



# Barriers/solutions for a secure supply of RM in Europe - Feedback from the EEC

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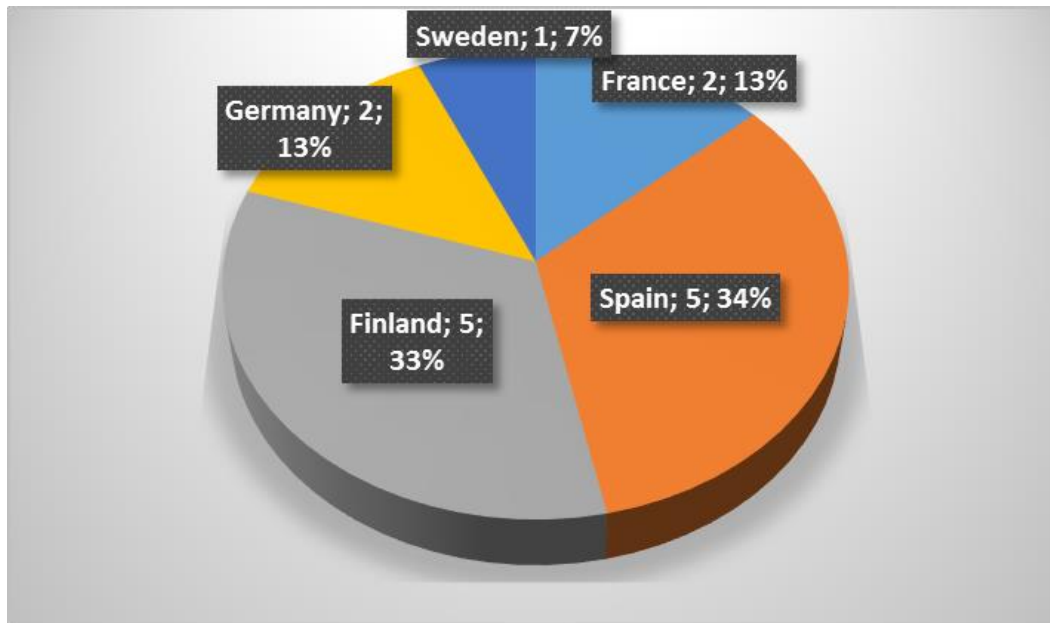
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# Survey

- Sent to 138 partners and experts
- 15 responses



- CEA
- BRGM
- University of Salamanca
- VTT (2)
- GTK
- MoReW (W. Kummer)
- IGME
- SIEMCALSA
- Lapland University of Applied Sciences
- IDENER
- Lappeenranta University of Technology
- University of Kaiserslautern
- Swerea MEFOS AB
- General Directorate of Energy and Mining-Junta de Castilla y León

# Barriers and potential solutions

	<b>Primary mining (M)</b>	<b>Secondary resources: tailings and industrial waste (TW)</b>	<b>Secondary resources: urban mining (UM)</b>
<b>Policy / Society (PS)</b>	M/PS1, M/PS2...	TW/PS1, TW/PS2...	UM/PS1, UM/PS2...
<b>Market (M)</b>	M/M1, M/M2...	TW/M1, TW/M2...	UM/M1, UM/M2...
<b>Technology (T)</b>	M/T1, M/T2...	TW/T1, TW/T2...	UM/T1, UM/T2...

