Roadmap

for critical raw materials substitution

ICT & Electronics

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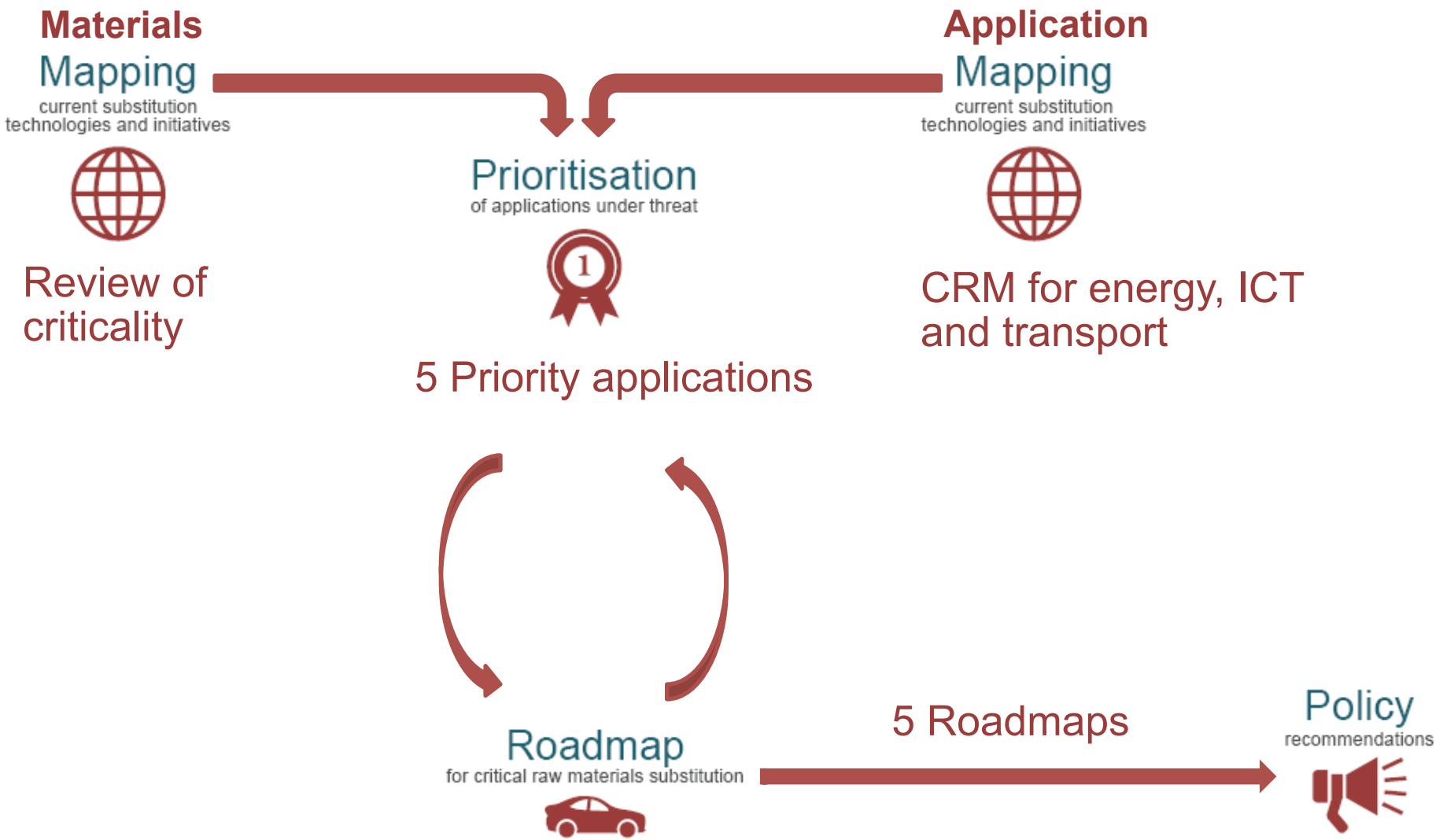
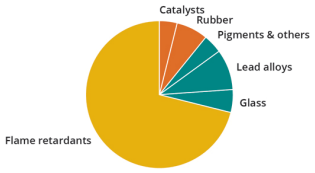
Substitution of Critical Raw Materials


Materials
Mapping
current substitution technologies and initiatives
Review of criticality
Application
Mapping
current substitution technologies and initiatives
CRM for energy, ICT and transport
Prioritisation
of applications under threat
1
5 Priority applications
Roadmap
for critical raw materials substitution
5 Roadmaps
Policy
recommendations

CRM_InnoNet
Material Profiles

ANTIMONY



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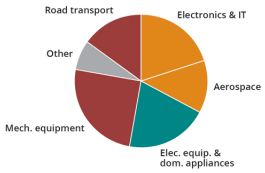
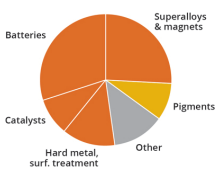
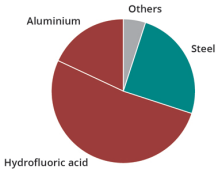


