



# Report on the RM research and innovation network: the relevant players and their roles

D3.1 – Report on the RM research and innovation network:  
the relevant players and their roles

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WP3 – Defining and exploring the playing field



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<b>Author</b>	Agustín Blanco – TECNALIA
<b>Email</b>	<a href="mailto:agustin.blanco@tecnalia.com">agustin.blanco@tecnalia.com</a>
<b>Reviewed by</b>	Dirk Nelen – VITO
<b>E-mail</b>	<a href="mailto:dirk.nelen@vito.be">dirk.nelen@vito.be</a>
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# 1. Terminology

## 1.1. Objective

***The objective of this chapter is to establish a coherent framework of raw materials related terminology. Such a framework is an indispensable prerequisite for the coordination of raw materials research and innovation. As indicated in the Strategic Implementation Plan for the European Innovation Partnership on Raw Materials, terminology and reporting standards related to raw materials are heterogeneous throughout the EU member states<sup>1</sup>. Furthermore, different areas within the raw materials sectors use different terminologies and classifications for raw materials and their properties. In order to address VERAM's first objective to facilitate information exchange, overcome fragmentation and promote cross-fertilization, a common terminology related to definitions of raw materials, their classification and concepts defining properties relevant for guiding research and innovation is elaborated in this report.***

The development of the framework of raw materials related terminology takes into account the views of all relevant stakeholders in the field of raw materials research and innovation. Importantly, however, the framework builds on the most recent efforts by the EIP Raw Materials to develop a European Union Raw Materials Knowledge Base (EURMKB)<sup>2</sup>. With the help of EU countries, the EURMKB will collect, store, maintain, upgrade, analyse, and disseminate information on the raw materials. This knowledge base will serve industry and policy makers as a valuable source of data. As this knowledge base will be a core element of the realisation of EIP's goals, it seems important to align terminology and classification used in VERAM with those used in the EURMKB context. Two main building block projects of the EURMKB that are particularly relevant for terminology are the Raw Material System Analysis (RMSA)<sup>3</sup> and the Minventory project<sup>4</sup>. These projects have been set up to create a comprehensive data inventory of material flows in industry and society (RMSA), and to provide structured statistical information on quality and quantity of EU raw material deposits (Minventory).

Chapter 2 elaborates on the relevant definitions for raw material, primary and secondary materials, and their classifications. Terminology related to properties of raw materials relevant for the scope of the VERAM project, such as reserves, resources, criticality, scarcity etc., is defined in Chapter 3.

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<sup>1</sup> [Strategic Implementation Plan for the European Innovation Partnership on Raw Materials- Part I](#)

<sup>2</sup> [https://ec.europa.eu/growth/sectors/raw-materials/specific-interest/knowledge-base\\_nl](https://ec.europa.eu/growth/sectors/raw-materials/specific-interest/knowledge-base_nl)

<sup>3</sup> <https://ec.europa.eu/growth/tools-databases/msa/>

<sup>4</sup> <https://ec.europa.eu/growth/tools-databases/minventory/>

## 1.2. Raw materials: definitions and scope

### 1.2.1. Raw materials

As defined by the EU Raw Materials Strategy<sup>5</sup>, raw materials include metalliferous minerals, industrial minerals, construction minerals, wood and natural rubber<sup>6</sup>. In this sense, raw materials represent the starting point of the material supply chain that converts mineral or organic substances into processed materials that are used by various industries to manufacture products. The division of raw materials into different groups is based on their characteristics and on their use in downstream industries. This classification is used across different aspects of EU policy making related to raw materials, including Research & Innovation (H2020) and European Innovation Partnership on Raw Materials.

The definition and classification used at EU level differ slightly from those used by UNEP<sup>7</sup> and OECD<sup>8</sup>. The latter two classify raw materials into metals, minerals, fossil fuels and biomass, and thus includes agricultural and energy-related materials. Nevertheless, all three definitions for raw material put the emphasis on the *utility* of raw materials, i.e. “the usable materials or substances extracted from natural resources” (OECD), and “Materials are substances or compounds used as inputs to production or manufacturing because of their properties.” (UNEP). The next paragraphs provide further detail on the different raw material categories used in EU policy context.

**Metalliferous minerals** are minerals or aggregates of minerals from which metal can be extracted. Metals may be present either in their native form (e.g. gold, platinum), but more commonly as oxides, sulphides, sulphates, silicates etc. They include semi-metallic elements or metalloids (e.g. antimony, arsenic, germanium), which are frequently intimately associated with metals. The metals extracted from metalliferous minerals are commonly subdivided into ferrous and non-ferrous metals. The EU metallic minerals sector produces a wide range of ores yielding metals or metallic substances. The EU is an important producer of chromium, copper, lead, silver, and zinc. In order to fully supply the EU metals industry however, most metallic minerals need to be imported.

**Construction minerals** are natural, recycled and manufactured aggregates, clays and gypsum, and building stone used for a wide range of construction purposes. These uses may be either directly as aggregates (e.g. sand and gravel) or in making cement, lime, concrete, plasterboard, bricks, asphalt mixes for surfacing roads, glass, ceramics and other building products. Natural aggregates include crushed rock of sedimentary, igneous and metamorphic origin.

**Industrial minerals** are minerals that are neither metallic nor energy related that are valued for their physical or chemical properties in a range of industrial applications. ‘Physical’ minerals include baryte, bentonite, graphite, kaolin, diatomite, feldspar mica, silica, and talc, whilst ‘chemical’ minerals include fluorspar, potash, magnesite, salt and others. These appear in a range of industrial applications such as the

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<sup>5</sup> <http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52011DC0025&from=EN>

<sup>6</sup> In accordance to the VERAM project scope, agricultural and energy-yielding raw materials are excluded from the scope of the EU Raw Material policy domain.