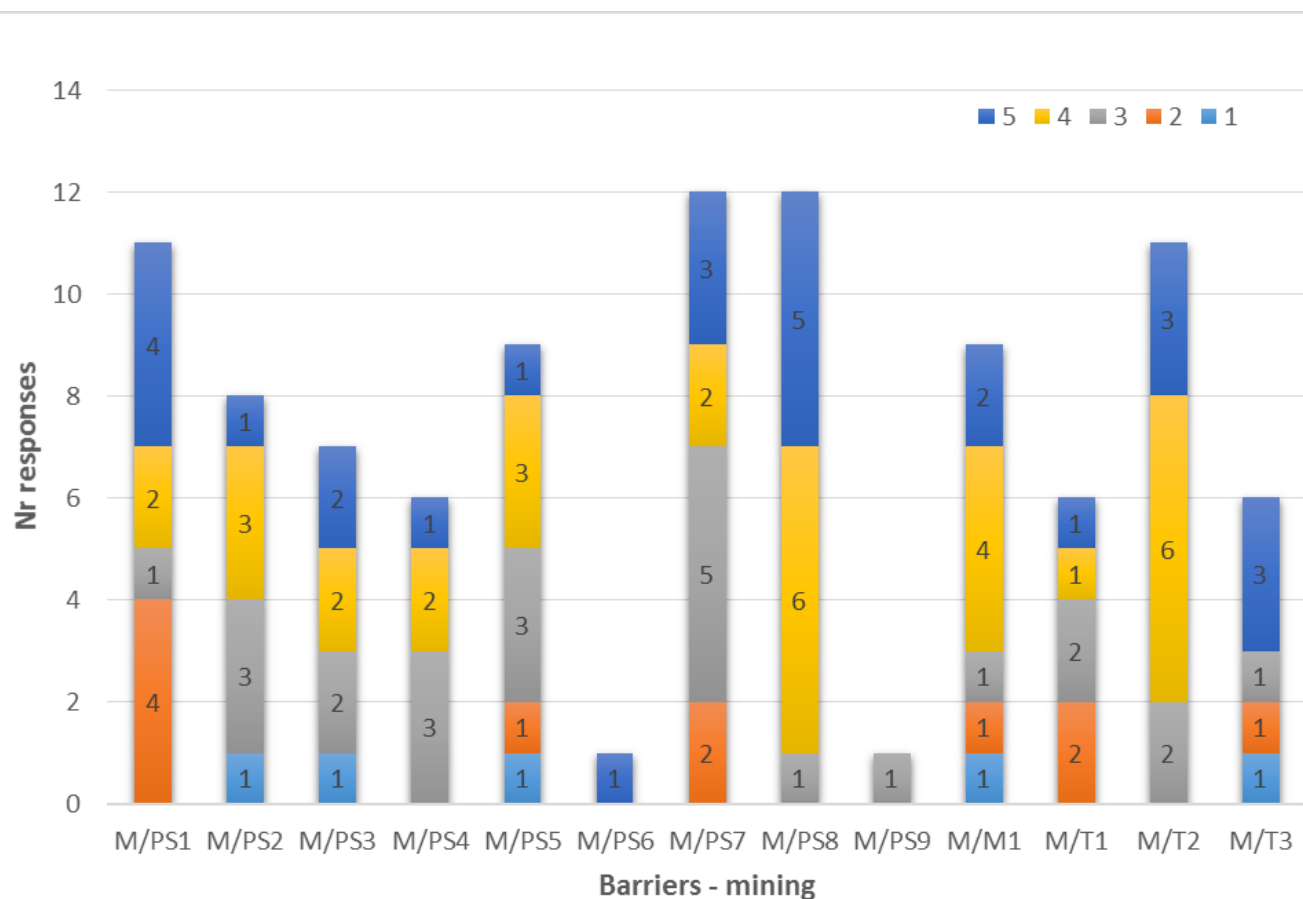
# Questions

1. Does this barrier exist in your country/region? Please, describe the situation in your region/country, how it was solved (if so), how do you think it can be mitigated.
2. Based on your opinion, please **rate the importance of the barrier in your region/country and in Europe (1 small barrier, 5 important barrier)**. Please distinguish the geographical scope: region-country-Europe if necessary.
3. Are there any other barriers in your region/country that you have identified?

	<b>BARRIER - MINING</b>	<b>TOTAL RESPONSES</b>	<b>TOTAL SCORE</b>
<b>M/PS1</b>	<b>Long and complex permitting procedures with local, regional and national administration</b>	<b>11</b>	<b>39</b>
M/PS2	The land is qualified with other uses	8	27
M/PS3	Obsolete mining domains	7	25
M/PS4	Differences between countries regarding permission procedures	6	22
M/PS5	Legal frameworks are unstable and highly influenced by social pressure	9	29
M/PS6	Lack of social awareness regarding the importance of mineral raw materials for the economic, social and technological development required by the current welfare society	1	5
<b>M/PS7</b>	<b>Lack of information/investigation of existing and/or new deposits in the EU</b>	<b>12</b>	<b>42</b>

	<b>BARRIER - MINING</b>	<b>TOTAL RESPONSES</b>	<b>TOTAL SCORE</b>
<b>M/PS8</b>	<b>Social opposition, negative perception about mining.</b>	<b>12</b>	<b>52</b>
M/PS9	European deposits too "small" (high grade but small deposit) or not rich enough	1	3
M/M1	Unstable prices	9	32
M/T1	Accompanying metals in the W mines are not considered (except for gold) on their quantities and recoveries	6	19
<b>M/T2</b>	<b>Low rates of recovery of metals</b>	<b>11</b>	<b>45</b>
M/T3	Oxidative roasting of primary Mo ore has significant environmental impacts	6	21

# Mining barriers - Nr Responses



## POLICY & SOCIETY

- PS1: Long & complex permitting procedures
- PS2: Land qualified with other uses
- PS3: Obsolete mining domains
- PS4: Difference bt countries (permission proc)
- PS5: Unstable framework (social pressure)
- PS6: Lack of social awareness
- PS7: Lack of info existing deposits