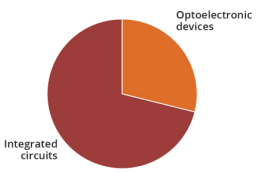
COBALT



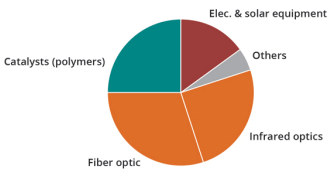
FLUORSPAR



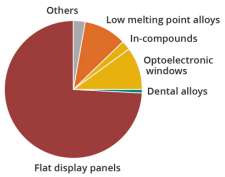
GALLIUM



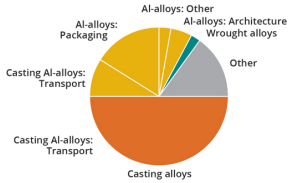
GERMANIUM



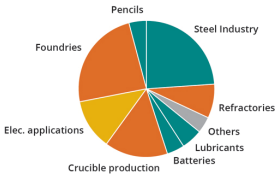
INDIUM



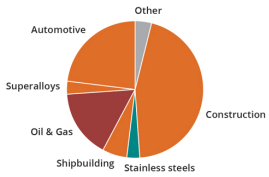
MAGNESIUM



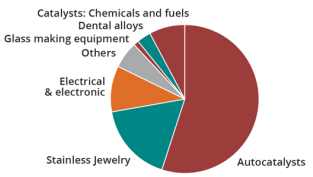
NATURAL GRAPHITE



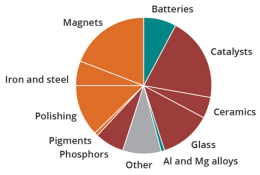
NIOBIUM



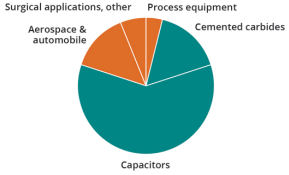
PLATINUM GROUP METALS



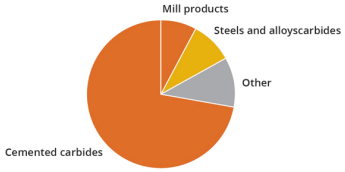
RARE EARTH ELEMENTS

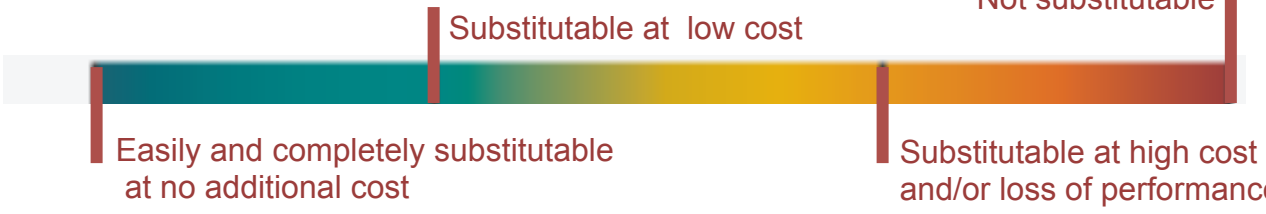


TANTALUM



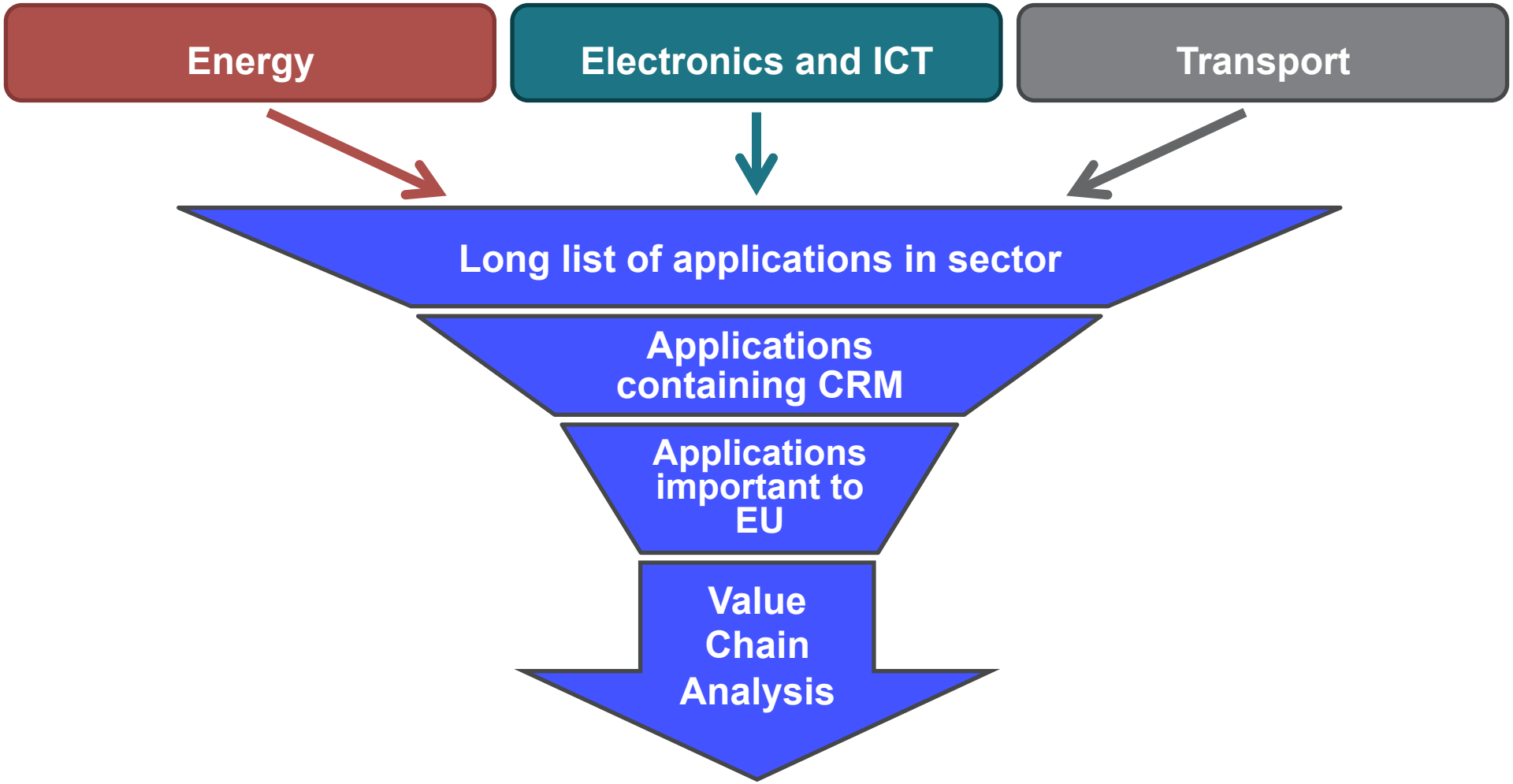
TUNGSTEN





CRM_InnoNet
Substitution of Critical Raw Materials

Application Mapping: Value Chain Analysis



Priority Applications

Energy

- Wind turbines
- Thin film photovoltaics
- Energy storage

Electronics and ICT

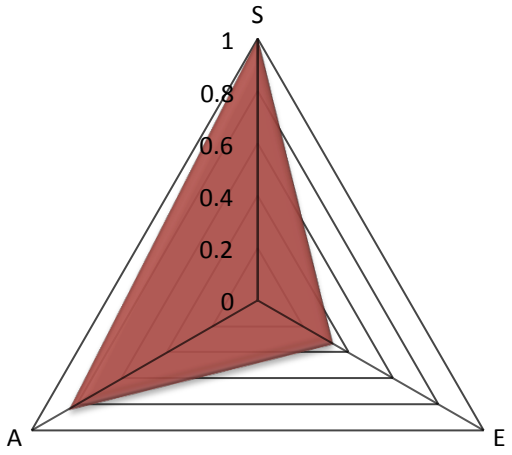
- Magnetic Resonance Imaging
- Fibre optics
- LEDs
- Large household appliances
- Displays and screens
- Printed circuit board

