



GoldSET[®]

**Application of a Sustainability Decision
Support Tool to the Mining Industry**

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Environmental Issues in the Mining Industry



Outline



- Sustainable Development
 - A Business Imperative for the Mining Sector
- GoldSET
 - How to “Operationalize” the Principles of Sustainability within Projects
- Case Study
 - Evaluation of Tailings Alternatives
- Conclusion

Successful Sustainable Organizations

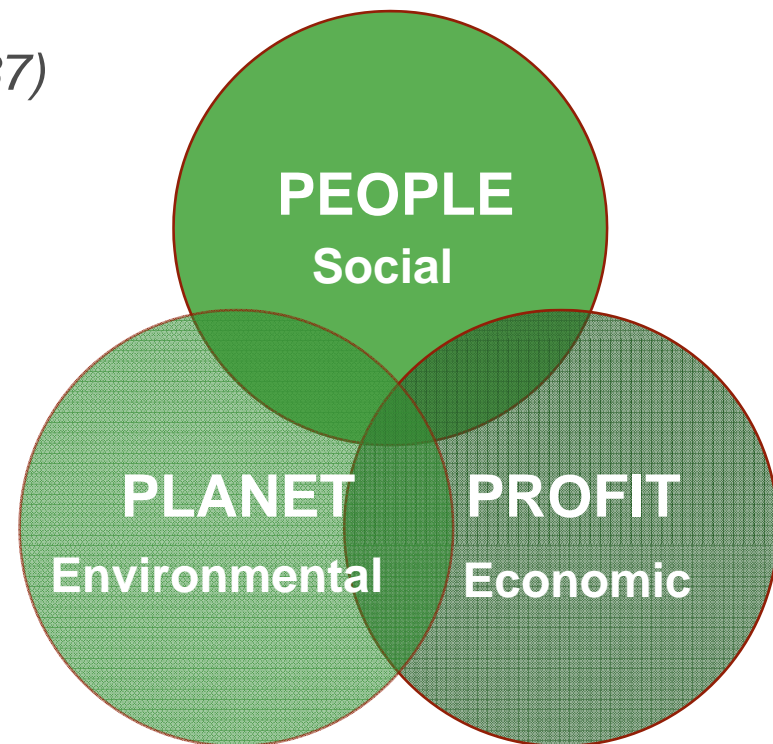


Sustainable Development

“Development that meets the needs of the present without compromising the ability of future generations to meet their own needs.”

(Our Common Future, WCED, 1987)

It's about maintaining the delicate balance between Profit, People and Planet:
the new corporate Triple Bottom Line



Sustainable Organizations : What are the Drivers?



- Development of sustainable projects and organizations requires the management and cohesion of conflicting priorities:
 - **Profit:** Corporate and shareholder value, stakeholders, industry, bankers
 - **People:** Employees, Consumers, Communities, Countries (governments)
 - **Planet:** Meeting global and local agreed-upon environmental standards



How to manage the pressure?