- PS8: Social opposition
- PS9: EU deposits too small

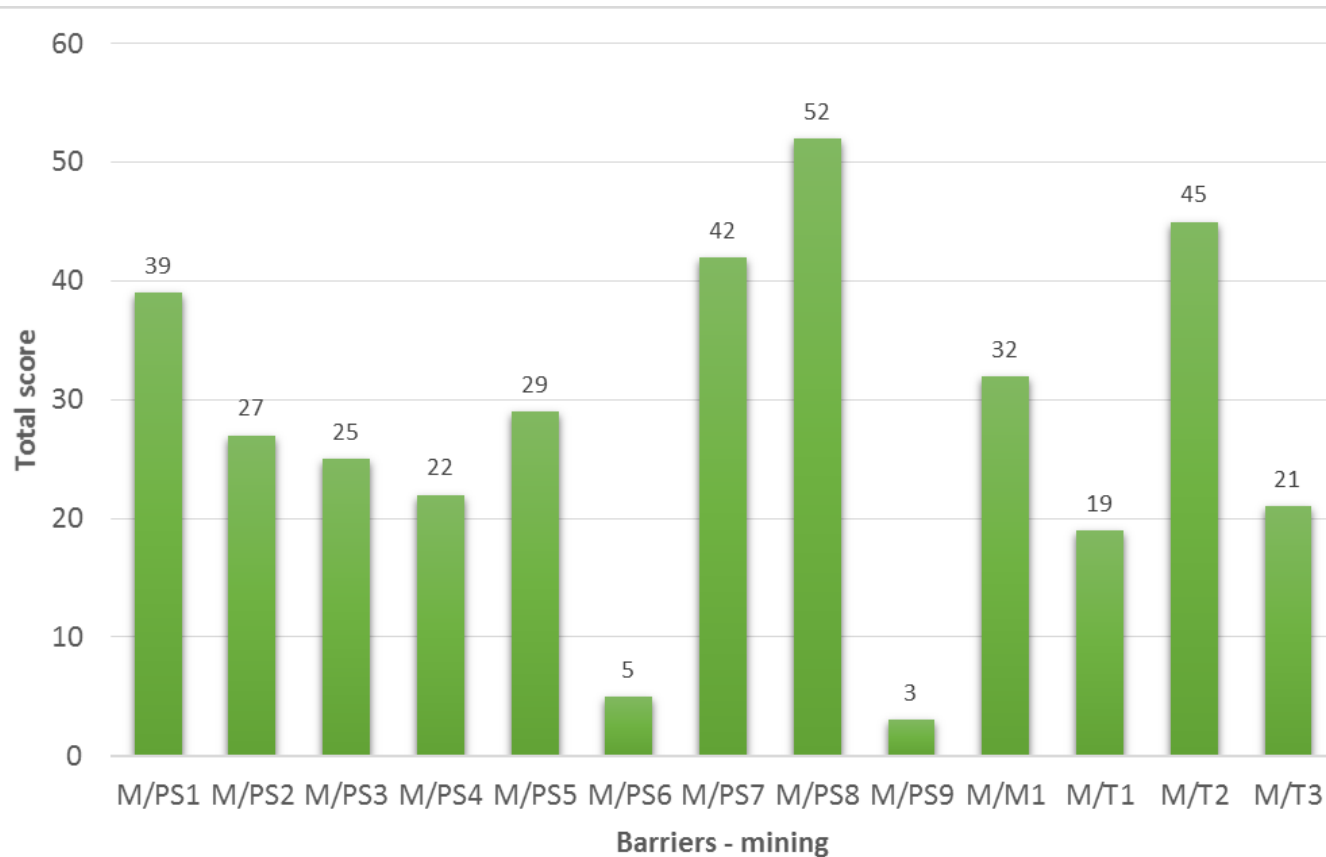
## MARKET

- M1: Unstable prices

## TECHNOLOGY

- T1: Accompanying metals not considered
- T2: Low rates of recovery of metals
- T3: Environmental impacts of Oxidative roasting of Mo

# Mining barriers - Total SCORE



## POLICY & SOCIETY

- PS1: Long & complex permitting procedures
- PS2: Land qualified with other uses
- PS3: Obsolete mining domains
- PS4: Difference bt countries (permission proc)
- PS5: Unstable framework (social pressure)
- PS6: Lack of social awareness
- PS7: Lack of info existing deposits
  
- PS8: Social opposition
- PS9: EU deposits too small

## MARKET

- M1: Unstable prices

## TECHNOLOGY

- T1: Accompanying metals not considered
- T2: Low rates of recovery of metals
  
- T3: Environmental impacts of Oxidative roasting of Mo



# M/PS8: Social opposition, negative perception about mining

- Mining Certification regarding Sustainability, e.g. ISO 26000, GRI-based sustainability reporting, etc.
- Social License to Operate (SLO)
- The mining industry should communicate about positive achievements, concrete actions need to be disseminated.
- Dissemination of the image of modern mining activity:
  - Respect and conservation of the environment
  - Committed to the rehabilitation of the natural space affected by the exploitation

# M/PS8: Social opposition, negative perception about mining

- Creating new jobs for the people living in the neighbourhood as a stimulating factor.
- A carbon tax for imported products from outside EU when there is a lack of transparency or ethical behaviour, or poor labour practices (Ta in Central Africa is the right example)
- Mix of private and public organizations to develop mining project in a social and environmental tolerable way (e.g. **Finland or Australia**).
  - **Finland:** research activities at national level e.g. **Green Mining by Tekes** – including social issues, the mining sustainability etc.

## M/T2: Low recovery rates

- More R&D is needed; pilot scale trials should be carried out to improve the economic, environmental and technological feasibilities of mineral processing and metallurgical processes.

# M/PS7: Lack of information on deposits in the EU

- Establish areas for mineral raw materials, update and improve national raw materials databases
- Update prospecting guides
- Consider the 3D/4D geologic knowledge as a public good, e.g. Variscan.
- Promote exploration at EU level (H2020, ESIF, etc.)
  - Some areas in Sweden as well as in other EU countries.
  - Stimulated by the shortage of RMs, e.g. exploration and opening of Mo mines lacks stimulation due to the abundance and availability of Mo products from the global markets.