Transport

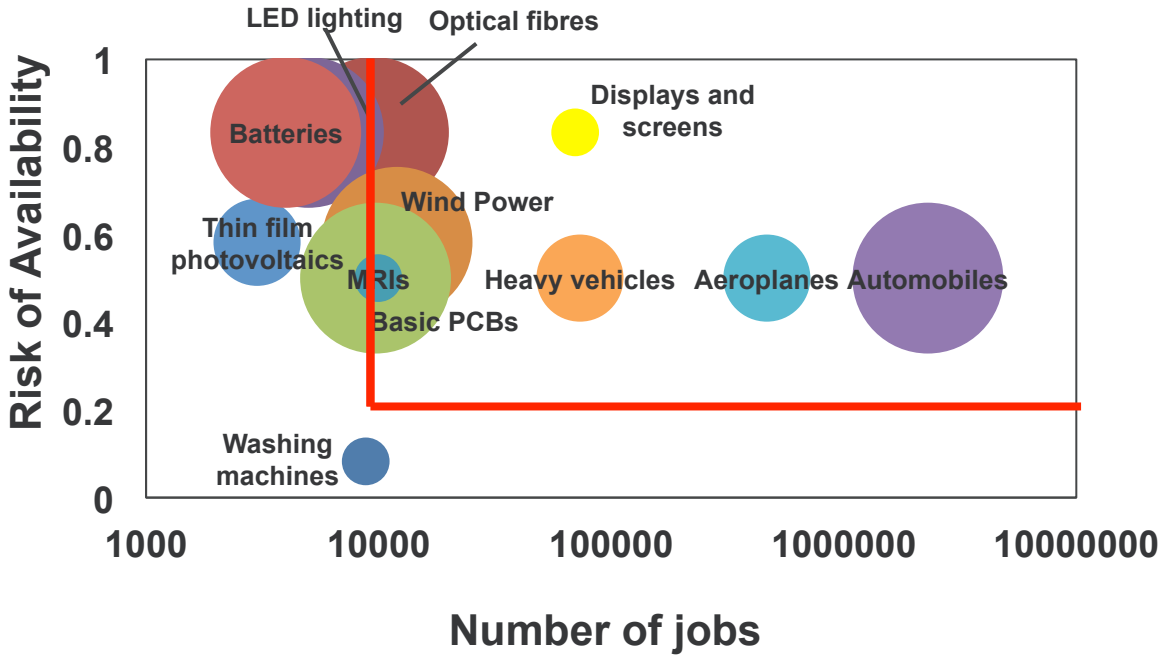
- Automobiles
- Heavy vehicles
- Airplanes

Optical Fibres

Dimension	Criterion	Score	Comment
Economic (E)	Global market share of European production	1	In Europe one major company is producing 17% of global supply.
	Jobs involved in the EU (excluding indirect jobs)	1	9,500
Risk of Availability (A)	Amount of CRMs involved	1	Low levels of germanium
	Expected future market development	3	Global market growing
	CRM function	3	Dopant elements like Germanium to significantly enhance the optical properties of the fibre
	Availability and status of substitutes or mitigation potential	3	Substitute only in research phase and inferior performances of the substitute
Strategic Relevance (S)	Availability of the application is of relevance for specific European policies	3	Relevant as communication technologies



