



1st Project Cluster Meeting on Substitution of Critical Raw Materials



Dr. Erno VANDEWEERT

Directorate Key Enabling Technologies
DG Research and Innovation

Project Technical Adviser: **Dr. Peter Ramaekers**
Rapporteur: **Prof. dr. Ewa Jedryka**

10 February 2015, Brussels.

Does not represent an official legal opinion of the European Commission

1. Policy context

- a. **Raw Materials Initiative and European Innovation Partnership on Raw Materials**
- b. **Key Enabling Technologies for Societal Challenges**
- c. **Community-building initiatives**

2. Project Clusters

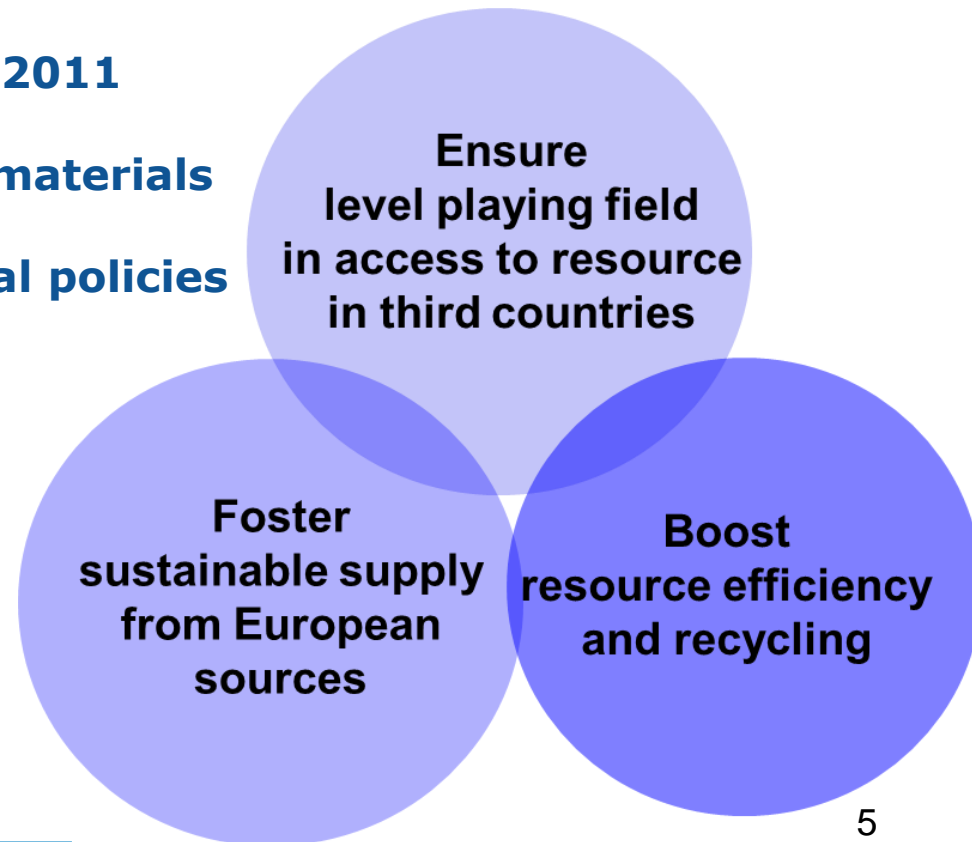
- a. **What?**
- b. **Why?**
- c. **How?**

