

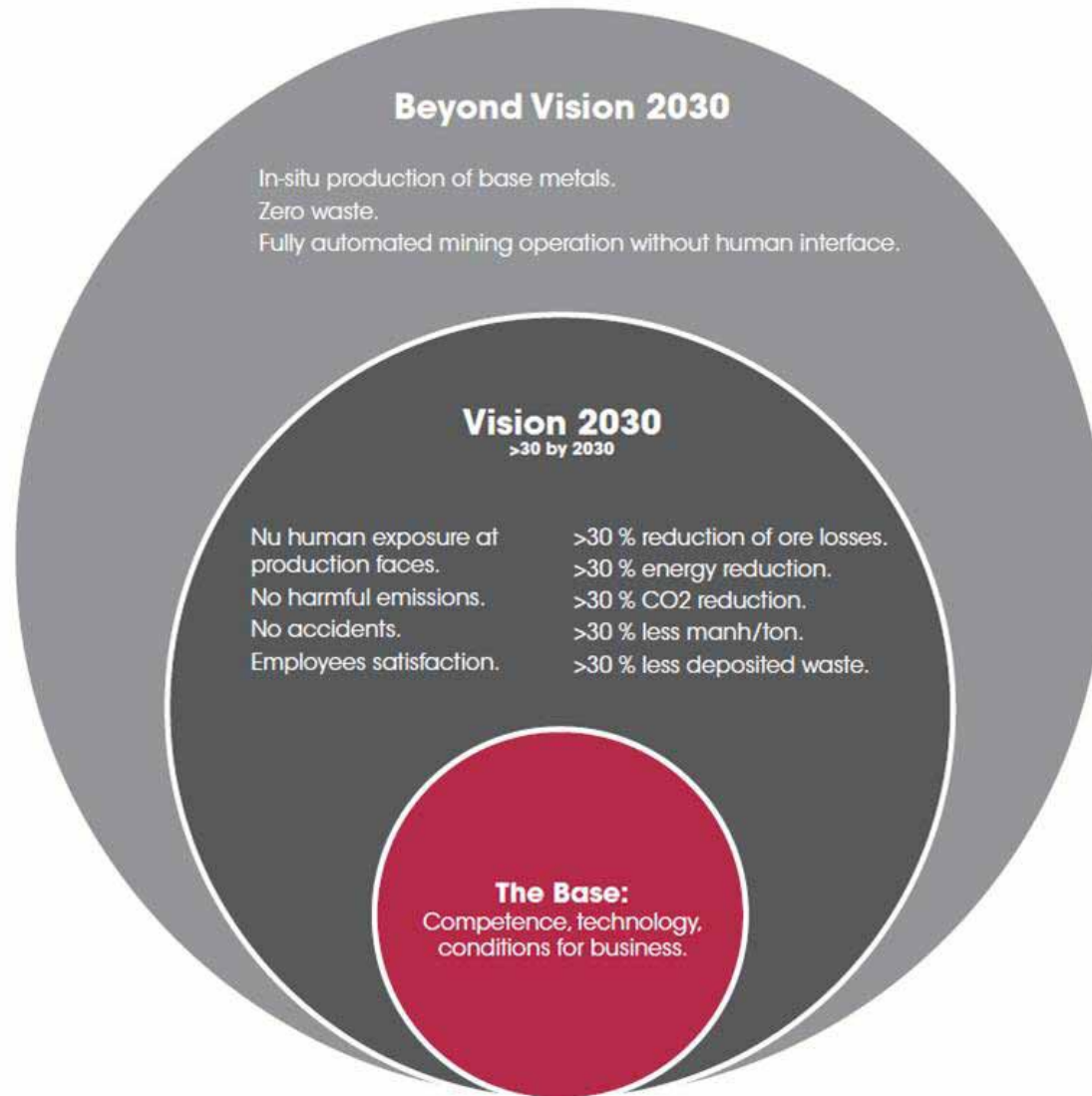
# Smart Mine of the Future

Johan Hedlin

CEO, The Bergforsk Foundation

CEO, Nordic Rock Tech Centre AB

# The vision – Mine of the