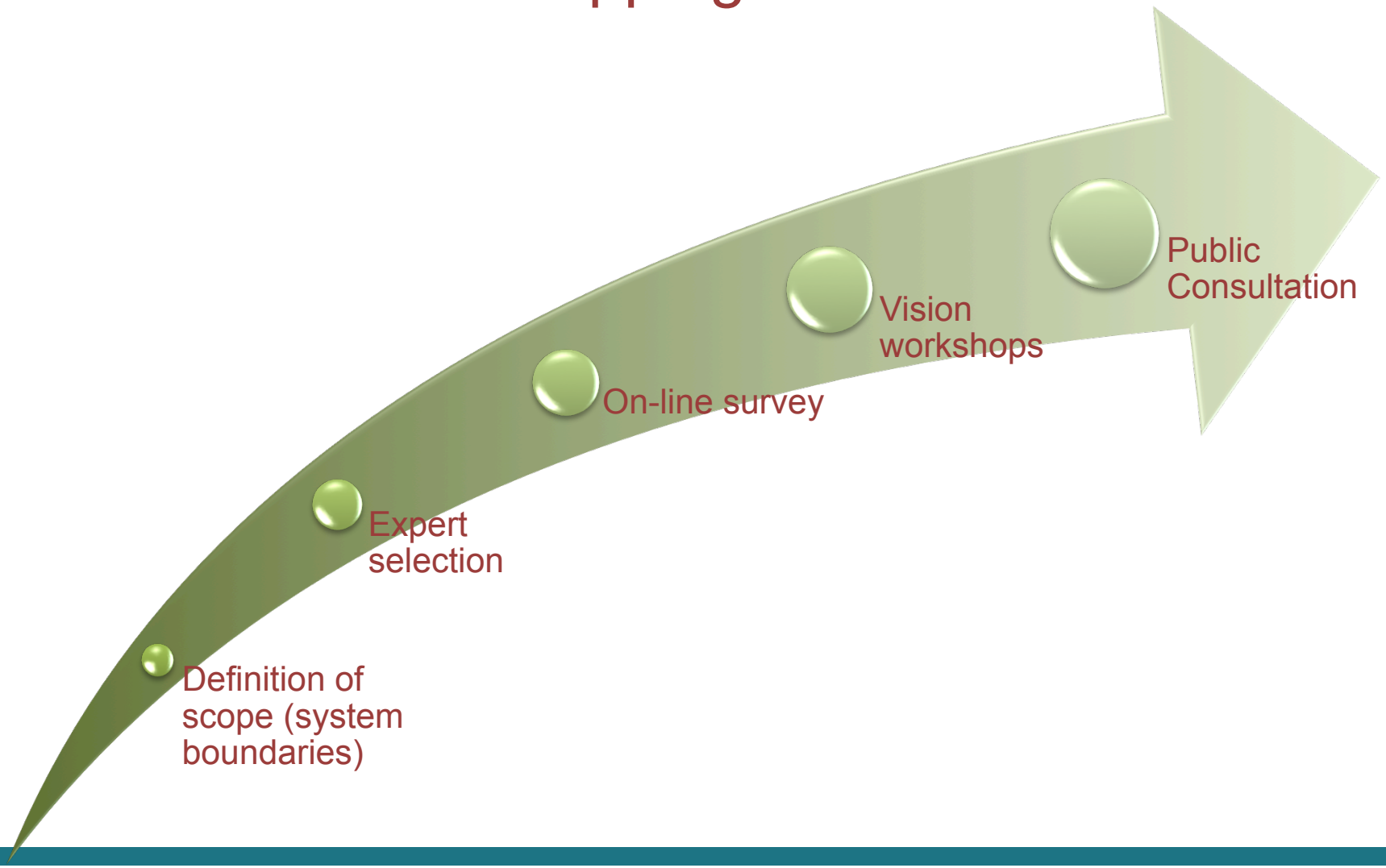
Prioritisation of roadmap themes



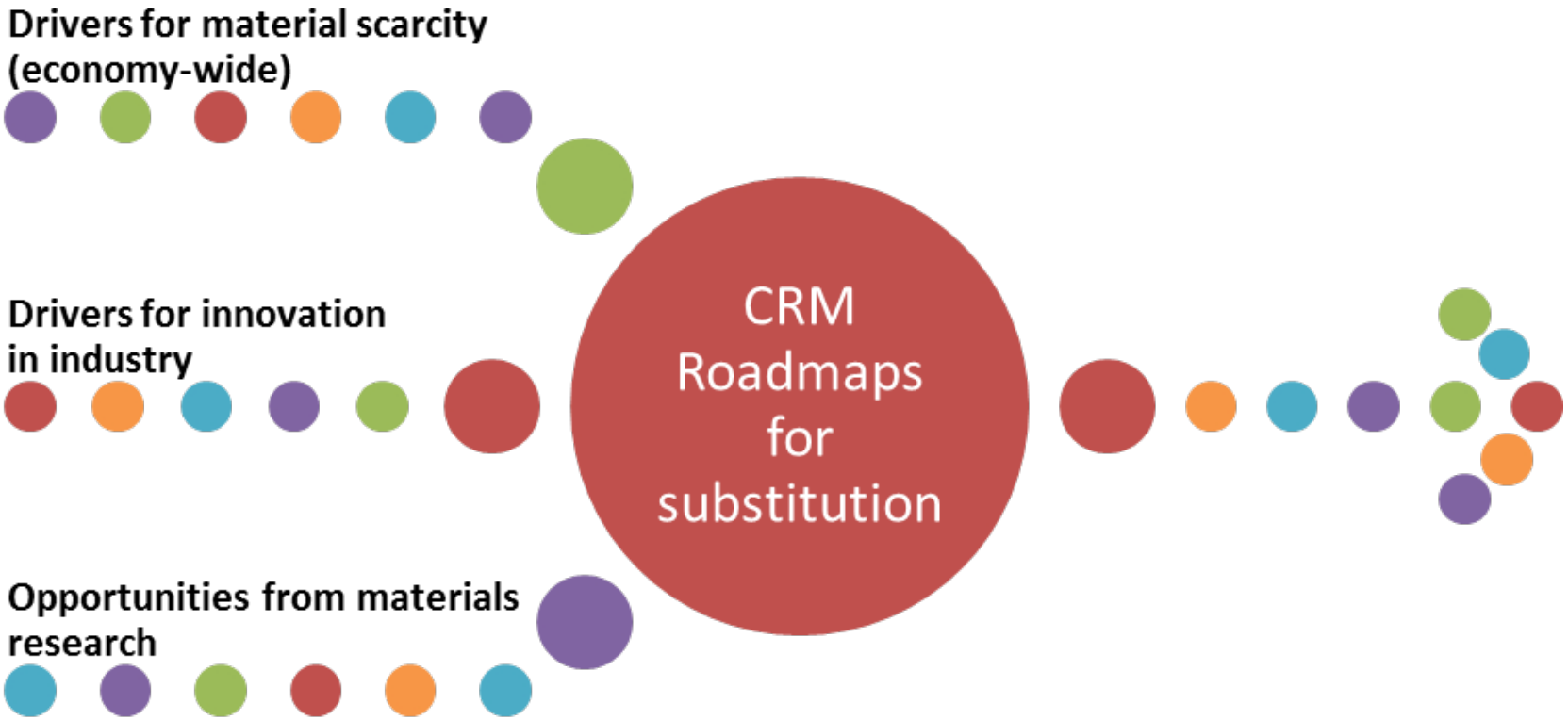
1. Motors and drives
2. High value alloys
3. PCBs and electronics
4. Batteries and accumulators
5. Photonics high end optics