# M/PS1: Long & complex permitting procedures

- Improve the performance of the competent administration:
  - The administration personnel related to the growing industry's needs.
  - Processes should be less time consuming and more transparent
- Develop general rules/guidelines at EU level to be implemented by local, regional, national authorities for an integrated and homogeneous approach.
- A typical framework for new projects, e.g. impact studies with comprehensive **LCA assessment** of different options, social acceptance survey with number of jobs created...

## M/PS1: Long & permitting procedures

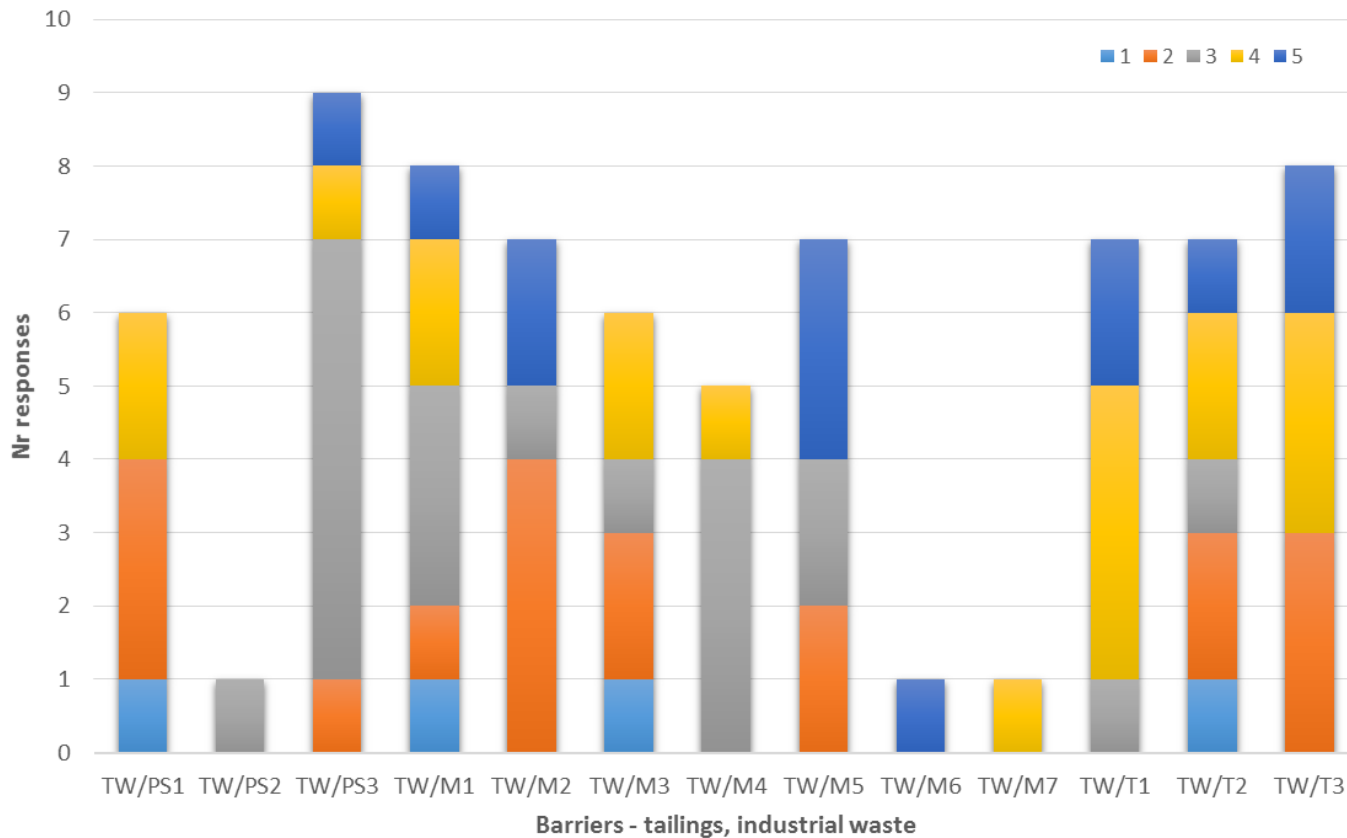
- High economic incentive and/or un-availability of RMs from global markets are the factors that may make a change for the policy/society.
- **Finland:** although they are long, this is not a barrier for RM mining. There is very strong policy support for mining.
- **France:** French administration is very centralized, more regional decisions would be welcome.
- **Spain:** a single integrated procedure is needed.

	<b>BARRIER - TAILINGS, INDUSTRIAL WASTE</b>	<b>TOTAL RESPONSES</b>	<b>TOTAL SCORE</b>
TW/PS1	Uncertainties of the owner about the tailing management	6	15
TW/PS2	Usability of combined side stream materials (e.g. slags)	1	3
<b>TW/PS3</b>	<b>Tailings recovery from existing/old mines: even more difficult than new mines if they have been already restored as in new mines tailings are nowadays minimized</b>	<b>9</b>	<b>29</b>
<b>TW/M1</b>	<b>EU mining and metallurgical companies export their production due to economic reasons</b>	<b>8</b>	<b>25</b>
TW/M2	Low prices of Mo: important secondary resources (mill scale, dust) are not fully recovered due to low competitiveness	7	21
TW/M3	Reduced availability of tungsten secondary raw materials.	6	16
TW/M4	Other uses for the tailings, in case of obsolete permission, e.g. as aggregates.	5	16
<b>TW/M5</b>	<b>Scrap containing Ta is not recovered in the EU</b>	<b>7</b>	<b>25</b>