Future



**Regional  
centre**



**Mine site**

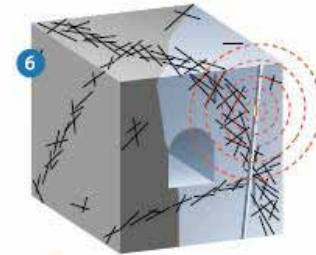
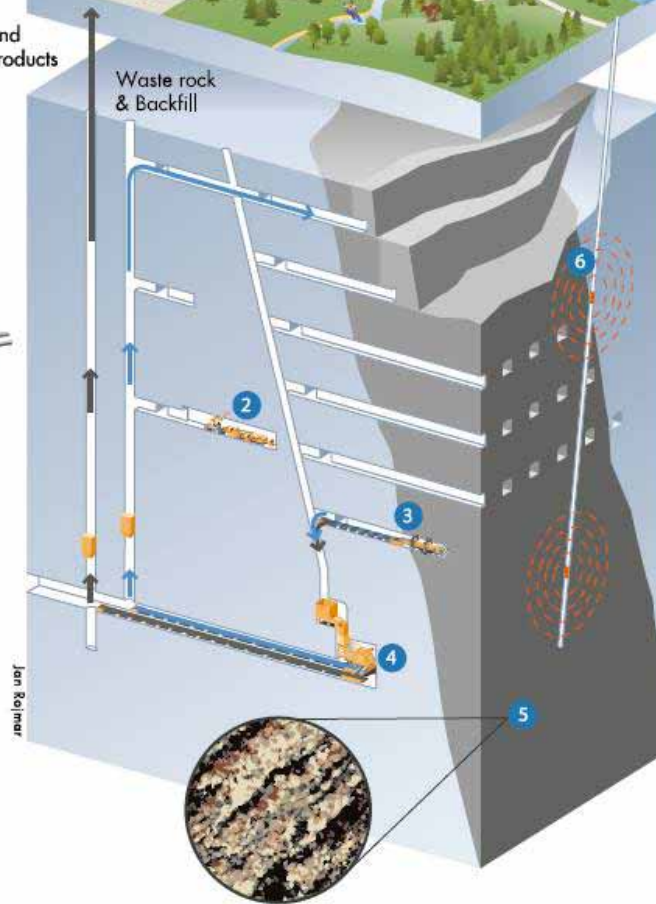
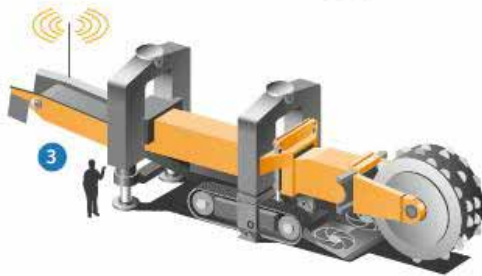