POLICY CONTEXT

Raw Materials Initiative and European Innovation Partnership on Raw Materials

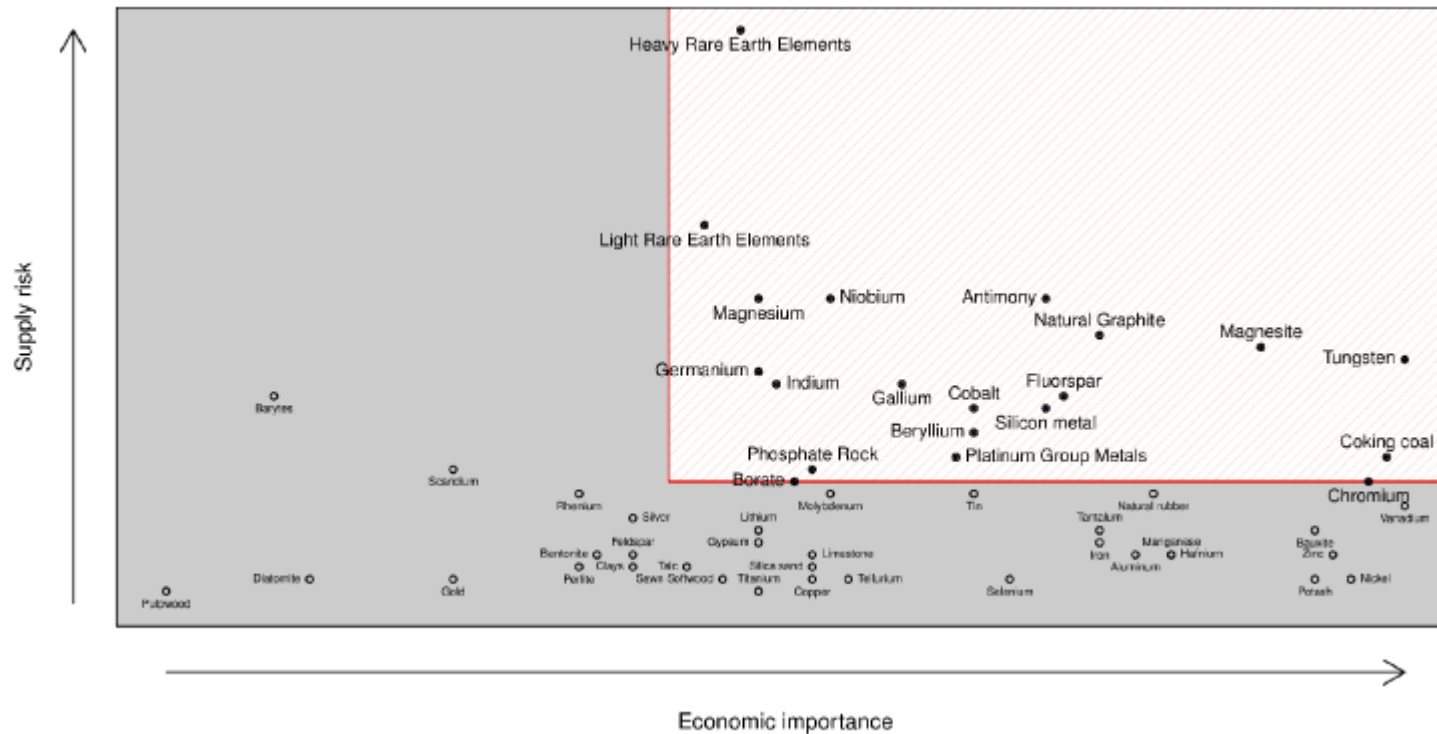
EU “Raw Materials Initiative”

- **Aim:** securing sustainable supplies of raw materials
- **Launched in 2008, consolidated in 2011**
- **Non-energy, non-agricultural raw materials**
- **Connecting EU external and internal policies**
- **Integrated strategy (3 pillars)**
- **Introduced list of Critical Raw Materials (CRM) in 2010**
- **Revision of the list of Critical Raw Materials (CRM) in 2014**





European Commission



Antimony	Beryllium	Borates	Chromium	Cobalt	Coking coal	Fluorspar
Gallium	Germanium	Indium	Magnesite	Magnesium	Natural Graphite	Niobium
PGMs	Phosphate Rock	REEs (Heavy)	REEs (Light)	Silicon Metal	Tungsten	

European Innovation Partnership on Raw Materials – a novel concept

Speed up breakthrough innovations

- **by pooling resources through a challenge-driven approach**
- **and acting across research and innovation cycle**
- **bringing together all relevant actors to connect supply and demand side for a societal challenge, covering much more than R&D**

Innovation required for the entire value chain of raw materials – industrial approach

- **Exploration, exploitation, processing, using, recycling, **substitution**, etc.**
- **Sectors: mining, engineering, pulp and paper, product design, robotics, etc.**

European Innovation Partnership on Raw Materials

Overall objective:

Contribute to the 2020 objectives of the EU Industrial Policy (to increase the share of industry in GDP to 20%), the Innovation Union and the Resource Efficiency 'flagships'

