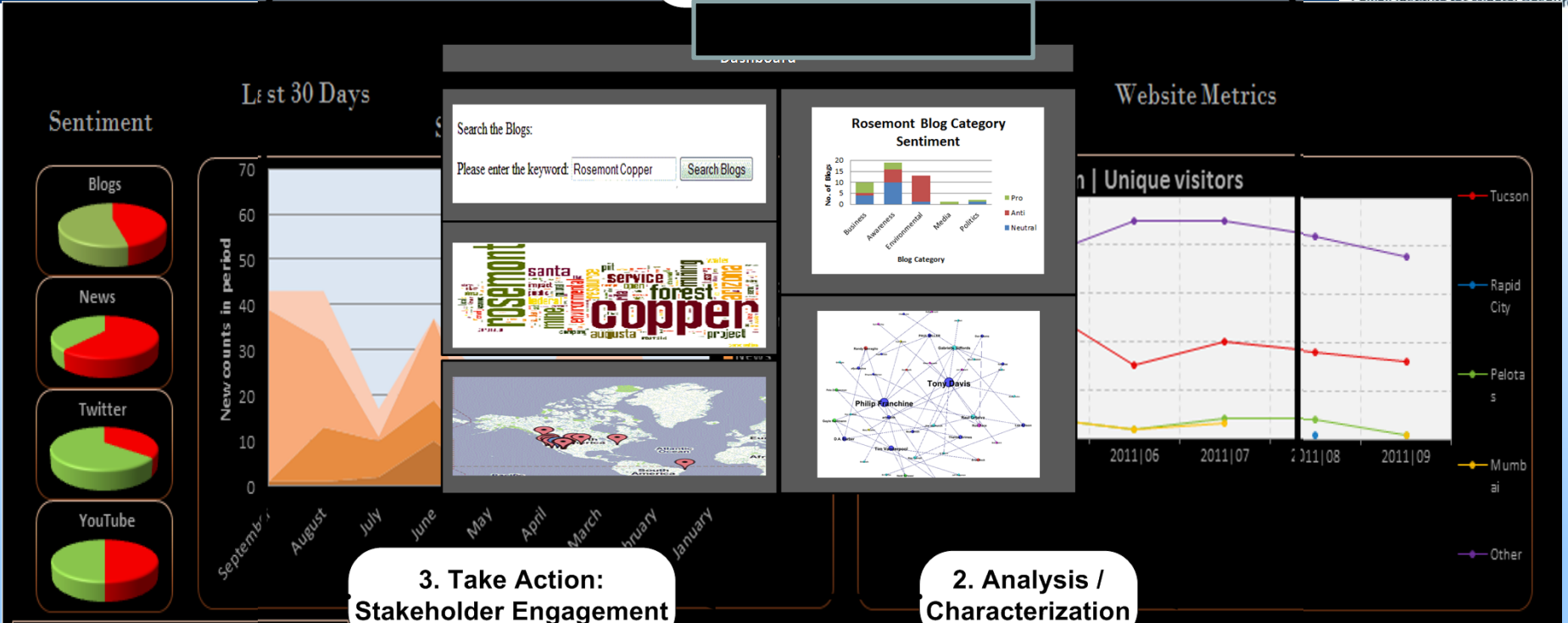
3. Take Action: Stakeholder Engagement

2. Analysis / Characterization

Influencers

Top Positive	Top Negative
...opper	vailjin...
...Z	Randy
...mpson	Barbar...
...vor	Mark I...
	stefan...
	skeets...
7 Toby Herschler	plumb...
8 Arizona Daily	noodls_sMat...
9 lisavanwagenen	phallio
10 azroberth	azsolarpowered

- Respond to mis-information
- Marketing / Information campaigns to media, blogs
- Measure impact over time
- Direct interaction with key opinion leader

Identification of specific stakeholders for engagement through:
- Sentiment analysis
- Tag word analysis
- Geographic location
- Visual Networks

Forest Environmental Valley Rosemont Green County Daily Service

Change Management & Education

- Technology "black belts"
  - Employees get advanced education and generate the ideas

- Stay current with continuing education
  - Hands on technology curriculum with short courses

- Champion change in organization
  - "See – Do – Teach"

Gracias!