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# Creating sustainable open innovation in the mining industry



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# The basis of competition....

- Mining companies are increasingly characterized by the need for novel solutions in the areas of business development, commerce and especially in the area of technology development;
- It is perhaps no longer a game of the big that eats the small but rather the fast that eats the slow – has the rules of competition in the mining industry remained the same?;
- The cycles for technology development and innovation in mining are slow...however this is debatable;
- Mining companies focus increasingly on innovation to drive long term investment decisions and enable technological development and R&D effort.

# The notion of open and closed innovation...

“Traditionally, industrial firms developed new technologies for their own products internally. Thus, most companies pursued relatively “closed” innovation strategies meaning limited interactions with the outside environment.”  
*(Lichtenthaler, 2011)*

- Some exceptions like chemicals industry.

“In recent decades, these strategies have begun to change as firms across industries have increasingly acquired external technologies to complement their internal knowledge bases.” *(Lichtenthaler, 2010)*

- These strategies necessitate knowledge about the external environment.
- The notion of open and closed end approaches to innovation.

# The development of open innovation

Open innovation (and crowd sourcing) should result in knowledge creation in the mining industry.

Open innovation and crowd sourcing popularized by publications that explain the effect of the knowledge of the “crowds” on the adoption and implementation of novel ideas

- Malcolm Gladwell (2000) The tipping point ...”one, contagiousness: two, the fact that little causes can have big effects...”

- Henry Chesbrough (2003) Open innovation: The new imperative for creating and profiting from technology. Open innovation described as innovation processes in which firms interact extensively with their environment, leading to a significant amount of external knowledge exploration and exploitation.”
- James Surowiecki (2004) The wisdom of crowds... “convincingly argues that under the right circumstances, it’s the crowd that’s wiser than even society’s smartest individuals.”

# The development of open innovation

- Tapscott and Williams (2006) Wikinomics..." The new art and science of wkinomics is based on four powerful new ideas: openness, peering, sharing, and acting globally."
- Lindegaard (2010) The open innovation revolution...."Open innovation is very much about bridging internal and external resources to make innovation happen."
- Open innovation and crowd sourcing can be defined as seeking knowledge outside and inside of the traditional internal knowledge resources.
- Firms can and should use external ideas as well as internal ideas, and internal and external paths to market, as the firms look to advance their technology."
- However..."Despite its growing importance, many firms experience severe challenges in actively managing the process of open innovation...." "...and there are major intrafirm differences in how open innovation is successfully managed." (Lichtenthaler 2010:75

# The need for open innovation in mining....

- Tilton (2003) summarised the perspectives of thought leaders on the technological intensity of the mining industry in Creating wealth and competitiveness in mining.
- Bartos (2007) states: "There is a widespread perception that the mining industry is conservative, traditional, and resistant to change. Some argue that this may have been true in the past, but that this is not reflective of today's realities."
- The mining industry is "really a high-tech industry, utilizing sophisticated and productive machinery in its quest to produce minerals at ever decreasing costs."
- In similar vein a need for technological innovation to process low grade ores.
- Some examples which (since 2007 already) proliferate the literature: Remote sensing for exploration; Bio-leaching of low-grade sulfide material, and automated haul trucks, SX-EW or (solvent extraction technologies).
- However, "mining has more commonalities with so-called mature industries such as cement and glass than with the rapidly evolving minicomputer industry (Bartos, 2007).

# The challenges of innovation

- Most models show innovation paths, representing a stage-gate type of activity and controlling the progress from idea to market introduction, rather than giving insight in the dynamic properties of the innovation processes themselves;
- “Science is viewed primarily as technology orientated (natural and life sciences) and R&D is closely linked to manufacturing, causing insufficient attention to the social and behavioral sciences.
- As a consequence, the emotional (or soft) components of innovation – being responsible for many failures – are hardly addressed;
- The complex interactions between new technological capabilities and emerging markets are a vital part of the innovation process, but they are underexposed in current models;
- The role of the entrepreneur (individual or team) is not captured.” (Berkhout, 2000)

# The challenges of innovation

**Factors that need to be regarded when designing an innovation strategy. These include, but are definitely not limited to, issues such as:**

- Product and process innovation;
- Creativity, idea capturing and management
- Human resource deployment
- Organisational fit
- Marketing and commercialisation strategy, including venturing
- Management of technology, including the management of the dynamics of technological change
- Leveraging of alliances
- R&D strategy
- Assessment of technological threats and opportunities, including technology assessment, forecasting and environmental scanning
- Legal issues, including intellectual property issues such as patenting, copyright and design protection
  
- And knowledge management maturity...