<sup>7</sup> [http://www.unep.org/resourcepanel/Portals/50244/documents/IRP\\_Draft\\_Glossary.pdf](http://www.unep.org/resourcepanel/Portals/50244/documents/IRP_Draft_Glossary.pdf)

<sup>8</sup> <https://www.oecd.org/environment/indicators-modelling-outlooks/MFA-Guide.pdf>

manufacture of chemicals, glass, paints, plastics and paper. Industrial minerals include ‘construction minerals’ used for non-construction purposes, such as gypsum and limestone. Industrial minerals such as barytes, kaolin, or salt are extracted within the EU to supply a wide range of industries. For some minerals such as magnesite, fluorspar, kaolin, and potash, Europe is among the major global producers.

**Wood** relates to all forest based resources used in the woodworking, furniture, paper and pulp, packaging, printing, hygiene products, bioenergy and biofuels sectors. The EU woodworking industries include the production of sawn wood, wood-based panels, and wooden construction materials and products. About 70 % of the wood in the EU is used in construction and furnishings. More than 400 million cubic metres of wood is sustainably harvested in Europe each year and used in the down-stream industries.

### **Natural rubber (saps)**

About 1 million tons of Natural Rubber is used in the EU. More than 90 percent of the natural rubber comes from Asia.

### **Cork (bark)**

There are about 2,200,000 hectares of cork forest worldwide; 34% in Portugal and 27% in Spain. The annual production is about 200,000 tons.

## **1.2.2. Primary and secondary raw materials**

Using the concept for raw materials elaborated above, the concepts of “primary” and “secondary” raw materials refers to the origin of the raw materials that are fed into the material production supply chain. Although the concept of secondary raw materials has existed for almost 40 years<sup>9</sup>, a clear and transparent distinction between primary and secondary raw materials does not exist. The main reason for this is the different perspectives that can be used to look at secondary raw materials.

A simple, yet vague, distinction between primary and secondary raw materials is to identify primary raw materials as natural inorganic or organic substances *used for the first time*. Any material not used for the first time can then be labeled as secondary. This intuitive approach is reflected in UNEPs definition of resource extraction: “the removal of primary (‘virgin’, ‘native’) resources or harvest from the natural environment for landscape modelling, and for extracting valuable raw materials (used and unused extraction) for subsequent processing.” The concept of “primary raw material” thus applies specifically on raw materials directly derived from the natural environment.

For secondary raw materials, there is no such clear boundary delineating the source from which the raw materials are sourced. Within the Minventory project, a literature review was conducted on the definition and use of the term secondary (raw) material, from which it was concluded that the term is mostly defined by providing examples of materials, and/or by providing specific context<sup>10</sup>. One of the key ambiguities

<sup>9</sup> Minventory final report

<sup>10</sup> Minventory final report Annexe C: Secondary Raw Materials definition – terminology review

related to the term is that it is not clear whether secondary raw materials relates to wastes that could be reprocessed and refined (recyclables); or that it relates to the products of such a reprocessing operation (recyclates).

In absence of a generally accepted definition, it is important to choose a definition and scope that is fit for the purpose of the issue being addressed. For example, the Minventory project defined secondary raw materials as “Waste materials that have been identified for their potential for recycling or reprocessing to generate raw materials (potentially displacing the use of primary materials), for example: mining wastes, manufacturing and processing waste, including scrap, and contents of landfill. For the purposes of this work, only the long-lived, accumulated and hence permanently geo-located sources have been considered, namely mining and landfill wastes.” As the purpose of Minventory is to set up a harmonized structure for data on raw material deposits, the chosen definition definitely seems appropriate, as it includes those types of secondary raw materials that can be geo-referenced in the geosphere (see Figure 1).

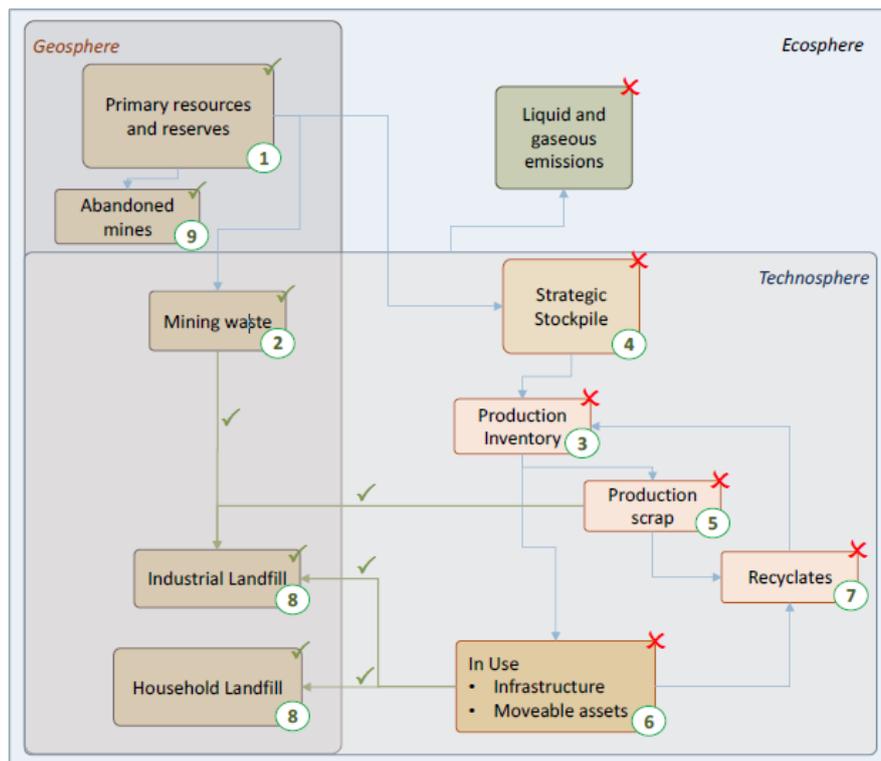


Figure 1: scope of materials included in the Minventory project, showing the focus on secondary materials that can be considered part of the geosphere (Source: Minventory final report)

As the final objective of the VERAM project is to contribute to the competitiveness of EU industry, by assuring its material supply, the most relevant perspective for defining secondary raw materials is that of the start of the supply chain of raw materials. It thus seems useful to consider as secondary materials the materials obtained from end-of-life products and goods, that through (pre-)processing have been made available to be used as an input for industrial production. This definition aligns with that of primary raw

materials as materials directly mined from the environment and fed into the supply chain for the first time. The distinction between primary and secondary would then reside in the fact whether a material had a preceding functionality or not.