	<b>BARRIER - TAILINGS, INDUSTRIAL WASTE</b>	<b>TOTAL RESPONSES</b>	<b>TOTAL SCORE</b>
TW/M6	High volatility of metal prices	1	5
TW/M7	Lack of information regarding the content of refractory metals in the industrial waste, which can impede the development of a recycling plant and the avaluation of its profitability	1	4
<b>TW/T1</b>	<b>Recovery of RM from tailings has not been demonstrated for all secondary and EOL materials, there is in several cases uncertainty about the processability of some materials (e.g. oxidation) and the suitability of the existing technologies</b>	<b>7</b>	<b>29</b>
TW/T2	The high melting point of Tungsten and its carbides makes its recovery very difficult due to economic reasons (high associated energy cost).	7	21
<b>TW/T3</b>	<b>Important secondary resources such as copper smelting slags and tin slags are not fully recovered for Ta-Nb production due to technical challenges to overcome</b>	<b>8</b>	<b>28</b>



# Tailings, industrial waste barriers - Nr Responses



## POLICY & SOCIETY

- PS1: Owner uncertainty tailing manag.
- PS2: Usability of comb side stream mat.
- PS3: Tailing recovery old mines

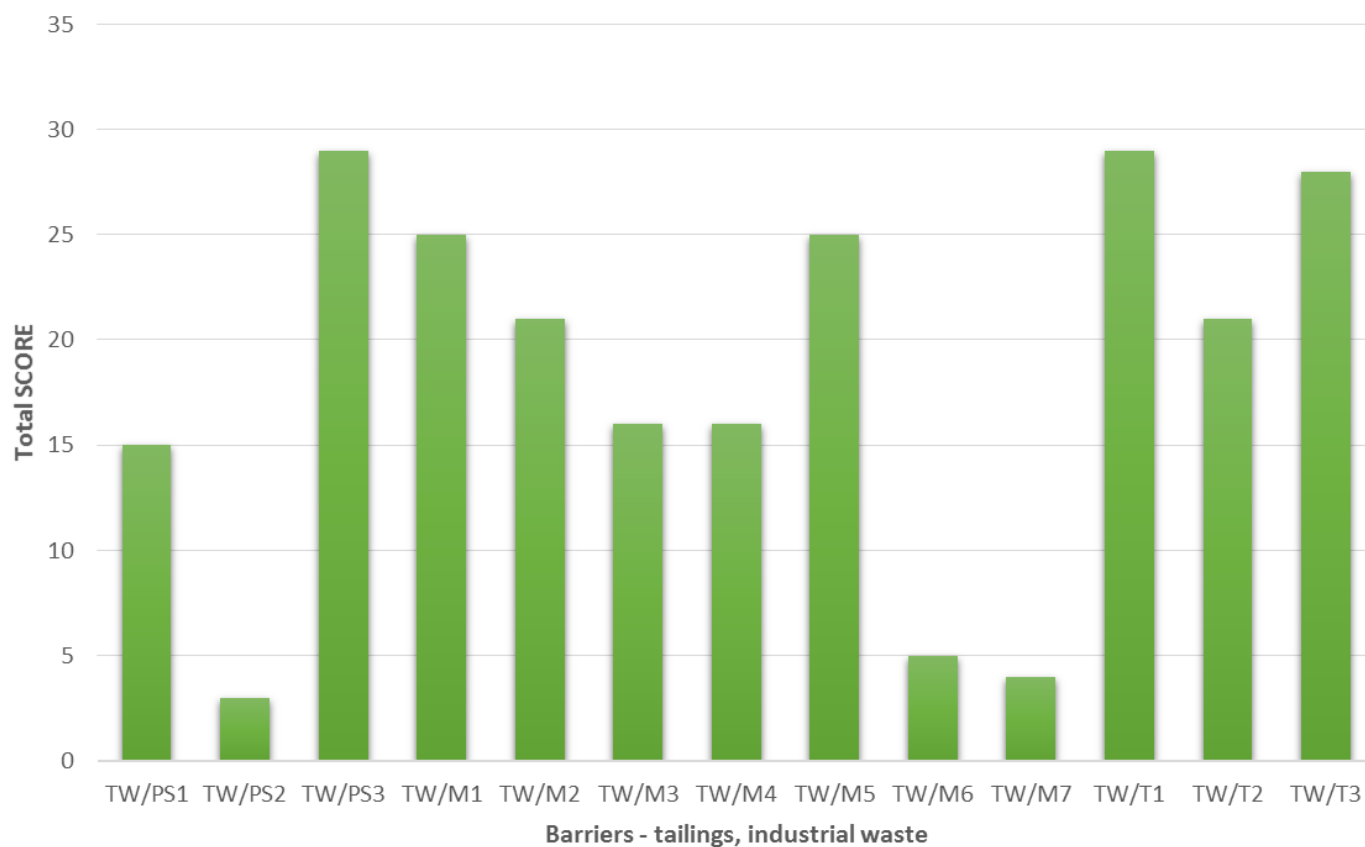
## MARKET

- M1: Export EU Materials
- M2: Low prices Mo - unrecovery of sec.
- M3: Reduced availability of sec. for W
- M4: Other uses for the tailings
- M5: Scrap with Ta not recovered in EU
- M6: High volatility of metal prices
- M7: Lack of info of RM in industrial waste