An Executable Framework for Sustainability



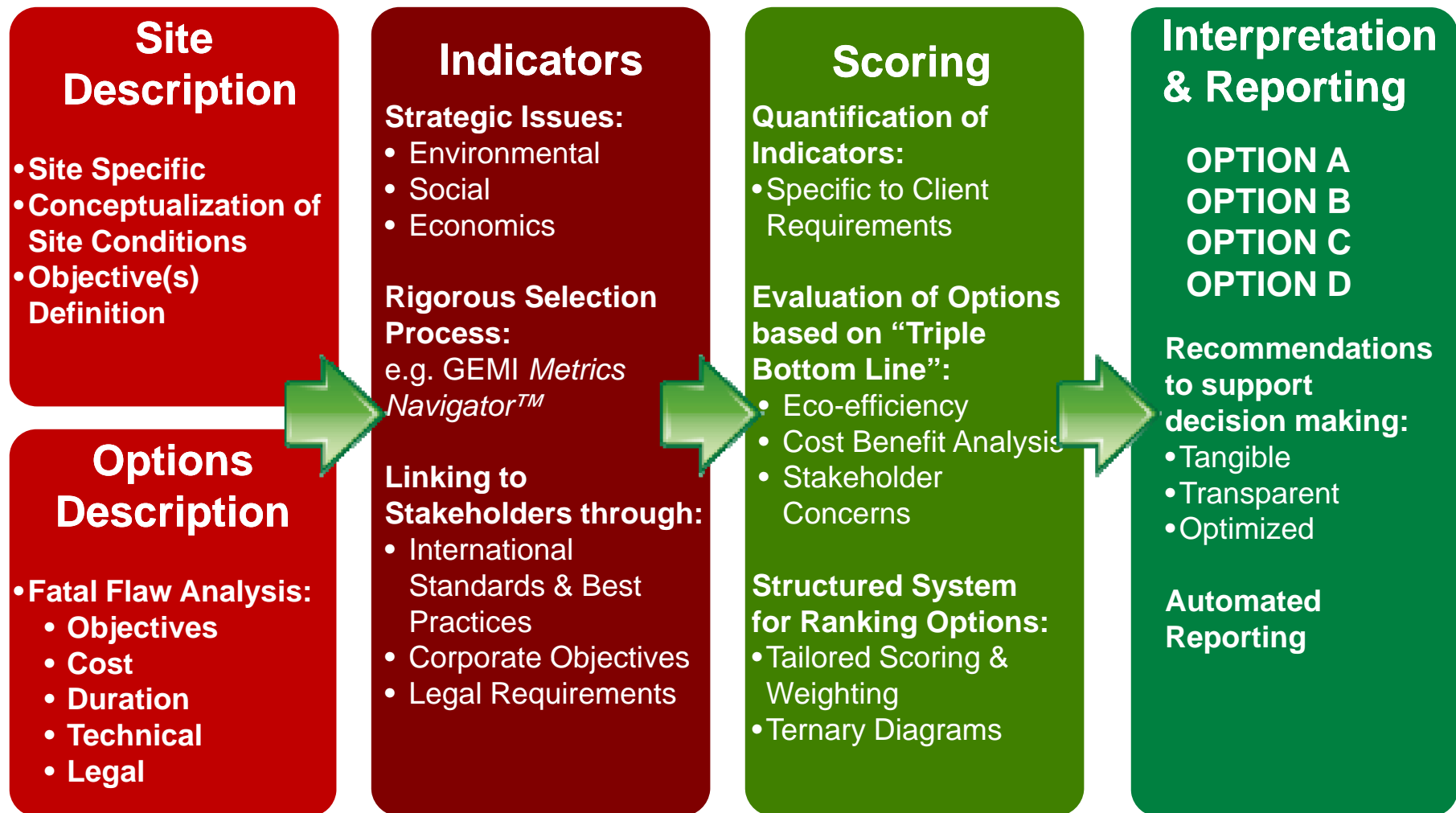
- There is a need for an analytical framework to evaluate sustainability options
- An impartial, balanced and comprehensive assessment can:
 - Enhance the understanding of SD issues
 - Support proactive stakeholder engagement
 - Become instrumental in managing risks
 - Lead to better operational practices
- Improve your “**Triple Bottom Line**”
 - Achieving sustainable **financial** performance while promoting **environmental** integrity and **social** equity

Operational Level



- GoldSET was designed to bring Sustainable Development at the operational level so that organizations can “Walk the Talk”
 - Addresses the evaluation of the “Triple Bottom Line”: Economic, Social and Environmental
 - Transparent decision process for stakeholders, investors and regulators alike
 - Provides a quantitative and qualitative evaluation
 - Measures direct and collateral impacts and benefits
 - Efficient and effective decisions
 - Easy to communicate and understand
 - Tailored to the organization undertaking the activities
 - Balanced, impartial and comprehensive, yet simple to use
 - Reduces overall economic impacts through optimization

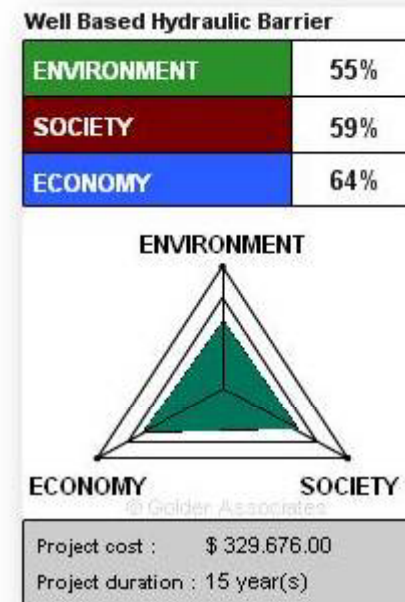
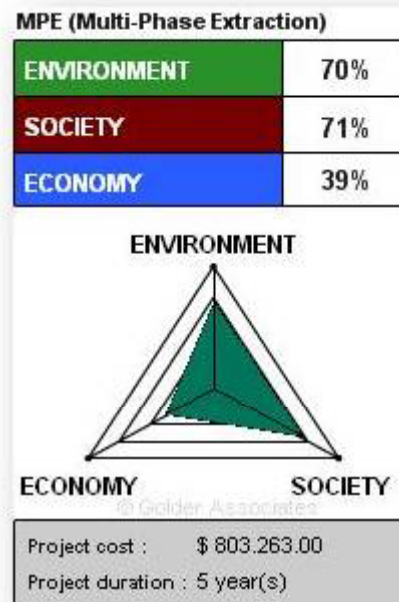
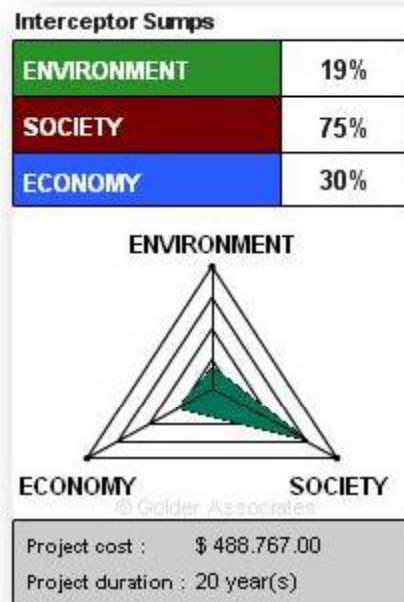
GoldSET : Sustainability Evaluation Tool