Another way to put it would be to make a distinction between “materials sourced from primary resources and materials sourced from secondary resources”. Primary resources include mineral ores, natural aggregates, biomass harvested from biomass. Secondary resources include mining waste, industrial and household waste landfills, and end-of-life products.

### **1.2.3. Materials within the scope of this study**

An overview of different materials and their primary and secondary sources within each of the raw material categories is shown below. The raw materials listed under minerals are taken from the materials specified by the Raw Materials Initiative (COM (2008) 699 final) on land and in marine environments, and reflects the scope of materials included in the Minventory data portal.

Raw Material	Resource
<b>Metalliferous minerals</b>	
Antimony, Bauxite, Cadmium, Chromium, Cobalt, Copper, Gallium, Gold, Indium, Iron, Lead, Manganese, Molybdenum, Nickel, Niobium, Platinum Group Metals, Rare Earth Element, Silver, Tantalum, Tin, Titanium, Tungsten, Vanadium, Zinc	Primary: - metal ores  Secondary: - mining wastes - End-of-Life electronic goods, cars - production waste, metal scrap
<b>Construction minerals</b>	
Aggregates: sand & gravel, crushed rock; Building stone; Clay; Gypsum; Dolomite; Limestone	Primary: - quarries & mines - marine sources  Secondary: - construction & demolition waste
<b>Industrial minerals</b>	
Baryte, Bentonite & Fuller's Earth, Diatomite, Graphite, Feldspar, Fluorspar, Kaolin, Lithium minerals, Magnesite, Mica, Potash, Talc	Primary: - quarries
<b>Wood</b>	
Timber Cellulose Lignin Hemicellulose Bark	Primary: - forests  Secondary: - Sawdust and other manufacturing side-streams, pulping process products: black-liquor, lignin, recycled wood, hemi-cellulose

	recycled paper and paper board, recycled wood
<b>Natural rubber</b>	
	Primary: - rubber tree plantations

## 1.3.Relevant concepts in the Raw Materials domain

### 1.3.1. Difference between reserves and resources

#### Primary material resources

Characterizing stocks that can be used to extract raw materials is an essential, yet complex part of managing raw materials supplies. The Committee for Mineral Reserves International Reporting Standards (CRIRSCO) is an advisory body (without legal authority) set up to promote best practice in the international public reporting of mineral exploration results, mineral resources and mineral reserves. CRIRSCO has developed an international reporting template to be used by (inter)national reporting bodies in order to create a common understanding of the classification of mineral deposits of primary raw materials between different (inter)national systems such as Australasia (JORC Code), Canada (CIM Code), Chile (Comisión Minera), South Africa (SAMREC Code), United States (SME Guide), Russia (NAEN Code) and Europe (PERC Reporting Standard).

The standard CRIRSCO definition for a **mineral resource** is:

“A Mineral Resource is a concentration or occurrence of solid material of economic interest in or on the Earth’s crust in such form, grade or quality and quantity that there are reasonable prospects for eventual economic extraction. The location, quantity, grade or quality, continuity and other geological characteristics of a Mineral Resource are known, estimated or interpreted from specific geological evidence and knowledge, including sampling.”

The standard CRIRSCO definition for a **mineral reserve** is:

“A Mineral Reserve is the economically mineable part of a Measured and/or Indicated Mineral Resource. It includes diluting materials and allowances for losses, which may occur when the material is mined or extracted and is defined by studies at Pre-Feasibility or Feasibility level as appropriate that include application of Modifying Factors.

Mineral resources are subdivided, in order of increasing geological confidence, into inferred, indicated and measured categories. Mineral reserves are subdivided in proved reserves and probable reserves, reflecting a range in the level of confidence on the economic viability of extraction.

Within mineral resources, mineral reserves may be defined by the consideration and application of ‘modifying factors’<sup>11</sup>. The modifying factors are considerations used to convert mineral resources to mineral reserves and vice versa. The relationship between mineral resources and mineral reserves and their subdivisions is shown in Figure 2.

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<sup>11</sup> [http://www.crirSCO.com/templates/crirSCO\\_international\\_reporting\\_template\\_2013.pdf](http://www.crirSCO.com/templates/crirSCO_international_reporting_template_2013.pdf)

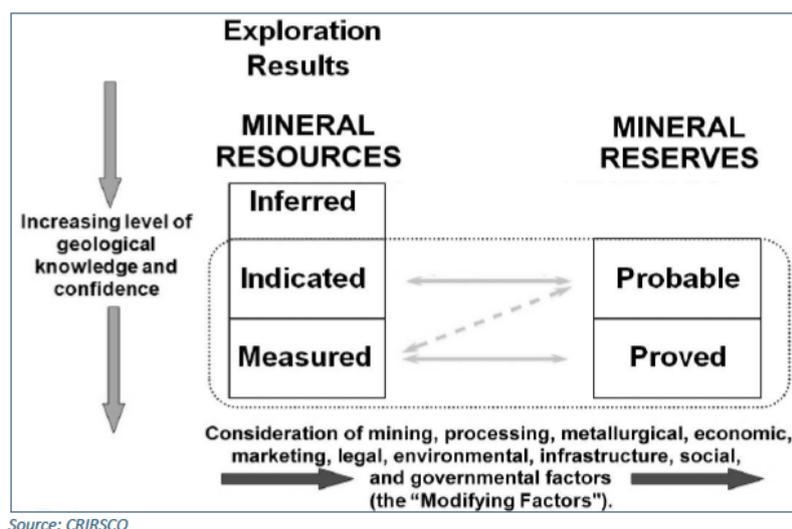


Figure 2: CRIRSCO classification system for mineral resources and reserves (Source: Minventory final report)

