

**STRATEGIC IMPLEMENTATION PLAN**  
**FOR**  
**THE EUROPEAN INNOVATION PARTNERSHIP**  
**ON**  
**Raw Materials**

**Part II**  
**PRIORITY AREAS, ACTION AREAS AND**  
**ACTIONS**

**FINAL VERSION – 18/09/2013**

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# Acronyms

AMDC	African Minerals Development Centre
BBI	Bio-based Industries
C&D	Construction and Demolition
CEN	European Committee for Standardization
CENELEC	European Committee for Electro-Technical Standardization
CRM	Critical Raw Material
CYTED	Programa Iberoamericano de Ciencia y Tecnología para el Desarrollo
EC	European Commission
EEE	Electrical and Electronic Equipment
EERA	European Energy Research Alliance
EGVI	European Green Vehicles Initiative
EIA	Environmental Impact Assessment
EIP	European Innovation Partnership
EP	European Parliament
ERA-NET	European Research Area Network
ERA MIN	ERA-NET on non-energy mineral resources
ETP	European Technology Platform
ETP SMR	ETP on Sustainable Mineral Resources
EU	European Union
EURMKB	European Raw Materials Knowledge Base
FCH JU	Fuel Cells and Hydrogen Joint Undertaking
FET	Future and Emerging Technologies
FTP	Forest-based Sector Technology Platform
FSC	Forest Stewardship Council
ICMM	International Council on Mining and Metals
ILO	International Labour Organisation
IPR	Intellectual property rights
ISO	International Organisation for Standardization
ITO	Indium Tin Oxide
JRC	Joint Research Centre
KIC	Knowledge and Innovation Community
LED	Light-emitting diode
MS	Member State
NEEI	Non-Energy Extractive Industry
NGO	Non-Government Organization
NMP	FP7 'Cooperation' - Research theme: 'Nano sciences, nanotechnologies, materials and new production technologies'
OG	Operational Group
OLED	Organic Light-Emitting Diode
PEFC	Programme for the Endorsement of Forest Certification
PGM	Platinum Group of Metals
PPP	Private-Public Partnership
R&D	Research and development
REE	Rare Earths Element
RM	Raw materials

SAGE	Sustainable And Green Energy
SET	Strategic Energy Technology
SIP	Strategic Implementation Plan
SME	Small and Medium Enterprises
SSL	Solid State Lighting
TBT	Technical Barriers to Trade
UNCTAD	United Nations Conference on Trade and Development
UNEP	United Nations Environment Programme
UNIDO	United Nations Industrial Development Organization
WBCSD	World Business Council for Sustainable Development
WEEE	Waste Electrical and Electronic Equipment
WP	Work Package

Units Conventional SI units and prefixes used throughout: {k, kilo, 1,000} {M, mega, 1,000,000} {G, giga,  $10^9$ } {kg, kilogramme, unit mass} {t, metric tonne, 1,000 kg}

## I. TECHNOLOGY PILLAR

### I.A Priority Area: Raw materials research and innovation coordination

#### *Action area n° I.1 Improving R&D&I coordination in the EU*

##### **Objectives:**

The objective of this action area is to strengthen coordination of the research initiatives (such as Horizon 2020, ERA-MIN, PPPs and ETPs), efforts, knowledge, tools and research infrastructures in order to maximise impacts of the research initiatives and actions in the area of Raw materials carried out by the EU, Member States, industry and research communities for the benefit of the society.

##### **Problem definition:**

The research and development in the area of Raw materials is scattered amongst different players. Major R&D funding comes from the individual companies, EU Research Framework Programmes and the Member States funding.

Already several years ago different European industries, academic and research organisations set up the European Technology Platforms (ETPs) in order to develop the common long term Visions, Strategic Research Agendas and the Implementation plans and collaborate in the implementation of the planned actions. There are several ETPs that contributed to the area of Raw materials, particularly the European Technology Platform on Sustainable Mineral Resources (ETP SMR), but also Forest-based ETP (FTP), Sustainable chemistry (SusChem), Construction ETP (ECTP), Steel ETP (ESTEP), Advanced materials ETP (EUMAT).

The European Commission re-opened the space for the Raw materials R&D in the EU 7<sup>th</sup> Framework Programme on Research and development under different themes, particularly NMP and Environment. Raw materials gained a clear position as a societal challenge in the next EU framework programme called Horizon 2020 covering not only Research aspects, but also Innovation. There also is a major step forward in the cooperation between several Member States in the framework of an EU funded network of European organisations owning and/or managing research programs on raw materials called ERA-MIN. ERA-MIN published in March 2013 its Strategic Research Roadmap and launched the first Joint research call in April 2013.

The EU also promotes the research Public-Private Partnerships to link better the EU funding to the industrial needs. There are several PPPs relevant to Raw materials linked to Horizon 2020, such as SPIRE on resource and energy efficiency in the process industries, PPP on Bio-based Industries, Factory of the Future or Energy Efficient Buildings.

These are the first steps in improving and coordinating the efforts in the area of raw materials. There is however need to improve coordination between industrial players and researchers in the EU and across the whole value chain, facilitate the effective communication between EU and MS authorities, industry and research community.

**Approach:**

The EU, Member States, industry and research community are invited to improve the collaboration and coordination of the efforts through four specific actions:

**Actions:**

- 1) Coordination of industrial initiatives: Improving coordination and collaboration of all the Raw materials relevant ETPs and other industrial initiatives, and engaging new players in the area of raw materials;
- 2) Coordination of Member States and EU initiatives: Further strengthening Research and Innovation coordination between the Member States and with the EU in the field of Raw materials;
- 3) Collaboration between Raw materials community and society: Strengthening the Raw materials Research and Innovation dialogue; collaboration between the EU and MS authorities, industry and research community; and improving the awareness of the related needs and initiatives in the society;
- 4) Research and innovation platforms: Establishing EU-wide research and innovation platforms that bring together a wide range of actors from basic and applied research to large industrial firms and innovative start-ups pooling knowledge, tools and research infrastructures related to raw materials, as for example in the area of substitution, metallurgy or mining.

**Potential players:**

EU, Member States, industry and academia.

**Impacts:**

The success of the proposed actions would

- Maximise the impact of the other actions in the Technology pillar;
- Improve the translation of the industrial needs into governmental planning, policy and decision making and vice versa resulting in improving the environment for the industry in the EU;
- Identify the most appropriate ownership of the different technology oriented actions resulting in clearer responsibility for their implementation;
- Facilitate the transfer of the best Research and Innovation practices to the different regions in the EU and make expertise and infrastructure available to a wider range of stakeholders in the EU, including SMEs;
- Improve the understanding of the Raw materials Research and Innovation needs and initiatives by the wider society in the EU.

**Links with other actions of SIP:**

This action is linked to all the Actions in the Technology pillar and complement the Priority Area "Knowledge and skills on raw materials" with R&D activities. It can also be linked to the Action Area "Optimised raw materials flows along value chains".

**Links with other initiatives:**

The actions have to be coordinated with the MS initiative in the ERA-NETs, particularly ERA-MIN but also Wood-Wisdom-Net, with the European Technology Platforms, particularly ETP SMR, but also SusChem or Forest based; and with the PPPs such as SPIRE, Bio-based Industries, Factory of the Future or Energy Efficient Buildings.

**I.B Priority Area: Technologies for primary and secondary raw materials production*****Action area n° I.2: Exploration*****Objective:**

Objective of this action area is to develop (i) new cost-effective exploration concepts and technologies providing high quality data and information including high resolution 3D geo-data down to 150-4000 meters depth, and (ii) their interpretation through geo-models in order to facilitate both finding new mineral deposits on the continent and in the seabed, as well as fostering industry investment to mining.

**Problem definition:**

In general, there is a direct relation among the market supply and demand conditions, the exploration expenditure and the value of discovered raw materials deposits. However there is continuing difference in demand and supply spikes, as growing demand – when not balanced by sufficient supply – triggers price rises which in return attract investments into exploration – that in average will materialise in case of success into new production about 10 to 15 years later

The major challenges are the geological uncertainty, technological and economic feasibility of mine development, high and growing costs for exploration. In average, only one of about thousand exploration projects ever leads to a producing mine.

In Europe additional challenges include difficult operation in densely populated areas (access to land), and the fact that the majority of new deposits in Europe will, most likely, be found at greater depths.

The factors controlling the concentration of rare metals as by-products in certain deposits (e.g. germanium or indium in zinc deposits) are poorly understood: two neighbouring ore deposits can have very different by-product contents. Research in metallogenesis (ore-

body forming processes) is needed to understand the geological/ geochemical factors controlling the distribution of rare metals as by-products.

### **Approach:**

The partnership proposes to improve resolution of the EU and marine raw materials maps thus reducing the industry exploration costs and risks, while building on the world-class geological competences in several EU geological surveys and universities, other research organisations and technology providers and other sectors, such as oil industry. Demonstration of a set of new exploration techniques and technologies leading to industrially relevant high resolution maps with newly identified deposits should be achieved by 2020. This will be achieved through the following actions for both land and marine raw materials:

### **Actions:**

- 1) New exploration technologies: Developing new or improved highly efficient and cost-effective exploration technologies, such as new drilling techniques, integrated drilling and analytical technologies, down-hole and cross-hole sensing, 3D geophysical (seismic, gravimetric, magnetic, electrical and electromagnetic) and other relevant tools.
- 2) Geo-models: Developing new geo-models of mineral deposits or belts formation interpreting in a useful form the data and information obtained from integrated geological, geophysical, geochemical and other methods. Models would increase knowledge on mineral deposit / belt types, including in the controls conditioning the deposition of rare metals as by-products in carrier “main” ore minerals, and also decrease the exploration costs (such as the number of needed expensive deep drills).

### **Potential players:**

EU, MS (including geological surveys), industry (investors, mining industry, equipment suppliers, academia).

### **Impacts:**

- It is anticipated that the same amount of metals and minerals can be extracted at 500 and 1000 m depth as from surface discoveries.
- Reduce the industry exploration costs

### **Links with other actions of SIP:**

The actions in the Exploration area on new concepts, technologies and models are linked to the action area “Improving R&D coordination in the EU” and shall serve as tools to the raw materials data providers (geological surveys, industry) for creating new reliable

data (link to action area “EU mineral potential”) in order to feed the “EU Knowledge base on primary and secondary raw materials”. The newly developed tools can be used by the authorities to better develop Land Use Planning.

**Links with other initiatives:**

There is a need to coordinate these actions with the most relevant initiatives in the field, including ERA-MIN, ETP SMR, United Nations Convention on the Law of the Sea (UNCLOS), and relevant institutions such as the International Seabed Authority (ISA).

*Action area n° 1.3: Innovative extraction of raw materials*

**Objectives:**

The objective of this action area is to enable continental and deep-sea extraction of minerals and extraction of wood in a socially acceptable, environmentally responsible and economically viable way by developing new technological concepts and solutions leading to social acceptance of extraction in the whole Europe and around the world.

**Problem definition:**

Europe has been actively mined over many centuries and many easy-to-access mineral deposits are mostly depleted. The major opportunities to access raw materials within the EU are in greater depths, in remote, but also in populated areas, in former mine sites, in low grade deposits, and in small deposits where larger mining operations may not be feasible. Europe can build on existing EU actions, such as the EU-funded I<sup>2</sup>Mine Project on Intelligent Mining and national mining programmes and actions.

The ocean bed also contains huge amount of valuable raw materials, such as ferrous metals, copper, zinc, gold, silver, and other metals. Europe has an opportunity to make a concerted effort to re-gain technological leadership in deep-sea mining in order to be able to claim its share in the growing world-wide competition for marine mineral deposits. With regards to marine ecosystems, necessary precautions have to be undertaken to avoid harming biological resources which might also turn out to have a high economic and scientific value.

The main economic, technological and environmental challenges of mining include reducing high investment costs, reducing generation of waste and large tailings, identifying and addressing environmental impacts on the marine ecosystems, and improving flexibility, automation and safety of operations. The main challenges of forest operations include reducing cost by improved productivity, eliminating or reducing soil disturbances and improving flexibility, automation and safety of operations.

**Approach:**

The partnership proposes to address the objective in a close multidisciplinary (geology, mining, robotics, environmental assessment, marine sciences etc.) cooperation between

academia and industry through the complementary actions, while taking technical lessons from other industries, particularly from the oil and gas industry.

Public demonstrations of innovative pilot operations in different regions of the EU and in marine environment for mining different minerals combined with public education on the new solutions contributing to social acceptance of extraction should be achieved by 2020.

**Actions:**

- 1) Automated mining: Developing cost-effective highly automated mining operations to reach deeper seated deposits and to avoid exposure of workers underground with in-situ minerals winning, pre-processing and backfill to reduce the amount of waste rock to be transported to the surface.
- 2) Mining of small deposits: Developing cost-effective and environmentally sound concepts and solutions for exploitation of small or low-grade mineral deposits with pre-processing and refining capacities in their vicinity, using the assets of a larger mine or flexible and mobile mining technologies.
- 3) Alternative mining: Developing safe and environmentally sound alternative techniques to extract the ores, such as “in-situ” leaching, solution mining or applying biotechnologies substantially reducing generation of mining waste and large tailings.
- 4) Deep-sea mining: Developing new concepts and working cost-effective and environmentally-responsible deep-sea mining technological solutions a cost-efficient and pilot for minerals production, with a test-site at which technologies and methods for deep-sea mining can be tested and evaluated under real-world conditions.
- 5) Forest operations: Developing cost-effective and environmentally sound concepts and solutions for automated exploitation of wood from forests.