CRM_InnoNet
Substitution of Critical Raw Materials

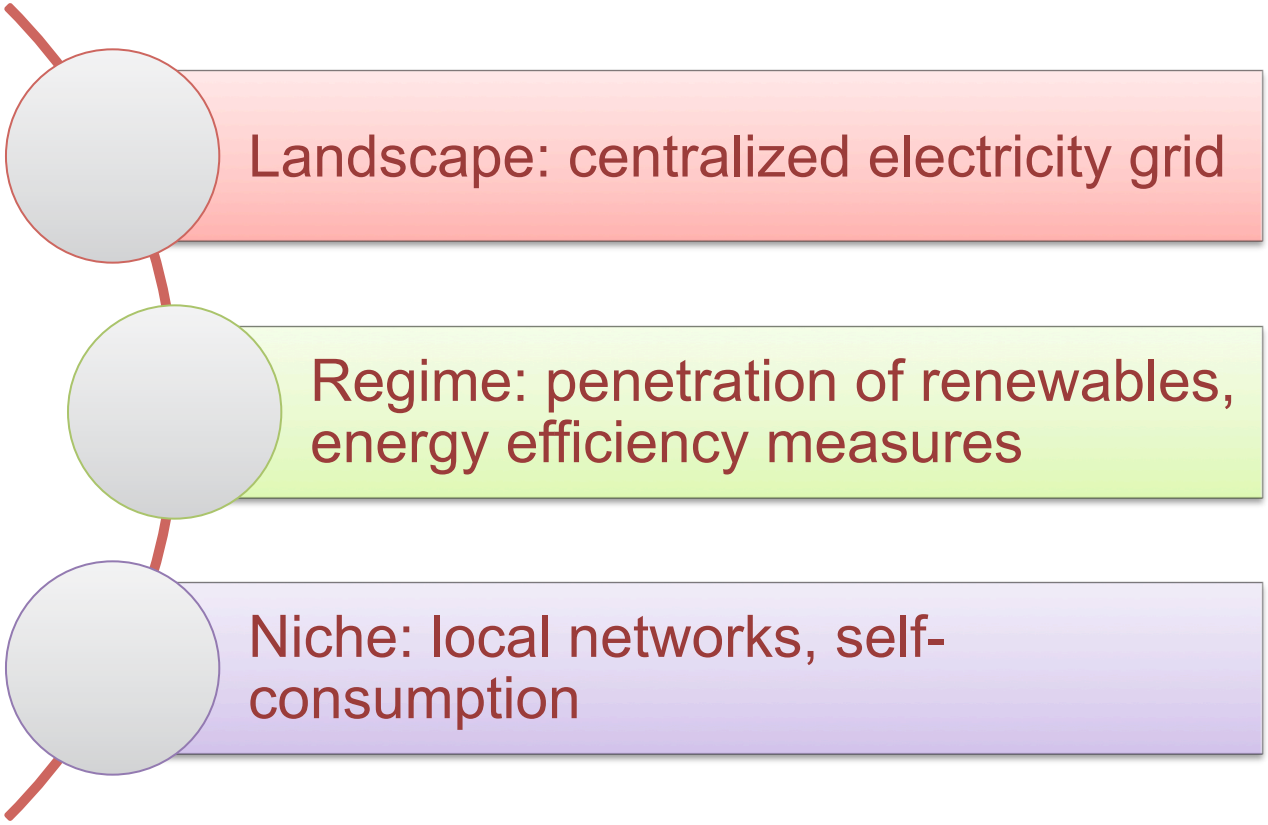
Roadmapping Process



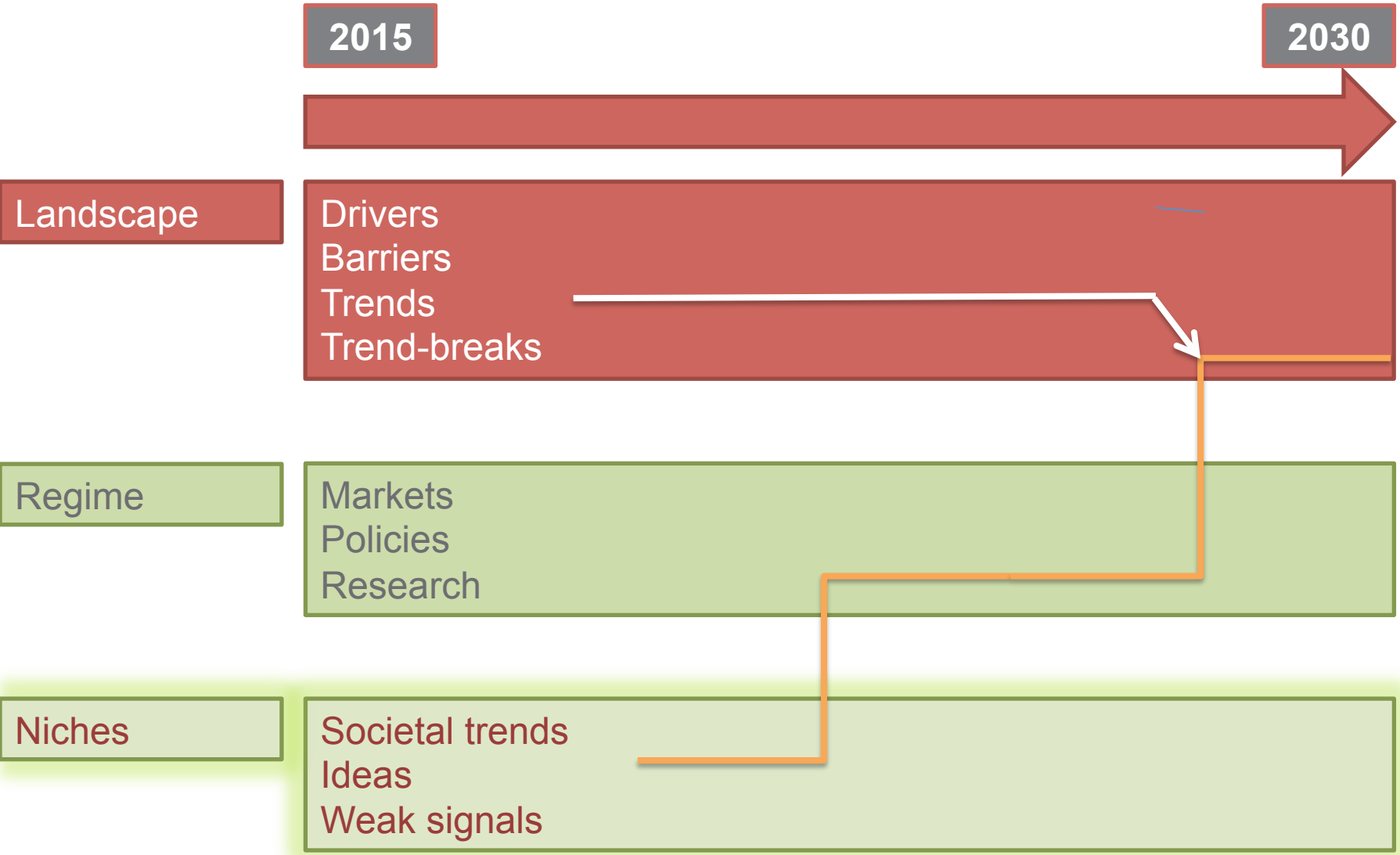
Drivers


Drivers for material scarcity (economy-wide)
Drivers for innovation in industry
Opportunities from materials research
CRM Roadmaps for substitution