**Suppliers**



Ore and  
by-products

Waste rock  
& Backfill



**Smart Mine of the Future**

**RTC**  
ROCK TECH CENTRE

## Regional centre

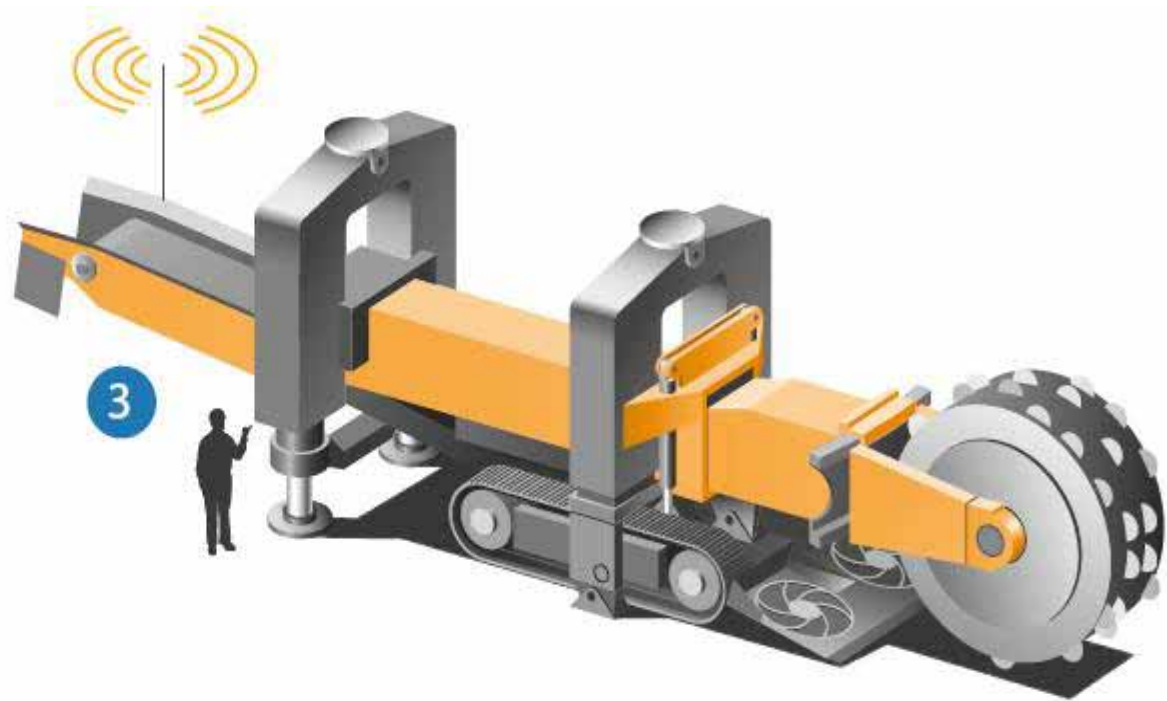


- 1. One control room.** The control room receives on-line processed information from the rock, from the personnel and from the machinery and equipments that permits the control and fine-tuning of the complete operation (process control and product control) from resource characterisation to the final product. Sensors and the extensive use of cameras and image techniques permit “live performances” in the control room or elsewhere as needed.



2. **No human presence in the production areas.** All work processes (including rock characterisation) are remote controlled or automated. Special robots are developed for the preventive maintenance of equipment and safe retrieval operations. The maintenance of the robots as well as necessary equipment repair are executed in structurally safe underground vaults. All equipment underground is electrical and the use of diesel is banned.

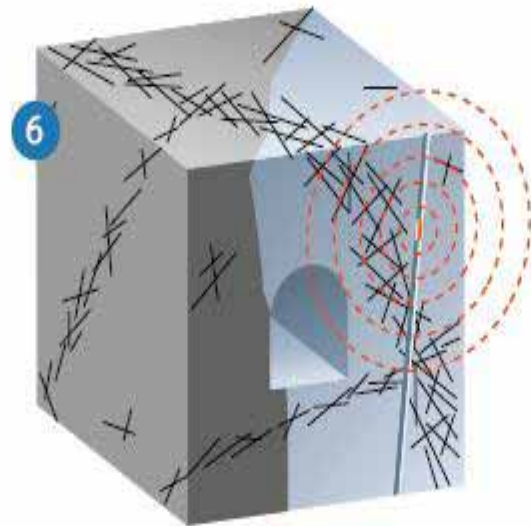
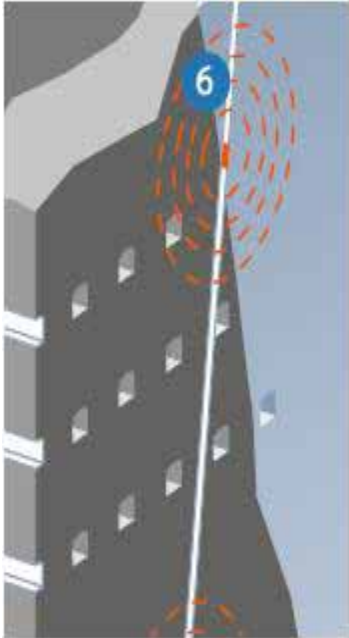




- 3. Continuous mechanical excavation.** The continuous flow is a key issue for lean mining and further automation. The future mine is a continuous process, and therefore continuous mechanical operation is also used in hard rock



4. **Pre-concentration.** Barren rock is separated underground to minimise energy consumption for haulage and transport as well as environmental impact on the surface.



6. Resource characterisation – structural control. Systems are used that describe the rock with its structures to aid process control.



