DE LA RECHERCHE À L'INDUSTRIE

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European Commission

PROMETIA
3RD ANNUAL EVENT
BERLIN, 14-15 DECEMBER 2016

PROMETIA

Stéphane BOURG

PROMETIA *EXCOM Chairman*

Project Manager at CEA

www.prometia.eu

From a Commitment to an Association

Dec-13 – Apr-14 | Apr-14 – Dec-14 | Dec-14 - …..

EIP-RM Commitments

European Commission

A European Hydrometalurgical Institute

A European Pilot Plant Network

A European research network on ore processing and extractive metallurgy

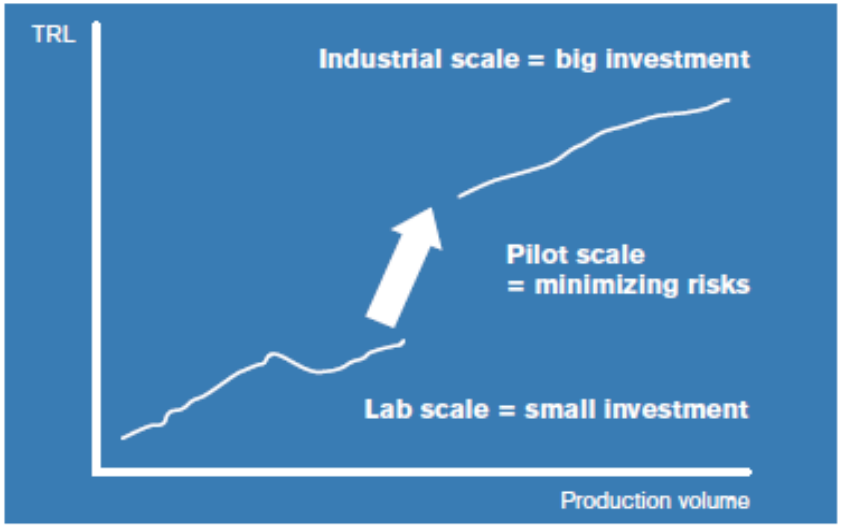
*Mineral **Pro**cessing and Extractive **Met**allurgy for Mining and Recycling **I**nnovation **A**ssociation*

Non-Profit International Association
Officially created in Belgium (Jan.15)
Technical secretariat ensured by LGI

Metnet: European Pilot Plant Network for Extractive Metallurgy and Mineral Processing -

- EIP Raw Material Commitment 2014, EIT Raw Materials Network of Infrastructure 2016

- Metnet brings together the competence and equipment of pilot plants in Europe to provide an overall solution for development, validation, and up-scaling of processes through pilot scale testing for mineral and metallurgical processes.
- Metnet provide upscaling infrastructure capability from raw materials to metals.
- More info on the website: www.metnet.eu