Specific objectives:

- **Reduce import dependency**
- **Improve supply conditions from European and other sources**
- **Push Europe to the forefront in raw materials sectors**
- **Provide alternatives in supply**
- **Mitigate negative environmental and social impacts**

EIP RM - Strategic Implementation Plan

•I. Technology Pillar

- I.A Raw materials research and innovation coordination
- I.B Technologies for primary and secondary raw materials' production
- I.C **Substitution of raw materials**

•II. Non-Technology Policy Pillar

- II.A Improving Europe's raw materials framework conditions
- II.B Improving Europe's waste management framework conditions and excellence
- II.C Knowledge, skills and raw materials flows

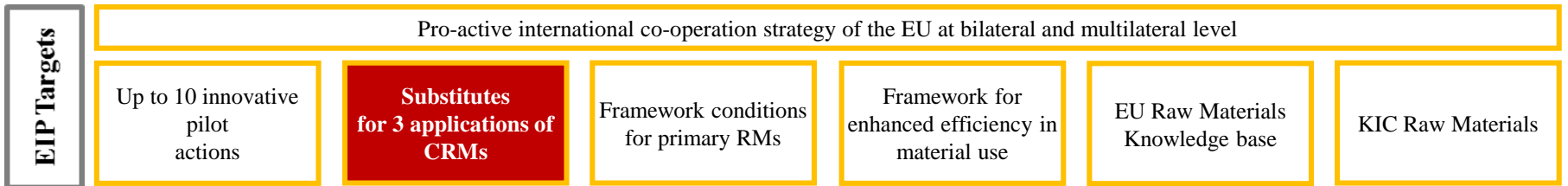
•III. International Cooperation Pillar

- III.1 Technology
- III.2 Global Raw Materials Governance and Dialogues
- III.3 Health, Safety and Environment
- III.4 Skills, Education and Knowledge
- III.5 Investment activities

Latin American countries were identified by EIP stakeholders as key partners to cooperate in the international pillar

EIP Scheme

Objectives	To reduce dependency on imports To promote the production and exports				To put Europe at the forefront in RM sectors	
	To improve supply conditions from EU	To diversify raw materials sourcing	To improve resource efficiency including recycling	To find alternative raw materials	To make Europe a leader in the RM capabilities	To mitigate environmental, social and health impacts



Strategic Implementation Plan (adopted on 25 September 2013)



Key Enabling Technologies

Horizon 2020

Total budget: 77.0 billion €*

Excellent science

- *European Research Council*
- *Future and Emerging Technologies*
- *Marie Curie actions*
- *Research infrastructures*

Budget:
24.4 billion €*

Industrial leadership

- **Leadership in enabling and industrial technologies**
- *Access to risk finance*
- *Innovation in SMEs*

Budget:
17.0 billion €*

Societal challenges

- *Health, demographic change and wellbeing*
- *Food security, sustainable agriculture, marine and maritime research and the bioeconomy*
- *Secure, clean and efficient energy*
- *Smart, green and integrated transport*
- **Climate action, resource efficiency and raw materials**
- *Inclusive, innovative and reflective societies*
- *Secure societies*

Budget:
29.7 billion €*

* 2014-20, actual budget (as originally published in OJ L347/173, 20/12/2013)
Includes 5.9 billion € for "widening participation", "science with and for society", JRC and EIT
– not shown in three priorities above.

Leadership in enabling and industrial technologies (LEIT)

Priority 1: Excellent Science

Priority 2: Industrial Leadership

Leadership in enabling and industrial technologies (LEIT)

(i) ICT including micro- and nano-electronics and photonics

(ii) Nanotechnologies

(iii) Advanced Materials

(iv) Biotechnology

(v) Advanced Manufacturing & Processing

(vi) Space

Access to risk finance

Leveraging private finance and venture capital for R&I

Innovation in SMEs

Fostering all forms of innovation in all types of SMEs

Priority 3: Societal Challenges

Industrial Leadership

- Key Enabling Technologies (KETs) and partnerships with industry, to recover from economic crisis
- Emphasis on R&D and innovation with strong industrial dimension
- Activities primarily developed through relevant industrial roadmaps (ETPs, PPPs)
- Involvement of industrial participants and SMEs to maximise expected impact → key aspect of proposal evaluation
- Funded projects will be *outcome oriented, developing key technology building blocks and bringing them closer to the market*

Mastering and industrial deployment of Key Enabling Technologies (KETs)

What are KETs?