The UNFC-2009 framework is a classification system to classify mining projects according to three fundamental criteria that determine the feasibility of mining a deposit: socioeconomic viability (E-axis), field project status and technical feasibility (F-axis), and knowledge on composition and extractable material content (G-axis) (see Figure 3). The framework has been developed by the UNECE Working Party on Coal to enable comparison of the resources available in the formerly centrally-planned economies to those in the market economies<sup>12</sup>. The framework makes a distinction between commercial, potentially commercial, non-commercial and exploration projects. It is aligned with the CRIRSCO scheme, as can be seen in Figure 4.

<sup>12</sup> [http://www.unece.org/energy/se/unfc\\_2009.html](http://www.unece.org/energy/se/unfc_2009.html)

UNFC-2009 Categories and Examples of Classes

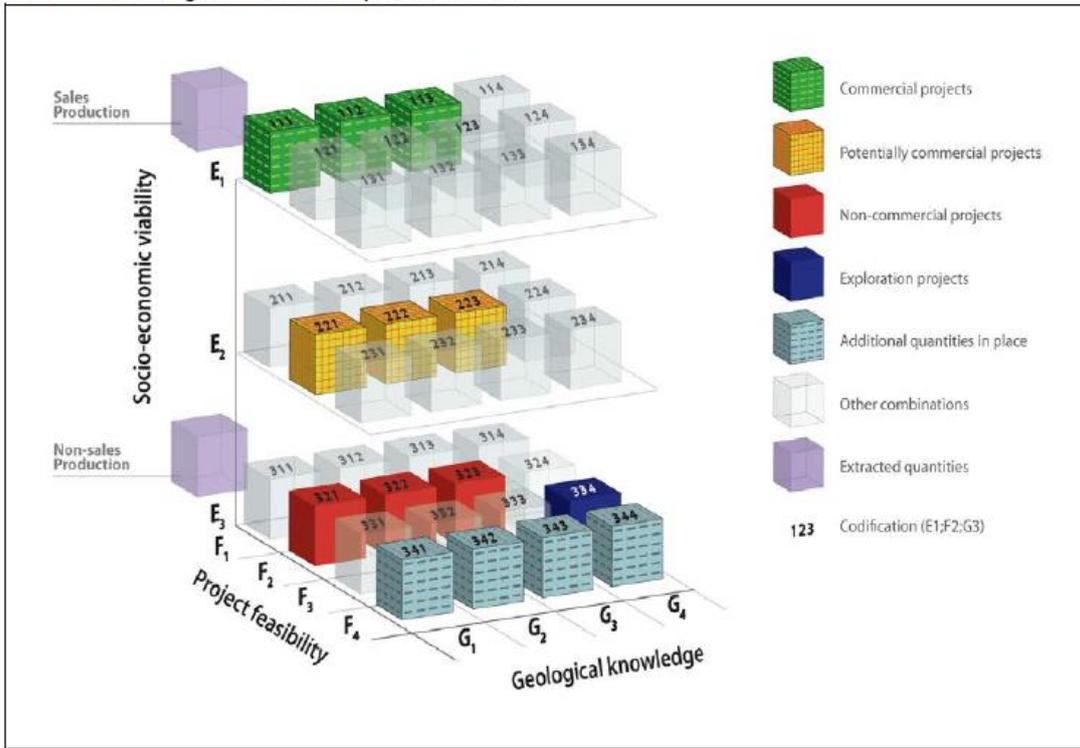


Figure 3: UNFC-2009 classification system for mining of primary resources (Source: UNFC-2009)

CRIRSCO Template		UNFC-2009 "minimum" Categories			UNFC-2009 Class
Mineral Reserve	Proved	E1	F1	G1	Commercial Projects
	Probable			G2	
Mineral Resource	Measured	E2	F2	G1	Potentially Commercial Projects
	Indicated			G2	
	Inferred			G3	
Exploration Results		E3	F3	G4	Exploration Projects

Figure 4: alignment of UNFC-2009 classes with CRIRSCO template categories (Source: UNFC-2009)

### Secondary material resources

While currently no standardized system exists to classify stocks of secondary material resources, there is growing interest among researchers to develop a classification system that allows to create a comprehensive overview of different types of potentially extractable secondary (or “anthropogenic”) resources (Winterstetter et al, 2016<sup>13</sup>). To facilitate comparisons between secondary and primary resources, research efforts focus on the integration of secondary resources into the UNFC-2009 framework (e.g. Mueller et al., 2015, Winterstetter et al., 2015<sup>14</sup>). Recently, the applicability of the UNFC-2009 framework for assessing the “mineability” of secondary resources has been confirmed (Winterstetter et al., 2016<sup>15</sup>). For each category (E1-3, F1-4, G1-3) of the UNFC-2009 framework, definitions were adapted to the context of secondary resources, and applied to 3 case studies: a landfill, a stock of obsolete PCs, and a stock of in-use wind turbines (see Figure 5). While the assessment criteria differ from those for primary resources, the classification result is consistent with the existing UNFC-2009 framework, generating a common standard for evaluation of the feasibility of extracting raw materials from primary and secondary resources.