Actionable Result Output



- The best approach from a sustainability standpoint is based on:
 - The biggest, most balanced triangle.
 - Highest performance in each dimension
 - Balanced performance between all dimensions
 - Local specificities must be considered in selecting the option



GoldSET at a Glance



Evaluation of Options

Home Analyst : [bbourque](#) (Log Off)
Active Project : [Demo 2](#)

Golder Associates Contact

Project Selection | General Information | Site Description | Option Definition | Indicator Selection | Quantitative Indicator | Evaluation of Options | Results and Report

Step 6 - Evaluation of Options

Environmental Aspect						
Code	Indicator	Option 1	Option 2	Option 3	Weight	
ENV-1	Soil Quality	50	50	50	1	
ENV-2	Sediment Quality	90	100	90	2	
ENV-3	Soil Vapour Intrusion	90	100	90	2	
ENV-4	Groundwater Quality	50	0	90	2	
ENV-5	Off-Site Migration	100	50	100	3	
ENV-6	Short-Term Impacts on Biodiversity and Species Status	0	100	100	1	

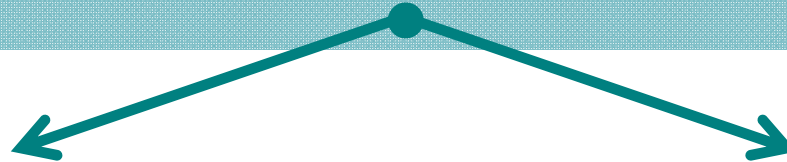
Social Aspect						
Economic Aspect						

Save Go To Next Step

Applications for the Mining Industry



GoldSET for the MINING Industry



Recurrent Projects

- Extension of tailings area
- Extension / Modifications to infrastructures
- Site Remediation

Major Decision Points

- Impact assessment **(new mining site)**
- Design:
 - **Tailings area**
 - **Waste rock**
 - **Processes**
 - **Mine infrastructures**
 - **Water management**
- Closure plan

Case Study: Evaluation of Tailings Alternatives



- Case study adapted from an existing project conducted by Golder Associates in Canada
- Objectives of the project:
 - To provide an integrated approach leading to the most sustainable solution for tailings, mine rock and slag management over the long term
 - To respond in a proactive way to pressures for change in mine waste management
- Client was involved throughout the evaluation process



Case Study: Evaluation of Tailings Alternatives



- Both Process Technologies and Deposition Layouts were evaluated with an SD approach
- Process Technologies – Alternatives considered :
 - Option 1 – Slurry (base case)
 - Option 2 – Slurry with Cyclone
 - Option 3 – Thickened Tailings
 - Option 4 – Paste
 - Option 5 – Filter Cake