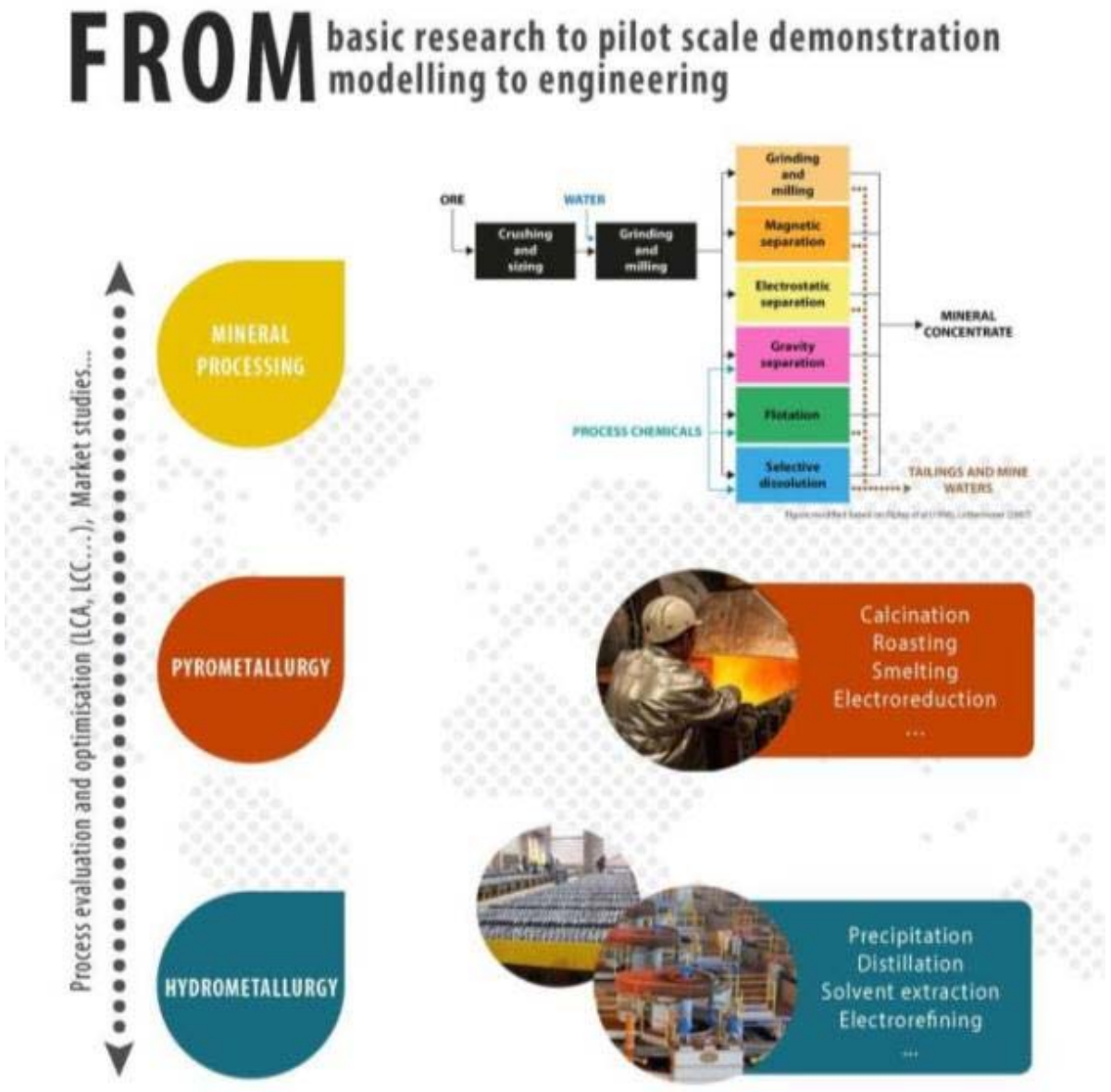


Members of Metnet

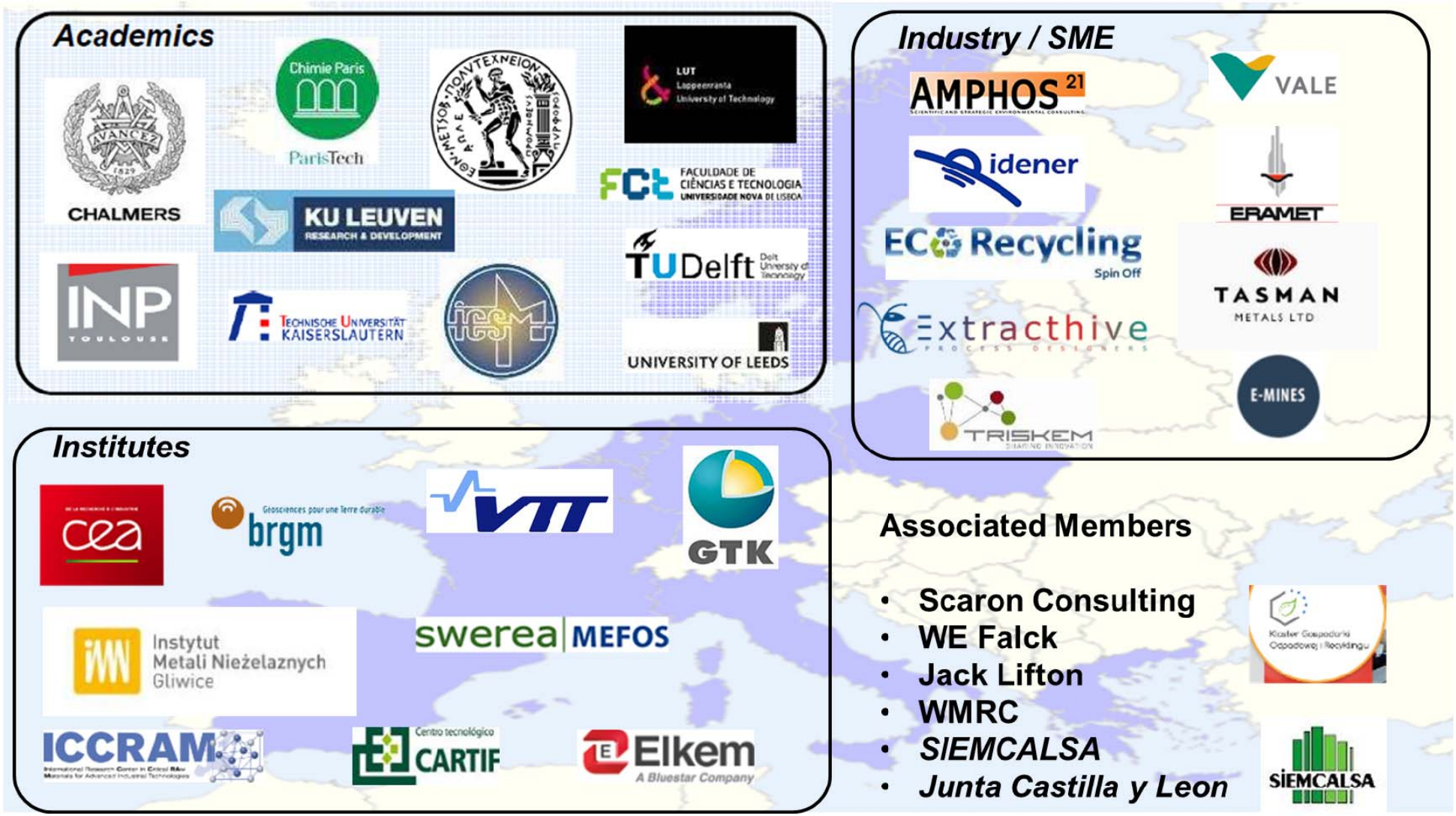
- BRGM, France
- CEA, France
- CRM Group, Belgium
- ELKEM Technology, Norway
- ERAMET Research, France
- Extracthive, France
- GTK, Finland
- IMN, Poland
- Materials Processing Institute, UK
- Swerea MEFOS (coordinator), Sweden

PROMETIA

Mineral processing and extractive metallurgy for mining and recycling innovation association



35 members (11/2016)



* At November 2016, 29 full members + 6 associated members

PROMETIA
contributing to Capacity Building

development of skills, instincts, abilities and resources that are needed to survive, adapt, and thrive in a fast-changing world

Develop innovative technological solutions for optimizing raw materials and waste treatment

R&D

Primary resource
Ore mining
(clean, efficient, accepted mines)

Secondary resources
Urban mines
(EoL products, recycling waste)

Secondary resources
Industrial waste
(solving environmental issues by valorising by-products)

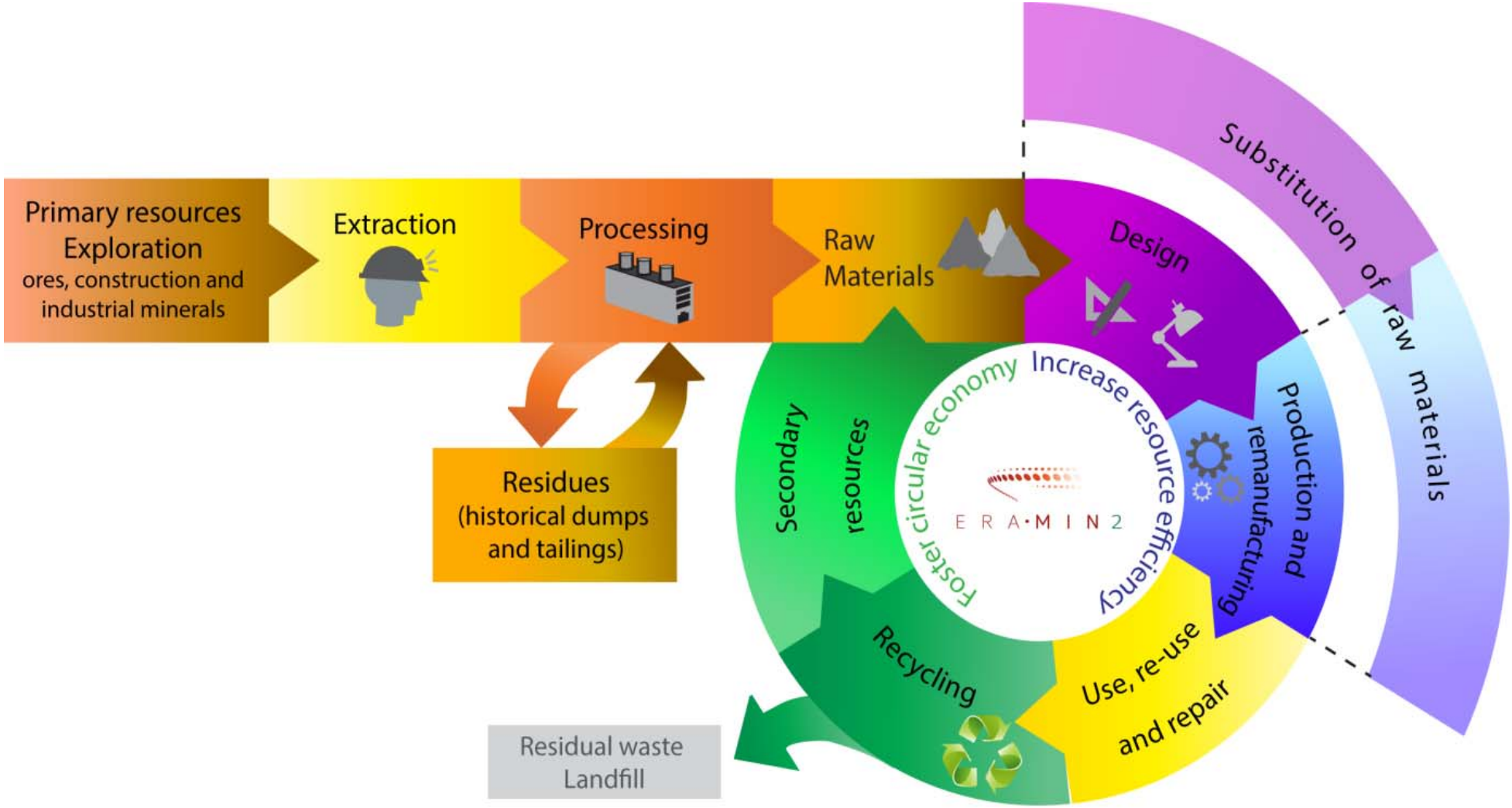
Industry

To boost innovation capacity of raw materials related sectors in EU and create wealth in Europe