## Suppliers



7. Final product. For reasons of sustainability, waste rock should be turned into products. The metal should, if possible, be manufactured at the mine site to avoid unnecessary transportation. Added value generated in situ should also contribute to a richer social life at the mine site.

# Way forward ?

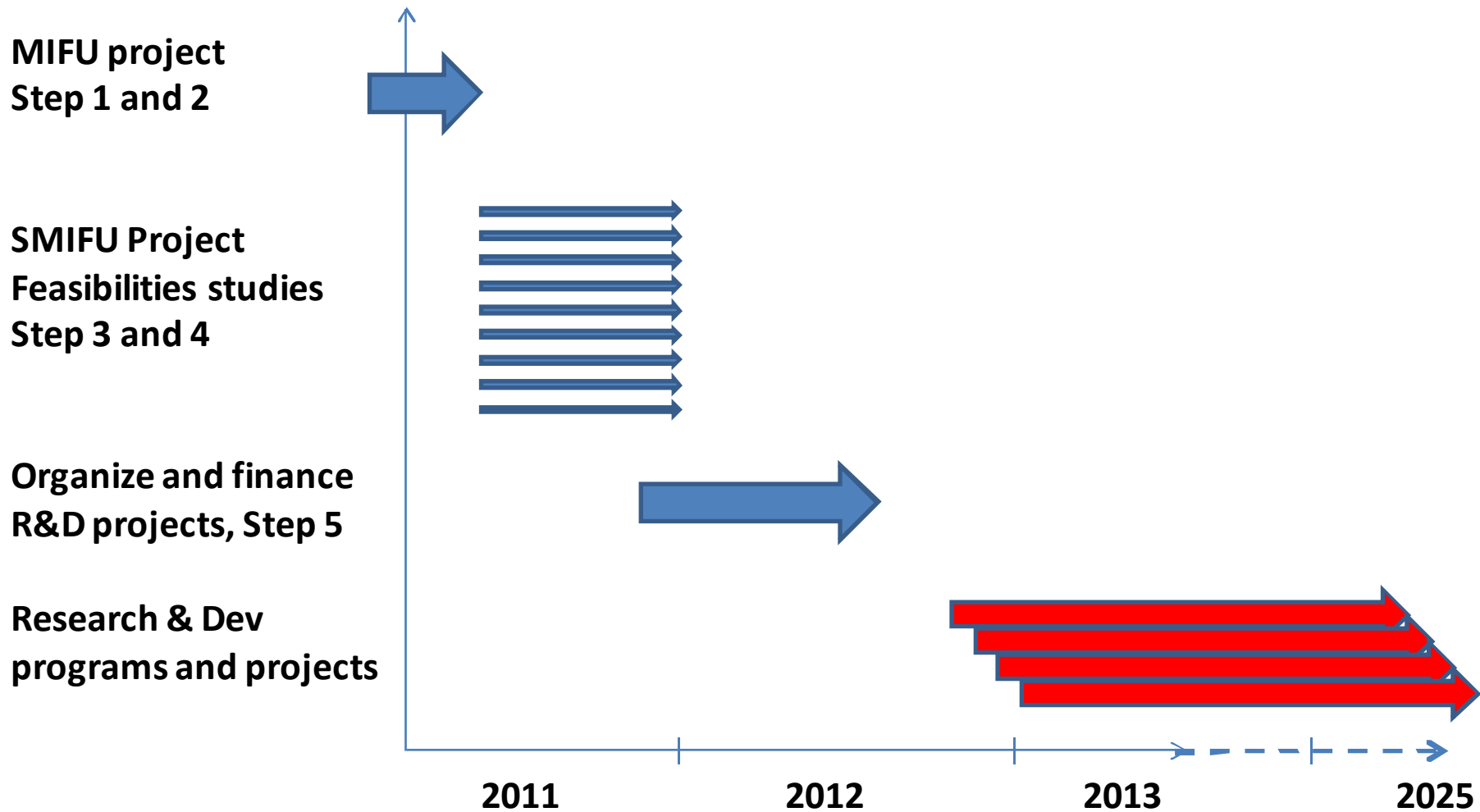
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# Our process way forward