**Potential players:**

EU, MS, regions and municipalities, industry, academia, research institutes, civil society.

**Impacts:**

Success of these actions would

- Significantly improve Europe’s and also global marine resource base by unlocking deeper deposits in the EU, small deposits not worth exploiting using ‘conventional’ technologies, and global sea-bed deposits using tested and evaluated innovative technologies;
- Create numerous new jobs in mining and equipment manufacturing industries in many regions of the EU, including remote and coastal areas;
- Push Europe to the forefront in the areas of extraction concepts, technologies and related services;

- Reduce both the environmental impact of the mine operation and the risks to the population and natural life caused by potential failures of tailings dams or mining operations;
- Reduce energy and water consumption by the reduction of the volume of materials to be extracted from the mine; it will also contribute to reduction of land use for mineral raw materials provision;
- Improve productivity in harvesting and significantly reduce the risk for soil disturbances from forest machines.
- Facilitate wood mobilisation, enhance the cost-effectiveness of wood supply, and increase the added value of wood products leading to higher competitiveness of European forest based sector. Improve public understanding of new technological solutions and facilitate dialogue on mining opportunities.

**Links with other actions of SIP:**

The actions in the area of Extraction shall enable and facilitate developing the exemplary raw materials exploitation activities in a sustainable way to provide evidence facilitating the Public Awareness, Acceptance and Trust of mining and forest harvesting, and supporting streamlining of the permitting process (Minerals Policy Framework) and ultimately to increase domestic EU production of raw materials.

**Links to other initiatives:**

There is a need to coordinate these actions with the most relevant initiatives in the field, including ERA-MIN and individual national funding programmes in mining, FTP, ETP SMR, United Nations Convention on the Law of the Sea (UNCLOS), and relevant institutions such as the International Seabed Authority (ISA).

***Action area n° I.4: Processing and refining of raw materials***

**Objective:**

Objective of this action area is to develop and demonstrate new holistic processing concepts and systems with higher technical, economic, energy and environmental performance and flexibility, versatility and modularity for processing and recovery of different raw materials from low grade and/or complex feeds with changing composition and logistically distributed material sources along all processing steps and the entire chain of the industrial operations.

**Problem definition:**

Available primary and secondary raw materials feeds are becoming more complex and low grade, and they may also vary in composition over time and contain different size of

particles from coarse to very fine grains. Their efficient processing requires a series of complex and integrated solutions. Processing at industrial scale is usually the most capital- and energy-intensive step in the raw materials value chain and it will only be economically viable when operating at certain size (economy of scale) and for a predictable time taking into consideration volatility of raw materials prices and evolving regulatory framework.

Due to limited availability of water in certain areas there is a need to develop new processes with reduced consumption of water, such as dry processing or using (desalinated) sea water.

The other challenge is linked to the geographic distribution of raw material sources, and the resulting complexity of supply logistics. Modularity, and even mobility of the process solution needs to be considered to meet economic constraints.

Conventional technologies for the processing of industrial minerals are based on the concept where one technology is used for one mineral. All modules of such plants are mostly tailored and optimized for the processing of a single mineral with minimal incorporation of waste from similar mineral processing operations or urban waste.

In every loop of the recycling process, in a paper mill, between 10% and 30% of the incoming material is lost. Main components of these losses are fibre, sludge and plastics.

Today, paper recycling residues are at best used for energy generation, but often incinerated or discarded. Re-introduced to the process fibre residues would increase raw material availability. Conversely, non-fibre residuals may be unwanted in the paper production process, but are a source of many valuable components for other industries. Moreover, obtaining maximum value per unit of paper for recycling is increasingly important economic factor of paper production.

### **Approach:**

The partnership proposes to address the objective in a close multidisciplinary cooperation between research community and industry through the complementary actions to achieve technical leadership in sustainable processing and refining.

Public demonstrations of innovative pilot operations in different regions of the EU for processing different raw materials should be achieved by 2020.

### **Actions:**

- 1) Innovative and flexible processing: Developing new economically viable flexible, and where appropriate mobile or modular, processing solutions, for lower grade and complex ores and industrial residues, industrial and construction minerals and wood-based fibres, of different size of particles, able to process different raw materials in the feed with higher recovery rates and with minimal wastes, and minimal energy and water consumption to provide better separation and higher recovery rates while utilising the potential of unconventional or hybrid technologies;

- 2) Metallurgical systems: Developing a holistic design and optimisation of an integrated metallurgical system (including pyro-, hydro-, bio-, electro-chemistry) for further primary and secondary metals processing and refining, with respect to metal yields, energy and water consumption, environmental footprint and economic viability, considering upstream (pre-processing) and down-stream (treatment/use of metallurgical wastes such as slags, dusts, effluents) interfaces. This could be done via the creation and consolidation of poles of expertise (involving Academia, industry and technology suppliers) in metallurgy as well as sharing of (1) equipment up-scaling, and (2) knowledge in process development and sustainability.
- 3) Paper waste processing: Developing solutions with a full recovery of the material from the feed in a paper mill through combining different elements of innovation to reduce losses, re-use fibre from residues and turning it into value added products and energy carriers, while increasing the process efficiency (including water and energy consumption).

**Potential players:**

EU, MS, regions and municipalities, industry, academia, research institutes, civil society

**Impacts:**

The success of this action would

- unlock a substantial volume of various raw materials from deposits that cannot be economically or environmentally exploited within or outside EU through enabling the better efficiency of exploitation of raw materials' resources and increasing the range and yields of recovered raw materials;
- create numerous new jobs in processing and equipment manufacturing industries
- result in higher economic viability and investment security of processing operations;
- push Europe to the forefront in the area of raw materials processing technologies
- increase the process efficiency (including water and energy consumption);
- increase availability of recovered raw material and create added value products through reducing the quantities of the industrial waste and residues to be disposed or landfilled.

**Links with other actions of SIP:**

The actions in the area of efficient Processing of primary and secondary raw materials shall help to unlock a substantial volume of valuable materials from low grade and/or complex feeds in Europe through increasing the range and yields of recovered raw materials and thus impact on certain actions in the Priority Area "Improving Europe's

waste management regulatory framework conditions and excellence”. The actions shall also reduce the environmental footprint and increase Public Awareness, Acceptance and Trust of raw materials processing operations. For waste paper processing there is a link to legislation on waste, and in particular its implementation in national and local permitting, is often not designed to take the usage of residues (by-streams) in consideration, hindering the usage of by-streams as production facilities

**Links to other initiatives:**

There is a need to coordinate these actions with the most relevant initiatives in the field, including ERA-MIN, PPP on Bio-based Industries, SPIRE, ETP SMR.

***Action area n° I.5: Recycling of raw materials from products, buildings and infrastructure***

**Objective:**

Objective of this action is to develop and demonstrate cost-effective, resource and energy efficient and environmentally sound solutions for recycling and recovery of valuable raw materials from complex products, buildings and infrastructure, and other waste streams.

**Problem definition:**

Advances in many products, buildings and infrastructure, such as energy efficient buildings, Electronic and Electric Equipment (EEE), (electric) vehicles, airplanes, renewable energy installations, multi-barrier packaging solutions, bring to the society benefits in the form of a better performance, reduced transport weight, decreased energy consumption etc.

However, evolution towards more complex products, buildings and infrastructure containing a multitude of metals (including Critical Raw Materials and other technology metals), minerals, wood-based materials, or polymers, creates new challenges for the raw materials recycling.

Generally, the related recovery schemes are complex and imply different steps, including collection and logistics, disassembly and mechanical pre-treatment aimed to selectively removal of hazardous and valuable components; concentration of desirable materials using mechanical and/or chemical processing; and refining and purification of desirable materials.

The major challenge is to minimise losses in different recovery steps, for example, only one third of EEE waste is collected within the official recycling systems in the EU27, or the recycling rate of fibres from beverage cartons is only 37%, compared to overall paper recycling rate in the EU of 70%. Losses also appear during the mechanical pre-processing of complex materials and the chemical/metallurgical processing of rare metals such as rare earth elements, indium, and tantalum.

**Approach:**

In order to address the objective, new innovative separation, sorting, recycling and/or reuse processes are needed to treat complex products and buildings. The partnership proposes to address the objective in a close multidisciplinary cooperation between research community and industry through targeted actions:

**Actions**

- 1) End-of-life products recycling: Developing innovative technological solutions for recovery of technology metals from complex end-of-life products in two subsequent interrelated processing steps: (i) pre-processing technologies for complex products to generate output fraction which optimally fit into subsequent metallurgical extraction and refining; (ii) metallurgical recovery from such output fractions with focus on comprehensive recovery of technology/critical metals from difficult/thermodynamically incompatible mixes (feeds). An interface management and an iterative interdependent development between the two sub-actions are crucial for success and a coordinated approach and close cooperation will be essential. The final stage of the action can be demonstration/pilot processes to test, verify and further improve in practice the results.
- 2) Packaging recycling: Developing innovative technological solutions for recovery of materials from multi-material packaging in order to increase recycling rate. This could be achieved with a modular European waste sorting and raw materials recovery demonstration facility. Such facility would enable testing the efficiency of innovative separation and sorting technologies for packaging under realistic conditions. Knowledge gained from this can aid further development of new packaging solutions with improved recyclability characteristics.
- 3) Construction and demolition (C&D) waste recycling: Developing solutions for a better recovery of construction and demolition (C&D) waste, particularly in the most promising targets, as deconstruction of the non-residential buildings. The aims are to demonstrate (i) the feasibility of increasing the recovery rate of C&D waste (e.g. metals, aggregates, concrete, bricks, plasterboard, glass and wood), and (ii) the economic and environmental advantages associated with C&D waste treatment, thereby closing the current gap between the reality and the overall 2020 recycling target of 70% for C&D waste as set in the Waste Framework Directive.

**Potential players:**

EU, MS, industry, academia, research institutes, civil society

**Impacts:**

- Enabling significantly improved recycling of collected WEEE arising from the new collection targets set out in the 2012 WEEE Directive.
- The action can boost recycling of technology metals which are currently lost or recycled with low rates only. Via its integrated system approach, it will secure a

true holistic optimisation including the final metallurgical step and secure high outputs of a wide range of pure (technology/critical) metals and a better economic viability of recycling. The results of this action can be transferred beyond WEEE to vehicles and other End-of-Life (EoL) products.

- Increasing recycling rate of all packaging materials in Europe from 15-65% (Source: European Packaging Waste Directive) to 50-70%, lowering or maintaining energy consumption in the waste recycling system, enabling the design of innovative packaging solutions that bring benefits to society and are easier to recycle.
- Increasing recycling rate, depending on availability of recycling facilities, of demolition wood to 95 % in 2030 in regions where recycling is possible. In regions where recycling is not a reasonable option, energy recovery will be the preferred option.
- Increasing the recovery rate of aggregates to more than 80% from current 40%, EU27 demand covered by 10-12% from recycled aggregates from current 6%.
- push Europe to the forefront in the area of products and buildings recycling

#### **Links with other actions of SIP:**

The actions in the area of Recycling of products and buildings are linked to the Priority Area “Improving Europe's waste management regulatory framework conditions and excellence” in terms of standardisation, including a classification of construction waste as construction materials; as well as of recycling complex products and buildings containing a lot of valuable raw materials in a cost-effective, resource and energy efficient and environmentally sound way in order to increase domestic EU production of raw materials.

#### **Links to other initiatives:**

There is a need to coordinate these actions with the most relevant initiatives in the field, including ERA-MIN, ETP SMR, FTP.

### **I.C Priority Area: Substitution of raw materials**

#### ***Action area n° I.6: Materials for green technologies***

#### **Objectives:**

The objective of this action area is to promote a coherent set of specific actions that cover the most important application areas for which CRM are a key component and their substitution will make a substantial difference to the competitiveness of European industry (notably in sectors related to the energy, chemical, and automotive industries).

**Problem definition:**

A recent study<sup>1</sup> examined the use of CRM in the six low-carbon energy technologies of SET-Plan. The study concluded that several metals are at a particularly high risk, with special relevance to the wind and photovoltaic energy generation technologies. Catalysts are estimated to be involved in 90% of the commercially produced chemical products at some stage of their manufacture. Catalytic converters, in particular in the automotive sector, now account for over 50% of the end use of PGMs. Even if recycling rates for some of these materials could be optimised to the highest possible extent, the overall increasing CRM demand urges Europe to roll-out substitution-based solutions within the next decade.

**Approach:**

Four synergetic specific actions in overlapping application areas are proposed that are aimed to lead to innovative and sustainable solutions for the reduced use of CRM, or the substitution of these materials, and the systems or products in which they are critically used. This should be done in a close multidisciplinary cooperation between research community and industry.

**Actions:**

- 1) Substitution of heavy REE in magnets: Substitution of heavy rare earth elements, neodymium and praseodymium in permanent magnets and their applications;
- 2) Substitution of CRM in batteries: Reduction / substitution of CRM in rechargeable batteries with new types that have improved energy density, are smaller, use less critical materials and offer the same or better performance and are cost-competitive;
- 3) Substitution of CRM in catalysts: Reduction / substitution of CRM in catalysts in different applications, for instance catalytic converters and electrode catalysts in fuel cells and catalysts used in the chemical industry;
- 4) Substitution of CRM in photovoltaic materials: Reduction / substitution of CRM and harmful substances in new-generation solar cells without decreasing the energy conversion efficiency;

**Potential players:**

The EU and an increasing number of MS have been active in devising a comprehensive policy framework to support the substitution of CRM. R&I activities should be industry-driven yet in close cooperation with research based in universities (in particular through the EERA for the energy technologies) and research centres.