T&E

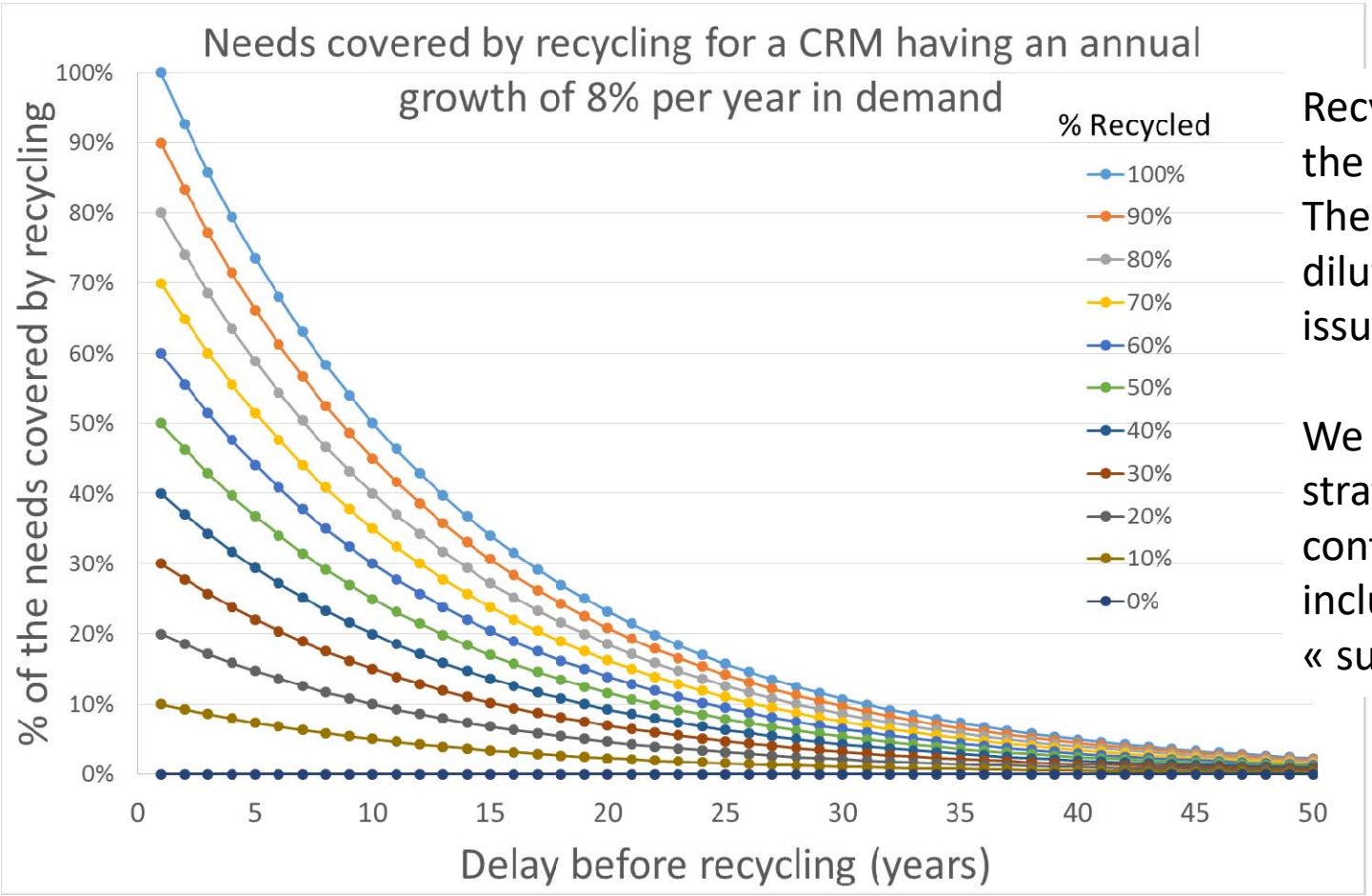
To enhance EU skills in mineral processing and extractive metallurgy and train next generation of engineers

In the CIRCULAR ECONOMY



From ERA.MIN2

Circular economy
Mining vs Recycling…

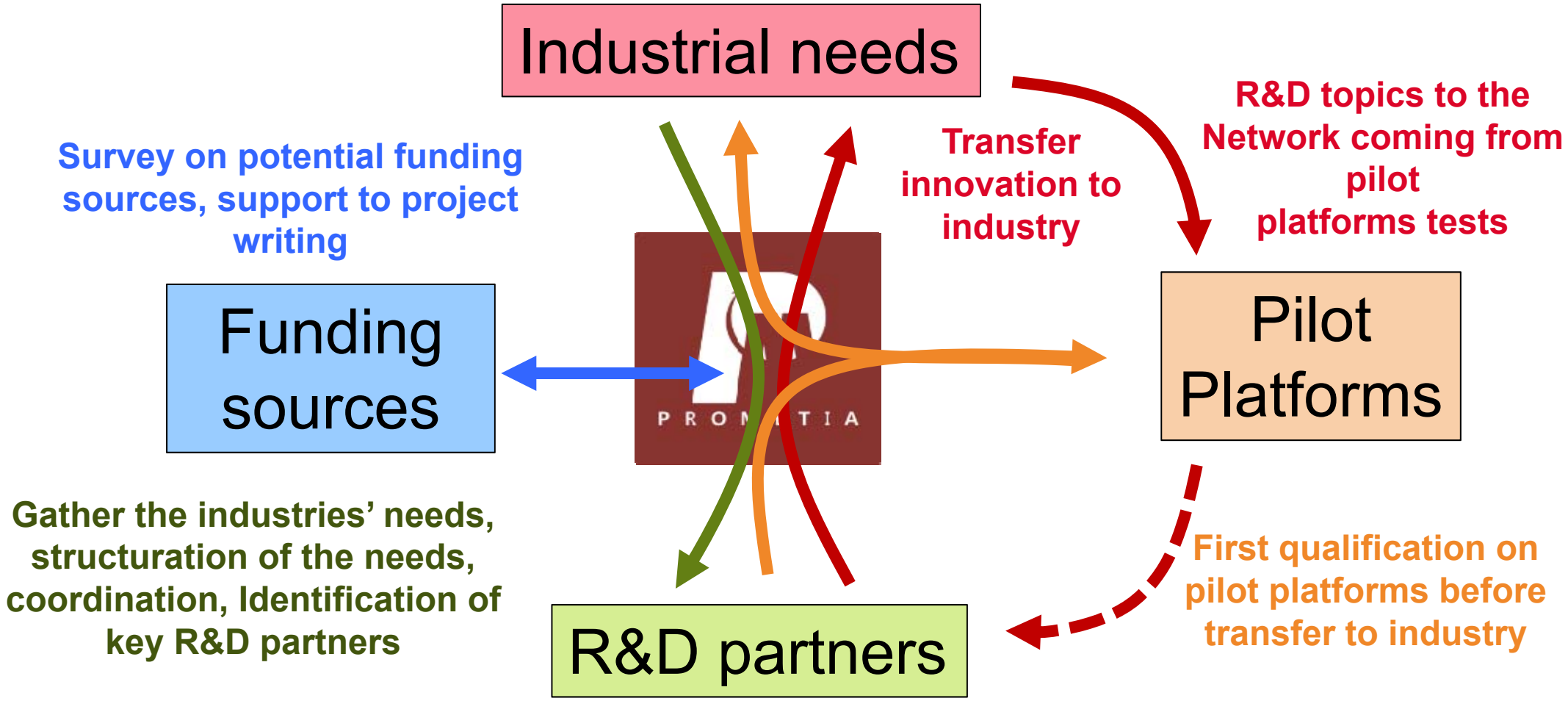


Recycling EoL products will never cover the needs of a metal in growing demand… The recycling rate, the collect and the dilution in complex media are the main issues

We need to develop new mining strategies, relevant in the European context… cleaner, safer, more efficient, including the post-mine management. « sustainable mining »

The PROMETIA "*value-flow*": becoming an efficient link between industry and R&D

Promoting wealth creation and innovation by strenghtening the link between industry and research




PROMETIA


MSP
REFRAM

At a glance…

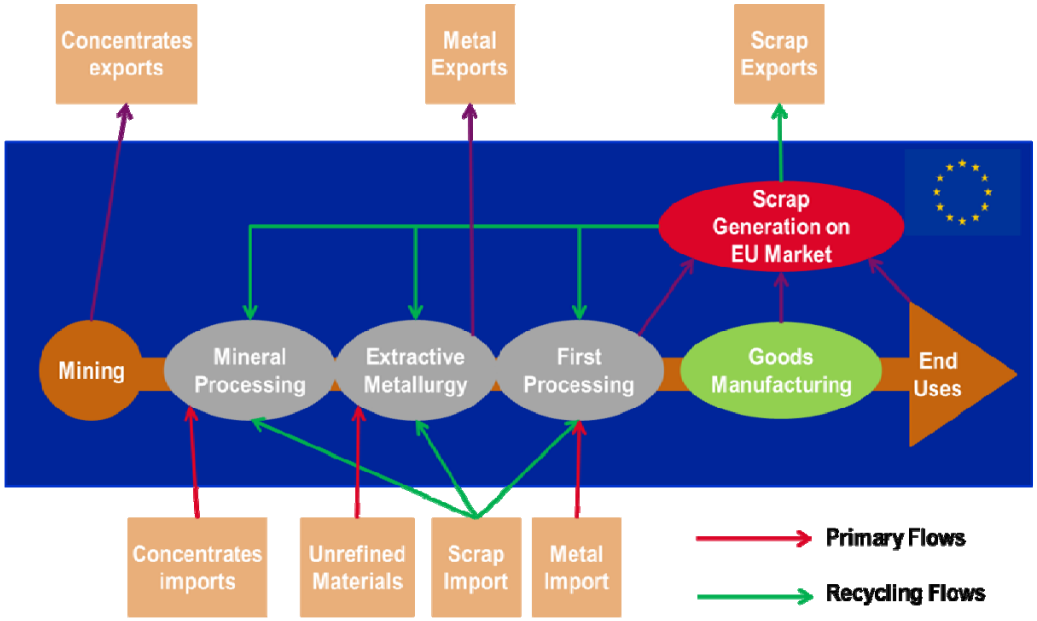
Creation of a common multi-stakeholder platform focused on **the refractory metals** across their whole value chain. This initiative involves partners from across the value chain, including **mining, processing, recycling**, application, public sectors (national/regional/local) and civil society