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<sup>13</sup> <http://www.sciencedirect.com/science/article/pii/S0959652616305479>

<sup>14</sup> <http://www.sciencedirect.com/science/article/pii/S0956053X15002329>;  
<http://www.sciencedirect.com/science/article/pii/S0921344915000051>

<sup>15</sup> <http://www.sciencedirect.com/science/article/pii/S0959652616305479>

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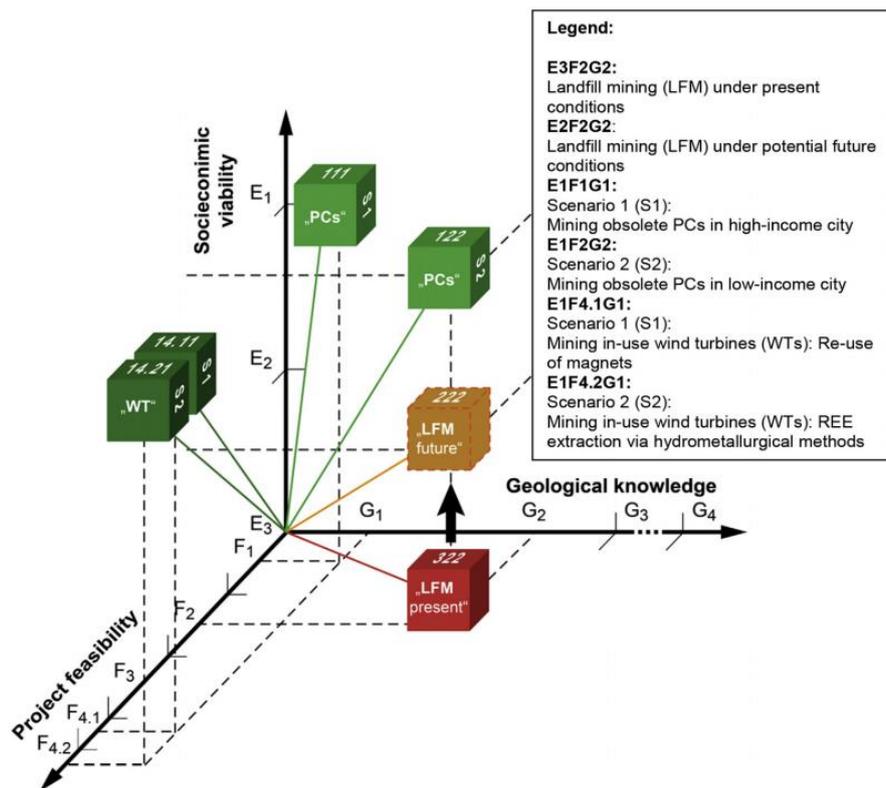


Figure 5: UNFC-2009 classification applied to 3 types of secondary resources: a landfill, a stock of obsolete PCs, and a stock of in-use wind turbines. (source: Winterstetter et al, 2016)

### 1.3.2. Depletion, scarcity, criticality and supply risk

In this section, different terms that relate to the strategic availability of raw materials are explained and put into the international policy context.

#### Conceptual framework

Van der Voet (2013) distinguishes three related concepts: depletion, scarcity and criticality. She acknowledges that these concepts are related, but not identical:

- **Depletion** of a resource means that its amount present on earth is being reduced. It refers to geological/natural stocks.
- **Scarcity** of a resource means that the amount available for use is, or will soon be, insufficient.
- **Criticality** of a resource means that it is scarce and at the same time essential for the present society.

Additionally, the US National Science and Technology Council (2016)<sup>16</sup> defines the concept of ‘**strategic minerals**’, that are regarded here as a subset of critical minerals and are those that are essential for national security applications. Also in the EU, initiatives have been taken in order to secure the supply of critical materials for the military industry<sup>17</sup>, but since defence is ultimately taken care of at Member State level, minerals that are relevant to EU security have only received minor attention compared to the raw materials that are critical for economic development. Anyway, the distinction between ‘strategic’ and ‘critical’ is not always used consistently.

Abiotic **depletion** does not suggest the disappearance of materials from the earth. Instead, the concept refers to a marginal decrease in ore grade for minerals (Vieira et al., 2012)<sup>18</sup> and to the irreversible chemical conversion of fossil fuels. Depletion results in a diminished geological availability under current production technologies, and affect both mineral resources and mineral reserves as defined by CRIRSCO (see section 3.1). Materials obtained from extracted minerals do not disappear, but are absorbed in in-use stocks, and might become available as secondary resources again after being discarded as waste. These materials from anthropogenic stocks (as opposed to geological or natural stocks), can be classified again as reserves or resources, applying the UNFC-2009 classification (see section 3.1). Usually, risks for depletion involve long term time horizons (> 20 years).

Resources can be **scarce** because of limited geological reserves, e.g. metals with a low geochemical concentration in the earth’s crust. Resources also can become scarce because of elevated extraction rates as compared to the existing reserves. The effects of the latter type, i.e. the scarcity caused by fossil resources and minerals depletion, are mainly socio-economic, by causing an increase in marginal costs of extraction and refining (Ponsioen T., 2013)<sup>18</sup>, and to a lesser extent environmental. Environmental effects can be expected when depleting those resources that are part of biogeochemical cycles or have a function in ecosystems, or as a consequence of increased mining and exploitation efforts (Sala S., 2013)<sup>18</sup>. The effects of scarcity as a consequence of depletion of biotic resources are always environmentally relevant, since biotic resources constitute ecological niches and habitats and deliver ecosystem functions.

**Criticality** adds a value judgment to scarcity. Therefore, a resource that is critical to one country, industry or sector, might at the same time not constitute a problem for others. Criticality assessments usually involve short time horizons (< 10 years).