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<sup>1</sup> Critical Metals in Strategic Energy Technologies, Assessing Rare Metals as Supply-Chain Bottlenecks in Low-Carbon Energy Technologies, R.L.Moss, E.Tzimas, H.Kara, P.Willis and J.Kooroshy, 2011 (ISBN 978-92-79-20698-6) [expanded study in preparation].

**Impacts:**

The proposed specific actions should result in

- reduced CRM content in the application and dependency to mitigate the risk from future bottlenecks in the metal supply-chain in energy technologies.
- opened way for the European industry to develop new magnet based technologies to be applied on all scales (generators, earphones, micro-actuators), to become leader in battery technologies for a wide variety of purposes,

**Links with other actions of the SIP:**

Some CRM, notably the PGM, can potentially be more efficiently recycled but ELV directives should be rapidly enforced (Action area n° II.5) as, e.g., currently a substantial part of the used cars contingent leaves the continent. Developing substitution strategies still make sense given the predicted increase of the material needs.

**Links to other initiatives:**

An increased deployment of low-carbon energy technologies is one of the major contributions to make the EU energy system clean, secure and efficient. This is strongly embedded in the EU Strategic Energy Technology Plan (SET-Plan). The availability of high-performing electro-motors and energy storage plays a decisive role in the decarbonisation of the transport sector (electrification of the vehicle) which is one of the key activities of the EGVI PPP. CRM, in particular the PGM, are used as catalysts or as materials for catalytic convertors including fuel cells. This touches upon the activities of the FCH JU and the potential SPIRE PPP

*Action area n° I.7: Materials for electronic devices***Objectives:**

The objective of this action area is to promote a coherent set of specific actions that cover the most important application areas for which CRM are a key component and their substitution will make a substantial difference to the competitiveness of European industry, notably in sectors related to the electronic and lighting industries.

**Problem definition:**

Electric and electronic equipment use substantial amounts of a certain CRM, including indium in transparent conductive coatings on touch screens and "smart windows" and rare earth-based phosphors in solid state lighting (SSL) and flat panel displays. Although the amount of material per product in general is very low, the huge number of products manufactured makes the total amounts very impressive (e.g., 75% of the world production of In is for use in ITO). In particular for these elements, recycling rates are

very low. The full deployment of SSL would represent a substantial reduction in the use of electricity (office buildings use up to 50% of their total electricity consumption for lighting, while this share is 20-30% in hospitals, 15% in factories, 10-15% in schools and 10-12% in residential buildings). However, the high initial purchase cost slows down the market penetration. Price volatility and reduced availability of the CRM needed for the fabrication of the current and future devices could critically hamper their roll out.

**Approach:**

Two specific actions in key application areas are proposed that are aimed to lead to innovative and sustainable solutions for the reduced use of CRM, or the substitution of these materials, and the systems or products in which they are critically used. This should be done in a close multidisciplinary cooperation between research community and industry.

**Actions:**

- 1) Substitution of indium in transparent conductive layers: developing solutions for substitution of indium in transparent conductive layers involving end users from a variety of concerned sectors such as the built environment (smart windows), touch screen, flexible electronics, solar energy and OLED lighting. In particular, Europe is well positioned with the FET Flagship on graphene and the possible Photonics PPP.
- 2) Substitution of CRM in light sources: Cost-effective substitution of CRM in light sources and promote the large scale adoption of new technology in Europe

**Potential players:**

The EU and an increasing number of MS have been active in devising a comprehensive policy framework to support the substitution of CRM. Research and innovation activities should be industry-driven yet in close cooperation with research based in universities (in particular through the possible Photonics PPP) and research centres.

**Impacts:**

The proposed specific actions should result in

- a reduced dependency on CRM to mitigating the risk from future bottlenecks in the material supply-chain.
- Turning the R&D materials leadership into business success and put on the market innovative products that could be mass-produced in Europe using large-area manufacturing processes
- Increased competitiveness of the EU lighting industries.

**Links with other actions of the SIP:**

CRM used in transparent conducting films and advanced lighting sources, notably indium, can potentially be efficiently recycled but WEEE directives should be rapidly

enforced as, e.g., currently the majority of the used electronic devices leave Europe without any pre-treatment. Developing substitution strategies still make sense given the predicted increase of the material needs.

**Links to other initiatives:**

Substitution of indium by carbon based materials, including graphene, is often proposed and thus could be linked to the FET Flagship on graphene. Emerging lighting, including OLED that could partially contribute to the replacement of REE containing phosphors in current generations LED lighting are a focus area in the proposed Photonics PPP under H2020. Energy saving through smart lighting is also in line with initiatives taken by the Smart Cities initiative and the Energy efficient Buildings PPP.

*Action area n° I.8: Materials under extreme conditions*

**Objectives:**

This action promotes coherent set of specific actions that cover the most important application areas for which CRM are a key component and their substitution will make a substantial difference to the competitiveness of European industry (notably in the steel and metallurgy sector, but also and economically more important in sectors that are critically depending on components and systems ).

**Problem definition:**

With high production volumes, super alloys, hard materials and steels alloyed with scarce elements use substantial amounts of refractory metals (W, Mo, Ta, Nb, Hf, Zr, Cr, V, Ti) and other scarce metals (e.g., REE, Re, Ir in heat resistant super alloys, hard materials, speciality steels, and CRM in thermal barrier coatings). Although the direct economic value of these metals and the components in relative terms of the EU GDP is comparatively small, these materials are key to the development of low carbon energy technologies, “green” aircraft engines, hard cutting and mining tools, amongst others.

**Approach:**

Three specific actions in key application areas are proposed that are aimed to lead to innovative and sustainable solutions for the reduced use of CRM, or the substitution of these materials, and the systems or products in which they are critically used. Particular focus is on the substitution of refractory metals and other scarce metals which has been proven very difficult to be done without loss of performance. This should be done in a close multidisciplinary cooperation between research community and industry.

**Actions:**

- 1) Substitution of CRM in heat resistant super alloys;

2) Substitution of CRM in hard materials.

**Potential players:**

The EU and an increasing number of MS have been active in devising a comprehensive policy framework to support the substitution of CRM. R&I activities should be industry-driven yet in close cooperation with research based in universities and research centres.

**Impacts:**

The proposed specific actions should result in:

- availability of new materials with improved performance under extreme conditions that can have a dramatic impact in many industrial sectors, including the energy, transport, tooling and process industry.

**Links with other actions of the SIP:**

Unknown.

**Links to other initiatives:**

The availability of high performance materials that can operate under extreme conditions would allow operating important energy technologies (gas turbines, heat exchanger, fission and fusion reactors...) at higher efficiencies. This is essential for the deployment of low-carbon energy technologies and is as such recognised in the Materials Roadmap Enabling Low Carbon Energy Technologies (SEC (2011) 1609) that supports the implementation of the SET-Plan. These materials are also key for the development of the "Sustainable and Green Engine" (SAGE), one of the Integrated Technology Demonstrators of the Clean Sky Joint Technology Initiative.

***Action area n° 1.9: Applications using materials in large quantities***

**Objectives:**

This action area demonstrates that the substitution of raw materials used in large quantities is feasible in a sustainable and affordable way without loss of functionality. The objective is to reduce the EU's dependency on import of different raw materials, while exploring new innovative technologies and products, and bringing them to the level of industrial production.

**Problem definition:**

In several applications raw materials are used in very large quantities, the number of suppliers can be very small and geographically concentrated. This impacts price volatility and availability of these raw materials.

For example, stainless and alloyed steels contain refractory metals (W, Mo, Ta, Nb, Hf, Zr, Re, Ti) and other scarce metals (e.g. REE, V, Cr). Even though the relative proportion

of these elements is not high, but due to high volumes of the steel, the consumption of these elements is high 13% of tungsten worldwide is used for alloyed steels, and around 6% REEs used in metallurgy.

Natural rubber, currently produced mainly from *hevea brasiliensis* in South East Asia, is used mainly in tyre industry. Europe is largely dependent on its imports of around 1.2 million tons representing 11% of world production. Opportunities exist in the alternative cultivations, such as Dandelions and Guayule, that are technically feasible in Europe or substituting by a different material with similar or better performance as for example synthetic polyisoprene from biomass.

**Approach:**

Specific actions in two key application areas are proposed. This should be done in a close multidisciplinary cooperation between research community and industry.

**Actions:**

- 1) Substitution of *hevea brasiliensis*-based natural rubber in tyres
- 2) Substitution of CRM in super alloys and steels alloyed with scarce elements

**Potential players:**

R&I activities should be industry-driven yet in close cooperation with research based in universities and research centres.

**Impacts:** The proposed specific actions should result in

- reduction of import dependence of rubber used in high-volume applications and diversifying their supply in a sustainable and affordable way, creating a competitive advantage for the EU industry and new jobs.
- Reduce the use of CRM in alloys and steels produced in large volumes for the automotive, medical, pharmaceutical and energy industry.

**Links with other actions of the SIP:** Diversification of natural rubber raw material is also addressed in the international cooperation pillar by enhancing cooperation with African partners.

**Links with other initiatives:** The substitution of natural rubber can be linked to "Innovating for Sustainable Growth: a Bioeconomy for Europe" one of the operational proposals of the Europe 2020 Strategy, contributing to several of its flagship initiatives, including "A Resource Efficient Europe".

Super alloys and steels alloyed with substitutes for scarce, critical, toxic or unsustainable materials have applications in the process and pharmaceutical industry, touching on the activities of the possible PPP SPIRE.

## II. NON-TECHNOLOGY PILLAR

### II.A Priority Area: Improving Europe's raw materials framework conditions

#### *Action area n° II.1: Minerals Policy Framework*

##### **Objectives:**

The objective is to provide a stable and competitive supply of raw materials from EU sources while promoting good governance and facilitating public acceptance. It will be achieved by strengthening the exchange of best practices in the area of mineral policies and related regulation among Member States, that may lead to streamlining the permitting procedure along the whole chain of mining activities (prospecting, exploration, extraction, processing, closure, post closure activities) with regard to the time frame, the regulatory co-authority regime, the financial and administrative conditions, and ensure stable, predictive environment. Another objective is to increase transparency on raw materials availability in the EU. Information on exploration, mineral production, trade, reserves and resources should be standardized and systematically reported by EU and Members States, when information is available and without breaching competition rules.

##### **Problem definition:**

Minerals policies are sometimes not clear and effective enough because they are either dispersed among other policies or have no public and implementation support. Coordination and implementation of minerals policies at different levels (EU, MS regional, local) and horizontally with other sectorial policies is often not straightforward and therefore in some cases contradictory and time consuming. Even in the cases where Member States have recently issued a modern minerals policy strategy, adapted to the needs of society and the economy, this could prove to be ineffective if this policy is not strongly linked with other national policies such as an appropriate land use planning policy, environment policy including biodiversity and mine waste management and also with a common understanding and categorization of mineral deposits of local, regional, national and EU importance.

The permitting procedure is often lengthy and involves many authorities with potentially overlapping and even conflicting requirements. Thus the whole permitting chain sometimes does not have a clear course since various and sometimes repetitive requirements are requested based on different pieces of legislation. Some of the required information is frequently not available to investors at the time of permit application on one hand, and on the other permit applications frequently lack the required information, which should be provided by investors. In many permitting procedure segments, especially at the local / regional level, qualified personnel may be missing or be insufficiently trained. Transparency regarding the permitting procedures as well as the level of permitting fees, royalties, etc. is not always sufficient. The permitting procedure would be enhanced if the EU mineral potential were considered in the design of national mineral and land use planning policies.

Environmental impact assessment (EIA), mining waste management and restoration are important factors in the legislative framework for raw materials. The EIA Directive provides a framework so that effects on the environment are taken into account at the earliest possible stage in all the technical planning and decision-making processes. It is a means to inform decision makers on environmental aspects, challenges, solutions and alternatives. It should also be used in a way that maximises the benefits to the society and enhances the civil society engagement in mining. However, the EIA, either integrated in the authorisation and permitting procedure or as part of land use planning, can be a lengthy and burdensome process, depending on national systems and the number of authorities involved. While the EIA should be seen as an important factor for gaining social acceptance for mining activities, private companies often perceive the EIA as being used as a means to block new extraction sites. The Commission has recently proposed an amendment to the EIA Directive, with a view to addressing the abovementioned shortcomings (COM(2012)628). The proposal is subject to an ordinary (co-decision) legislative procedure.

The management of mining waste from extractive industry Directive (2006/11) provides the framework for the management of waste resulting from whole mining chain. Restoration of mining sites is, in most cases, solved before authorisation. In both cases poor implementation of restoration requirements can cause problems.

Knowledge of raw materials reserves and resources is dispersed and terminology is often heterogeneous throughout the Member States. Reporting standards vary according to the different Member States. Moreover, reporting can serve different purposes and will be adapted accordingly. Information in most cases cannot be used for other reporting uses. Compatibility between the reporting standards used is yet to be ensured.

### **Approach:**

Mineral policies must be developed integrating instruments and mechanisms for guaranteeing the accessibility of the raw materials for the industries and the society, public acceptance and transparency of EU market.