Case Study: Evaluation of Tailings Alternatives



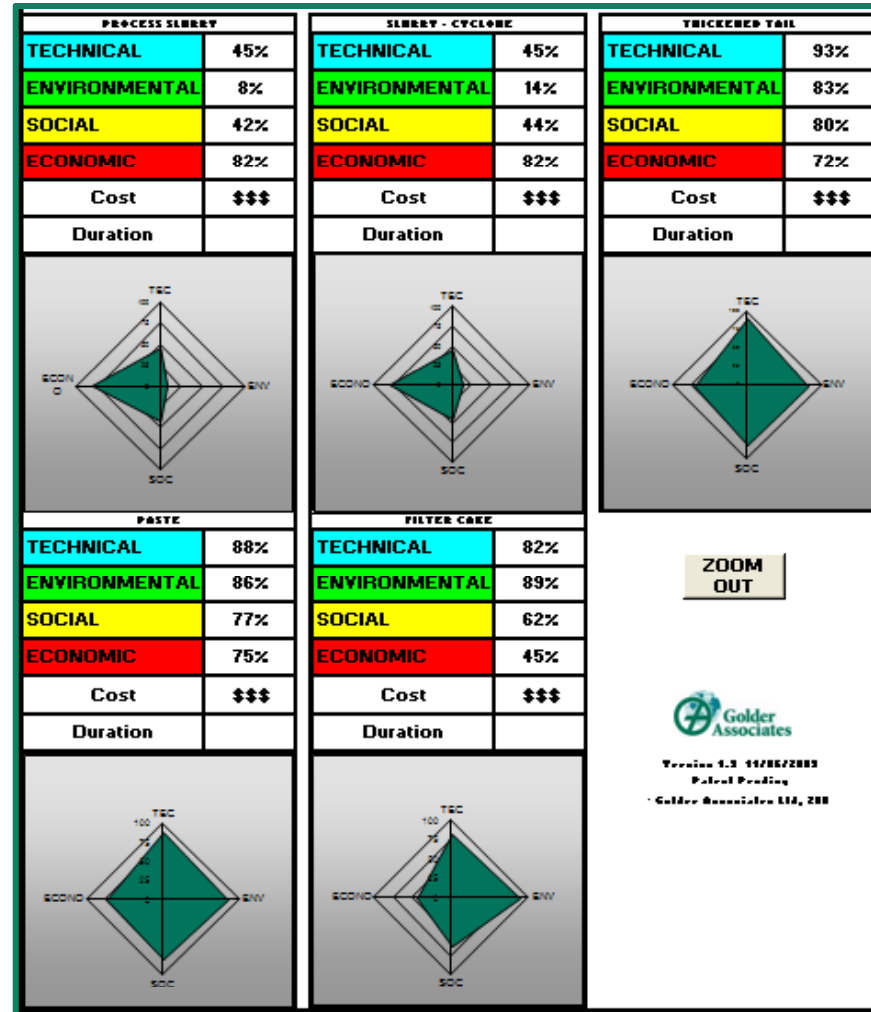
- Four dimensions to be evaluated:
 - Technical – Reliability Vs. Complexity
 - Environmental – Direct & Indirect Impacts
 - Social – Benefits & Nuisances
 - Economics – Bottom Line
- Specific indicators were developed for each dimension to assess SD performance of the alternatives
- Technical dimension broken down into sub-systems:
 - Dewatering & Transport
 - Stack & Dam Stability
 - Capacity
 - Reactivity of Stack
 - Cover System

Technical Criteria
Flexibility of system
Design complexity
Reliability of system
Impact on other processes
Environmental Criteria
Impacts on water
Air quality
Impacts on ecosystems
Potential for spills
Social Criteria
Health and safety
Aesthetics
Impacts on community
Public acceptance
Transportation and infrastructure
Economical Criteria
Capital cost
Operating cost
Closure cost
Pyrrhotite recovery
Distribution of costs over time
Overall project level of confidence

Case Study: Evaluation of Tailings Alternatives



- Process Slurry (w/o Cyclone) are under-performing
 - Inferior for Environmental, Social and Technical dimensions
- Filter Cake is optimized for Environmental performance, but low on Economics (expensive!)
- Thickened Tailings vs. Paste
 - Both suggest balanced performances
 - Economics: Similar performances & Competitive with Slurry
 - Technical: Edge to Thickened Tailings
 - Issues with Paste regarding potential plugging in pipelines and performance in winter
- Thickened tailings as best option to carry forward into prefeasibility with base case



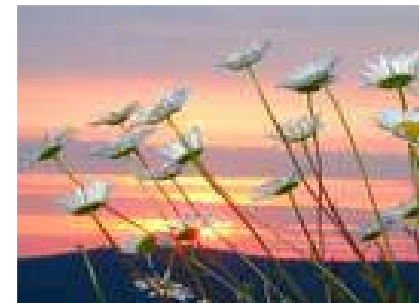
Conclusion



GoldSET :

- Is a hands-on visual tool
 - Structures the decision-making process
 - Provides transparent decision making
 - Simplifies an abstract concept
 - Helps manage business risk

- Provides tangible benefits
 - Re-engineering & optimization
 - Positive corporate image
 - Good communication tool of impacts & benefits



- Effective Performance
- Responsible Development
- Sustainable Communities

Questions?