European Commission defines **critical raw materials** as ‘those which display a particularly high risk of supply shortage in the next 10 years and which are particularly important for the value chain’. The criticality assessment methodology applied by the ad-hoc working group on critical raw materials considered three components to be taken into account in the assessment:

- **Economic importance**, based on use of each material per a defined mega-sector weighted by the value added of the sector that uses this materials as production input

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<sup>16</sup> National Science and Technology Council (2016). Assessment Of Critical Minerals: Screening Methodology And Initial Application.

<sup>17</sup> <http://criticalrawmaterials.org/eu-to-secure-supply-of-critical-materials-for-defence-industry/>

<sup>18</sup> In: Mancini, L., De Camillis, C., Pennington, D. (eds.) (2013). Security of supply and scarcity of raw materials. Towards a methodological framework for sustainability assessment. European Commission, Joint Research Centre, Institute for Environment and Sustainability, Publications Office of the European Union, Luxemburg.

- **Supply risk**, composed of:
  - level of concentration of worldwide production of raw materials, using the Herfindahl-Hirschman Index (HHI) which accounts for market competitiveness;
  - political and economic stability of the producing countries, using the World Bank's Worldwide Governance Indicator;
  - potential of substitution of the raw materials, based on a substitutability index estimated through experts' opinion and aggregating the substitutability for the different uses;
  - recycling rate, considering the shares of EU consumption of raw materials addressed through secondary materials;
- **Environmental country risk**, which refers to the risk that producing countries could implement environmental protection measures, thus constraining the raw materials' supply.

The **limitations of criticality studies** have been analyzed in the Polinares project<sup>19</sup>. Since the criticality argument is frequently used when analyzing and defining raw material research needs, the limitations are relevant to the VERAM WP3 gap analysis. The most important limitations are:

- A bias towards technology minerals by emphasizing high-tech applications and the role of market power of producers in small markets.
- A lack of predictive power beyond the short term
- A tendency to overstate the economic impact of a possible supply disruption of 'critical' minerals.
- A failure to distinguish between short-term and long-term problems.
- Insufficient taking account of the diversity and particularities of the analyzed resource markets.
- Exclusive focus on risks related to mining and export of raw materials, disregarding the larger production chain.

The **criteria used for criticality** are of very different nature, encompassing geological, technological, geo-political, economic, environmental and social factors, and ranging from short-term (national) supply-demand imbalances to long-term global producer dominance and political risks. Moreover, criteria differ greatly among assessments, resulting in different lists of materials that are considered as critical.

In view of the limitations summarized above, and the diversity of criteria used to determine criticality, Buijs et al. (2012)<sup>19</sup> have made some suggestions in order to **improve the suitability of criticality studies to guide long-term policies**. They propose to separately consider the different aspects that are hidden behind the lists of critical raw materials, including

- an analysis of (historical) trends and links between them;
- an improvement of the quality of data required for criticality assessments;
- a move forward towards a more systemic and dynamic interpretation of the concept of criticality

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<sup>19</sup> Buijs B, Sievers H, Tercero Espinoza LA (2012). Limits to the critical raw materials approach. Waste Resour Manag 165:7

Some of the efforts for looking at criticality from a longer term perspective are briefly summarized in the next section.

[Application of the criticality concept to raw materials, regions, countries, technologies and industrial sectors](#)

A considerable number of raw material criticality studies are ongoing or have been published for specific regions, countries, sectors and technologies.

In Table 1, an illustrative, non-exhaustive summary is given on the criticality of metals in **low-carbon technologies**<sup>20</sup>.

*Table 1: Metals used in low-carbon technologie*

Technology	Device	Metals
Wind	Permanent magnets in generators	Dysprosium, neodymium, praseodymium
	Steel alloys (eg, for offshore applications)	Copper, chromium, manganese, molybdenum, nickel
Solar (photovoltaic)	Crystalline silicon	Silicon, silver, tin
	Thin films	Cadmium, copper, indium, gallium, germanium, selenium, tellurium
Solar (concentrating)	Solar mirrors	Silver
Bio-fuels	Catalysts	Cobalt, palladium, platinum, ruthenium, rhodium
Nuclear energy	Reactor control rods	Cadmium, chromium, cobalt, copper, hafnium, indium, lead, molybdenum, nickel, niobium, silver, tin, tantalum, titanium, tungsten, vanadium, wolfram, yttrium, zirconium
Hybrid- and electro vehicles	Motors	Copper, dysprosium, neodymium, praseodymium
Electricity storage	Li-Ion Batteries	Cobalt, lithium, manganese, nickel
	Ni-MH Batteries	Cerium, cobalt, lanthanum, manganese, neodymium, nickel, praseodymium

<sup>20</sup>

[http://www.realinstitutoelcano.org/wps/portal/web/rielcano\\_en/contenido?WCM\\_GLOBAL\\_CONTEXT=/elcano/elcano\\_es/programas/energiacambioclimatico/publicaciones/ari12-2013-solera-critical-metals-risks-opportunities-spain](http://www.realinstitutoelcano.org/wps/portal/web/rielcano_en/contenido?WCM_GLOBAL_CONTEXT=/elcano/elcano_es/programas/energiacambioclimatico/publicaciones/ari12-2013-solera-critical-metals-risks-opportunities-spain)

Fuel Cells		Cerium, cobalt, gallium, lanthanum, manganese, nickel, iridium, palladium platinum, rhodium, ruthenium, vanadium, yttrium
High efficiency lighting	LED, halogens and fluorescent lamps	Cerium, dysprosium, europium, gallium, indium, lanthanum, niobium, scandium, terbium, yttrium
Electricity grids	Cables	Copper, lead
Carbon capture and storage (CCS)	Steel alloys	Cobalt, copper, chromium, manganese, molybdenum, nickel, niobium, vanadium

Source: US DOE Critical Materials Strategy (2010 & 2011); JRC, Oakdene Hills & HCSS (2011); IZT & Fraunhofer ISI (2009).