# Enablers of successful open innovation...

- The impact of the strength of dyadic ties (Granovetter, 1973);
- Dynamic properties of the innovation process (Berkhout, 2000);
- Innovation is a complicated process in which it is necessary to account for a multitude of factors, most of which are time dependent (Pistorius & Mentz, 2001);
- Innovation process, strategy of the organisation and the innovation model (Pistorius & Mentz, 2001);
- The adoption of open innovation processes may be determined by drivers at multiple levels – the need for sufficient fit between open innovation processes and a firm's corporate strategy and culture (Lichtenthaler, 2011);
- Social influence have an effect on the use of open innovation and the wisdom of the crowd effect (Lorenz et al., 2011).

# The strength of weak dyadic ties

The role of trust in the internal ecosystem of the innovation processes;

Knowledge management proposes that innovation and collaboration necessitate strong internal ties;

- The strength of a tie is “measured by a (probably linear) combination of the amount of time, the emotional intensity, the intimacy (mutual confiding), and the reciprocal services which characterizes the tie. Each of these is somewhat independent of the other...” (Granovetter, 1973);

- Granovetter (1973) states the importance of weak ties in open innovation processes:
- “Linkage of micro and macro levels is thus no luxury but of central importance to the development of sociological theory. Such linkages generates paradoxes: weak ties, often denounced as generative of alienation are here seen as indispensable to individuals’ opportunities and to their integration into communities; strong ties, breeding local cohesion, lead to overall fragmentation.”

# Effect of social influence on innovation

Lorenz et al., (2011) states: "The aggregate of many people's estimates tends to be closer to the true value than all of the separate individual or even expert guesses."

Lorenz et al., (2011) concur with Granovetter (1973) and explain that: When individuals become aware of the estimates of others, they may revise their own estimates for various reasons:

- Others may have better information;
- Partially follow the wisdom of the crowd;
- Peer pressure toward conformity;
- Group may engage in a process of deliberation about the facts.

**A unique challenge for open innovation in terms of internal of Knowledge management processes?**

# Knowledge management

**Traditionally Knowledge management entailed five basic knowledge processes:**

- Knowledge creation or innovation;
- Knowledge capturing;
- Knowledge sharing or leveraging;
- Knowledge organising;
- Knowledge use or application;
  