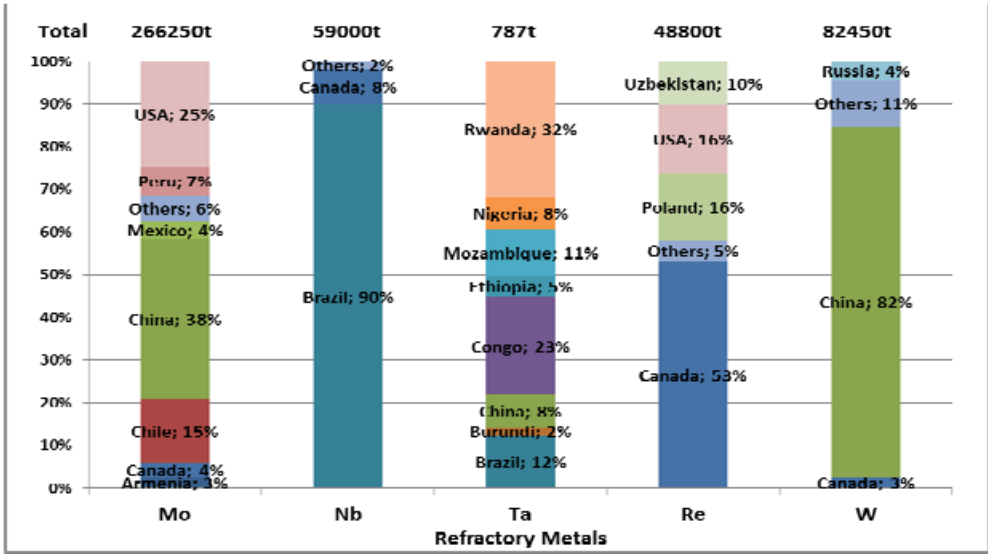
21 consortium members + 30 External Experts

European Commission

19 Months, 1.5M€

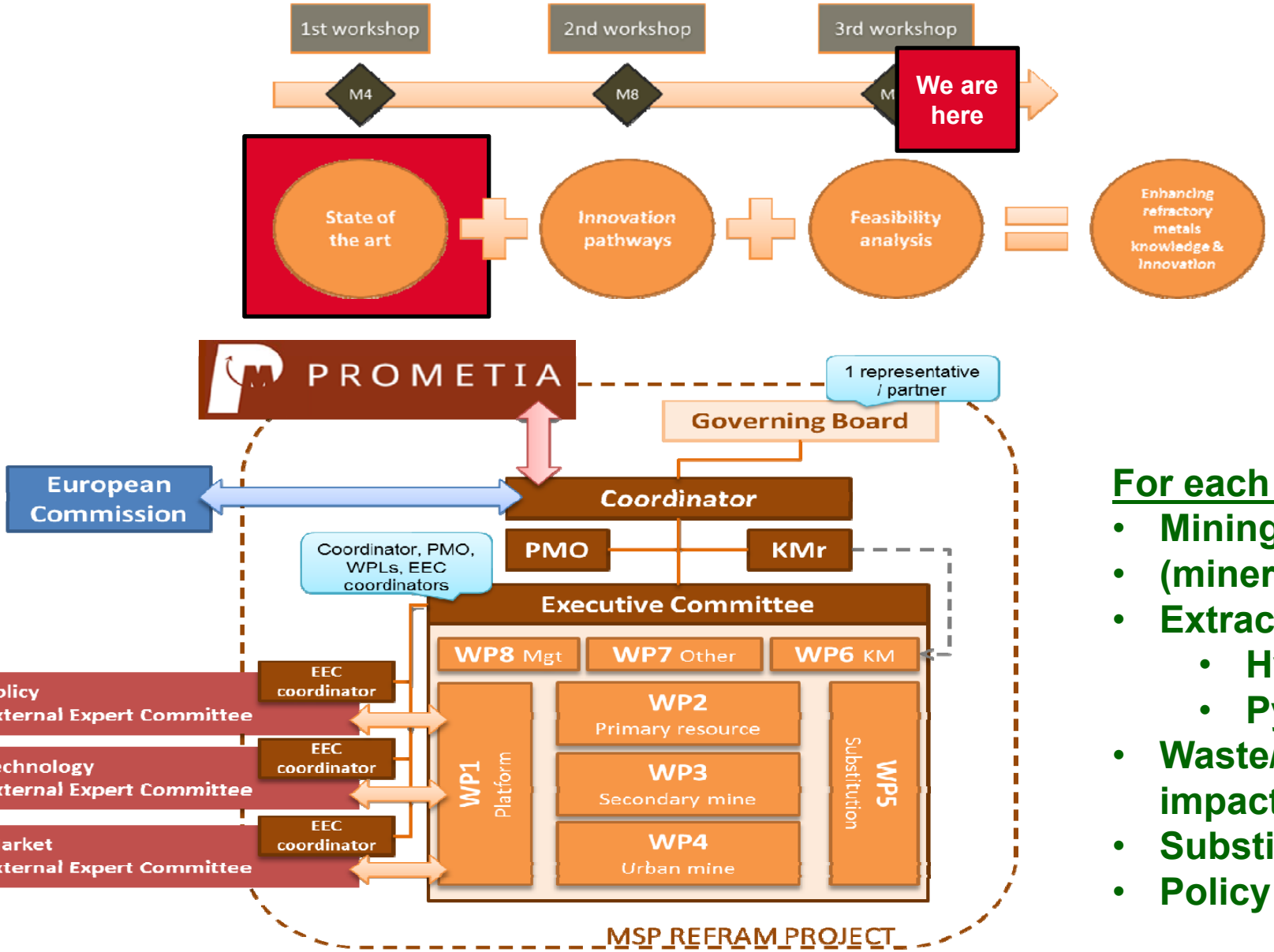
Project funded under the SC5 H2020 work-program, project n° 688993, 2016





The refractory metals world annual production (2014)