The permitting procedure should be enhanced by considering the EU mineral potential in the design of national mineral and land use planning policies. Regarding the EIA, communication among EIA stakeholders is to be improved.

An appropriate reporting system should be developed, which ensures compatibility between the reporting standards in use without replacing them.

### **Actions:**

#### **MS practices**

- 1) Benchmark analysis of existing national minerals policies against recommendations of Raw Materials Initiative for improvement. Develop a comprehensive guide to relevant EU and Member States' legislation and mineral policy, containing short description and links to the relevant internet sites;

- 2) Carry out at EU level a fitness check to assess the cumulative effect of EU policies/legislation on the non-energy extractive industries (NEEI) and develop a minerals policy scoreboard.
- 3) Develop a permitting toolbox as an outcome of best practice exercise covering the whole chain of mining and all types of permitting authorities, covering the major common elements of geological, mining, spatial development and environmental legislation.
- 4) How to manage mining waste as a resource including how to deal with liability issues around old mine tailings facilities should be explored as well. In addition the Member States' competent authorities should ensure linkages between EIAs prepared at different stages (e.g. regarding exploration and extraction, where time intervals can stretch up to five years) in order to avoid unnecessary repetition.
- 5) Regular exchange of best practices (also based on action II.1.1 – above), via the organization of different targeted workshops aiming at inter alia improving the current EU minerals policy framework. Joint annual meetings at EU level of Member States' mining relevant authorities, agencies, inspectors, including National Geological Surveys. Organize a capacity building for the competent authorities, as well as the capacity of other stakeholders (industry, local community, NGO's).
- 6) Encourage to translate (a) national and regional policy and law, (b) sufficient information of permitting into the appropriate language(s) when appropriate and publish on factsheets or/and websites.

#### **EU guidance and legislation**

- 7) Develop EU guidance with regard to permitting procedures. Set a monitoring system at EU level to assess the real time and identify bottlenecks of the permitting procedure, also with regard to mineral deposits of public importance. Assess, where appropriate, the feasibility of a Framework Directive.
- 8) Develop EU guidance on the streamlined application of the EU environmental legislation (e.g. the EIA Directive) to various mining operations including exploration (if applicable), extraction, processing, waste management, closure, restoration and post-closure activities, including R&D activities through the whole mining chain, taking into account the results of the on-going co-decision procedure on the amendment to the EIA Directive<sup>2</sup>.
- 9) Application of the concept of mineral deposits of public importance as to facilitate investment in similar way as for hydrocarbons but ensuring that mineral property rights are sufficiently protected.
- 10) Explore the feasibility of implementing existing rules or developing alternative ones (at first the recommendations) for the exploitation of sub-surface and deep sea

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<sup>2</sup> (COM(2012)628)

resources, across Member States borders taking into account UNCLOS when sea resources are considered.

### **Communication**

- 11) Ensure at EU level better communication and dissemination of the Commission's guidance on Natura 2000 and non-energy extractive industries (in relation to Appropriate Assessment under the Habitats Directive), which is currently not well known and generally applied among Member States' competent authorities.
- 12) Develop guidelines with EU reporting standards based on internationally accepted conventions with regard to raw materials. This will include the standardized input, data and outputs, supply chain due diligence as well as the transparency of sources and information. Develop national and EU mineral reporting schemes (including mineral yearbooks, reporting on reserves and resources) based on standard terminology.

### **Potential players:**

EU, MS, industry, academia, local communities.

### **Impacts:**

The successful implementation should

- Promote, by good governance, the investment into minerals sector, and consequently increase the sustainable minerals supply from EU sources.
- Lead to transparent and streamlined permitting procedures in a predefined timing, financial and fiscal framework together with other stable conditions, which would increase the interest for exploration as well as extraction of raw materials.
- Improve the environmental management, including the EIA. This will reduce time and costs on one hand and increase stakeholders' engagement and trust on the other.
- Improve the transparency of information on raw materials through public reporting. This will allow prudent use of existing and future mineral deposits as well as former mining site to be re-opened if appropriate.
- Contribute to develop monitoring systems on raw materials flows and early warning systems on EU dependency on certain raw materials.

### **Links with other action of the SIP:**

This action has strong link with the action areas "Exploration" and "Innovative extraction of raw materials" and the priority area of Strategic international dialogues.

**Links with other initiatives:**

A revised EIA Directive is undergoing the EU legislative procedure (see: <http://ec.europa.eu/environment/eia/review.htm>). On mining waste, a study on establishment of guidelines for the inspection of mining waste facilities, inventory and rehabilitation of abandoned facilities and review of the BREF document has been carried out for the European Commission

(see: <http://ec.europa.eu/environment/waste/mining/legis.htm> under 'Studies').

***Action area n° II.2: Access to Mineral Potential in the EU*****Objectives:**

Objective of this action area is to foster access to known and still undiscovered mineral deposits, improve the conditions for sustainable access and supply of raw materials in the EU and safeguard the mineral wealth for future generations by classifying within a regulatory framework, the importance for society of certain mineral deposits. With regard to the land use planning or marine spatial plans the aim is to ensure that NEEI are considered on equal terms as all other, often competing sectors such as agriculture, forestry, housing, industrial areas, etc. This would ensure an appropriate time frame for long term investment into minerals extraction and processing/refining.

**Problem definition**

While the overall potential for mining and quarrying in Europe is strong, the area available for extraction in the EU is constantly decreasing, turning access to land into a key challenge for the extractive industry. Competing land use like building can sterilise deposits for future use. On the other hand Europe is under-explored with regard to subsurface (under 150 meters) and at sea in the EU Member States exclusive economic zones.

**Approach:**

Introducing and applying the concept of mineral deposit of public importance would increase the mineral potential within EU. Mineral deposits of public importance on different levels (local, regional, national, EU) once defined, will be safeguarded with various levels of protection for potential future extraction.

Land use planning policies at different levels (local, regional, national) should be better co-ordinated and linked with the general rules and guidelines for minerals land use planning issued at national level covering potential, current and past extractive areas. These rules and guidelines should include tools and mechanisms for forecasting long term supply of raw materials which are important at local, regional, national and EU level in view of the foreseen demand. Land use planning procedures are long and NEEI are mostly considered as an environmental degradation, not as an economic activity that

is temporarily using land, therefore receiving a relatively low ranking compared to other land uses such as urbanization, nature conservation, agriculture, infrastructure, recreation etc. Procedures should include also mine closure and potential future use of closed mines and/or processing facilities.

#### **Actions:**

#### **Implementation of the concept of “mineral deposit of public importance”**

- 1) Elaborate the detailed definition and qualifying conditions of the concept of mineral deposits of public importance covering but not limited to critical raw materials’ occurrences and in next step define and map deposits of local, regional, national or EU interest and importance.
- 2) Examine how to incorporate the concept of mineral deposits of public importance in the national and regional minerals policies. Take into account the issue of minerals export potential when designing national minerals policies.
- 3) Intensify the general exploration/public identification of mineral potential through MS and EU funds and/or by designating exploration as potentially tax-deductible research foster private investment into exploration.

#### **EU legislation**

- 4) Safeguard mineral deposits of public importance at the relevant level (local, regional, national, EU) with an adequate regulatory framework (similar to NATURA 2000 with regard to safeguard natural assets). The full range of options will be considered from taking no action, to the development of guidance or of a legislative proposal following an appropriate impact assessment covering all possible options.
- 5) Develop the INSPIRE directive guidelines where this is not the case yet to fully integrate them into the above policies and planning practices and support the capacity building in its implementation.

#### **MS practices and EU guidance on land use planning**

- 6) Exchange the practices in the minerals land use planning related to minerals management and develop guidelines for a long term sustainable minerals supply planning at different levels (local, regional, national, EU) that would include NEEI logistics (transportation routes, processing, manufacturing plants).
- 7) Explore the feasibility of applying an integrated mapping combining land use planning and sub-surface use planning. In addition develop the INSPIRE directive guidelines where this is not the case yet to fully integrate them into the above policies and planning practices and support the capacity building in its implementation.
- 8) Link land use planning policies to national minerals policies and incorporate the concept of mineral deposits of public importance where the results of research

projects on geological availability need to be made available to the planning authorities. Not only should basic or detailed known deposits be considered, but also land-use plans should be regularly adaptable to incorporate new knowledge from detailed exploration work.

**Potential players:**

EU, MS (mining and planning authorities or agencies, geological surveys), industry, academia.

**Impact:**

Successful implementation of this action should

- Allow prudent use of existing and future minerals reserves and resources. Clear and efficient land use planning procedures and decisions related to minerals will safeguard access to mineral deposits, enhance public awareness, acceptance, and trust and simplify the permitting framework and encourage investment in NEEI in the areas with mineral potential.

**Links with other actions in the SIP:**

This action area has a strong link with the action areas “Exploration” and “Innovative extraction of raw materials” and the priority area” Strategic international dialogues” (Cooperation with Australia, US , Canada, South Africa and Latin America on promoting the positive impacts of mining (environmental and social) including exchange of best practices on integration of raw materials in land use planning).

**Links with other initiatives:**

Member States’ minerals safeguarding initiatives.

***Action area n° II.3: Public Awareness, Acceptance and Trust***

**Objective:**

The initiative, mostly industry-led, but also supported by all concerned stakeholders (communities, institutions and regulatory bodies at all levels – local, regional, national, European – medias, NGOs, academia, schools, etc.) is dealing with increasing at first the public awareness of the benefits and potential costs of the raw materials supply, secondly obtaining its acceptance and finally gaining the trust for the activities of the sector throughout its production cycle. This action area aims at enhancing public acceptance and trust by improved communication and transparency, notably during the permitting procedure and the production cycle (exploration, mine operation, after-mining).

## **Problem definition**

While public awareness is not only the concern of industry, but also other stakeholders, the acceptance and trust are predominantly in the industry focus. Public awareness is the first step in facilitating the raw materials supply. It is followed by the acceptance and lastly also the trust, that are more linked to the supply locations. All three are crucial for fostering the supply of raw materials from EU sources, and would have a positive impact on the regulatory framework and smooth licensing procedures. Public awareness, and in particular the acceptance and trust are linked to the mining industry performance particularly to the public perception of environmental and social aspects.

While in general, public mistrust in some Member States toward the raw materials sector is sometimes based on bad mining legacy and to accidents, it often derives just from prejudices and lack of awareness of the importance of raw materials for the society.

There is also a need to change misperceptions on wood extraction and modern forest management and to assure society that sustainable forest management and forests' ecological services can be reconciled with the economic activity and contribute to the economy and creates jobs in particular in rural areas.

## **Approach:**

Appropriate actions that will clearly outline the positive and negative impacts of the sector, such as benefits for the society, wealth and transparency, but also possible trade-offs and mitigation measures (best practices) can increase awareness, acceptance and trust.

## **Actions**

- 1) Incorporate recent best practice examples of communication with stakeholders tailored for EU conditions (densely populated areas, different cultural and social background, and the integration of mining activities into the landscape)
- 2) Promote early and open communication with neighbours and local communities explain the advantages of modern mining, the mitigation strategies put in place to avoid undesired impacts explaining the environmental challenges and solutions envisaged. Information and communication should start as early as possible. Possible guidance to brokering mutual benefit for developers, authorities and local communities.
- 3) Launching a multi-stakeholder industry led information campaign to promote raw materials exploration and extraction and education on different levels (e.g. organization of -EU Minerals Days)
- 4) Encourage industry to adopt and raise awareness of the extent to which industry adheres to the voluntary codes based on good governance and sustainable, transparent performance (e.g. EMAS, ISO, CSR, GRI sustainability assessments, ICMM Sustainable Development Framework, FSC and PEFC or others).

**Potential players:**

, Industry MS, EU, academia, local community, NGOs

**Impacts:**

The successful implementation of this action should

- Contribute to increasing knowledge and building trust in the resource companies and enhance acceptance of their activities.

**Links with other actions in the SIP:**

This action area has strong link with the other two action areas: mineral Policy Framework and Access to EU Mineral potential as well as with the priority area: Strategic international dialogues (Promoting inward investments into European mining; Cooperation with Australia, US , Canada, South Africa and Latin America on promoting the positive impacts of mining (on economic growth and employment as well as environmental and social well-being) including exchange of best practices in land use planning).

**Links with other initiatives: GRI, EITI, ISO****II.B Priority Area: Improving Europe's waste management framework conditions and excellence*****Action area n° II.4: Product design for optimised use of (critical) raw materials and increased quality of recycling*****Objective:**

The objective of this action area is to minimise critical and other raw materials needed in products to perform particular functions, support product life extension and maximise the amount of materials recycled/reused through the development of new design strategies for various product ranges. Overall, it will help define a coherent resource-efficient product policy framework, thereby contributing to a sustainable supply of raw materials through resource efficiency and recycling.

**Problem definition:**

In view of the current pressure on raw materials, product designers have three strategies at their disposal: 1) material efficiency, 2) product life extension and 3) product recycling. Raw materials selection and product design at the manufacturing stage largely impact the potential for substitution, reuse and recycling.

Products are becoming increasingly complex, in particular those containing technology/critical metals. They are sometimes designed in a way that makes their

dismantling and recycling difficult, thereby uneconomic or simply impossible. Another challenge is to determine *when* to apply *which* product life extension strategy. For this, there is a need to understand how to optimise product lifespan (e.g. product refurbishment) from a sustainability perspective without compromising the product's economic viability.