Transition Theory



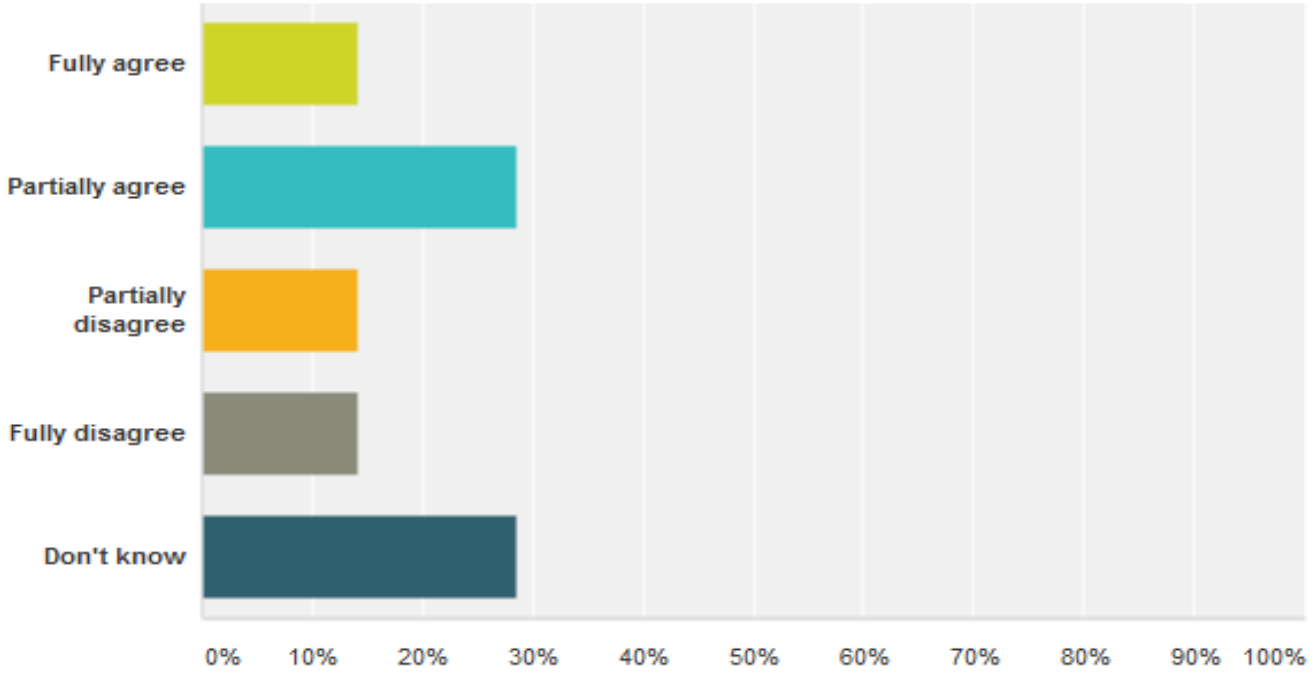
CRM_InnoNet Roadmaps – the not yet final picture



Roadmap Focus

- Drivers for Technology
- Drivers for Industry
- Regulation Trends
- Novel Research Solutions

a. Price increases for PGM (platinum, palladium, ruthenium) will increase the need for material substitution in the electronics industry

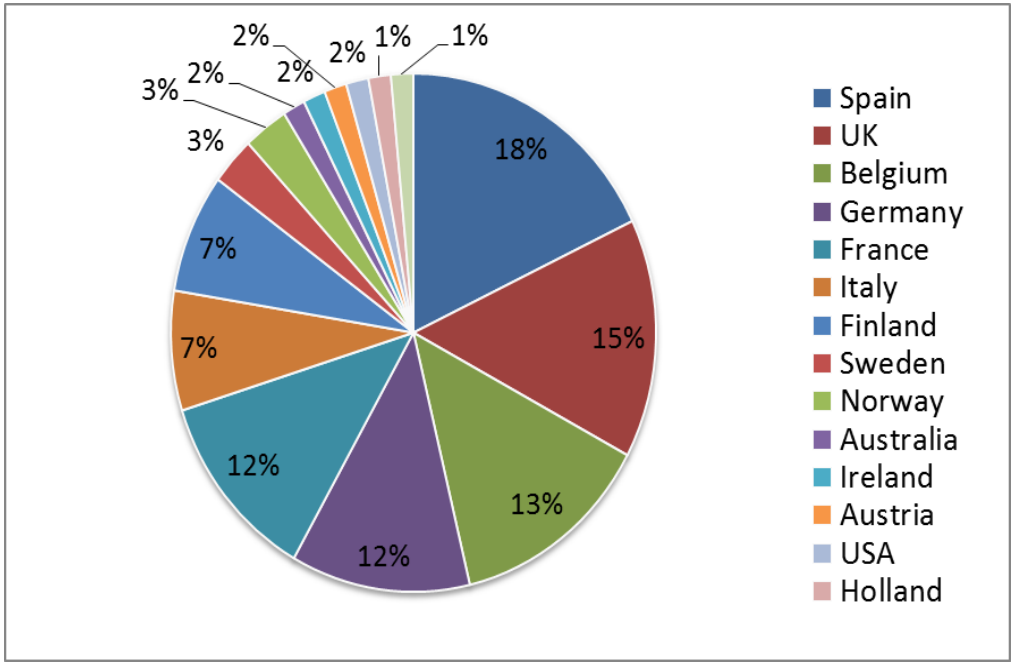


Opciones de respuesta	Respuestas	
Fully agree	14,29%	1
Partially agree	28,57%	2
Partially disagree	14,29%	1
Fully disagree	14,29%	1
Don't know	28,57%	2
Total		7