The concept

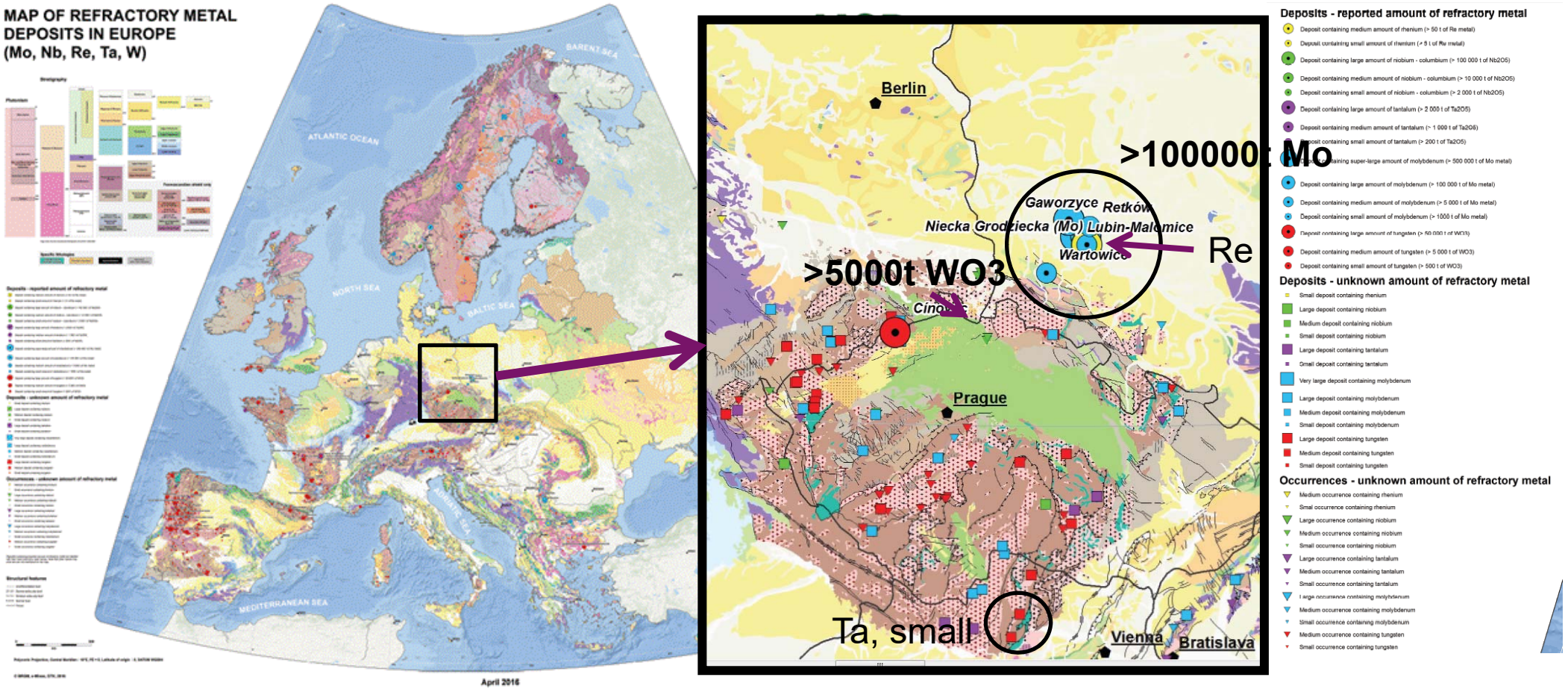


For each metal:

- Mining/collection
- (mineral) processing
- Extractive metallurgy
  - Hydro
  - Pyro
- Waste/ Environmental impacts
- Substitution
- Policy issues/regulations

State of the art

MAPPING OF THE PRIMARY RESOURCES IN EUROPE



MAPPING OF THE SECONDARY RESOURCES

Secondary resources of Molybdene

Type of Material	Company/ Mine	Location	Grade of Mo	Reserve, Mineralogy and Characterization	Ref
Waste tailings Waste rock	Boliden Aitik	Sweden	0.00027%	Aitik porphyry Cu-Au-Ag-(Mo) deposit Ore feed, 36 000 with a Mo concentration of 0.849 kt. Tailing produced of 17 700 000 and 26 000 Kt/year of waste rock	[35], [18]
Waste tailings	Knaben Molybdenumines	Norway	40 ppm acid-soluble Mo Molybdenita and Molybdate (MoO_4^{2-}) Associate with fine-grained silicates or oxidates. Size particle: 0.2-0.9	Inactive mine. 8 million tonnes of waste material produced and deposited in two ponds. 420000 tonnes have been washed and deposited sabdbars of the river. Chemical ccomposition of tailing pond: Cu 215, Mo 51. Other materials: Ba, Cu, K, La, Li, Mg, Mn, Mo, S, Th, Y, Zn	[36]
Waste tailing	Boliden Garpenberg	Sweden	2.9 mg/Kg	500 000 tonnes of tailings/yr Other minerals: Pb, S, As, Ba, Fe, Ni, P, V, Zn, Cu.	[18]
Waste tailing	KGHM Lubin	Poland	15 g/t	Underground mine Tailings: 27 000 000 kt/yr Other minerals: V, N, Co, Ag, As, K	[18]
Waste tailing	KGHM Polkowice-Sieroszowice	Poland	12 g/t	Underground mine Tailings: 27 000 000 kt/yr Other minerals: V, N, Co, Ag, As, K	[18]
Waste tailing	KGHM Rudna	Poland	8 g/t	Underground mine Tailings: 27 000 000 kt/yr Other minerals: V, N, Co, Ag, As, K	[18]
Waste tailing	Kiruna and Svappavaarra Mine	Sweden	15-11 ppm	Iron mine Other minerals: Cu, Nb, Ni, Pb, V, W, Zn...	[18]

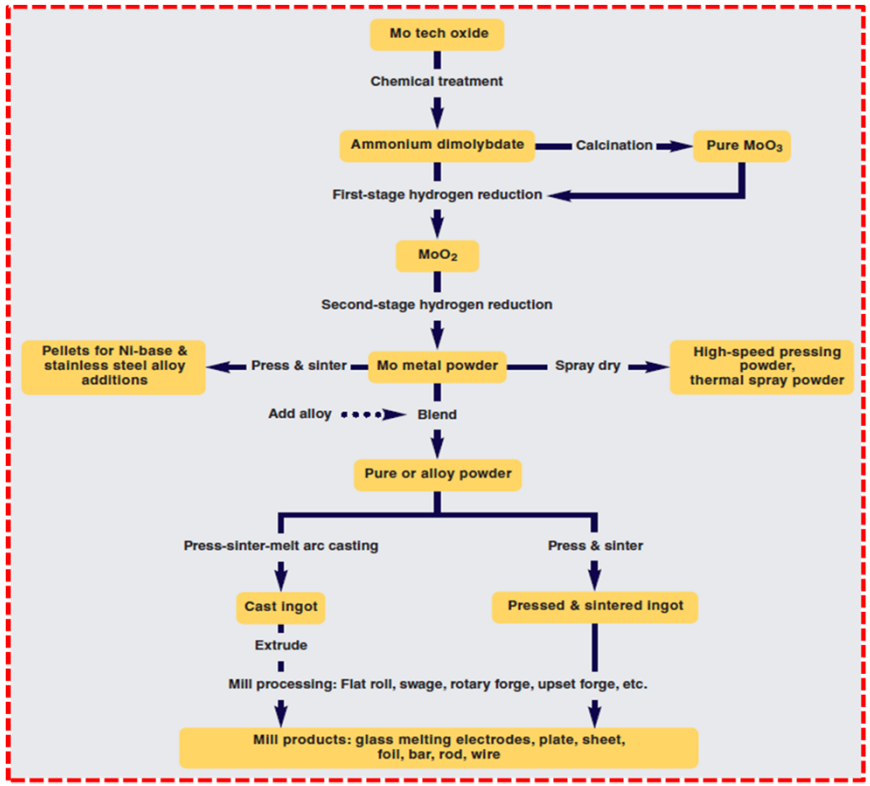
Estimated Rhenium production from recycled materials

	Mg
Germany	4.0
Poland	0.5
France	1.0
Estonia	1.0
Czech Republic	0.5
Global	**7.0**

Total quantities of WEEE collected in the EU28+ Norway in 2012

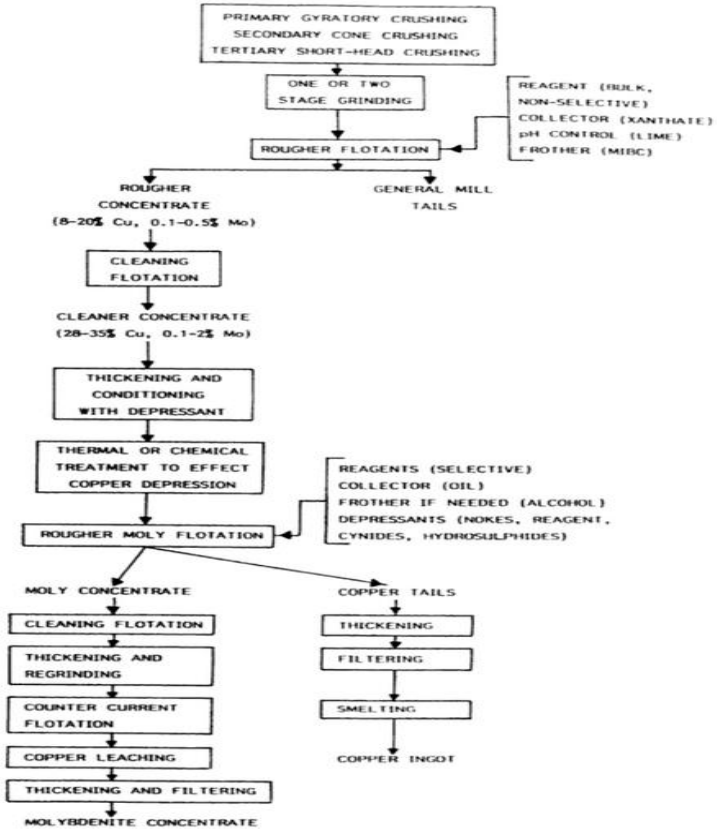
Large household appliances	1 495 000
Small household appliances	224 500
IT and telecommunications equipment	615 000
Consumer equipment	572 500
Other	187 000
Total WEEE	3 474 000

PROCESSING AND EXTRACTIVE METALLURGY



Molybdenium metal and alloy production in the value chains (shown in Figure 1).