In most cases, recyclers miss information on the presence of critical raw materials (rare earth metals, copper, silver, etc...) in products or on how they may be recovered. Information required for proper pre-processing and recycling does not currently accompany the product through its lifecycle, so waste flows are not monitored properly.

**Approach:**

The idea behind this action area is to address the issue of product design and its impact on the use of raw materials and their recovery, through a range of regulatory and non-regulatory/voluntary measures.

**Actions:**

- 1) Eco-design Directive: This action would consist in increasing – where feasible – the emphasis on raw materials and material efficiency, without loss of functionality, in the implementation of the Eco-design Directive (also known as the Energy-Related Products Directive). This action could be implemented through a step-wise approach starting with one or two product groups so as to validate the approach and assess its economic and technological viability and effectiveness, and then gradually be extended to other product groups, if appropriate. Priority could initially be given to relatively simple type of Eco-design requirements that focus for example on use of materials (weight, volume, substitutes), the consumption of materials throughout the life cycle, or improving the extractability of key components (those that have a greater amount of critical/precious raw materials and greater impacts on the products life cycle) in order to increase the ease of reuse and recycling. At a second stage, and subject to methodological improvement on standardised measurements, Eco-design requirements aimed at setting minimum material requirements, i.e. recyclability requirement for products (or certain key components) could be considered further. For this action, attention must be paid to the need to develop clear and robust material requirements and to ensure market surveillance in all EU Member States to avoid distortion of competition.
- 2) EU-wide research on product life extension strategies and development of sustainable circular business models. This action would develop an improved understanding of the extent to which product lifespans have been changing, and to assess the degree to which changing lifespans are affecting overall environmental impacts. This work would use waste stream data and could result in either requirements to collect more detailed data and regulations / standards to address product life and corresponding recycling. This action would also develop an understanding of requirements when designing a product that is to be refurbished several times during its life. For instance, this will require designers to obtain in depth knowledge of how the product and its parts wear and tear, and of how to decide which parts should last, and which should be replaced,

and when. Functional, emotional, aesthetic and economic considerations will all play a role. In respect to legal product requirements such information will be invaluable. Developing such business models and successfully bringing them to the market would require collaboration between various stakeholders.

- 3) Critical Raw Materials in product and waste flows: this action should help increase the knowledge on the presence of Critical Raw Materials (CRM) in complex products, so as to improve recycling rates.

It would involve encouraging further development and uptake of environmental product declarations (i.e. “type III” declarations as described in ISO 14025, which are primarily intended for use in business-to-business communication) that include bill of material, as well as improving the monitoring of e-waste flows. The PEP ecopassport program (see [www.pep-ecopassport.org](http://www.pep-ecopassport.org)), covering electrical, electronic and heating & cooling industries, could be a starting point and/or serve as a good model. This action could also be linked to the further refinement of a product environmental footprint methodology (see the Communication from the European Commission on Building the Single Market for Green Products and the Commission Recommendation on the use of the Product Environmental Footprint (PEF)).

This action would also involve making use of advanced ICT technologies to trace materials in products and wastes, to include information required to maximize the recovery of materials and to improve control of waste flows.

Prerequisites for the action are participation of the different actors in the supply chain and the further development of appropriate standards. Implementation would be done based on pilots for specific e-waste streams on a voluntary basis and in respect of confidential business information.

**Potential players:**

EU, MS, industry, academia, standardisation bodies, NGOs

**Impacts:**

The full potential of the circular economy is estimated at 540 billion Euro (USD 700 billion) in materials savings alone. These actions are expected to increase raw materials recovery for collected e-waste and increase the recovery levels of critical raw materials e.g. rare earth metals, indium, tantalum, from currently less than 1%.

**Link with other action areas of the SIP:**

This action is linked to actions on “Optimised waste flows for increased recycling” and “Optimised raw materials flows along value chains”.

**Link to other initiatives:**

There is an overlap between the action on “critical raw materials in product and waste flows” and a recommendation by the European Resource Efficiency Platform

## *Action area n° II.5: Optimised waste flows for increased recycling*

### **Objective:**

The objective of this action area is to boost the quality and quantity of collected waste/end-of-life products, in particular those containing technology/critical metals and minerals in significant quantities – and improve the life-cycle management of products, thereby preventing losses of valuable raw materials and to then ensure their high quality treatment and recycling. This would in turn help further develop recycling activities, promote increased access to secondary raw materials and reduce the EU dependency on imports of many of these metals, including critical metals, in the EU, thereby contributing to increasing the share of industry in Europe's GDP.

### **Problem definition:**

Many high-tech metals, essential for EU high-tech industries, still have global recycling rates below 1% after decades of use. Across the EU, only one third of WEEE generated is properly collected and recycled according to official statistics. Very low collection rates for certain end-of-life consumer products containing technology/critical metals prevent end-of-life products from entering the recycling chain, although existing recycling technology would permit their recovery. There are insufficient economic incentives for collection and recycling of certain valuable and critical materials (technology/critical metals) within the EU. The relatively small amounts Critical Raw Materials (CRMs) used in Printed Circuit Boards (PCBs) make separation of CRMs in WEEE currently uneconomic. The fragmentation of some recycling value chains also comes into play.

Current recycling rates for wood are rather low – 40%, partially due to contamination of recovered wood and insufficient logistics for collection of dispersed materials. Much of used wood still ends up in landfill 30% - 25% with a lost opportunity to increase supply of valuable secondary raw materials. Out of the 85 million tons of paper consumed in Europe, 70% is already recycled. There is a potential to further increase collection rates by about 10 million tons of paper, currently landfilled or incinerated.

In addition, not all collection practices allow for optimal recycling. As at mid-2013, several Member States continue operating the comingled collection of paper, metals, plastics and glass streams, which may be detrimental to the quality and quantity of recycled materials.

Moreover, although EU waste legislation includes a combination of collection targets and recycling/recovery targets (e.g. for packaging, tyres, end-of-life vehicles, batteries and WEEE), these are weight-based, which means that there is no incentive to recycle critical materials. These materials therefore end up in slag, road constructions or waste deposits.

Extended Producer Responsibility (EPR) schemes can achieve a closing of the loop for raw materials recycling. For instance, when the pre-paid fees can contribute to the emergence of recycling facilities (investments), since long-term contracts with waste-operators allow them to invest. However, the efficiency and effectiveness of EPR schemes vary considerably among EU Member States.

Finally, there is currently insufficient understanding of the behaviour of consumers and of other stakeholders and of what the psychological, economic and practical drivers of reuse and recycling are. As an illustration, thousands of tonnes of used batteries and WEEE are kept by consumers in drawers.

**Approach:**

The approach of this action area involves improving the regulatory framework conditions and developing innovative business models and infrastructures (e.g. deposit systems or leasing) for increased recycling.

**Actions:**

- 1) **Qualitative targets:** Qualitative targets in EU legislation that are smart and pragmatic would trigger the development of technology in the field of collection, pre-treatment and recycling to cope with more complex products. For these targets to be achieved, the development of infrastructures, know-how, technologies, tracking etc. is needed. This action could involve developing more relevant and category-specific targets and/or setting criteria for such targets for certain waste streams (such as batteries, WEEE, end-of-life vehicles, wood) and prioritizing certain materials including critical raw materials and materials which may have high environmental impacts and/or have a high energy content (such as aluminium), and introducing the notion of overall material yield and life-cycle environmental impacts (rather than focusing on total weight).

To this end, the European standardisation process could be further used, taking into account the need to set qualitative targets that are technically and economically feasible, the fact that material contents in products and waste are changing over time, the need to avoid excessive information requirements and the market demand for secondary raw materials of various quality grades. New targets should support application of the waste hierarchy and take account of life-cycle environmental impacts as well as raw material specifications including on recovery of materials. Targets' achievement calculation also needs to be harmonised – detailed definition of data to be collected and processed, which will guarantee comparability at EU level. In addition, implementation of new targets could be done in stages taking account of the stages of achievement of collection targets in Member States having more or less developed waste management systems.

- 2) **Landfill ban for recyclable waste and incineration ban for certain waste:** Paper and wood as well as other recyclable materials such as glass, metals, etc. should be considered for an EU list of waste banned from landfill. In this context, lists that currently apply e.g. in the Netherlands, Germany, Austria, Sweden, Denmark, France, Belgium, Norway and various US states and Canadian provinces should be considered.

As for the waste to be subject to a ban on incineration, it should apply to waste that has not been subject to source separation or sorting and also to separated/sorted waste that may be recycled under technically and economically feasible and

environmentally safe conditions. To this end, a separate EU list should be developed and gradually expanded.

This action could involve a number of measures to clearly define the scope and to increase the effectiveness of the landfill and incineration bans on re-usable/recyclable materials, such as 1) Establish – and gradually expand – lists under relevant EU legislation of waste categories that are to be banned from landfill and incineration respectively, taking into account their materials content, environmental impacts and the possibility of re-use/recycling under technically and economically feasible and environmentally safe conditions in the different Member States of the EU; 2) Define common classification of recovered material and of contamination limits, to facilitate trade; 3) Improve the organisation structure and logistics for the collection of post-consumer waste at national and municipal levels; 4) Clarify the status of used recycled materials as secondary raw materials in the EU legislation and standards (Waste Framework Directive and relevant standards).

- 3) Waste collection systems and Extended Producer Responsibility (EPR) Schemes: This action could involve mapping and assessing existing waste collection systems in Member States, including the economic advantages of different approaches and barriers for implementation (e.g. in relation to moving from co-mingled systems to separate collection for paper, metal, glass and plastic waste) and sharing good practices. It could also involve consideration of the need to strengthen the provision on separate collection in the Waste Framework Directive. Furthermore, it could involve sharing at EU level of best practices found in EPR schemes operating in EU Member States, looking into their economic, social and environmental impacts, and ways to ensure that 1) there are incentives for consumers to return end-of-life products, that costs for business do not disproportionately increase; 2) there is transparency in the operating method, financing and reporting; 3) that any additional costs for municipalities are covered through the national EPR scheme where appropriate – in this respect the mission of collection schemes should be defined so as to avoid a pure economic approach which would neglect other strategic objectives such as recycling or access to raw materials. It would also look into EPR schemes which 4/ further promote traceability of end-of-life materials, from collection, pre-treatment to recycling as well as integration into new products including the development of appropriate tracing and tracking technologies as well as verifiable documentation tools, if necessary to be set and managed by administration.
- 4) Innovative approaches and infrastructures for reuse and recovery of end-of-life consumer products: This action would involve analysing and benchmarking several business models integrating the whole recycling value chain, (e.g. service-based models such as *leasing*, market-based mechanisms such as *product take-back* or *deposit-return systems*), identifying the successful models (e.g. in municipalities achieving over 75% recycling) and practical hurdles to innovative business models. This should cover a better understanding of the factors that influence consumer acceptance of new ownership models and other product service systems.

The action would take a material specific approach and attempting to close the recycling loop by applying a successful innovative approach/business model: Focus could be on a short list of selected substances, based on the list of 14 critical raw materials identified by the European Commission in 2010.

The action would then imply developing the Business Model Blueprint focusing on integration of the different activities of the recycling value chain and on the economic and environmental benefits that can be generated (e.g. establish what quantities of WEEE are necessary to secure adequate feedstock; identify optimum logistics and processing models).

The next step would be to pilot the implementation and measure the results, starting with a number of pilot product groups/regions, in order to then further extend the approach to more products and regions incorporating “lessons learned” and fine-tuning the business models including consideration of specific regional/cultural characteristics.

**Potential players:**

EU, CEN/CENELEC, MS, industry, academia, NGOs

**Impacts:**

There is a potential to further increase collection rates by about 10 million tons of paper, currently disposed of by landfill (or incineration) and up to 15 million m<sup>3</sup> of used wood annually.

Extended producer responsibility, if well applied in combination with other economic and legal instruments, can promote sustainable production and consumption behaviours, enhance waste management performance and move towards a European recycling society. An additional €1 Bn could be generated in the EU economy by increasing efficiency in recycling and recovery of WEEE. In France, new investment in recycling facilities was achieved through EPR in implementing the WEEE Directive. Decision-making to invest in facilities was facilitated through having a flow of money (financed through consumption) going to compliance schemes (controlled by the national authorities). 5 years after the beginning, more than 3000 jobs directly related to WEEE recycling were created and more than 20 plants taken into operation.

**Link with other action areas of the SIP:**

The action area is linked with Action area “Recycling of raw materials from products and buildings” and action on Eco-design Directive, the “Action areas “Optimised raw materials flows along value chains” and “Optimised material recovery”. It is also linked to certain action areas from the Technology pillar and is expected to have an impact on the Action areas “Materials for green energy technologies” and “Materials for electronic devices”.

**Link to other initiatives:**

There is an overlap between the actions on targets, on EPR and on landfill ban and a recommendation by the European Resource Efficiency Platform. A study on good practices and guidance on Extended Producer Responsibility was launched recently by DG Environment, see <http://epr.eu-smr.eu/>. The Commission is currently also carrying out a waste target review to be completed in 2014, see [http://ec.europa.eu/environment/waste/target\\_review.htm](http://ec.europa.eu/environment/waste/target_review.htm).

***Action area n° II.6: Prevention of illegal shipments of waste*****Objective:**

The objective of the action area is to prevent illegal shipments of waste from the EU to non-EU countries, thereby preventing losses of valuable raw materials, to ensure that more waste is treated in a way that increases reuse and recycling, taking into account effects on human health and the environment (implementing the environmental sound management provision of the EU Waste Shipment Regulation), and to avoid unfair competition.