1. Describe the vision and long term objectives
2. Identify certain areas of needs and prioritize
3. Carry out feasibility studies
4. Identify research and development areas
5. Organize, finance and start R&D projects

# Our process way forward



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# Project organization – feasibility studies

Steering committee

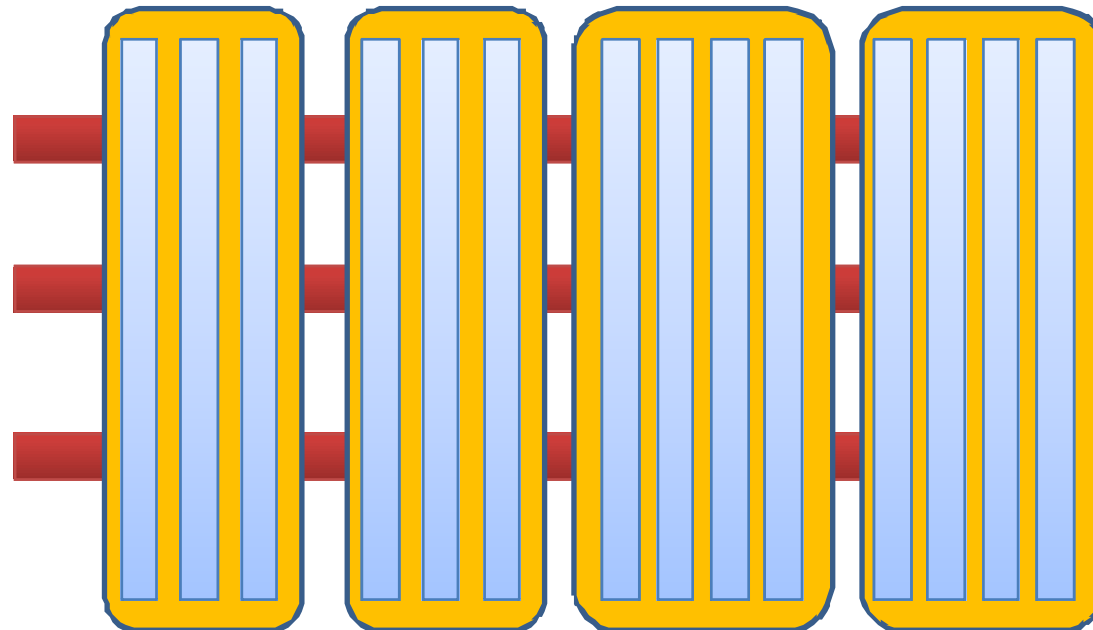
University AGH  
Luleå University of  
Technology  
KGHM, Boliden, LKAB

Future development, next phase, wp 15

Coordination  
Environmental

Coordination  
Safety

Coordination  
Lean



Work packages 1 to 14

Project management and administration, RTC

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# Feasibility studies

1. Zero entry in the production area
  2. Rock mechanics and ground support
  3. New power sources for underground vehicles and equipment
  4. Basic mechanisms for breakage on hard rocks.
  5. Reduce nitrogen emissions
  6. Pyrite removal
  7. Pre-concentration
  8. Improved ore recovery
  9. Process and equipment reliability
  10. Continuous mechanical excavation
  11. Integrated Process control by improved connectivity, model.
  12. Resource characterisation and Sensor and auto data proc
  13. The Attractive Workplace – design guidelines
  14. Mine site metal production
  15. Future development, next phase
- Åke Kruukka, LKAB  
Per Ivar Marklund, Boliden  
Stefan Törnman, LKAB  
University AGH Poland  
Anders Lundkvist, LKAB  
Pia Lindström, Boliden  
Witold Pawlos, KGHM, MPP  
Hamid -Reza Manouchehri, Boliden  
Sunniva Haugen, Boliden  
Krzysztof Barrek, KGHM  
Å Krukka, M Strömsten, LKAB  
Perti Lamberg, LTU  
Elzbieta Idzik, KGHM  
Andreas Berggren, Boliden  
Johan Hedlin , RTC

# Companies and organizations involved in the feasibility studies

LKAB, Boliden, KGHM

Luleå University of Technology, University AGH

Metso, Atlas Copco, Akzo, Georange, Sandvik, ÅF, ABB,  
Outotech, Gett

amongst others.