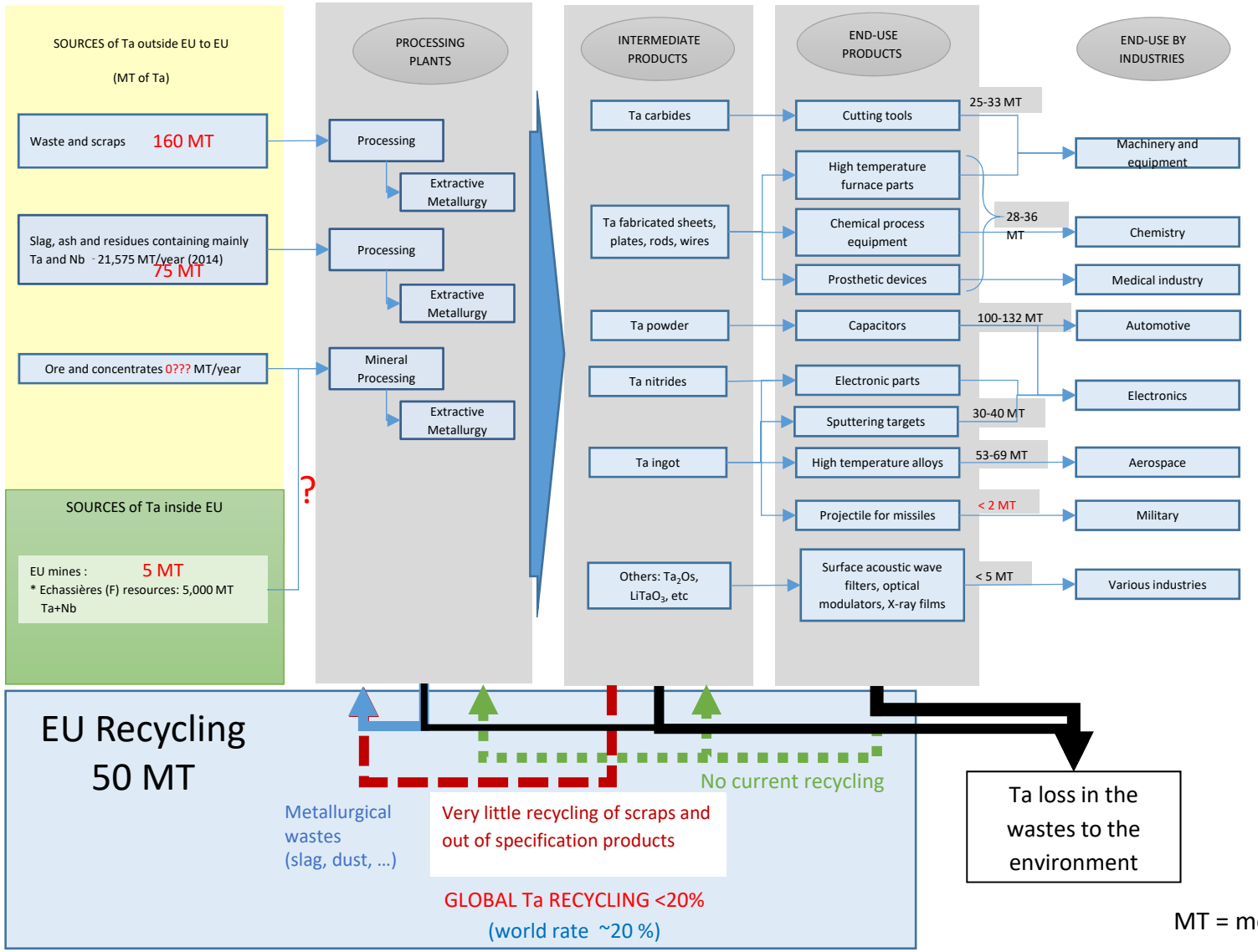
A basic by-product Mo recovery flowsheet from porphyry coppers



Current and future value chains

The current value chains
Example on tantalum

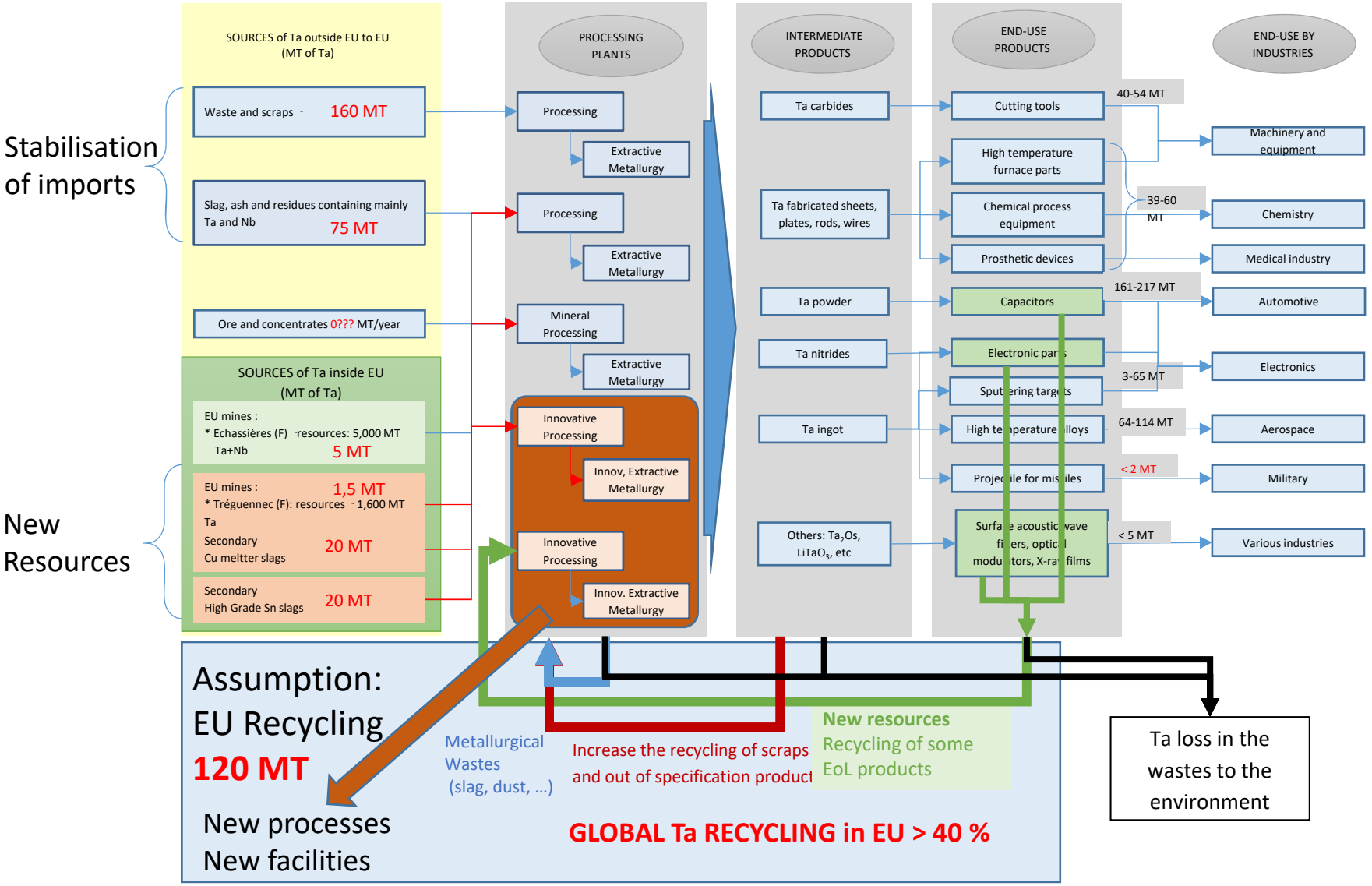
As an example: Current value chain of tantalum (based on 290 MT/year)



MT = metric tonne

The future value chain
Example on tantalum

As an example: Future value chain of tantalum (based on 400 MT/year)



Innovation pathways

FIRST TRENDS FOR INNOVATION: Example on tantalum

1. Recovery From Slags

High-grade tin slags (>10% Nb+Ta)

→ **could be developed in Europe with no further R&D efforts**

Low-grade tin slags (<10% Nb+Ta)

→ no economic reason to be recycled

Copper smelting slag

- **a limited R&D programme could be proposed, including recovery of the different valuable metals (not only W)**

2. Recovery of Ta from alloy scrap

- Currently Ta from alloy scrap is recycled to low-value mill products
- New process based on iodization of Ta scrap (Lessard, 2015)
  - Process designed for the production of electronic grade Ta nanopowders
    - → clearly innovative but what about its cost at industrial scale?

