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International Meeting: The skills needed in the mining sector in the XXI century

Guayaquil, 22 October 2019

La Palma Research Centre

Work Package 2: Raw material skill gaps – future skills for the digital area and socially responsible mining
Adrienn Cseko, Marco A. Konrat Martins

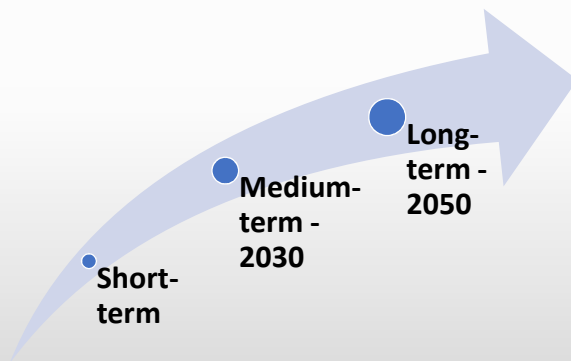
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WP2 - Skill Gaps

- **Short-term:**
 - Review of position papers
- **Medium –term**
 - Focus Group
- **Long-term**
 - Delphi survey



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Many sectoral reports available..

McKinsey Global Institute

Skill shift: Automation and the future of the workforce

May 2018 | Discussion Paper

The Future of Work: the Changing Skills Landscape for Miners

A report for the Minerals Council of Australia

IMPC Mineral Processing Education ROADMAP

WORLD ECONOMIC FORUM
COMMITTED TO IMPROVING THE STATE OF THE WORLD

Insight Report

The Future of Jobs Report 2018

Deloitte.

NORCAT



Future of Work in mining:
Attracting, developing and retaining talent

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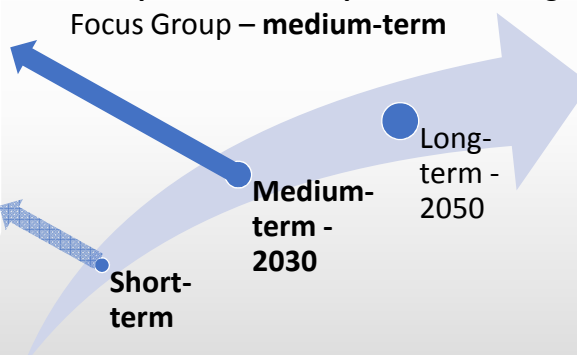


WP2 - Skill Gaps

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



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Focus Group & Manifesto

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

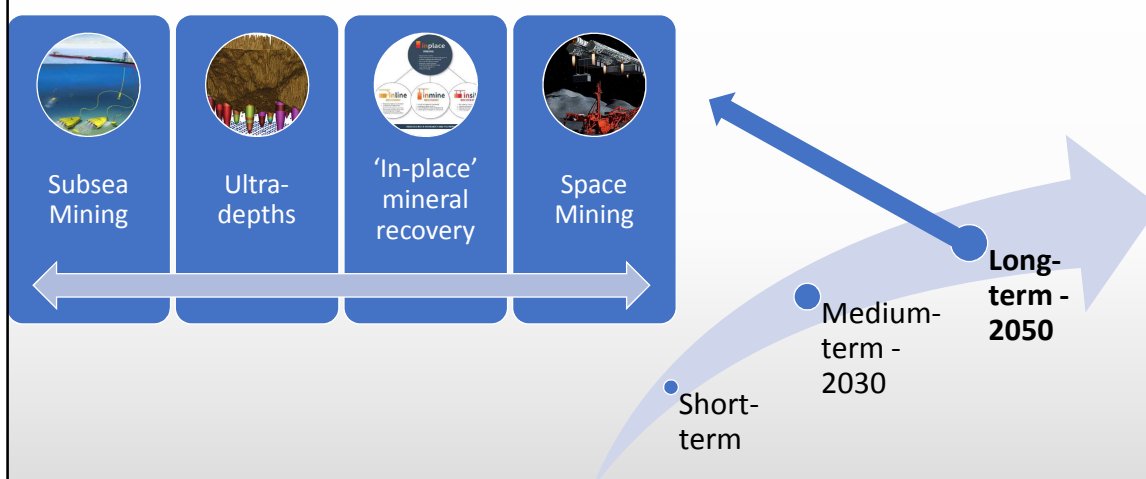
- Communication, leadership & training skills are expected to increase in demand;
- Responsible sourcing of minerals: skills related to mining rehabilitation and waste management;
- New branding/repositioning "Raw Materials Providers";