In the EU, Germany has been a frontrunner in identifying those raw materials critical to the development of **national industries**. Already in 2007, the Federal Ministry of Economics and Technology published a first document on national raw material strategies. (2007)<sup>21</sup>. In 2009, the criticality of **hi-tech metals** was analyzed from a **long-term (2030) demand perspective**, for a wide spectrum of advanced technologies<sup>22</sup>.

Another **longer-term criticality assessment** was done for the group of **OECD countries**, looking out to 2030<sup>23</sup>. The assessment included:

- supply risk predictions for 2030, using the production-to-reserves ratio method as well as the reserve distribution instead of production;
- expected future economic importance in 2030, based on estimates on how the consumption of minerals in the future will be shared between different end-use sectors, the expected relative economic importance of these sectors, and the relative value added by sector;
- required changes in recycling and substitutability in order to mitigate criticality in 2030.

Regarding to the **changes in substitutability** required in 2030, this OECD study concludes that for minerals such as borate, barytes, phosphate rock and molybdenum, very large increases in substitutability would be required from a very low starting point, suggesting that significant investments in R&D would be necessary for these minerals. By contrast, only small improvements would be required for manganese, bauxite, copper and potash, although again in the cases of manganese and bauxite substitutability is currently very low, so gains may not be won easily.

On the **recycling rates**, the development of new recycling technologies is required to lower the supply risk of those minerals that currently have recycling rates near zero, such as barytes; borate; fluorspar; gallium;

<sup>21</sup> Federal Ministry of Economics and Technology (2007). Elemente einer Rohstoffstrategie der Bundesregierung.

<sup>22</sup> IZT & Fraunhofer ISI (2009). Rohstoffe für Zukunftstechnologien, 15/V/2009.

<sup>23</sup> Coulomb, R., Dietz, S., Godunova, M. & Nielsen, T. B. (2015). Critical Minerals Today and in 2030: An Analysis for OECD Countries. (OECD Publishing, 2015)

germanium; indium; magnesite; phosphate rock; heavy rare earth elements; light rare earth elements; silicon metal, and; vanadium.

Particularly at EU level, much attention has been given to the concept of **Key Enabling Technologies (KETs)**, that are crucial for the competitiveness and renewal of European manufacturing. KETs are defined as *‘knowledge intensive technologies associated with high R&D intensity, rapid innovation cycles, high capital expenditure and highly skilled employment. They enable process, goods and service innovation throughout the economy and are of systemic relevance. They are multidisciplinary, cutting across many technology areas with a trend towards convergence and integration.’*<sup>24</sup> The KETs that have been defined and demarcated are presented in Table 2<sup>25</sup>:

KET	Definition and demarcation
NT (nanotechnology)	An umbrella term that covers the design, characterisation, production, and application of structures, devices, and systems by controlling the shape and size at an atomic, molecular, and supramolecular scale. Nanotechnology holds the promise of leading to the development of smart nano- and microdevices and systems and to radical breakthroughs in vital fields such as healthcare, energy, environment, and manufacturing.
MNE (micro- and nanoelectronics)	Deals with semiconductor components and/or highly miniaturised electronic subsystems and their integration into larger products and systems. They include the fabrication, design, packaging and testing from nano-scale transistors to micro-scale systems integrating multiple functions on a chip.
PHOT (photonics)	A multidisciplinary domain dealing with light, encompassing its generation, detection, and management. Among other things, it provides the technological basis for the economic conversion of sunlight to electricity (which is important for the production of renewable energy) and a variety of electronic components and equipment such as photodiodes, LEDs and lasers.
AM (advanced materials)	Leads both to new reduced-cost substitutes to existing materials and to new higher-added-value products and services. Advanced materials offer major improvements in a wide variety of different fields, e.g., aerospace, transport, building, and healthcare. Advanced materials facilitate recycling, lowering the carbon footprint and energy demand as well as limiting the need for raw materials that are scarce in Europe.
IB (industrial	Also known as “white biotechnology”, it is the application of biotechnology for

<sup>24</sup> European strategy for Key Enabling Technologies – A bridge to growth and jobs (COM/2012/0341 final)

<sup>25</sup> De Heide M, Butter M, Kappen D, Thielmann A, Braun A, Meister M, Holden D, Livesey F, O’Sullivan E, Hartmann C, Zaldua M, Olivieri N, Turno L, Deschryvere M, Lehenkari J, Ypma P, McNally P, de Vries M (2013) Vision and characteristics of multi KETs pilot lines. mKPL Project Report. Delft: mKETs-PL Project.

biotechnology)	the industrial processing and production of chemicals, materials and fuels. It includes the practice of using microorganisms or components of microorganisms like enzymes to generate industrially useful products in a more efficient way (e.g., less energy use or fewer by-products) or to generate substances and chemical building blocks with specific capabilities that conventional petrochemical processes cannot provide. There are many examples of such bio-based products already on the market. The most mature applications are related to enzymes used in the food, feed, and detergent sectors. More recent applications include the production of biochemicals, biopolymers, and biofuels from agricultural or forest wastes.
AMT (advanced manufacturing systems)	AMTs encompass the use of innovative technology to improve products or processes that drive innovation, including all production equipment that deploys a KET or any other innovative technology, but excluding the actual production as this is attributed to the individual KETs.
Cross-cutting KETs	While individual KETs are recognised as indispensable sources of innovation, the cross-fertilisation of different KETs is vital, in particular for the transition from R&D to pilot and industrial scale production. Cross-cutting KETs' activities bring together and integrate different KETs and reflect the interdisciplinary nature of technological development. They have the potential to lead to unforeseen advances and new markets, and are important contributors to new technological components or products.