FIRST TRENDS FOR INNOVATION: SUBSTITUTION

NIOBIUM

EU consumption of niobium → **24%** of global niobium consumption.

No primary niobium production in Europe → scrap is the only available intra-European raw material source

Ores and concentrates, oxides and niobium metal → Imported

Need to recycle and find potential substitutes to satisfy increased demand

Potential (partial) substitutes for Nb in steel: 'Titanium & Molybdenum' and 'Vanadium & Molybdenum' combinations

TANTALUM

no primary production of tantalum in Europe

clear need for substitution or increasing recycling rate

most substitutes have higher costs or adverse properties.

In low performance capacitors, possible substitutes exist (by aluminium and ceramics),

In other application areas possible substitution of tantalum by niobium (**CRM**) is possible – rationale?

- In cemented carbides also titanium carbides (TiC) and nitride (TiN) are possible
- In corrosion-resistant equipment: glass, platinum, titanium, and zirconium
- In high-temperature applications: hafnium, iridium, molybdenum, rhenium, and tungsten

PROMETIA

SCRREEN

Solution for critical raw materials, a European Expert Network

SCRREEN
At a glance

This **project** has received funding from the **European** Union's **Horizon 2020** research and innovation programme under **grant** agreement No **730227**

30 Partners in the Consortium
+ 60 in the wide Network

30 month (+1?) , (Nov-16 – Mai-19) (Jun-19?)
3M€

Coordinated by CEA

CEA	FhG ISI & IZM	LGI
AFNOR	GEO-ZS	Minpol
Amphos21	GEUS	PNO
BGR	GTK	SGU
BGS	ICCRAM	Swerea Mefos
BRGM	Idener	Tecnalia
Chalmers	IMN	NTU Athens
ECODOM	JRC	TU Delft
ENCO	KTN	UNU
ENEA	Leiden Uni	VTT

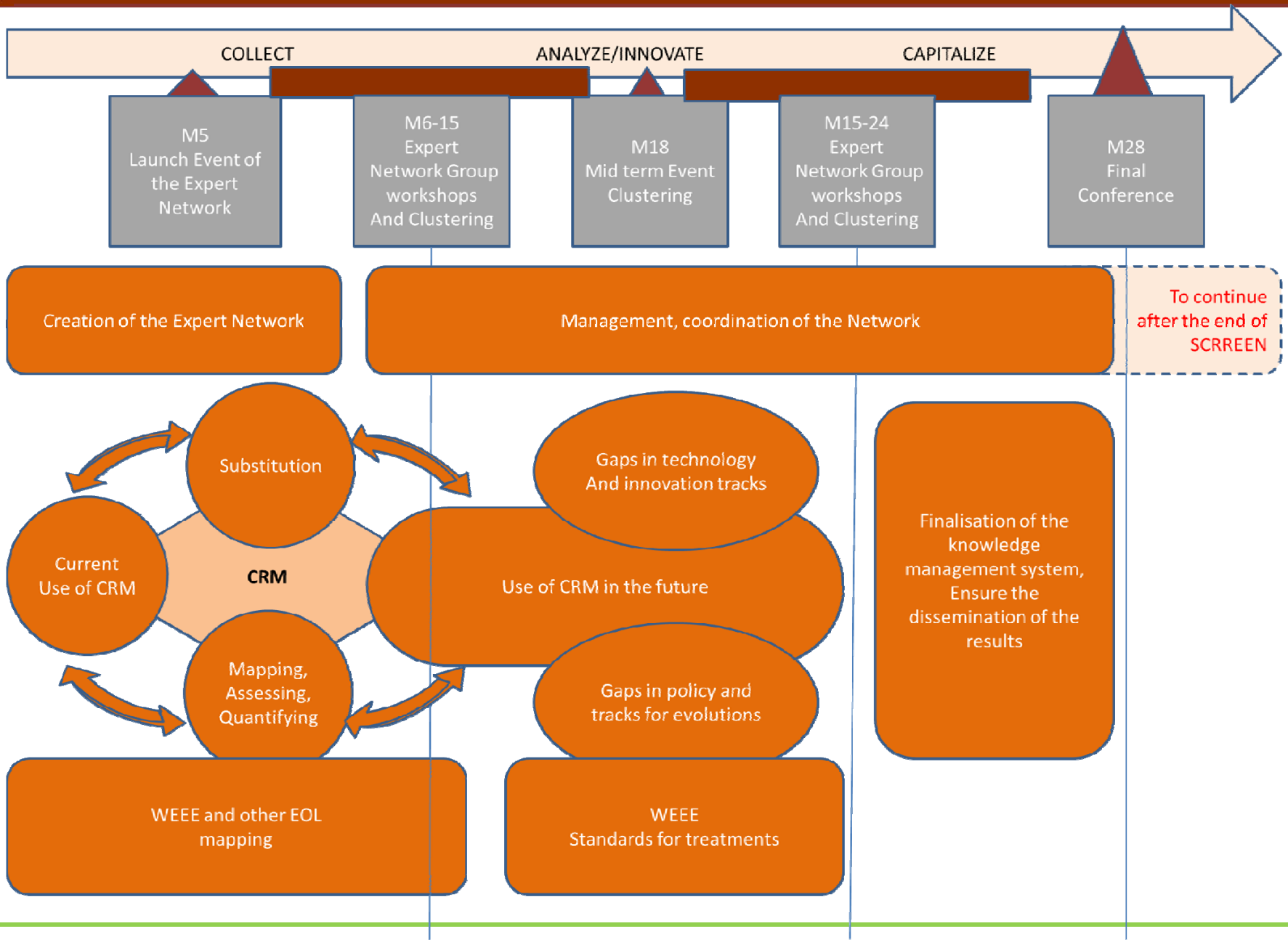
Objective

establish a
long-lasting Expert Network on Critical Raw Materials.

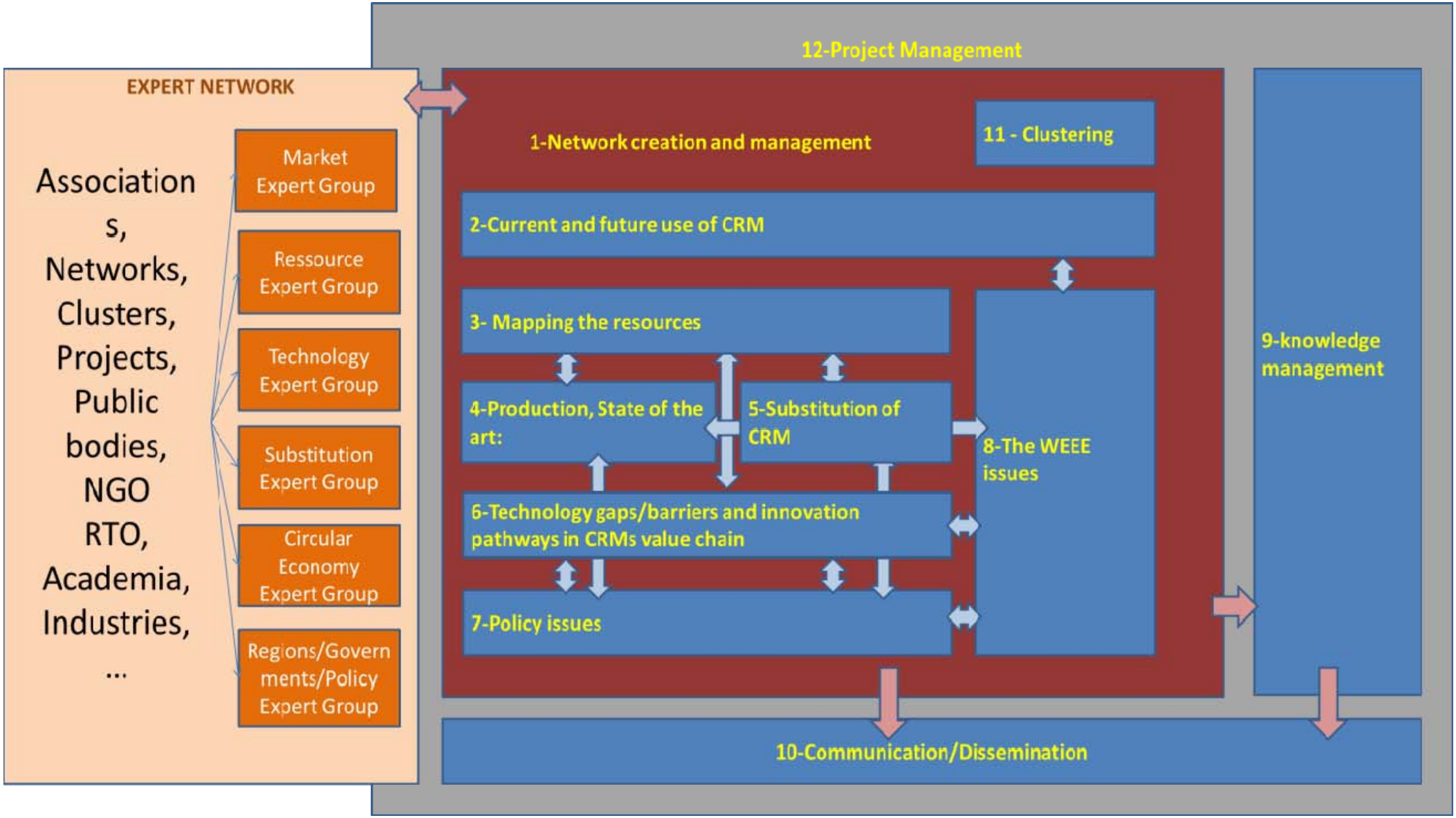
Addressing all **the CRMs issues** including mining, processing, recycling, substitution and final applications in relation with the crosscutting aspects: **policy/society, technology, standards and markets**.

