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A Diversified Metals & Mining Company

Partnerships in Innovation

Mines Ministers Conference, Whitehorse
August 2006

Mining Industry 2006

- Major contributor to the Canadian economy
- Diverse and complex: commodities, locations, types of operation, social and environmental constraints
- Mergers & Acquisition Activity
 - Few large companies
 - Many smaller companies – exploration focused

Mining Industry - Technology

- Public perception: low tech, conservative
- Reality: high tech, risk tolerant:
 - Exploration – cf. Pharmaceutical R&D
 - Numerous computer-assisted innovations in process control, modeling, simulation, automation
- Innovation cognizant but traditionally slow to adopt new technology

Technological Innovation

- Structural Constraints
 - Fragmented industry
 - Many small players
 - Secretive – confidentiality issues
 - Operational autonomy
 - Financial constraints – cost cutting

- Diverse Activities
 - Environment - sustainability
 - Exploration
 - Mining and processing
 - Product development

Government – traditional role

- Collection and distribution of geoscience – fundamental data for attracting exploration; Federal and Provincial Governments
- Deposit characterization and process development – equipment and expertise not available in the industry; Federal (CANMET) and locally Provincial Governments (e.g., energy)
- Funding for university-based research and collaborative programs

Innovation Pathways

- In-house R&D
- Consulting Services
- Sponsored Research
- Government Funded Programs
- R&D Partnerships

In-house R&D

- Significant decline over last 20 years
- Compounded by consolidation
- Active areas in some companies:
 - Exploration - geophysics
 - Mineral processing – hydrometallurgy
 - Improvement technology
 - Product development
- Not an option for small companies

Consulting Services

- Solid capabilities
- Can be expensive
- Sometimes offer proprietary technologies
- A “Closed” solution – one company – one solution provider

Sponsored University Research

- Generally excellent capabilities
- Can be narrowly focused in a few individuals
- Talent consolidation in “Centres of Excellence”
- Risk of cultural misalignment – academic vs industry
- Intellectual Property ownership can be an issue
- Sometimes a “Closed” solution – one company – one solution provider

Government Funded Research

- More industry inclusive – helpful to smaller companies
- Consensus on deliverables can be challenging
- Significant “criteria”, “qualification” and “reporting” requirements
- Timeline challenged?

R&D Partnerships

Advantages

- Attractive to industry
- Decrease individual risk
- Good R&D dollar leverage
- Many areas suitable – pre-competitive
- Industry / science response
 - Growth of research brokers – AMIRA, CAMIRO
 - Development of university-based research groups with critical mass and momentum – MDRU, CEMI

R&D Partnerships

Challenges

- Business Consolidation – M & A Activity
 - decreasing number of players
 - Smaller companies tend not to participate
- Research Consolidation – “Centers of Excellence”
 - hard for individuals to compete
- Collaboration may not promote innovation – tendency to “low risk” projects
- Government – limited support for programs, too many constraints, not enough innovation

Australian Comparison

“ Team Australia ”

- Similar resource-based economy
- Greater role by Federal Government – Geoscience Australia, CSIRO, AMSRI
- Innovative State Geological Survey programs – e.g., PACE in South Australia
- More programs to encourage/fund centres for partnering and collaboration:
 - Key Centres
 - Special Research Centres
 - Centres of Excellence
- Programs that balance applied and fundamental research, and encourage innovation

Australian Comparison

- AMIRA
 - Origin in Australia
 - Now the dominant international research broker for the minerals industry
 - International offices in Toronto, Santiago and Johannesburg
- Engaged at a high level with industry

Australian Comparison

- Australia: not perfect but out competing Canada
 - Extent of programs
 - New technology developments (Falcon, MLA, QuemScan)
 - Financial support
 - \$15M to CODES
 - \$11M to AMSRI
 - Focus on results and innovation

Opportunities for Canada

- Improve opportunities and mechanisms for partnering
- Increase funding for collaboration
- Facilitate and demand innovation
- Support implementation of new technology
- Educate the next generation