- Six strategic technologies
- Driving competitiveness and growth opportunities
- Contributions to solving societal challenges
- Knowledge- and Capital- intensive
- Cut across many sectors

- **Nanotechnologies**
- **Advanced Materials**
- **Micro- and nano-electronics**
- **Photonics**
- **Biotechnology**
- **Advanced Manufacturing**

European KET Strategy:

- **EC Communications**
(2009)512 & (2012)341
- **KET High-level Group**

The issues regarding KETs

- Europe has strong position in science and in patenting activity
- EU actors are at top of patent ranking in each KET
- But there is a gap between the technology base and the manufacturing base
- We need to add demonstrators, competitive manufacturing and product development to the technologies

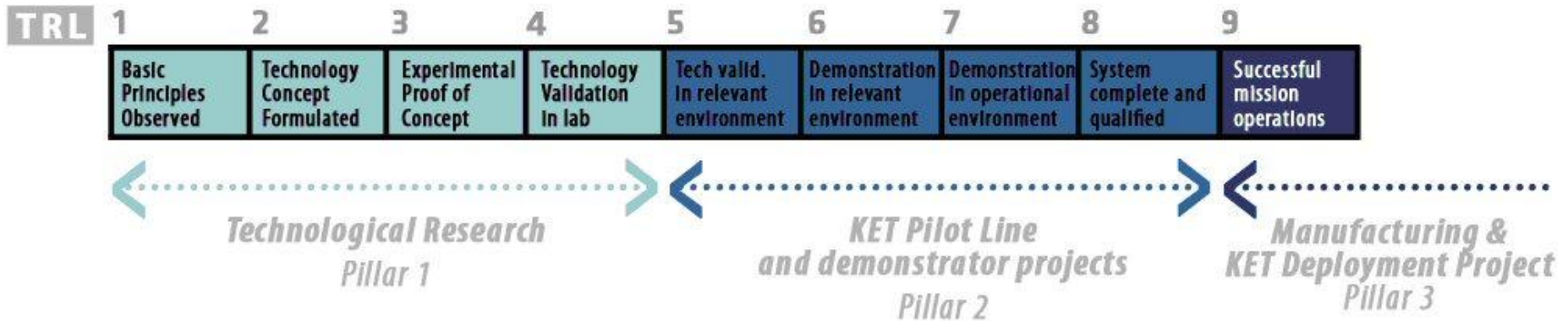
From Lab to Industry to Market

Main priorities for KETs

- Technology development and validation, aiming at industrial deployment of Key Enabling Technologies (KETs)
- Strategic research agendas, roadmaps and value chains (applications in several sectors)
- Industrial engagement / leverage
- Pilots and demonstrators
- Cross-cutting KETs (combinations of KETs and manufacturing), 30% of KET budget
- Enabling applications in societal challenges

Technology Readiness Levels (TRLs)

A useful tool in development and deployment of KETs



- NMP in FP7: TRLs 1 – 4;
up to 5 – 6 in 2012-13 (pilots and demonstrators)
- LEIT KETs: TRLs 3/4 – 7; centre at TRLs 5-6

H2020 – LEIT/KETs: From R&D to close-to-market activities

- Use of Technology Readiness Levels (TRLs from 3-4 to 8)
- Two funding rates
 - 100%** funding: TRLs 3-6
 - 70%** funding: TRLs 5-7
- Non-profit participants can claim 100% funding
- Cross-cutting KETs (combinations of KETs and manufacturing)
- Seamless coverage provided by FETs/ERC – LEIT – Societal Challenges
- Ground prepared in FP7 (first pilots and demonstrators, innovation activities)

General Policy Issues in LEIT

- Exploitation and business plans
- Industrial-size projects to look at additional funding/financing sources
- Contributions to solving societal challenges and to focus areas
- Open to International Cooperation
- Engagement with Social sciences and humanities
- Responsible approach to research and innovation
- Gender and diversity issues