Expert Selection

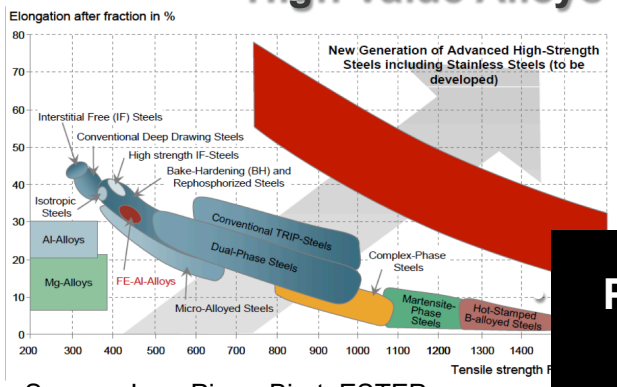
- 49% industry – 51% academia

Workshop	Number of experts
Printed Circuit Boards and electronic components	16
Permanent Magnet based applications	17
Advanced accumulators and batteries	9
High-value alloys	16
Photonics – high-end optics	10
TOTAL	68

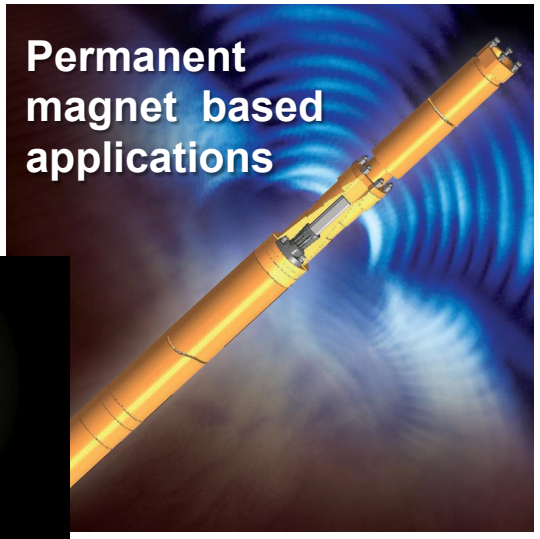


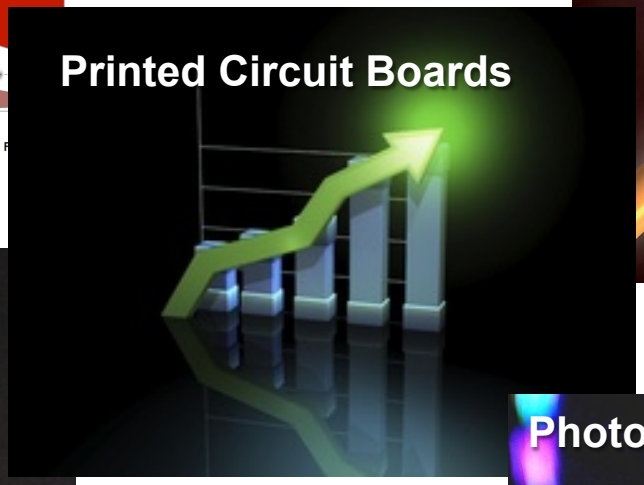
Vision Workshops

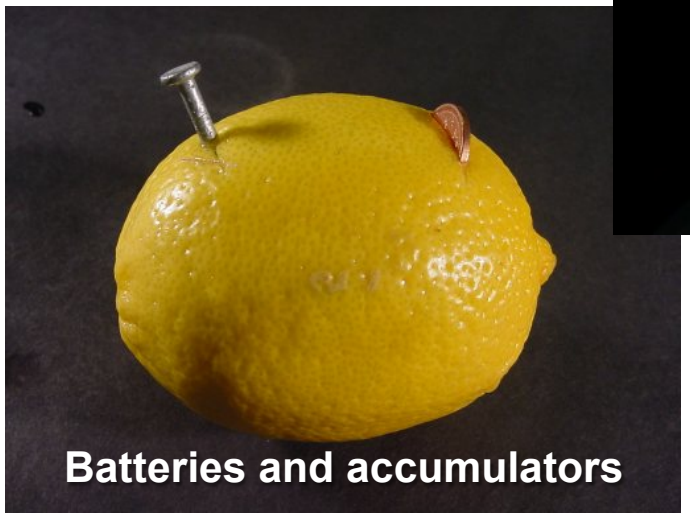
High-value Alloys

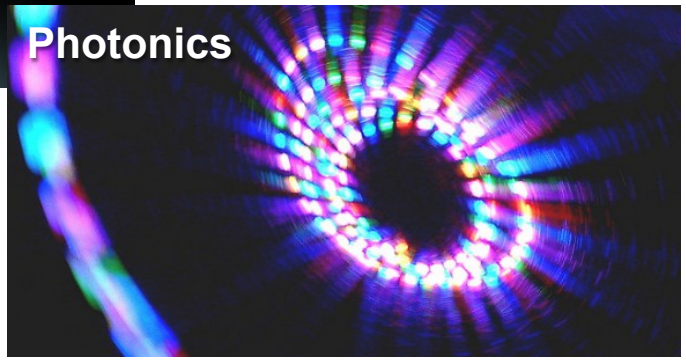


Source: Jean-Pierre Birat, ESTEP

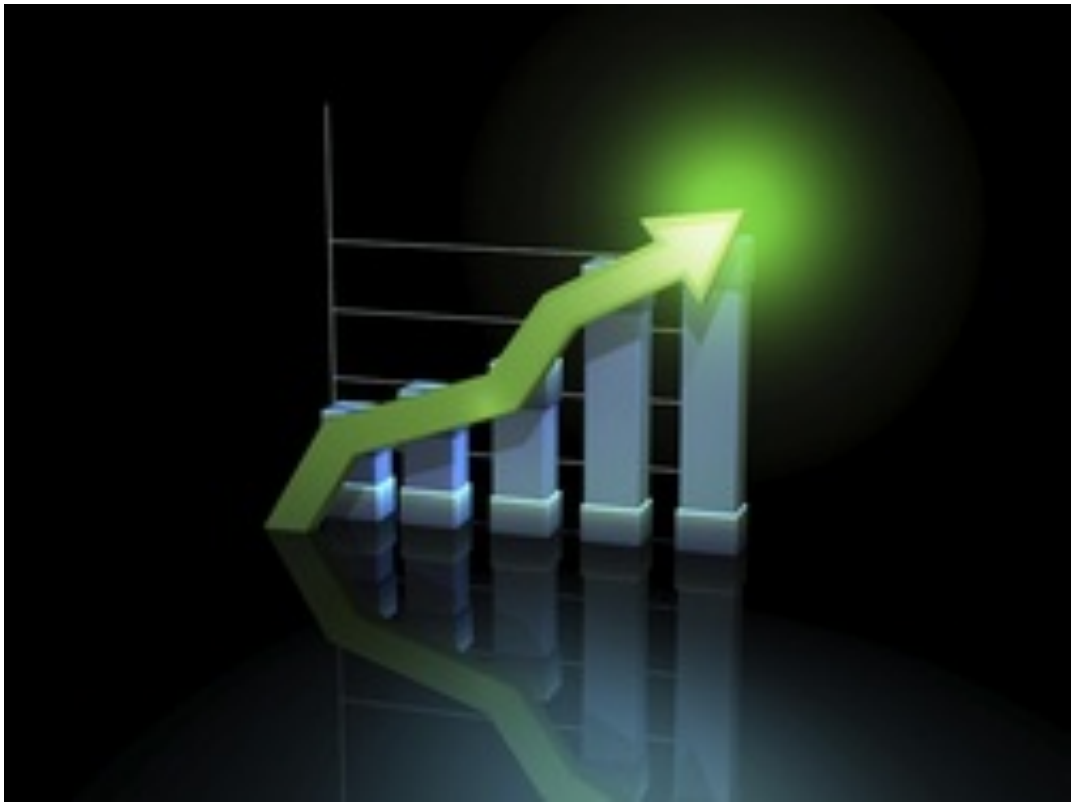








Printed Circuit Boards

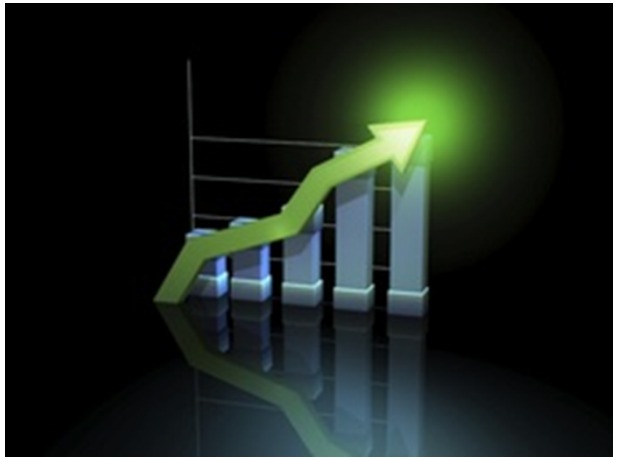


First Conclusions from Vision Workshop

Currently about 90 % of the production in Asia/Pacific

Market and product expectations:

- Embedded components e.g. in carbon fibre
- Flexible electronics
- In home monitoring
- Safety & Security
- Manufacturing 3.0
- PCB higher temperature resistant
- Privacy related technology



Key drivers for substitution

- Where recycling & reuse are not the option – e.g. miniaturisation and embedded in different materials
- Performance main driver but varies based on specifics of the application e.g. GaN 'wrong way substitution'