## TECHNOLOGY

- T1: Recovery of tailings not demonstrated
- T3: Cu and Sn slags not recovered in Nb-Ta production

# Tailings, industrial waste barriers - Total SCORE



## POLICY & SOCIETY

- PS1: Owner uncertainty tailing manag.
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## TECHNOLOGY

- T1: Recovery of tailings not demonstrated
- T3: Cu and Sn slags not recovered in Nb-Ta production

# TW/PS3: Impact of tailings recovery from old/existing mines

- Environmental studies. The activity should solve an environmental problem to demonstrate its feasibility. Tailings recovery must lead to a cleaner environment
- Two strategies to approach tailing 'use': stabilization or 'activation'/processing for other utilization e.g. mine filling, construction material, etc.
- Recovery of valuable minerals and neutralization of harmful compounds through advanced tailings/water/soil processing contribute positively to the social acceptance of mining activities
  - Mining company takes responsibilities seriously up to closure and rehabilitation of landscape).

# TW/PS3: Impact of tailings recovery from old/existing mines

- R&D studies on technology of recovering valuable metals from the existing/old tailings, and their utilizations and the management should be carried out.
- Demonstration plants with modern technologies at suitable mine sites to show the feasibility

# TW/T1: Uncertainty about the processability of secondary materials and the suitability of the existing technologies

- More R&D is needed; pilot scale trials should be carried out to improve the economic, environmental (including energy efficiency) and technological feasibilities of mineral processing and metallurgical processes.
- Successful demonstration plants should be built and results should be widely distributed.
- When the resource and energy efficiency of the processes will be improved and strong enough economical drivers have been implemented, these secondary resources also become attractive.

## TW/T3: Copper smelting slags and tin slags are not fully recovered for Ta-Nb production

- Some major European companies are able to recycle Ta / Nb, as they already manage to valorize plenty of elements (UMICORE, AURUBIS, H.C. STARCK)
  - What are their barriers? Potential solutions?
- Alternative options for other recovery – hydrometallurgy?
- More R&D and innovations are needed; pilot scale trials should be carried out to verify the economic, environmental and technological feasibilities of the process
  - Efficient way to recover Ta and Nb that exist in some copper slag
  - Comprehensive utilization of the copper slag, not only for extracting the valuable metals but also for using the slag to produce, for example, ceramic and cement.

# TW/M1: EU companies export their production

- Mining and metallurgical activities within the EU should be promoted and strengthened and encouraged to introduce (part of) the production in the EU market, e.g.
  - More restrictions for waste export outside of the EU
  - Simplified waste shipment regulations inside the EU
  - Legislation, taxes and other strong economical drivers should be developed in order to make the companies more interested about processing their own side streams

# TW/M5: Scrap containing Ta is not recovered in the EU

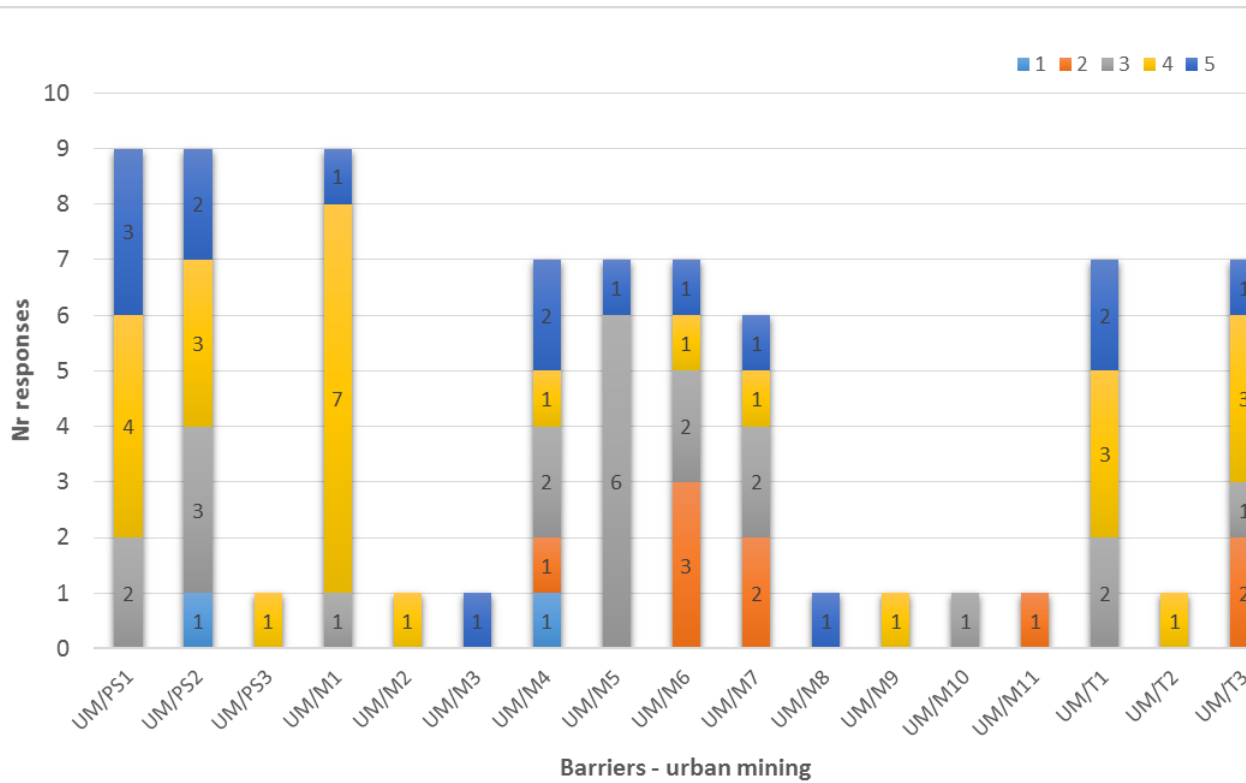
- Establishing more efficient sorting and recycling infrastructure
- Incentives for Ta (and other minor metals) recovery from scraps, e.g. electronic scrap
- R&D studies for the best technologies and economy assessment