Community Building



PROJECT CLUSTERS

Project cluster

- Bringing together EU projects related to a certain topic
- Promoted by the EC but coordinated by a project technical adviser (dr. Peter Ramaekers, currently on sick leave)
- Strong involvement, on a voluntary basis, by project coordinators (or designated partners)
- Can be structured in different working groups addressing different sub-topics/tasks
- Bottom-up approach
- No confidentiality issues (inter-project coordination, not at the level of project contents)
- 1-2 project cluster meetings per year (back-to-back to a major event)
- Time frame of Horizon 2020 but ideally continuing beyond

Running project clusters

- Photovoltaics (40 proj.)
- Thermo-electrics (8 proj.)
- Building (26 proj.)
- Catalysis (33 proj.)
- Carbon fibres (3 proj.)
- Upscaling (147 proj.)
- Sensors (15 proj.)
- Characterisation (15 proj.)
- Modelling (*European Materials Modeling Council*, +80 projects)
- Water (4 proj.)
- ...
- **Substitution of CRM (18 proj.)**
 - Heavy REE (8 proj.)
 - Catalysts (3 proj.)
 - Electronic devices (5 proj.)
 - Coordination actions (2 proj.)

Projects on substitution of CRM

Action area I.6. Materials for green technologies

Substitution for heavy REE in magnets:

ROMEO	Replacement and Original Magnet Engineering Options
NANOPYME	Nanocrystalline permanent magnets based on hybrid metal-ferrites
REFREEPERMAG	Rare-Earth Free Permanent Magnets
MAG-DRIVE	New permanent magnets for electric-vehicle drive applications
ARMEVA	Advanced Reluctance Motors for Electric Vehicle Applications
VENUS	Switched/Synchronous Reluctance Magnet-free Motors for Electric Vehicles
SYRNEMO	Synchronous Reluctance Next Generation Efficient Motors for Electric Vehicles
DRREAM	Reduce the use of rare earth elements in the life cycle of technologies that use magnetic phase change materials

Substitution of CRM in catalysts:

NEXTGENCAT	Development of novel eco-friendly nano-structured automotive catalysts that can partially or completely replace the PGMs
FREECAT	Development of new metal-free catalysts capable to replace traditional noble metal-based catalysts
NOVACAM	Novel cheap and abundant materials for catalytic biomass conversion

Projects on substitution of CRM

Action area I.7. Materials for electronic devices

Substitution indium:

IRENA	Indium replacement by single-walled carbon nanotube thin films
INREP	Towards Indium free TCOs
Infinity	Indium-Free Transparent Conductive Oxides for Glass and Plastic Substrates

Substitution of CRM in light sources:

CycLED	Cycling resources embedded in systems containing Light Emitting Diodes
---------------	--

Other:

HARFIR	Heusler Alloy Replacement for Iridium
---------------	---------------------------------------

Action area I.8. Materials under extreme conditions

Topic covered by Horizon 2020 SC5-12-2015 :

Substitution of CRM in heat resistant super alloys and hard materials

Projects on substitution of CRM

Other projects

- CRM_Innonet** Critical Raw Materials Innovation Network – Towards an integrated community driving innovation in the field of critical raw material substitution for the benefit of EU industry
- COBALT** COntributing to Building of Awareness, Learning and Transfer of knowledge on sustainable use of raw materials

Why cluster projects?

Improve on the (longer term!) impact of FP7 and Horizon 2020 R&I funding efforts in the domain of CRM substitution

- Knowledge base to improve on a common vision/coordination at EU level
- Monitor funding fragmentation/overlap/gaps
- Forging research alliances for knowledge transfer
- Foster synergies among stakeholders, research, academia, industries and EU initiatives (@materials substitution level)

Possible cluster activities ...

- **Networking**
 - Coordinate, link, integrate activities of EU funded projects on substitution
 - Create networking and synergies among existing networks
- **Knowledge transfer**
 - Stimulate open-minded, interdisciplinary workshops and discussion forums on new research frontiers
 - Contribute to regulations/standardization activities for closer to the market applications
 - Promote substitution to the larger public
- **Policy**
 - "Translate" existing roadmaps to the technology level
 - Input for Horizon 2020 policy (themes and topics for future calls)
 - Interaction with regional (Smart Specialisation) and national initiatives
 - International cooperation