EXPLORATION AND MINING (EM) BUSINESS REFERENCE MODEL

Presenter: Mike Woodhall & Sarina Viljoen

Canada 2010 mine planning conference
History

- **Gartner Mining: 2007**
- Proposed an industry collaboration
- Resulted in the establishment of EMMMv
Why?

The objective of EMMv (the Exploration, Mining, Metals and minerals vertical) is to:

realise sustainable business-value through collaboration around a common operating model and, by so doing, enable its members to put their Business-IT investment into areas of differentiation versus standard operating practices and support vendors in their delivery of technical and business solutions to the industry.

“From the boardroom to the rock face”
- Established formally under the auspices of The Open Group in 2008
- Vision, Charter and product portfolio defined
- Priority: Business Reference model
- Iterative approach
- Participation from members and others
- First active version of Business Reference model ready
Reference Model

Objectives:

» Comprehensive Core Business Process Model
» Cross Industry
» Scale independant
» Mining Type and Method Independent
» Product Agnostic
» Cross all Implantation Phases
  • Green fields
  • Brown Fields
  • Operational
» Extensible
» Customisable
What?

The Exploration and Mining (EM) Business Reference Model is the first active deliverable of the Exploration, Mining, Metals and Minerals vertical (EMMMv).
Global:

» South Africa,
» Australia,
» China

Current Member companies:

» Ajilon Australia
» Datamine SA
» Fortescue Metals Group (FMG)
» GijimaAst Mining Solutions International (GMSI)
» Lonmin
» Real IRM Solutions
» Rio Tinto
The Open Group is a vendor-neutral and technology-neutral consortium, whose vision of Boundaryless Information Flow™ will enable access to integrated information, within and among enterprises, based on open standards and global interoperability.

The Open Group enables an independent platform for collaboration, removing issues related to anti-competitive behaviour and claims related to intellectual property.
Post 2008 Mining organisations

- We believe the industry reference models will be the differentiator for focused exploration and mining operations.

**Headlines**

“Social risk mitigation taking mining’s centre stage” – Mining Weekly (Jan 2010)

“...right-sizing labour force....restructuring head office...” – SA Mining (May 2010)

“efficiency focus...” – SA Mining (May 2010)

“...companies focus on running the business better – efficiency, effectiveness and completeness are the issues ; understanding where you need to focus is our value add...” - Steve Rasmussen (retired CTO of Anglo Plat)
## Mining Methods

### Mine Type
- Tabular
- Massive
- Coal
- Other
- Solution

### Rock Type
- Hard
- Soft

### Mining Type
- Open Pit
- Glory Hole
- Placer
- Open Pit

### U/G
- SFCE

### Other
- Hard
- Soft
The Exploration and Mining Business Reference Model

Getting started with the Exploration and Mining business reference model positions the reader in terms of the first reference model of the group existing within the Exploration, Mining, Metals and Minerals vertical.

Concepts and Principles

March 2010

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Deliverables from the vertical

Discover

Defines the process by which an exploration target and/or a mineral resource is articulated and defined for acquisition purposes. The process includes:

- evaluation of grade and tonnes
- pre-feasibility phase
- examining the production options and acquisition

At a strategic level the term 'Discover' focuses on green fields’ discovery.

Synonyms
- Identify opportunity
- Qualify opportunity

Output
- A bankable feasibility study

Role
- Exploration Geologist
Next phase

- Deliverables available to members as prioritised by them including:
  - as documents,
  - models,
  - presentations and
  - source data in a database format
Future phases (wish list)

- Roles & Responsibilities model
- Information reference model
- Data model
- Candidate application capability reference model
- Application integration model
- Resource model
GARTNER

Research Project: **Mine of the Future**

An Architecture for an Integrated Mining Enterprise, 2020

“This initiative (EMMMMv Reference Model) is the broadest cross-mining activity in progress today”

“The team must be complimented on creating this substantial piece of work and for making it available to the public domain through the auspices of the Open Group.”
Who should Join EMMMv

All who operate in the Exploration, Mining, Metals and Minerals space

- Mining companies
- Refining companies
- Engineering support companies
- Consulting Organisations
- Application companies
Join EMMMv

- To influence what will become the standard reference models for the exploration and mining industry
- To ensure you need invest only in differentiators and not on the standard operating processes
- To join the collaboration conversation with a common language – (eg. between vendors and mining clients )
- To understand information resources through the use of an industry standard
- To optimise investment and enable shared services
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EMMMMv and GMSI
What has GMSI done with the Model?

- Replace our Mining Value Chain circa 1998
- Absorb the EM model into our Business Reference Framework exercise – focused architecture process
- Expand the detail by mining method to L3 and in some cases L4
- L0-L2 – generic; L3 mining method specific; L4 client specific; L5 developer conversation
- Add to base of accumulated L4 & L5 info
GMSI ‘Square Circles’

- Planning
  - PRESENTATION
  - Drawing
  - Visualisation
  - Plotting
- Spatial Intelligence
  - Partner & 3rd Party Connectors
- Optimisation
- Execution
- Risk Management
- Database Extensions
  - spatialDB
- Standard Operational Reporting
- Layer Management and Rules
- Spatial Office
- spatialDash
Plan-Do-Improve & Protect