**Problem definition:** Over the last decades EU exports of valuable waste materials have increased dramatically, while imports have dropped significantly. Illegal shipments of waste are difficult to quantify, but are said to be around 20-25% of all shipments according to IMPEL. Illegal shipments and poor recycling have adverse effects on human health and the environment, create unfair competition for law abiding operators and give rise to losses of valuable resources in case of poor or no treatment. However, port authorities and enforcement authorities have limited resources to control the ever increasing amount of material shipped and this without blocking the normal traffic. In addition, at the moment, there is no distinction in customs codes between “new goods” and “second hand goods” which implies that illegal waste shipments are often disguised as “second hand goods”.

**Approach:**

This action area addresses waste shipments inspections and certification of end-processing/recycling.

**Actions:**

- 1) Improved Waste Shipment Inspections: Implementing a risk-based approach by Member States' customs/port authorities to facilitate targeted controls of high risk shipments at all relevant EU ports, so as to better enforce the Waste Shipment Regulation and prevent illegal shipments. By extending existing customs co-operation within the EU – and with key countries of destination – identification of high risk shipments would be made according to the type of material shipped, the origin and the destination. Targeted checks would also be facilitated through

matching waste and customs codes and through identification of second hand goods in customs codes. In addition, better coordination, collaboration and information sharing between ports in Europe would be promoted and further efforts made to end differences in interpretation of the Regulation and other relevant legislation such as the provisions of the WEEE Directive on testing and on shipments of defective goods for repair under warranty.

- 2) **Certification for end-processing/recycling facilities:** This action could involve the setting up of a mandatory or voluntary certification scheme for end processing/recycling facilities for certain waste streams. It could start with those non-hazardous waste streams that are priority streams in terms of material supply risks and economic importance (criticality) and environmental/health impacts and for which appropriate EU, CEN/CENELEC, OECD, ISO and/or Basel Convention requirements, guidelines or standards exist or are under development. It would not apply to materials meeting applicable end-of-waste criteria. The certification scheme could include minimum standards and a verification procedure based on traceability through the supply chain from collection to end-processing. The action could lead to the establishment of a framework, while specific requirements could be developed in applications-specific standards. Inspection and certification could be done by accredited independent certifiers. When developing a scheme, a number of conditions must be met: (1) full compliance with applicable WTO rules and rules and principles of the Basel Convention, (2) no additional administrative burden for European SMEs in relation to the Waste Shipment Regulation, i.e. overall simplification compared to the existing situation, (3) full compliance with the principles of subsidiarity and proportionality of the EU Treaty. In addition, experiences from existing schemes should be analysed and taken into account.

**Potential players:**

EU, MS, IMPEL-TFS, Basel Convention Secretariat, customs authorities of Member States, industry, academia, customs/environmental authorities in key third countries, CEN/CENELEC

**Impacts:**

The actions should lead to a significant reduction of illegal waste shipments from current estimated levels of around 20-25%.

**Link with other action areas of the SIP:**

Progress on advanced ICT technologies to trace wastes should also be taken into account. This Action area has a close link to the International co-operation on health, safety and environment (specifically on recycling).

**Link to other initiatives:**

The Commission is about to propose harmonised EU legislative criteria and requirements for waste shipment inspections. IMPEL-TFS and Interpol are active in the area of illegal

waste shipments. The EU Expert Group on Customs Action to protect Health, Cultural Heritage, the Environment and Nature has a subgroup addressing waste shipment. A study has recently been carried out for the European Commission (DG Enterprise and Industry) on options for a certification scheme for the recycling of waste exported from the EU (available at [http://ec.europa.eu/enterprise/policies/raw-materials/files/docs/recycling-treatment-facilities-rpa2012-report\\_en.pdf](http://ec.europa.eu/enterprise/policies/raw-materials/files/docs/recycling-treatment-facilities-rpa2012-report_en.pdf)). At the 11<sup>th</sup> meeting of the Conference of Parties to the Basel Convention in May 2013, a framework on environmentally sound management of hazardous wastes and other wastes, which includes references to certification, was adopted. An FP7 project called CWIT (Countering WEEE Illegal Trade) aims to quantify the volumes of WEEE in Europe, develop detailed understanding of the destinations and routes used to carry illegal shipments, and to provide a set of recommendations to support the European Commission, law enforcement authorities, and customs organisations countering the illegal trade of WEEE in Europe.

### *Action area n° II.7: Optimised material recovery*

#### **Objective:**

The objective of the actions in this area is to improve the quality of recycled material by developing standards for e-waste recycling and encouraging the transition from waste to secondary raw materials.

#### **Problem definition:**

As far as WEEE are concerned, many high value and critical raw materials are currently not recycled. However, the WEEE Forum has developed, in co-operation with stakeholders from the producers and WEEE processors community, a set of standards concerning collection, transport, handling, storage, preparation of re-use and pre-processing of WEEE. ('WEEELABEX' project). The private WEEELABEX standards have, in the meantime, been lodged with CENELEC to be turned into a set of EN standards by 2013-15. The standards lay down requirements to be respected in order to meet high quality demands. They will cover preparation for re-use, pre-treatment and should be complemented by a standard on the end-processing of WEEE fractions (for recovery of the metals). Yet, they do not specify the type of high value and critical raw materials that are to be recovered.

The different legal status of waste vs. (recycled) materials in Member States (e.g. truck casings suitable for retreading) weakens customer confidence in the product quality resulting in a lack of incentive for reuse or recycling. E.g. 40% of truck casings suitable for retreading are not collected for reuse.

#### **Approach:**

The idea behind this action area is to optimise the recovery of materials, by developing a set of normative requirements with respect to the recovery of precious metals, e.g. Au,

Ag, Pd, and/or critical raw materials from specific types of WEEE, and by assessing the impact of end-of-waste criteria and where appropriate adopting additional end-of-waste criteria.

**Actions:**

- 1) European standards for treatment of WEEE maximising the recovery of high value and critical raw materials. This action involves enhancing the standards developed in the WEEELABEX project, to cover end-processing of WEEE fractions and specify the type of high value and critical raw materials to be recovered,, while also paying attention to proper treatment of residual (plastic) waste. This action would involve the following steps:
  - Research on existence of critical raw materials in specific types of WEEE
  - Draft set of requirements, including on the end-processing of the WEEE fractions to ensure proper recovery of high value and critical raw materials (and proper treatment of residual waste), and lodge with CENELEC
  - CENELEC standard, or amendment to existing standards
- 2) Close monitoring of the impact of existing end-of-waste criteria on internal EU recycling markets (e.g. for iron and steel scrap) and adoption of additional end-of-waste criteria (e.g. for tyres) where appropriate.

**Potential players:** CENELEC, EU, national standardisation bodies, industry

**Impacts:** Not estimated

**Link with other action areas of the SIP:**

The Action area can be linked to the actions on optimised waste flows for increased recycling

**Link to other initiatives:**

On the basis of article 8(5) of the WEEE Directive 2012/19/EU, the Commission has requested the European Standardization Organizations to develop European standards for the treatment of WEEE. The mandate is available for download in <http://ec.europa.eu/environment/waste/weee/pdf/m518%20EN.pdf>.

## **II.C Priority Area: Knowledge, skills and raw materials flows**

### ***Action area n° II.8: European Union Raw Materials Knowledge Base***

**Objective:**

The European Union Raw Materials Knowledge Base (EURMKB) will provide EU level data and information on raw materials from different sources in a harmonized and

standardized way. This will encourage activities of the raw materials sector, not only regarding exploration, extraction, processing/refining and recycling, but also trade, development, skills and education. This will consequently increase the supply of raw materials as well as strengthen Europe's position on the forefront of the RM sector. The action on knowledge base is the foundation for the technology and non-technology priority areas as well as a base for the international cooperation pillar.

**Problem definition:**

Data and information on raw materials in the EU, when existing, is scattered across different institutions, from ministries, agencies, geological surveys to research institutes, universities and other organizations. These data and information are stored in various formats, albeit being used for the same purposes. Because there is no raw materials knowledge infrastructure on EU level, data and information are not harmonized or standardized and therefore difficult to find and compare among MS in order to get compiled EU information. The outcomes (data) of projects ordered by the EU, and of other relevant projects are not maintained and updated after the end of projects. There is stakeholders' need (industry, investments, policy making) for reliable and uniform EU level data and information on raw materials and related skills to make use of them.

**Approach:**

A EURMKB on raw materials will serve both industry and policy making and create an added value on EU as well as on the data source level. It should provide a service containing the raw materials information infrastructure and intelligence, and could, if deemed appropriate, be organised as a permanent body. Close international co-operation could eventually lead to a world knowledge base on raw materials.

A EURMKB, providing a service at European level, should together with Member States collect, store, maintain, up-grade, analyse and disseminate data and information along the whole value chain on European raw materials. The raw materials are from primary and secondary sources, as well as stocks in use, namely metals, industrial minerals, construction materials, wood and natural rubber. The issue of confidential information should be addressed.

Data and information will be collected from sources such as EUROSTAT, JRC, Member States' relevant agencies, other national and international organizations, MS and EU funded projects and programmes, as well as industry. The EURMKB will apply EU and global standards; maintain and up-date the data and information and make it available to public through internet and publications. Selected parts of data and information will be analysed and reported to public as an expertise, such as Material flow analysis (MFA) for metals, including the recycling value chain of given applications (e.g. end-of-life vehicles, including tyres or WEEE). Spatial data will be available in an INSPIRE-compliant way, as well as in 3D when appropriate.

Data, information and expertise will serve the society; in particular markets (including investors, mining, wood based, recycling and down-stream industries), MS governments

and other lower level (regional, local) authorities, as well as the citizens (education, general public ...).

**Actions:**

- 1) Develop the appropriate conditions to provide a service, with structure that will include information infrastructure and intelligence, by starting with establishing and operating the technical groups that will define, implement and monitor the EURMKB development.
- 2) Organize relevant data input and establish relevant EU / global standards ensuring that the knowledge base would be interoperable with national databases and other relevant databases (such as FP7 projects). The databases should incorporate data and information of primary and secondary raw materials. Maps and evaluation of European stocks (primary mineral deposits, forests, waste facilities, tailings, urban mines and stocks in use of raw materials and their state. For secondary raw materials, the urban mine inventory should include also materials flows of end-of-life products (including tyres and e-waste) throughout the entire recycling chain (supported by the development of appropriate tracking and tracing technologies) with the stress on critical raw materials. It should also include information on existing techniques/technologies and business models that support circular economy (i.e. design trends, new products, material use, sorting, pre-treatment and treatment technologies which impact how materials are collected and treated).
- 3) Raw materials intelligence should use all relevant methods and tools, among others the following methods in particular: statistics (including waste statistics), LCA, MFA, 2-4 D modelling, forecasting global supply / demand and other trends based on benchmarking available information on appropriate scale, prediction scenarios that would be based on wide range of information (such as global primary, recycling and substitution industrial activity portfolios). It should also incorporate analysis on policy, regulations, and trade issues.
- 4) Reporting public data, based on EU / international reporting guidelines, should be done through the internet and publications. Reporting should include, but not be limited to web services and portals on raw materials with links to data providers, further to the EU European minerals yearbook, regular (annual) reports and early warning system based on outlooks on future supply and demand of raw materials from primary and secondary sources by modelling. Economic expertise and judgement skills at EU and Member State level should be available to evaluate whether primary deposits are viable or secondary potentials feasible.
- 5) Collaboration with the rest of the world on raw materials information should be established with 1) countries with high-performance raw materials information systems, such as US, Japan, Australia, Canada and others, 2) countries that are large or potential supplier of raw materials to Europe, 3) international organizations or initiatives (such as the International Resource Panel) and 4) neighbouring countries to develop cross-border maps, preferably 3D.

6) Improvement of data collection of raw resources at national and regional level in the EU and subsequent access to data.

**Potential players:**

EU, MS (mining authorities, geological surveys, forest authorities), industry, academia, non-EU MS, international organizations

**Impacts:**

Successful implementation of this action should

- Give guidance to EU and Member States policy and decision making on EU, MS level as well as in industry; informing also on strategic issues and providing foresight needed for decision making (policy, industry).
- Increase EU raw materials knowledge for different stakeholders;
- Add to the transparency of EU raw materials information.

**Links with other actions in the SIP :**

Outcomes of pilot actions and substitutions under the technology pillar will be maintained within the Knowledge Base when appropriate, while regulatory framework for primary and secondary raw materials (non-technology pillar) and industry lead initiatives will contribute and use data and information from knowledge base. Relevant information is related to the action area “Access to mineral potential in the EU” as well as the overall background information. Close links also exist with Priority Area “Improving Europe’s waste management regulatory framework conditions and excellence, particularly related to different stages of materials flow analysis where physical and other (such as economic) data and information are equally relevant. The “International Cooperation” pillar will use and share knowledge base related to raw materials diplomacy (investment, data exchange, mining practices), trade and development (education, skills).

**Links with other initiatives:**

The EURMKB is reflected in other initiatives such as ETP SMR strategic Research Agenda’s Strategic Ambition 1 related to inventory of resources as well as ERA-MIN Research Agenda WG 4 part related to the mineral intelligence. It is also linked to JRC projects on forest information.