	<b>BARRIER - URBAN MINING</b>	<b>TOTAL RESPONSES</b>	<b>TOTAL SCORE</b>
UM/PS1	<b>Product design that makes disassembly and material separation difficult or impossible</b>	9	37
UM/PS2	<b>A lack of social and economic awareness of the loss of resources and the recycling potential</b>	9	32
UM/PS3	Current volume based recycling targets (WEEE, ELV) do not encourage recycling of minor metals	1	4
UM/M1	<b>Target metals present in small quantities and their high dispersion in the waste generate high emissions and economic costs associated with their collection and sorting</b>	9	36
UM/M2	Target metals present in small quantities and their high dispersion in the waste can impede the efficiency of the concentration techniques and also the technico-economic feasibility of a plant dedicated to their recovery	1	4
UM/M3	Losses of the minor metals to dusts and residues in the current processing chains (this is a challenge to all minor metals in small amounts)	1	5
UM/M4	Presence of “grey recycling”, the informal collection sector.	7	23
UM/M5	Low prices of Mo: important urban mines (steel scrap, spent catalysts) are not locked in the EU community due to exportation or not fully recovered due to low competitiveness	7	23

	BARRIER - URBAN MINING	TOTAL RESPONSES	TOTAL SCORE
UM/M6	Recycling of superalloys and other rhenium containing wastes mostly takes place out of the EU	7	21
UM/M7	Lack of effective logistic system of Re containing spent materials. They are not segregated, which hampers their further processing	6	19
UM/M8	High volatility of metal prices	1	5
UM/M9	Lack of information regarding the content of refractory metals in the industrial waste, which can impede the development of a recycling plant and the avaluation of its profitability	1	4
UM/M10	Recycling of tantalum containing wastes (e.g. capacitors) mostly takes place out of the EU	1	3
UM/M11	Finding of market for the product may be challenging for small actors, especially if the total market is small. If a large share of material (for example W) is produced in one country this country is capable of controlling the market/price of the product by its actions	1	2
UM/T1	<b>Absence of smart size reduction and recovery technologies for dismantling parts with refractory metal content (low metal contain and irregular shape).</b>	<b>7</b>	<b>28</b>
UM/T2	Difficulties for good efficiency of the sorting techniques due to high porduction of fine particles	1	4
UM/T3	Rhenium superalloys containing materials are not currently processed due to the lack of appropriate technologies for production of ammonium perrhenate and other rhenium compound	7	24

# Urban mining barriers - Nr Responses



## POLICY & SOCIETY

PS1: Product design → difficult disassembly.  
 PS2: Lack of social-economic awareness  
 PS3: Volume recycling targets (WEEE, ELV) discourage recup. minor metals