- And recently Knowledge validation

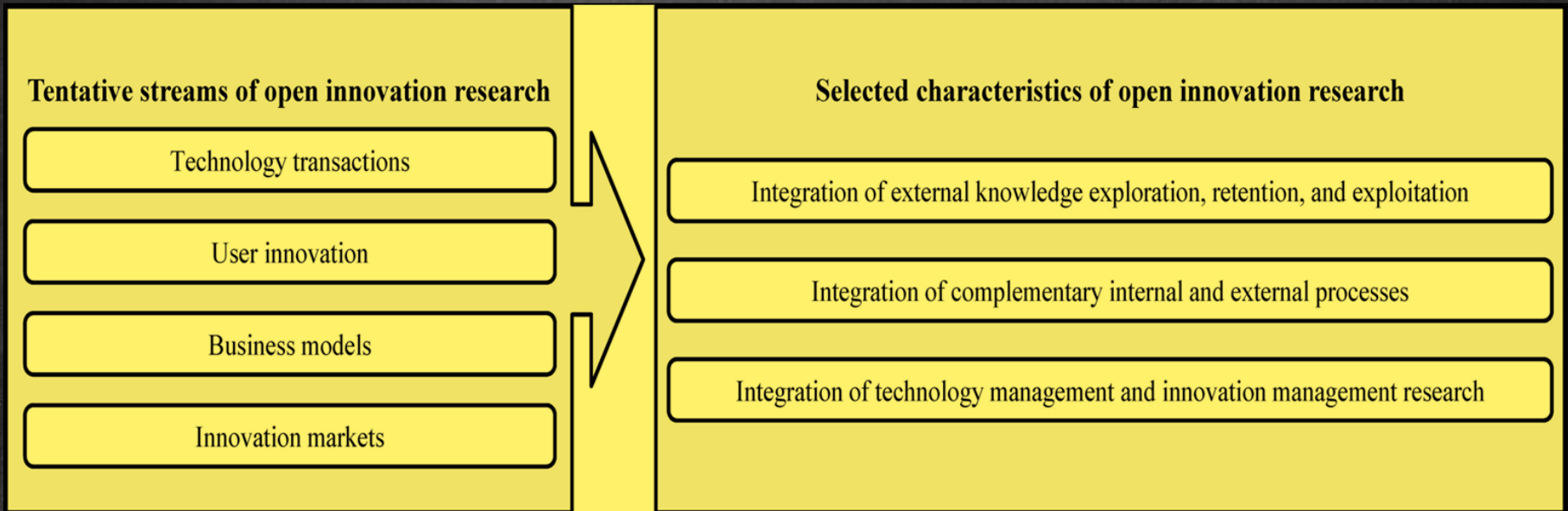
Focus on new or already existing knowledge.

Knowledge management means different things to different people?

# Knowledge management

- Lichtenthaler (2011) presents a “definition and conceptual framework which links the open innovation to related literatures, such as Knowledge management, organizational learning, and firm boundaries:
- “Open innovation is defined as systematically performing knowledge exploration, retention, and exploitation inside and outside an organization’s boundaries throughout the innovation process.”

# Conceptual framework...



# Conceptual framework...

		Knowledge exploration	Knowledge retention	Knowledge exploitation
<b>Internal</b>	Organizational level	Inventive capacity	Transformative capacity	Innovative capacity
	Project level	Make decision	Integrate decision	Keep decision
	Individual level	Not-invented-here attitude	Not-connected-here attitude	Not-sold-here attitude
<b>External</b>	Organizational level	Absorptive capacity	Connective capacity	Desorptive capacity
	Project level	Buy decision	Relate decision	Sell decision
	Individual level	Buy-in attitude	Relate-out attitude	Sell-out attitude

(Lichtenthaler, 2011)

Innovation is a highly knowledge intensive process and hence requires a Knowledge management intervention

# A possible solution to enable open innovation

Systematically performing: “To successfully manage these activities, companies need to develop relevant organizational capabilities at the firm level.”

Internally and externally focussed

## Additional knowledge processes:

- Knowledge exploration – identifying owners and types of knowledge
- Knowledge retention – capturing and organising knowledge
- Knowledge exploitation – application and use of knowledge
- Generate new knowledge inside the organisation and link to existing knowledge;
- To internally maintain knowledge over time;
- Matching inventions with the context of their final market;
- Ability to tap into weak ties and integration of knowledge without “groupthink”.

# A possible solution to enable open innovation

Systematically performing: “To successfully manage these activities, companies need to develop relevant organizational capabilities at the firm level.”

Internally and externally focussed

- Technology intelligence capability linked with an open innovation platform.
- Knowledge exploration – identifying external owners and types of knowledge
- Knowledge retention – capturing and organising knowledge
- Knowledge analysis – answering the question on the application and use of knowledge and the competitive advantage of the company.

# A possible solution to enable open innovation

- “A clear need to balance a Knowledge management and Technology Intelligence capability and hence the internal and external processes. These may be substitutes at the project level but are complimentary at the organisational level.” (Lichtenthaler, 2011)

Companies may capture synergies by aligning the internal and external processes;

Companies may benefit from aligning knowledge exploration, retention and exploitation.

# Conclusion

- Open innovation depends on the successful “fit” of the innovation model and process, organisational strategy and culture.
- Knowledge management and technology intelligence enables the integration of internal and external knowledge assets.



# Questions?