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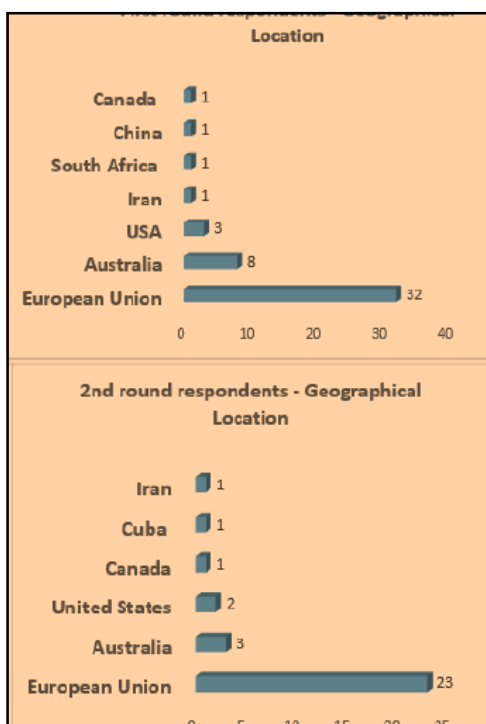


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Delphi Survey - areas covered

- **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.”

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Delphi Results

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

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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.**”

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Delphi Results - Emerging skills

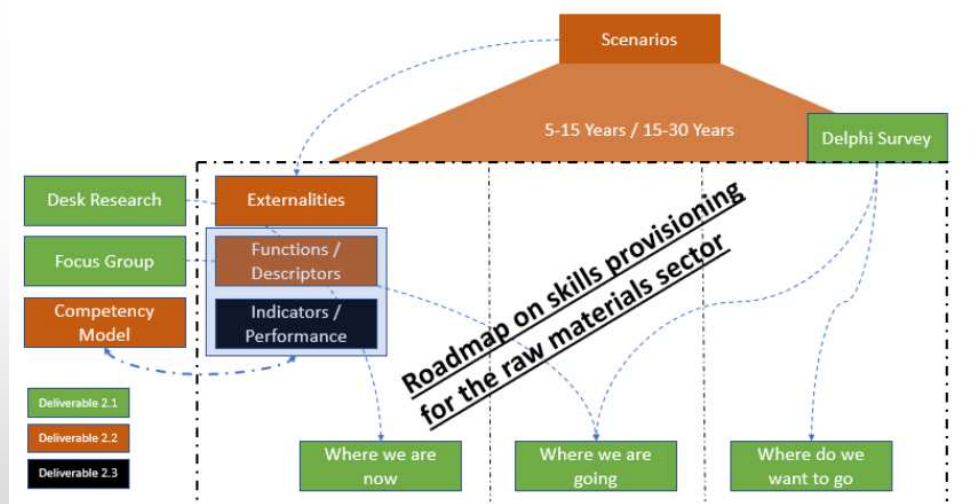
- “Demands on **geotechnical, hydrogeological, and mechatronics/automation specialists** will increase, there will be shortages in these skills and gaps in the required knowledge and expertise, and a generational gap in the 40-60 year age gap as experienced Post War Baby Boomers retire.”
- “In my view 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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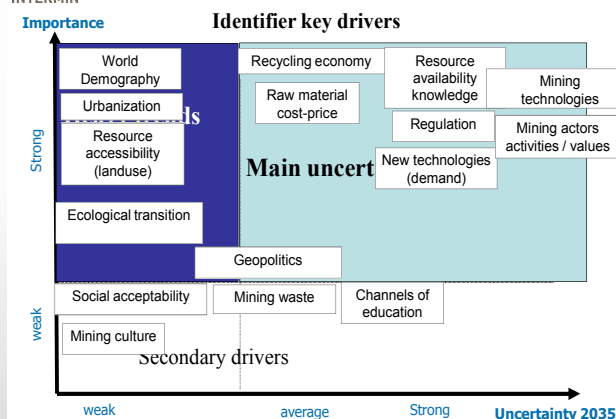


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Competency Model - Scenarios



Workshop 2 : sorting drivers GROUP 2



Areas of competency defined based on:

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

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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