Strengthening the CRM strategy in Europe.

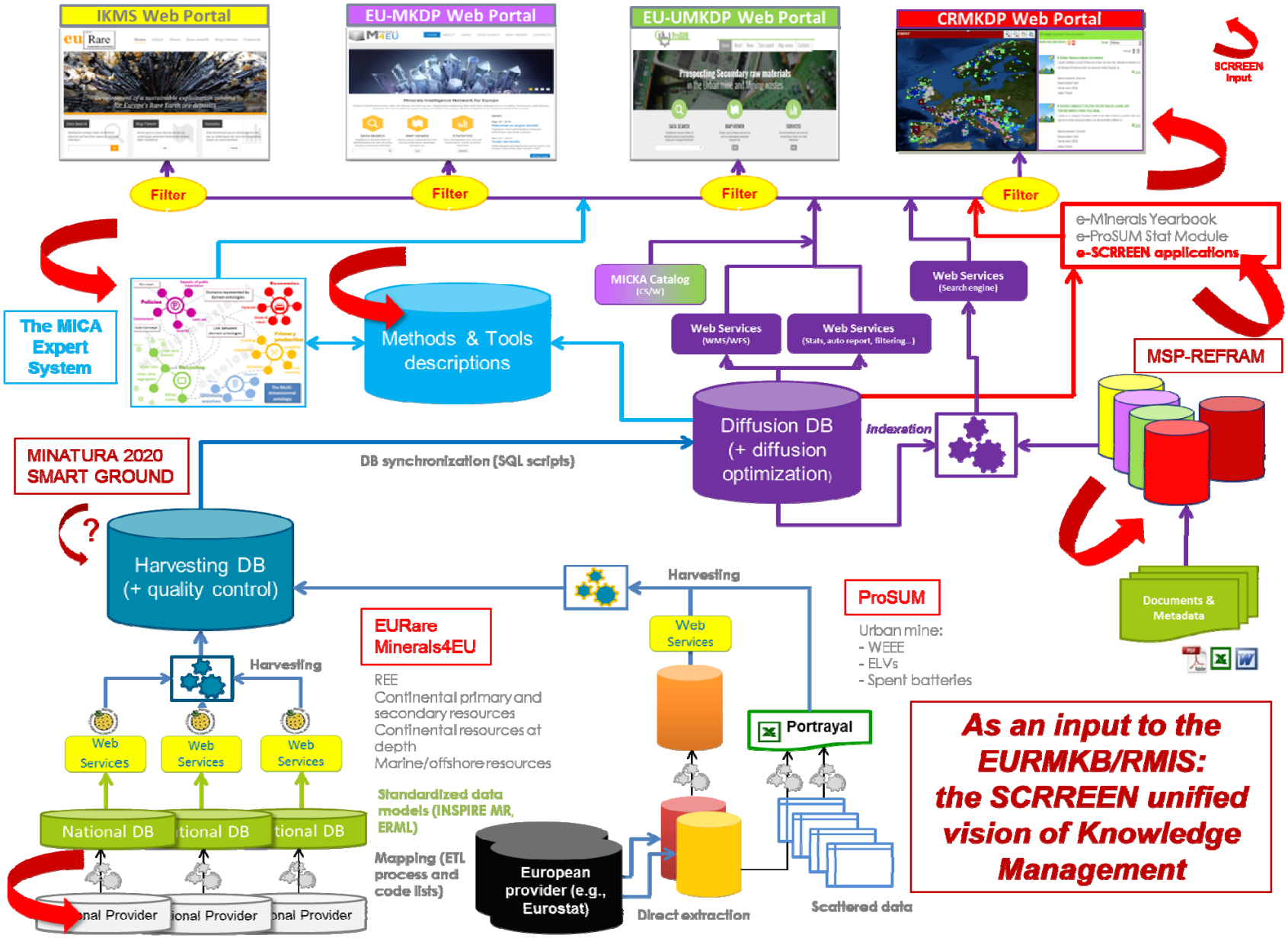
Plan


COLLECT
ANALYZE/INNOVATE
CAPITALIZE
M5
Launch Event of the Expert Network
M6-15
Expert Network Group workshops And Clustering
M18
Mid term Event Clustering
M15-24
Expert Network Group workshops And Clustering
M28
Final Conference
Creation of the Expert Network
Management, coordination of the Network
To continue after the end of SCRREEN
Substitution
Current Use of CRM
CRM
Mapping, Assessing, Quantifying
Gaps in technology And innovation tracks
Use of CRM in the future
Gaps in policy and tracks for evolutions
Finalisation of the knowledge management system, Ensure the dissemination of the results
WEEE and other EOL mapping
WEEE Standards for treatments

Structure


12-Project Management
EXPERT NETWORK
Association s, Networks, Clusters, Projects, Public bodies, NGO RTO, Academia, Industries, ...
Market Expert Group
Ressource Expert Group
Technology Expert Group
Substitution Expert Group
Circular Economy Expert Group
Regions/Governments/Policy Expert Group
1-Network creation and management
11 - Clustering
2-Current and future use of CRM
3- Mapping the resources
4-Production, State of the art:
5-Substitution of CRM
6-Technology gaps/barriers and innovation pathways in CRMs value chain
7-Policy issues
8-The WEEE issues
9-knowledge management
10-Communication/Dissemination

A Comprehensive Knowledge Management Structure



PROMETIA

CONCLUSION

Activities

Support to ERA.MIN2 – PROMETIA is member of the Advisory Board (advising on the orientation of the calls)

PROMETIA support partner of the EIT-RawMaterials

Presentation of MSP-REFRAM at ECO-Recycling

Presentation of PROMETIA and MSP-REFRAM at ReinEU conference in Bratislava, invited by DG-GROW

Presentation of PROMETIA at the EU-US-Japan trilateral conference on CRM as an association contributing to capacity building in Europe, invited by DG-GROW

A position paper sent to the DG-GROW commenting the H2020 SC5 work-program (and exchanges with Mattia Pellegrini on this paper)

Three MSP-REFRAM workshops

Videos and pictures at www.prometia.com

Conclusion

PROMETIA:

- a focused network (mineral processing, extractive metallurgy),
- about 35-40 members up to now
- with people
  - who meet and know each other
  - who can work together, learn the ones from each others,
  - who create synergism
- With a high visibility at the EU level

For academia, being in contact with SMEs/Industry is a driver for orienting R&D and making it attractive. It is also a driver for an up to date education program

For Industry, having direct access to research organisations can help when they have specific issues to be solved rapidly. It is also an access to training forces.

R&D is better focused – **importance of TRL 3-5 to fill the shelves and prepare the future**

www.prometia.eu

contact@prometia.eu