## *Action area n° II.9: Possible EIT Knowledge and Innovation Community(KIC)*

### **Objective:**

In order to boost excellence in the raw materials sector, a network of research, education and training centres on sustainable raw materials could be created as an EIT Knowledge and Innovation Community, which also involves the business community and bases on education, entrepreneurship and technology innovation). Technological innovation applies to the exploration and extraction sector as well as to processing/refining and recycling technologies, including substitution when appropriate that is to the whole production chain in the present and the future.

There is a need to increase the number of professionals in the raw materials sector (for both primary and secondary raw materials sectors) as well as to foster interactions between sub-sectors including (but not restricted to) geology, geochemistry, geophysics, mineral processing, forest operations, recycling, mining engineering, metallurgy, chemistry, materials sciences, process and product design, IT, social and human sciences, economy, etc. Furthermore awareness of necessities (in terms of higher education and innovation-entrepreneurship-business, while research in covered within Technology pillar) regarding the raw materials supply should be integrated along the entire value chain, e.g. product design should take into account recycling requirements and emerging materials alternatives. Public awareness of mining, harvesting, processing and recycling needs has to be increased.

### **Approach:**

This action is clearly linked to the Knowledge and Innovation Community (KIC) that is an independent but operational part of the European Institute of Innovation and Technology, which puts the innovation web into practise. KICs are legally and financially structured entities of internationally distributed but thematically convergent partners. These partners involve key actors from the three sides of the knowledge triangle: research, higher education, and innovation-entrepreneurship-business. KICs have substantial overall autonomy to define their working agenda, internal organisation and composition, which must, nevertheless, be aligned to its objectives and the needs of the partners.

### **Actions:**

- 1) EU coverage of network, that includes the entire raw materials chain (from exploration to recycling, and substitution) – for all raw materials covered by the EIP
- 2) Integrate sea-bed mining into KICs
- 3) SME network for knowledge sharing for resource maximising through innovative business models.

### **Potential players:**

EU, MS, industry, academia, research institutes

**Impact:**

Successful implementation of this action will

- Maximise resources efficiency by intelligent use of research and technology along the entire production chain and by optimizing the interactions along the entire raw materials value chain;
- Increase the number of highly qualified professionals in the raw materials sector;
- Directly promote innovative products and services through the business community.

**Links with other actions in the SIP:**

This action has strong links with the Technology pillar of the SIP, EU Knowledge base and with the priority area “Strategic international dialogues”, notably with regard to actions “Education and skills in the mining sector”; “Actively build African skills to support African mining sector mainly through AMDC” and “Strengthen mining/mineral skills of international organizations within the UN system”.

**Links with other initiatives:**

- National and other projects / programmes in some member States and elsewhere.
- Existing KICs

***Action area n° II.10: Optimised raw materials flows along value chains*****Objectives:**

The objective of this action area is to enhance the conditions of the raw materials value chain in order to optimise raw materials flows along value chains and improve the combined use of primary and secondary raw materials without the loss of quality through improved cooperation of actors along different value chains. .

**Problem definition:**

In several raw materials sectors, there is at the moment insufficient cooperation between different value chain players, resulting in lower recycling rates or suboptimal use of raw materials along the value chain from an environmental and socio-economic performance point of view. In the specific field of wood, this is referred to as the cascading use of wood, which prioritises high-value applications over the lower added value and as such contributes to resource efficient economy. Furthermore, there is a potential for an increased sustainable wood utilisation to meet the growing demand for wood, which requires close co-operation of various actors in the sector. The development of a bio-based economy will create an even stronger demand for wood as raw material for new

products and for wood as substitute for existing products produced from imported fossil fuel.

**Approach:**

The approach would involve improved cooperation within or along different supply chains, in order to improve the understanding of an optimal use of raw materials along the value chain. As for wood, the optimal use, from an environmental and socio-economic performance viewpoint, may vary between regions depending e.g. on infrastructure and proximity of downstream industries, thus a single solution would not apply. Similarly, practices and policies for wood mobilisation would also need to take into account differences between EU regions, including in forest types.

**Actions:**

- 1) Raw material partnerships: This action would be implemented by a common multi-stakeholder platform, and focus on a limited number of key raw materials. Partners from across value chains - mining, processing, recycling, application, public sectors (national/regional/local) and civil society - should participate resulting in cross-sectoral partnerships and knowledge exchange, respecting the conditions of each value chain (avoiding a one-size-fits-all approach). For instance, in the Netherlands, “Green deals” are successful in the areas of aggregates from secondary sources, recovered paper (together with the European Recovered Paper Council) and phosphate recycling. Phosphates Platforms at national level (in the Netherlands and Germany) and regional level (Flanders) are working in synergy with and in support of a European Sustainable Phosphorous Platform, each having specific and complementary missions. This has led to a commitment of Dutch waterboards to have 30% of their plants equipped with P-recovery by 2015.
- 2) Cascading use of wood: This action involves improving the understanding and application of the cascading use of wood by assessing the economics, policy and technological needs for the widespread and optimised application of the cascade, including an examination of existing EU and Member State policies and legislations and identification of good practices; developing models and tools for decision making and methodologies for assessing the cascade impacts; providing practical recommendations with guidance for policy-makers and value chain stakeholders and concrete actions for application; possible demonstration activities and dissemination of results.
- 3) Sustainable wood mobilisation: This action involves collecting existing and developing novel practices and policies along value chains for increased and sustainable supply of wood according to the quality needs; providing practical recommendations with guidance for policy-makers and value chain stakeholders and concrete actions for application; possible demonstration activities and dissemination of results. It may cover the following areas: effective forest ownership and land tenure, management, co-ordination and planning; adequate forest infrastructures and logistics; suitable market structures and transparency; improved recovery channels of

post-consumer materials; adequately trained workforce; structures and instruments for improved access to finance and public incentives and supportive legal framework; silvicultural measures through intensified forest management (including higher-growth species and forest breeding and plant material refinement).

**Potential players:**

EU, MS, industry, forest/wood-based value chain actors, national / regional industrial symbiosis networks, academia

**Impacts:**

Interdisciplinary and transnational cooperation will boost raw material sector in the EU.

Specifically on wood, the action will allow matching the supply and demand of wood for the EU industry, while creating greater added value to the economy and more jobs compared to direct energy use of material.

**Link with other action areas of the SIP:**

This action is linked to the technological pillar, as it may involve development of decision-support systems for optimised supply chain management, including for optimised use of wood by-products and residues, .

**Link to other initiatives:**

Possible Public-Private Partnerships SPIRE, Bio-based Industries.

### III. INTERNATIONAL COOPERATION PILLAR

#### *Action area n° III.1: Technology*

##### **Objective:**

This action area satisfies several objectives:

It aims at shortening the implementation time of new technologies in exploration and modern mining through cooperation with international players; utilising synergies between most advanced players in developing substitutes for Critical Raw Materials (CRM); developing ore metallurgy and processing techniques in an innovative way to increase metal recovery, decreasing energy consumption and improving the by-products recovery; engaging EU's partners in a dialogue on recycling technologies with the aim to improve the environmental performance of end-of-life products, increase the quality of recycling (from an environmental, health and process efficiency perspective; and developing technical cooperation related to IT-based environmental monitoring, including the development of new technologies and an appropriate use of obtained information , as well as capacity building and institutional strengthening to support pro-sustainable development strategies to develop national/regional minerals industries.

##### **Problem definition**

Promoting the international cooperation in Research and Development is an effective way to improve exploration success and exploit the synergies in R&D between different research programs and to promote European technology transfer to less developed countries. It will also help to the European equipment manufacturers and technology providers to maintain a leading position in the global market.

The EU, the US and Japan face a similar challenge of access to certain scarce or critical raw materials (CRM). There is a ground to define agreements for joint studies about different CRM. These countries already started to cooperate in developing substitutes for Critical Raw Materials (CRM) in order to optimise their R&D capacities. Further actions need to be planned to use the scientific and technological potential of the best world players in the area such as the substitution of CRM or minerals intelligence. Developed ore metallurgy and processing techniques will also allow several rare and high-tech metals to start being produced in some operating mines, as sub products.

Engaging EU's partners in a dialogue on recycling technologies should increase the supply of secondary raw materials on world markets and create a market for European recycling technologies export.

Mining has a bad public perception in certain parts of Europe, due to a long history of negative impacts on the environment and high risk. Advanced technologies can be used to monitor environmental impacts arising from mining, processing or metallurgical operations, including their waste facilities. The technology can be used to help determine what mineral types are on the ground, the economic feasibility of potential mining operations (including mining of waste), and expected future environmental hazards.

Essential components include satellite and airborne earth-observation technologies combined with in situ data collection infrastructure, data transmission capabilities and data management centres, which can alert the relevant authorities be it necessary. These could facilitate decision-making in order to conduct mining operations in an environmentally friendly, safe, manner. It can provide a cost-effective way of ensuring monitoring to meet high environmental standards and contribute to improving public acceptance. Within this context, international cooperation in the field of remote sensing methods should be strengthened, in particular cooperation on hyperspectral remote sensing techniques.

**Approach:**

The proposed co-operation covers R&D in exploration and modern mining technologies, R&D in the area of substitution and improved material management of CRM, innovative ore metallurgy and processing techniques, recycling technologies, and IT-based environmental monitoring and technologies for the mining sector, and an appropriate use of obtained information.

**Actions:**

- 1) Exploit the synergies in R&D with regards to exploration, extraction and processing including technological solutions for intelligent mining, safety and automation and create joint expert systems based on "lessons learnt" to replicate successes and avoid failures; strengthen international academic cooperation. Promote international Thematic Networks in the Raw Materials sectors (similar to the model of the CYTED – programme existing between Spain, Portugal and the Latin American region). Include innovation procurement as a way of implementation. In this context the deep sea mining is included as an important field of cooperation not only in research but also in discovering new resources and opening up mining sites and developing of worldwide applicable standards for the protection of the marine ecosystems, with a link to collaboration with the International Seabed Authority (ISA) of UN.
- 2) Promote the involvement of companies and organisations from developing countries in different European R&D programs and include raw materials sectors in the existing EU research cooperation programs and bilateral agreements with countries rich in mineral resources. Promote IPR rights when implementing technology transfer.
- 3) Cooperation and best practice sharing in the area of Critical Raw Materials (CRM) by improving materials management of CRM, that concerns substitution, material saving. These actions should involve the entire value chain.
- 4) Develop ore metallurgy and processing techniques in an innovative way to increase metal recovery, decreasing energy consumption and improving the by-products recovery with countries matching profiles (Latin America, Australia, USA, Canada, etc...), Develop and promote metallurgical techniques suitable to small-scale mining, especially avoiding the uses of cyanide and mercury in artisanal gold mining.

- 5) Dialogue with technologically advanced countries to develop an exchange of information on recycling technologies. Outreach activities on recycling with countries importing European waste – e.g. Africa, China, India. International dialogues in support of export of European recycling technologies including business support activities such as export promotion. Promotion of international discussion on recycling technologies in multilateral fora such as the OECD, UNEP, G20, G8.
- 6) Define scope with international partners on implementation of satellite and airborne technology for raw material remote sensing; conduct technical analysis; develop system concept and design as well as implementation; ensure investment; link to Copernicus (GMES).

**Potential players:**

USA, Japan, Latin America, Canada, Australia, South Africa

**Impact:**

Successful implementation of this action should

- Increase the knowledge and use of most advanced, economically effective and innovative technologies in the whole value chain of raw materials, from exploration, through extraction, processing and production to recycling and substitution;
- Facilitate the exchange of information for better design of the raw material flows along the value chain.

**Links with other actions in the SIP:**

The actions have links to all other Priority Areas, depending on the topic.

**Links with other initiatives:**

African Minerals Development Centre (African Union)

***Action area n° III.2: Global Raw Materials Governance and Dialogues***

**Objectives:**

This action area covers economically-important raw materials in general, and specifically two types:

- (1) Critical Raw Materials (CRM) as defined in EU documents;
- (2) natural rubber.

The objective is ensure the fair and unrestricted access to raw materials worldwide, by improving supply conditions for EU companies, ensuring a level playing field of all actors present in the trade of raw material commodities. Fairness from an economic point of view is extremely important in order to avoid competition distortions and different regulatory frameworks being contradictory to the principles of fair and undistorted trade.

**Problem definition:**

In the case of Critical Raw Materials, in its 2011 Communication the Commission formally adopted a list of 14 critical raw materials and proposed that it will monitor the issue of critical raw materials to identify priority actions, examine them with Members States and stakeholders and regularly update the list of critical raw materials at least every 3 years. Critical Raw Materials are economically important raw materials, subject to a higher risk of supply interruption. There are a number of reasons for this increased supply risk, one of which is the high concentration of the production of a raw material in a given non-EU country. On the other hand, many of those raw materials are vital to the high tech industry present in Europe.

In the case of natural rubber, 93% of its production is concentrated in 3 countries in South East Asia, it is thus important, in parallel to possible substitution, to explore possibilities for diversification of natural rubber sourcing. Africa is suitable for natural rubber production, thus possibilities to set up partnerships or programs in African countries could be explored that would aim at developing plantations, training farmers and exchanging best practices on production of natural rubber, and loan schemes.

**Approach:**

The subject of raw materials has been taken up as a priority especially since 2010, in international forums such as the G20, in the light of great price volatility, trade and sourcing issues, including trade distortions. Raising the subject to the highest political level would promote a dialogue between producers and consumers, between emerging and developed countries, and to allow concrete recommendations to emerge from the discussions.