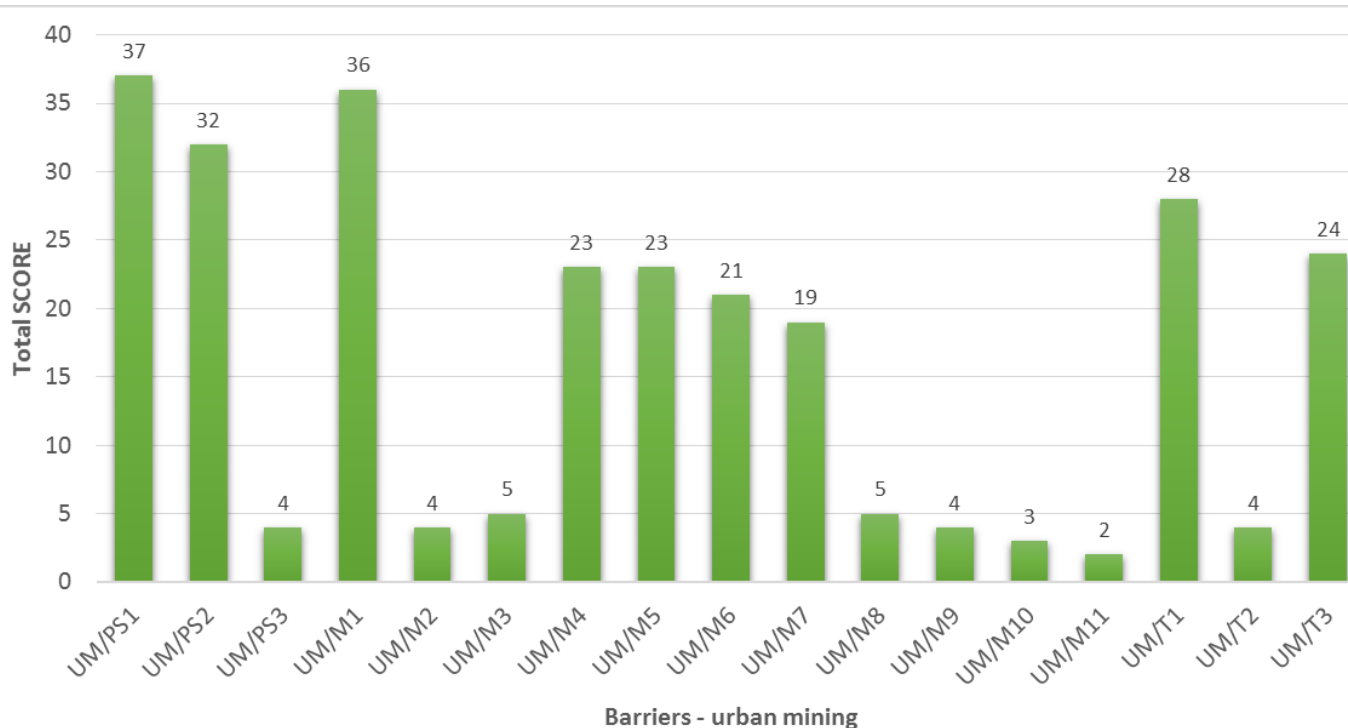
## MARKET

M1: Small quantities-high dispersion implies high collecting costs  
 M2: SQ&HD → low efficiency of concentration; low feasibility of recovery  
 M3: losses of minor metals (dusts&residues) in processing  
 M4: Grey recycling  
 M5: Low prices of Mo → urban mines exported or not recovered  
 M6: Recycling of Re containing wastes out of EU  
 M7: Lack of logistics Re containing wastes (not segregated)  
 M8: High volatility of metal prices  
 M9: Lack of info of RM in industrial waste → no evaluation rec. Plant  
 M10: Recycling of Ta containing wastes out of EU  
 M11: Market for small actors

## TECHNOLOGY

T1: No smart dismantling (low metal contain & irregular shape)  
 T2: Low efficiency of sorting (fine particles)  
 T3: Re superalloys not processed for no tech. on ammonium perRe

# Urban mining barriers - Total SCORE



## POLICY & SOCIETY

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T1: No smart dismantling (low metal contain & irregular shape)  
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# UM/PS1: Product design that makes disassembly and material separation difficult or impossible

- Encouraging manufacturers to improve design of products taking account of easy disassembly, reuse and recycling
  - Not technically difficult
  - Strong drivers are needed
- Wider issue in engineering field: what are the principles of design, e.g. DFMA – Design for the manufacture and assembly

# UM/PS1: Product design that makes disassembly and material separation difficult or impossible

- Extending of the practical implementation of Ecodesign directive to other properties than energy efficiency
  - Support to development of Ecodesign standards focusing on design for disassembly, recyclability, reusability, for example CEN/CENELEC mandate 543 for **electronics**
  - Standardization extended to other product groups

# UM/M1: Target metals present in small quantities and highly dispersed

- Evaluation and development of specific EU level strategies for recovery of minor metals, based on
  - Optimization of collection, sorting logistics, pretreatment and cleaning infrastructure for EoL products, e.g. WEEE and ELV (dismantling of components when feasible),
  - Pooling of same type of components or parts containing same metals (if feasible) from different applications.
  - The focus should be minor metals contained in different applications
- Best practice guidance, information campaigns
- Improve communication between industry, academia and authorities and between designers/producers and recyclers

# UM/PS2: A lack of social and economic awareness of the loss of resources and the recycling potential

- Public education and communication at all levels
  - Increasing awareness of children at school regarding the high consumption of resources in our society (including for example visits of recycling facilities)
  - Society: what are the resources needed for particular/current life style?
  - Resourcing Future Generations and Sustainable Development
  - Strategic metals content displayed on commodities (cellular phones...).
- Ongoing projects in the EIT - European Institute of Innovation and Technology RM related to this topic.
- Awareness raising to increase the recycling activities: increase market demand for secondary sources also increases business possibilities on raw materials sector.



# UM/T1: Absence of smart size reduction and recovery technologies for dismantling parts with refractory metal content

- More R&D and innovations in sorting, pretreatment and recovery technologies that are cost-effective and environmental-friendly, especially when the concentrates of RMs in certain kinds of scrap are very low.
  - Electronic elements (condensers, resistors, etc.) should have a permanent marking system, e.g. colour so a machine with image analysis systems can do the dismantling.
  - Design for disassembly, e.g. robotic sorting combined with identification technologies
  - Tracking solutions, such as RFID (Radio-frequency identification) tags
- Pilot scale trials should be carried out to verify the economic, environmental and technological feasibilities of the process

QUESTIONS?  
PROPOSALS?

THANKS FOR YOUR COLLABORATION!