- Availability of CRM

R&D funding to address gaps – types of ways to fund substitution

Collaboration

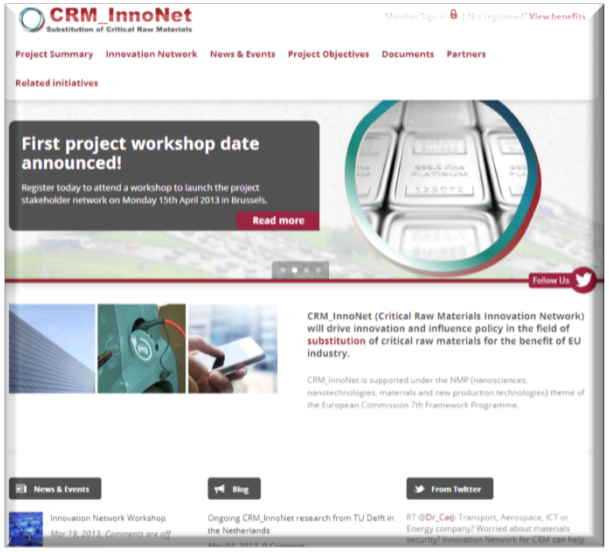
Next Steps & Participation

Roadmap
for critical raw materials substitution

Networking
of the substitution
stakeholder community

Roadmap Consultation

November- December 2014



www.criticalrawmaterials.eu

3rd Innovation Network Workshop

14th January 2015 Brussels

CRM_InnoNet Key Contacts

General Enquiries: criticalrawmaterials@ktn-uk.org

Mapping
current substitution technologies and initiatives

Value chain mapping:

Transport
Lena Smuk
Lena.Smuk@sp.se

Energy
Aymeric Brunot
aymeric.brunot@cea.fr

ICT and Electronics
Ulla-Maija Mroeuh
Ulla-Maija.Mroueh@vtt.fi

Materials mapping:

Luis Tercero
Luis.Tercero@isi.fraunhofer.de

Roadmap
for critical raw materials substitution

Policy
recommendations

Daniela Velte
daniela.velte@tecnalia.com

Networking
of the substitution stakeholder community

Nader Akil
Nader.Akil@pnoconsultants.com

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www.criticalrawmaterials.eu

susanne.coles@ktn-uk.org

claire.claessen@ktn-uk.org

Twitter: @CRM_InnoNet

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