A framework of toolbox for managing risks in the minerals sector

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The document of *The Future We Want*, resulting from UNCSD/Rio+20 states

- minerals & metals make a major contribution to world economy & modern societies
- mining industries are important to all countries with mineral resources, in particular developing countries
- to offer opportunity to catalyze broad-based economic development, reduce poverty & assist in meeting development goals such as UNMDG

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Nature of MD is such that adverse impacts on mines & local communities are inevitable.

Mine hazards such as ground collapses & roof falls, U/G explosions & outbursts, fires, floods & land slides often occur with tremendous harms to property & personnel.

Mineral extraction also involves large-scale & long-lasting alterations of the environment, leading to various forms of biological degradation, pollution, damage and human health & safety hazards around mining communities.
Introduction - interwoven impacts

- Negative externalities
  - Land conflicts and misuses
  - Resource curse and Dutch disease
  - Landscape alterations and geological hazards
  - Environmental and ecological degradation
  - Work and community safety and health

- Mining firms and SMEs
- Community sustainability
- Risk management

- Positive spillover
  - Resource base for global economies and societies
  - Poverty reduction and achievement of development goals
  - Importance to mineral rich and developing countries
  - Revenues in form of taxes, royalties, and license fees
  - Jobs and employment for community in related industries
  - Infrastructures and services such as roads, power and hospitals
Faced to OSH, E, E & socio-political, the question is not only sustainability but also responsibility & capacity by promoting app of RAM²T in MS thru strict professional & EE principles with respect for S/C values of countries where MMP occurs to mitigate W/P, S&E risks associated with MMD & conserve biodiversity & ecosystems WFEO & SME SD&M TF RAM²T group proposed a toolbox or KW approach for SMEs to build capacity in managing risks as associated with MMS
Problem & approach - total view

Goal: contribution to sustainability
Objective: application of risk tools
Context: SMEs and communities
Knowledge resources: any available

KWoRAMT approach

KWoRAMT design
SDIMI 2013 TF members

KWoRAMT prototype
SME TF work product

KWoRAMT system
SMEs and communities

Long-term Development

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Problem & approach - delineation

- **Goal**: aligned w/TF, KWoRAMT is to help raise U/S & E&T app to increase MMS contributions to ES&E wellbeing & SD & that of mining communities

- **Objective**: aligned w/TF Theme 5, KWoRAMT is to aim at promoting app RAM²T in MMS & SMEs

- **Context**: KWoRAMT users are SMEs & contexts such as E/S situations & S/H values are adapted to region by region levels

- **Knowledge sources**: KWoRAMT sources include all in 3 sectors from SME TF experts & Internet such as codes, standards, guidelines & best practices
Development cycle: three KWoRAMT stages
- design for conceptual/model
- implementation for illustrative prototype on Internet
- advancement for intelligence with KB & KD

SME TF work product: conceptual framework done & illustrative prototype anticipated as final work product/outcome of TF Theme 5

USTB research: intelligent KWoRAMT as medium-term or long-term efforts at USTB

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Model framework - dimensions

- **Architecture**: knowledge base/warehouse, B/S based platform, web oriented interfaces, ...

- **Functions**: navigation w/links, tools w/annotations, best practices w/cases, searching w/learning, guidance for users/stakeholders, ...

- **Components**: risks w/LC, hazards/risks sources, impacts/consequences/severity, likelihood, capacity or vulnerability, pathways, receptors, ...

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Risks: risks of OSH, ME & CE throughout MLC from prospecting, exploration, development, & exploitation to post-mining closure

Hazards: OSH, roof falls, outbursts, fires, floods, blasts/explosions, ground subsidence/collapse, disposals, toxic/chemical emissions to air, water & soil, ecological/aquifer/vegetation losses

Impacts/consequences: OSH, pollution, land/biodiversity damage, community interactions, economic effects, project profitability, resource efficiencies & other stakeholder needs
Vulnerability: hazards interacts with vulnerability or capacity & dynamically evolves from dormant thru armed with potential harm to active accident.

Pathways & receptors: in terms of HHRAP by US EPA, vulnerability links hazards onto receptors such as firms, employees, community & national level thru pathways such as energy releases, physical forces, air, waters, soil & biota in E or at W/P, families, schools, hospitals & transport in C, & profitability, jobs, financial services & insurances in E.
Techniques: ISO 31010 risk management involves communication & consultation, context establishment, assessment (identification, analysis & evaluation), treatment & mitigation, & monitoring & review

pros & cons or strengths & weaknesses for various techniques annotated for guidance & mitigation strategies developed to enhance opportunities & reduce threats of SMEs

Best practices: cases & best practices including experiences & lessons w/ problems, solutions & recommendations on solutions exemplified

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Introduction

An Intro to KWoRAMTs

KWoRAMTs is proposed to help small and medium sized enterprises (SMEs) in the mining and minerals sector build their capacity for risk analysis, mitigation and management (RAM) and gain their credibility and social license to operate while simultaneously strengthening their skills and confidence in their ability to apply the risk management techniques and methodologies.

KWoRAMTs is proposed to include risk management resources such as standards, guidelines, code of conducts, reports, academic papers, and internet websites. Key elements of the KWoRAMTs are focused on the critical, analytical, and in-depth comments and annotations such as pros or cons, strengths or weaknesses, and opportunities or threats of risk management issues, problems and techniques for various risk aspects and phases such as risk communication and consultation, risk context establishment, risk identification, analysis and evaluation; risk treatment and mitigation; and risk monitoring and review. Typical cases including experiences and lessons with the major problem, its solution, and annotations about how the solution was derived will also be exemplified.

In the end, the KWoRAMTs is designed by a team of students directed by Professor Zhongxue Li and other faculty members at the Department of Mineral Resources Engineering, University of Science and Technology Beijing (USTB), China.

Contents in KWoRAMTs

Risks in mine lifecycle

A risk is an effect of uncertainty state on objectives or a deviation from the expectations, and it is often expressed or characterized by a combination of the consequences of an event (including changes in states or circumstances) and the associated likelihood of its occurrence. Risks to be taken into consideration are those effects on mine occupational safety and health, mine property and performance, and community environment of mining engineering processes throughout the mine life cycle from prospecting, exploration, mine development, and exploitation to mine closure.
Prototype development - web pages

Exploitation

Blasting Accidents

When underground or opencast blasting, the warning is not strict, the people into the blasting area, or blasting personnel illegal operation caused by the injury of personnel. The blasting damage including early burst, delayed explosion, blasting and misfire accident caused by the earthquake, the air shock wave, flying rocks in blasting, blasting fume poisoning hazards.

Know Other Risks?

Blasting Accidents
Dust hazard
Electricity Injury

Pathways

Risk

Receptors

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Prototype development - web pages

Guidance

Intro
Risks and Hazards
Risk Managements
Risk Receptors
Surface Mine
Underground Mine

Risk Managements
Group Discussion
Scenario Analysis
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Risk Receptors
Firms
Employees
Natural Community

Risks and Hazards
Surface Collapse
Tailings Pond
......

Risks Categorized by Mine
Surface Mine
Underground Mine

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Presented - is KWoRAMT, a multi-SH oriented & B/S web based model framework of mine risk toolbox or KW for mitigating & managing MLC risks & building SMEs capacity to fulfill task of WFEO-SME SD&M TF Theme 5 & as M-L term research efforts at USTB

Wanted - are critical comments, instrumental suggestions & further collaboration for realization

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