WP2 - Skill Gaps

- **Short-term:**
  - Review of position papers
- **Medium-term**
  - Focus Group
- **Long-term**
  - Delphi survey
Many sectoral reports available...

Skill shift: Automation and the future of the workforce

WP2 - Skill Gaps

- **Identification** of main trends and drivers of change – **short-term**
- **Extrapolation and exploration** through a Focus Group – **medium-term**
Focus Group & Manifesto

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**Mining 4.0 Digital transformation**
- Shift towards higher cognitive & complex problem solving skills;
- Knowledge in different components of the value chain;
- Initiatives for re-skilling & up-skilling, support mobility & rotation;
- Attract talents from other sectors;
- Increase collaboration with universities;

**Social Skills**
- Communication, leadership & training skills are expected to increase in demand;
- Responsible sourcing of minerals: skills related to mining rehabilitation and waste management;
- New branding/repositioning “Raw Materials Providers”;

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WP2 - Skill Gaps

**INTERMIN**

- **Subsea Mining**
- **Ultra-deptths**
- **‘In-place’ mineral recovery**
- **Space Mining**

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Delphi Survey - areas covered

- Mass mining
  - “By 2050, the majority of mine sites will be fully autonomous operations”

- Mineral Exploration undercover
  - “Improvements to professional competences will come about much more on improving ‘exploration thinking’ rather than data processing – a computer is not the solution to discovering ore.”

- Seafloor & Space mining
  - “Deep-sea mining has evolved in close synergy with mining, oil & gas and space research.”

- Raw materials in the circular economy
  - “New and improved techniques for waste retreatment and processing will be developed for multiple commodities with multiple applications – dedicated, competent professions will deal exclusively with tailings re-use as well as working together with downstream users for identification of new products and applications.”

- Future of education
  - “Education system will be revolutionized, moving from certification and general preparation to a flexible needs-based education – professionals won’t have professions, but a portfolio of abilities and skills.”

Delphi Results

- 69 Participants
- 2 rounds – April-May, 2019
- 20 statements
  - Scale of agreement
  - Expertise
  - General Comments
  - Potential skills gaps
Delphi Results - Consensus

- “Sustainability professional roles will be consolidated including competences in social and environmental performance, Corporate Social Responsibility and post-mine rehabilitation and restoration.”
- “While conventional mining will evolve to deeper and larger open-pits and ultra-deep underground operations (‘supercaves’), it will co-exist with novel, not yet developed mining methods.”
- “Geophysical and geochemical knowledge in parallel with data science, modelling and geographic information system (GIS) skills will be a requirement for geologists working in mining.”
- “By 2050, the majority of mine sites will be fully autonomous operations.”
- “New and improved techniques for waste retreatment and processing will be developed for multiple commodities with multiple applications – dedicated, competent professions will deal exclusively with tailings re-use as well as working together with downstream users for identification of new products and applications.”

Delphi Results - Emerging skills

- “Demands on geotechnical, hydrogeological, and mechatronics/automation specialists will increase, there will be shortages in these skills and gaps in the required knowledge and expertise, and a generational gap in the 40-60 year age gap as experienced Post War Baby Boomers retire.”
- “In my view there will be needed experts in life cycle analysis to certificate the less harmful operations in terms of both resource consumption and emissions to the environment.”
- “Skills related to Electro-mechanical systems, biotechnologies, data science and management, rock fragmentation at depth.”
- “The level of expertise in bio-oxidation and biotechnology in the mining sector is still limited and requires more development of trained professionals.”
- “Geoscientists will need much more coding and data analytical skills. Also, holistic thinking and integration of all disciplines will be necessary”
- “Waste management, waste processing technology, legislative skills.”
- “More knowledge about social mechanisms is required on the curricula for miners”
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**WP2 - Skill Gaps**

- **Identified skills gaps (WP2)**
- **RM qualification framework (D3.1)**
- **Skills catalogue (WP1)**

Areas of competency defined based on:
- Identified skills gaps (WP2)
- RM qualification framework (D3.1)
- Skills catalogue (WP1)

**Competency Model - Scenarios**

- **Scenario driver files description**
  - 8 Drivers defined in Madrid

**Workshop for hypotheses testing**

**Scenarios description**

**Integration to deliverable**

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Competency Model – Scenarios

- **Business as usual**
  - Assembly of main past trend hypotheses. Not necessarily most probable in the future.

- **Environmentally Driven**
  - Responsibility of all stakeholders for the environment

- **Fragmentation**
  - A world of tensions and conflicts, companies tend to exploit new discoveries in difficult location (new frontiers)

- **Mining 5.0**
  - Scenario of radical innovation, new ways of mining in remote areas Invisible and profitable mining well accepted.

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Competence Model
Emerging areas of RM competencies

- Advanced data analytics and simulation modeling
- ‘New frontier’ mining
- Industrial ecology
- Deep rock engineering/geomechanics
- Investigation and development of new materials and processes
- Social mechanisms of community engagement – ‘deep’ SLO
- Market forecasting and modelling
- Blockchain-based smart contracts
- Supervision of recycling plants
- Advanced/predictive data analytics, digital twinning and simulation modelling
- Systems Engineering
- Biotechnology
- Nanotechnology
- Electrometallurgy

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Thank you for your attention!

Reports will be available for download at https://interminproject.org/work-packages/