- Planning identifies quantity & quality parameters which get monitored during execution. After ‘measuring’ there is an opportunity for reconciliation of plan vs actual and associated variance analysis.
- Risk Management is all about understanding probabilities and severities and during execution, collecting leading and lagging indicators (e.g. incident and accident figures) and subsequently undertaking risk mitigation.
- Optimisation is concerned with efficiencies or productivities and value for the organization and being able to supply standards and top down goals into the planning processes.
Plan-Do-Improve is cyclical

Need to understand the Business to Manage the Risk (Protect)
The Humungous Matrix

<table>
<thead>
<tr>
<th>L0-L2 as per E&amp;M Model L3 by mining method L4 some specifics</th>
<th>Definitions and Deliverables</th>
<th>Inputs and Outputs for Risk Management, Planning, Execution and Optimisation per L0-L2 Process</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Capital</th>
<th>Break Block</th>
<th>Break Block</th>
<th>Break Block</th>
<th>Break Block</th>
<th>Break Block</th>
<th>Break Block</th>
<th>Break Block</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inputs and Outputs for Risk Management</td>
<td>Planning, Execution and Optimisation</td>
<td>L0-L2 Process</td>
<td>L3 by mining method</td>
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<td></td>
</tr>
</tbody>
</table>
Here’s that Mining Problem again!
#### Optimise (improve)

**L1 Process of Breaking Rock**

<table>
<thead>
<tr>
<th>Inputs</th>
<th>Outputs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Optimisation opportunities for exploitation identified, eg:</td>
<td>Optimization opportunities identified, eg:</td>
</tr>
<tr>
<td>* Historical data on key performance items (KPIs)</td>
<td>* Optimised Exploitation processes</td>
</tr>
<tr>
<td>* Mining variance analyses in place: M2P indices, mining constraints,</td>
<td>* Optimal use of capacity</td>
</tr>
<tr>
<td>logistics</td>
<td>* Optimised Mining Method Characteristics</td>
</tr>
<tr>
<td>* Mining widths, draw control, grade control, fragmentation etc.</td>
<td></td>
</tr>
<tr>
<td>* Reliability and utilisation of resources / orebody.</td>
<td></td>
</tr>
<tr>
<td>* Data analysis for optimization</td>
<td></td>
</tr>
<tr>
<td>* Control &amp; measurement of KPIs for optimization</td>
<td></td>
</tr>
</tbody>
</table>
## Risk Management (protect)

### L1 Process of Moving Rock

<table>
<thead>
<tr>
<th>Inputs</th>
<th>Outputs</th>
</tr>
</thead>
<tbody>
<tr>
<td>* Identification of potential safety and health risks</td>
<td></td>
</tr>
<tr>
<td>* Breakdown potential (availability and utilization of total transport chain)</td>
<td></td>
</tr>
<tr>
<td>* Risk of not achieving required Utilization ★</td>
<td></td>
</tr>
<tr>
<td>* Knowledge of capacities and constraints (e.g.: haul truck sizes, consumptions, panto-lines, ore-pass capacities, half-level capacities, main haulage drive capacities, engineering capacities)</td>
<td></td>
</tr>
<tr>
<td>* Identification of potential loss, breakage of product (also over-creation of fines)</td>
<td></td>
</tr>
<tr>
<td>* Fragmentation characteristics that influence loading rates</td>
<td></td>
</tr>
<tr>
<td>* Knowledge of water usage and inflow and gas occurrence</td>
<td></td>
</tr>
</tbody>
</table>

Risk Mitigation Tactics to ensure consistent delivery.

Management requirements to ensure Minimal breakdowns, e.g.:

* Minimal secondary blasting and hang-ups ★
* Controls to reduce mud-rushes, flooding, explosions, poisonous gas occurrence
* Control system to minimise human exposure to open draw points, hang-ups, in-rushes of rock/mud/water
## Optimise (improve)

### L1 Process of Moving Rock

<table>
<thead>
<tr>
<th>Inputs</th>
<th>Outputs</th>
</tr>
</thead>
<tbody>
<tr>
<td>* Existing Rock handling system, routes, capacities and constraints, and its performance</td>
<td>* Rock handling system in balance</td>
</tr>
<tr>
<td>* Existing blast patterns resulting in current fragmentation ★</td>
<td>* Improved loading rates</td>
</tr>
<tr>
<td>* Geological, geo-technical and geo-metallurgical data</td>
<td>* Improved cycle times</td>
</tr>
<tr>
<td>* Geographical positioning systems</td>
<td>* More energy-efficient transport (eg: haulage method)</td>
</tr>
<tr>
<td>* Existing equipment performance criteria</td>
<td>* Reduced (Optimised) costs of ore / rock transport</td>
</tr>
<tr>
<td>* Means to conduct optimisation (spreadsheets, computer models, simulation, linear programming etc)</td>
<td>* Real-time control on rock movement (eg: Right time, right destination, minimum delays)</td>
</tr>
<tr>
<td>* Reconciliation &amp; Variance analysis of operational activities in place</td>
<td>* Optimised fleet management (eg: Optimal capacity, utilization &amp; availability) ★</td>
</tr>
</tbody>
</table>

★ Sign indicates key performance indicators or critical success factors.
Immediately Obvious Solution

Why not just a bigger truck?
Repository – mineRP Framework

- Accessible, Secure, Knowledge Base
- Multiple Entry Points
  - Process step
  - Plan-Do-Improve & Protect
  - Technical discipline
  - Mining method
- Tools
  - Microsoft standard toolset
  - GMSI domain
  - Consulting tool
Questions?

Canada 2010
mine planning conference