The access for the European industry to the natural rubber supply can be improved by diversifying geographically its supply by co-operation programs aiming to develop the cultivation in Africa and to increase the productivity of natural rubber plantations in the producing countries. Caution should be given to deforestation, biodiversity degradation and overexploitation.

**Actions**

- 1) Pursue dialogue with trading partners from an economic point of view to ensure a fair access to raw materials and improving supply conditions for EU companies on the world market
- 2) Actions related to CRM are (1) promotion of a dialogue in the International Study Groups through a joint seminar with a view to establish Critical Metals and minerals

Study Group, (2) pursuing the on-going dialogue within the UNEP International Resource Panel (3) establishing a G20 Dialogue where raw materials should be part of each G20 presidency priorities and a follow up of the work done in between presidencies has to be conducted and (4) envisaging a dialogue also on other minerals that are not part of CRM

- 3) The action related to natural rubber aims at enhancing the cooperation with African and other partners to facilitate the development of natural rubber cultivation and improve skills and expertise in the field of heveaculture for enhanced productivity (e.g. via loan programmes to small farmers, training programmes based on top of the art techniques and curricula aiming at eradicating diseases that affect production in Africa).
- 4) Foster imports in the EU of minerals and metals produced by companies publishing their sustainability performance by means of the GRI or equivalent verifiable reporting frameworks.

**Potential players:**

International associations, G20, European Development Bank, South East Asia, Africa (e.g. Ivory Coast and Cameroon), rubber value chain actors, International Rubber Study Group.

**Impact:**

Successful implementation of this action should

- Contribute to a more balanced situation on the world trade market in raw materials, elimination of barriers to trade or trade bans. This would benefit the economic stability, especially the high technology sectors using certain raw materials subject to trade distortions, as well as sectors using raw materials that experience technical barriers to trade or uncontrolled and unpredictable trade duties.
- Promote development in the concerned producing countries (e.g. in rural areas in case of natural rubber).

**Links with other actions in the SIP:**

The actions have links to all other Priority Areas, depending on the topic.

**Links with other initiatives:**

Regarding natural rubber, programmes set up by national governments in Africa.

**Objectives:**

The objective in this action area is twofold: on the one hand it aims at contributing to improving the health, safety and environmental performance of mining activities worldwide and contribute to development of sustainable mining in partner countries; and on the other hand it endeavours to improve the framework conditions for raw materials supply both in the EU and in its partner countries through dialogue on best practices, sharing experiences with regulatory solutions for raw materials supply and engagement with technology providers globally. Furthermore, the aim of this action is to facilitate free and fair trade of metallic and non-metallic raw materials.

**Problem definition:**

Imported raw materials constitute an important source of raw materials for European industry and the recovery of raw materials from waste through recycling has advanced in the recent years in many developed and developing countries with different regulatory solutions used. An exchange of best practices and sharing experiences on regulatory environment for raw materials supply can provide benefits to the formulation of supply policies around the globe thus increasing the availability of raw materials on the world market.

**Approach:**

This action area contains two specific actions: (1) International cooperation on regulatory environment for raw materials supply and on standards for secondary raw materials, and (2) Improvement of health, safety and environmental performance in mining and recycling activities

**Actions:**

- 1) Establish and foster exchange of information with countries engaged in sustainable mining in order to develop a set of best practices to label exemplary mining operations worldwide. Set up a network of certified mining sites with demonstration effect. Support developed and developing countries that want to engage with the EU on "sustainable mining" with European expertise, back-analysis and technical solutions. International voluntary codes of conduct should be acknowledged. Maintain and further develop engagement with international organisations, including the international raw material study groups, UNEP, OECD, which is crucial for the success of this action and its global outreach. Promote European activity, technology and expertise in terms of health, safety and environmental performance in mining activities, toxicity standards. Focus on selected countries in Africa and Latin America to promote cooperation and provide support in implementation of best practices through transfer of existing analysis and expertise (establish in the long term exemplary pilot mines; upgrade existing mines performance).

**Potential players:**

EU, MS, industry, academia, African countries, ICMM (International Council on Mining and Metals), industry including technology suppliers, Basel Convention and its regional centres, UNEP, OECD, national standardisation bodies, CEN/CENELEC, ISO, international study groups on raw materials, academia, NGOs professional organisations (ex: European Federation of geologists)

**Impact:**

The successful implementation of this action would

- Trigger positive environmental and social impacts, by improving environmental conditions in mining in the long term, as well as mitigating negative social impacts due to the perception of health and safety in mining sites and the mining value chain.

**Links with other actions in the SIP:**

This action area can be linked to certain actions in the Technology pillar, the European Knowledge Base and the Action area for prevention of illegal shipments of waste.

***Action area n° III.4: Skills, Education and Knowledge*****Objectives:**

This action area satisfies several objectives. Firstly it seeks to increase competence and expertise levels of Europe in selected areas of the mining sector by cooperation with the leading educational and research institutions in 3rd countries and improve the availability of workforce and skills in mineral resources related sectors such as geology, metallogeny, geophysics, geochemistry, mine engineering, mineral economics, ore processing, metallurgy; secondly, it aims at establishing the African Mineral Development Centre (AMDC) or similar bodies; thirdly it aims at defining a dialogue on skills and knowledge with Latin American countries involved in the mining sector; and finally it seeks to establish a functioning knowledge base system on material flows with cooperation of international partners to better understand the shortages and adapt to market developments, including the use of already existing data. It should not be forgotten that cooperation between different industries would give the possibility for new cross-industry innovations, which could bring resource efficiency benefits and decrease need for some raw materials.

**Problem definition:**

There is a shortage of specialists in Europe in some of the areas related to raw materials production and processing (e.g. mineral processing), and the problem should be addressed at European level. The problems faced by the mining sectors are the lack of

skilled workforce, no or sometimes bad image impacting interest in mining education and its relative unattractiveness, ageing workforce and lack of replacement. Several good examples on development of mining skills policies exist and could be used as models for international cooperation.

At present, it has to be stated that there is a lack of knowledge, skills and experiences in Africa, the need to coordinate projects and initiatives in Africa as well as to diversify EU policy processes and link them closer to the mining districts. The proposed AMDC (or a similar body) should help overcome these shortfalls, balance Chinese, North American and Australian interests in Africa and facilitate cooperation with African countries and future imports of minerals/metals from Africa. It should moreover improve governance of African minerals, which would in return create jobs through more sustainable mining projects. Thus it would, on the long run, support economic and social development in African mineral rich countries

The establishment of a permanent dialogue and exchange of best practices with main countries in Latin America involved in the mining sector would mutually benefit both sides. The continent has a strong potential in the sector, and its experience in tackling education as well as development of knowledge based mining and minerals economy can create benefits and spill-overs both in the EU and Latin America when it comes to advanced technology skills, continuous education and economic development/adjustment.

EU should make use of the work of UN organisations to support its raw materials policy and implementation. Furthermore the mining/mineral skills are at a low after reductions over many years and also focus on governance etc., not on the industry itself. New types of knowledge are necessary: Strategy/policy (compare energy where this type of work has been done for decades); Economics; Development aspects; Mining technology; Mineral processing; Exploration; Improving local democracy; How to run state companies.

The understanding of material flows is not fully developed and requires cooperation with international partners to obtain a full view of world flows. It is therefore necessary to monitor the streams of materials in import/export and life-cycle of materials.

#### **Approach:**

The action area would improve education, skills and knowledge in the mining sector in Europe, in Africa and in international organisations within the UN system. It would moreover facilitate the international management of minerals wealth by developing knowledge base on material flows on a global level.

#### **Actions:**

- 1) This action envisages mapping of the areas where lack of experts in Europe is significant, establishing cooperation with countries of high expertise (e.g. mineral processing in Canada, Australia) and development of a programme for educational cooperation with those countries. Foresee travelling lectures/short courses on

industry-related mineral resource skills. Foresee also Communication campaign coordinated with all MS promoting mining education , sector attractiveness and public awareness; create a platform/body/organisation for an international cooperation on education

- 2) Providing support to the establishment of the AMDC or similar: staff; funding; cooperation agreements, link academic research and industry and mining clusters experiences in Europe with Africa, involve other supporters of the concept: Australia; Canada; Sweden/Finland; Japanese government; World Bank; UN organisations.
- 3) Establish regular contacts with countries in Latin America, envisaging multilateral annual conferences, exchanges of staff; project funding; facilitate cooperation of industry clusters
- 4) Establish a monitoring system for material flows (including end of life products) possibly through an international agency on material flow analysis or depositing this task with an existing body. This action could be linked to the UN statistics data. Closely monitor critical raw materials. Continue to be actively present in International Study Groups (Copper, Lead&Zinc, Nickel) with a possibility to add a new group on iron ore.

**Potential players:**

EU, MS, Universities, Research centres, Industry, International Council on Mining and Metals, regional and international trade associations, ETP SMR, Australia, US, Canada, Japan, China, India, Latin American countries, OECD, UNCTAD, UNIDO, ILO, UNEP and regional offices

**Impact:**

The successful implementation of this action should

- Increase of overall knowledge and skills of people working in the sector;
- Through acquaintance of new specific education, improve the technological and economic management in the sector or raw materials, tackling as well industrial development (better mining techniques) as well as environmental protection (better tackling soil degradation, waste, maintenance of mining sites).
- In the long term, through better knowledge about raw materials and the mining industry, change the negative perception of people towards the mining sector.

**Link with other actions in the SIP:**

This action area can be mostly linked to European Knowledge Base.

**Link with other initiatives:**

ACP Group of States; Framework of Action for the Development of the Mineral Resources Sector

***Action area n° III.5: Investment activities*****Objectives:**

The objective of action is (1) to support, through specific policy tools, the European mining, research and geological companies in exploration and development of mining projects abroad, (2) to promote mining investment in Europe, and (3) to foster cooperation with some countries on promoting the positive impacts of mining (economic, environmental and social), including exchange of best practices in raw materials policy and social acceptance.

**Problem definition:**

EU-MS need to reduce import dependency in the raw materials field and better coordinate their approaches to non-MS countries in order to avoid duplication of actions. The objective of this action should be achieved by preparing a Coordination Plan of MS' actions towards foreign countries in areas where EU and national actions can be mutually supportive or better co-ordinated.

European mining companies have experience in investment in mining on international/global scale. European mining standards and achievements are not well promoted worldwide, while European environmental requirements which must be met by mining companies are not globally recognised. Europe is a place where GRI (Global Reporting Initiative) developed Sustainability Reporting Framework today used in reporting CSR activities and their progress by most of the global mining companies which have operations all over the world. European mining companies should benefit from support and promotion of their activities abroad.

At present there is lack of funding, other countries and regions much more active than the EU, with investment abroad it should improve self-sufficiency in Europe; bring in skills and experiences; ideas; staff., furthermore create employment in peripheral regions of Europe, increase capacity i.e. in the long run reducing metal/mineral prices, and explain stringent EU laws on mining protection

The problems for developing new exploration projects and open new mines in Europe are not related with a lack of mineral potential but with difficulties in having access to land due to land use conflicts.

**Approach:**

The action area has three specific actions (1) to promote and coordinate the activity of European companies active in the mining and raw material sector, in third countries,

(2) to promote inward investments into European mining and (3) Co-operation with Australia, US, Canada, South Africa and Chile on promoting the positive impacts of mining (environmental and social), including exchange of best practices in raw materials policy and social acceptance

**Actions:**

- 1) To present and promote Europe as a continent with long mining traditions, developed mining education system and high environmental requirements and standards which have to be met by the mining companies managing their operations situated in Europe. Specific focus within this action should be on African (encourage cooperation with African Union), Latin American and developing countries with the aim to develop strong and sustainable relationships with mineral-rich mining countries. Strengthening dialogue with the Russian Federation would be useful.
- 2) This action should develop further the series of ‘partnership agreements’ related to raw materials, signed between the EU and different countries, like: bilateral agreements; Memorandum of Understanding; Letter of Intent; joint declaration. The action could encourage concrete actions strengthening business collaboration and partnerships to inspire initiation of concrete projects. Supply chain due diligence could be included in this action.
- 3) This action should identify and promote, in the long term, "exemplary mining sites", meeting European standards in Africa and Latin America – fulfilling the conditions of the health, safety, supply chain due diligence and environmental best practice (see the action on "health, safety and environmental best practice" as well as intelligent, invisible, safe and green mines of the future to exemplify European responsible and sustainable way of doing business on these continents.
- 4) Promote inward (into European mining) and outward (by EU companies in 3<sup>rd</sup> countries) industrial investment in mining. This could include participation in international conferences and seminars under one EU hat, development of promotional material and joint data centres, increase availability of information (such as databases of drill core storages in EU), establish a mineral investment promotion centre
- 5) International cooperation should be established on trade related matters, including fair access to raw materials, tackling trade restrictions and TBT.
- 6) Foster exchange of best practices at the international level on land use planning

**Potential players:**

Australia, US, Canada, South Africa, Latin America

**Impact:**

Successful implementation should

- Ensure a sound economic development of the sector by increasing the investments flows of companies abroad;
- Increase the exploration and opening of new mining sites;
- Increase through shared databases information of mineral disposure around the world;
- On the long run, increase the competitiveness of the EU industry.

**Links with other actions in the SIP:**

This action area can be linked to the Priority Areas “Improving Europe’s raw materials framework” and “Improving Europe’s waste management regulatory framework conditions and excellence”.

**Links with other initiatives:**

Unknown.