# Summarize

Great challenges

Great possibilities

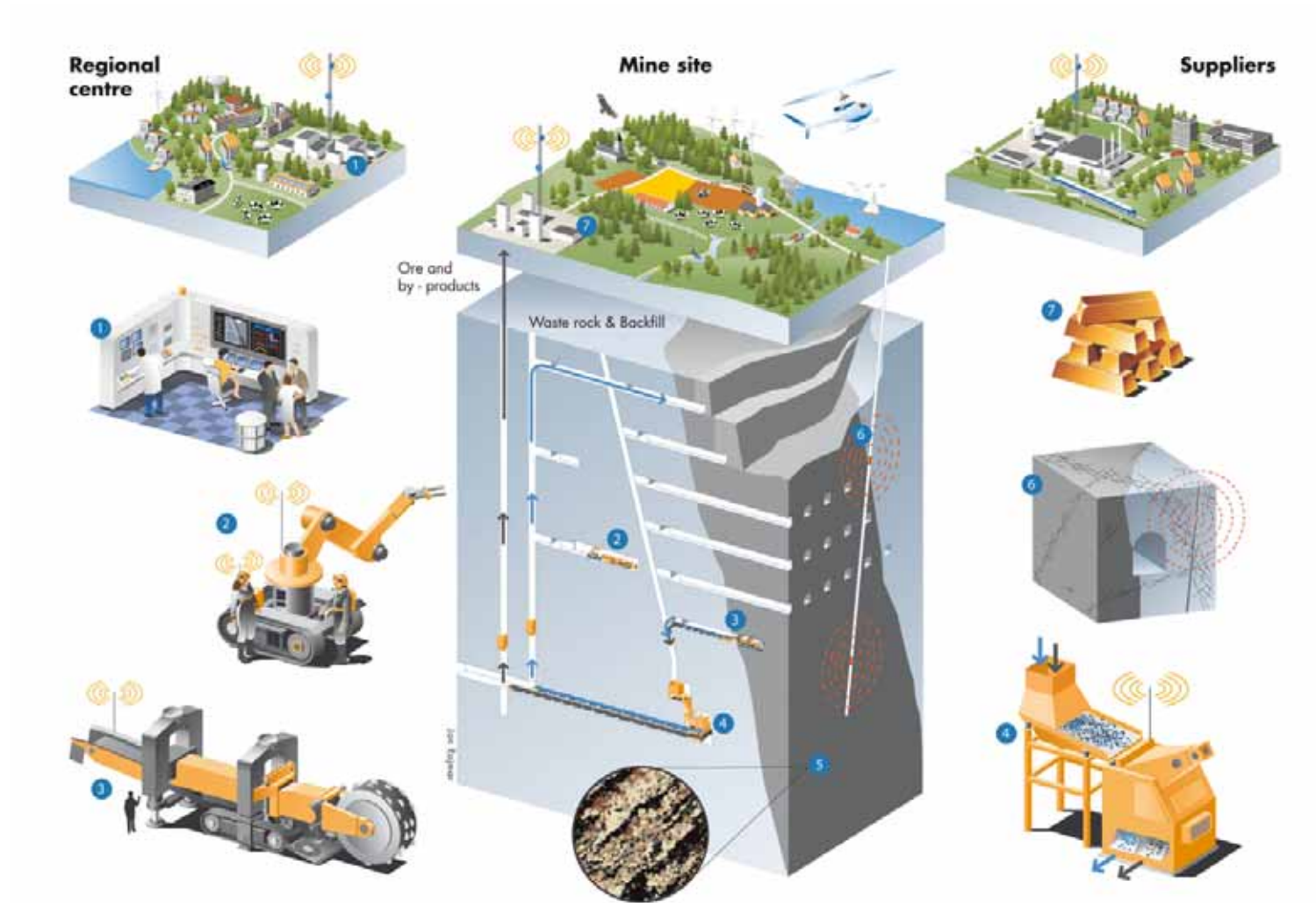
- for the mining industry
- for the suppliers,
- for Sweden and Europe

We need to cooperate

National and EU based research programs



# Thanks!



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