*Table 2: Overview of the definitions of the individual KETs*

A study for the European Parliament's Committee on Industry, Research and Energy (2014)<sup>26</sup> summarizes the role that the six different individual KETs play with regard to their contribution to EU competitiveness and the competitiveness of EU actors in a global context. It includes a non-exhaustive overview of relevant clusters on KETs and the actors involved, and it describes the relationship (i.e., interaction) between the EU value chains deploying KETs and non-EU actors.

<sup>26</sup> European Parliament (2014). Horizon 2020: Key Enabling Technologies (KETs), Booster for European Leadership in the Manufacturing Sector, IP/A/ITRE/2013-01

## 1.4. Raw Materials policies, strategies, programmes and plans

A **policy** is a set of goals, objectives, strategies and programmes, set within a precise timeframe and formulated in close collaboration with all concerned stakeholders<sup>27</sup>. An example is the EU raw materials policy. An raw material related example at national level is the Dutch raw material policy<sup>28</sup> that outlines the steps that are required to enhance the understanding of the problems surrounding raw materials – and the role of the Dutch government in this area. Individual country profiles regarding critical raw materials substitution policies are available from CMR\_InnoNet<sup>29</sup>.

- A **policy goal** is a broad statement of intent providing guidance for action. Policy goals are clear, credible and reflect the vision of citizens and policy makers. The goal of the EU raw materials policy is to secure a sustainable supply of raw materials for Europe.
- **Policy objectives** identify what is needed to achieve policy goals. Policy objectives are attainable, feasible, credible, technically sound, consistent with central government priorities and socially as well as politically acceptable. Objectives of the EU raw material policy are (i) to ensure a level playing field in access to resources in third countries; (ii) to foster sustainable supply of raw materials from European sources, and (iii) to boost resource efficiency and promoting recycling<sup>30</sup>. In order to secure the economic, social and political acceptability, a European Innovation Partnership (EIP) on Raw Materials was created, as a stakeholder platform that brings together representatives from industry, public services, academia and NGOs. Its mission is to provide high-level guidance to the European Commission, Members States and private actors on innovative approaches to the challenges related to raw materials.<sup>31</sup>
- **Strategies** describe how policy objectives and goals can be achieved. An example is the German government's raw materials strategy for safeguarding a sustainable supply of non-energy mineral resources, published in 2010<sup>32</sup>. In 2012, aiming at the specification and further development of the German raw materials strategy, a criticality assessment was performed that focused specifically on the supply of raw materials for high-tech German industries<sup>33</sup>.
- **Programmes** are sets of coherent and logically structured interventions and expected results. They are set within a timeframe with well-defined implementation tasks. Their specific objectives are

<sup>27</sup> [www.fao.org](http://www.fao.org)

<sup>28</sup> [https://ec.europa.eu/growth/tools-databases/eip-raw-materials/en/system/files/ged/46%20mss-netherlands\\_en.pdf](https://ec.europa.eu/growth/tools-databases/eip-raw-materials/en/system/files/ged/46%20mss-netherlands_en.pdf)

<sup>29</sup> [http://www.asd-europe.org/fileadmin/user\\_upload/Client\\_documents/ASD\\_Content/7\\_CROSS-FUNCTIONS/7.3\\_RT\\_and\\_RD/D-3.2-Country-profiles\\_1\\_.pdf](http://www.asd-europe.org/fileadmin/user_upload/Client_documents/ASD_Content/7_CROSS-FUNCTIONS/7.3_RT_and_RD/D-3.2-Country-profiles_1_.pdf)

<sup>30</sup>

<sup>31</sup> <https://ec.europa.eu/growth/tools-databases/eip-raw-materials/en/content/european-innovation-partnership-eip-raw-materials>

<sup>32</sup> <http://www.bmwi.de/English/Redaktion/Pdf/raw-materials-strategy,property=pdf,bereich=bmwi2012,sprache=en,rwb=true.pdf>

<sup>33</sup> TAB (2012). Die Versorgung der deutschen Wirtschaft mit Roh- und Werkstoffen für Hochtechnologien – Präzisierung und Weiterentwicklung der deutschen Rohstoffstrategie – Innovationsreport.

linked to the achievement of policy goals and objectives. Programmes can be subdivided in subprogrammes. An example is the EU Framework Programme for Research and Innovation.

- For each (sub)programme an **action plan** can be made. Action plans should also include expected results, related interventions as well as institutional responsibilities. Action plans focus on specific themes, arranged by specific topics. They can be structured in terms of the time allowed for achieving the expected results. Programmes, subprogrammes and action plans should comprise clearly identified targets and indicators. At EU level, a Strategic Implementation Plan (SIP) sets out the objectives, targets and actions to be reached or implemented by 2020. It contains EIP objectives, targets & methodology; overall strategy; Priority Areas, Action Areas & Actions targeting sector-specific stakeholders & practitioners. National examples are the strategic plan presented by the French government in 2010, which stressed the importance of critical metals for the low-carbon sector, and the action plan<sup>34</sup> jointly published by the UK Department for Business Innovation and Skills (BIS) and the Department for Environment Food and Rural Affairs (DEFRA), in which criticality is regarded as a driver for innovative solutions which encourage the diversification of technologies and the development of new business models.

## 1.5. Forecasting, foresight, roadmap and roadmapping, scenarios, vision and vision building

### 1.5.1. Forecasting / prediction

***Forecasting means projection of existing trajectories towards the future. Future projections are based on the knowledge and trends of past development.***

Forecasting cover quantitative analysis, extrapolations and modelling in particular. These activities can be combined with sensitivity analysis to establish a range of possible trajectories.<sup>35</sup> Forecasting itself can be approached as a process of making a forecast. Forward Thinking Platform states that forecast is usually applied to short-term futures – such as one year ahead<sup>36</sup>.

### 1.5.2. Foresight

***Foresight is action-oriented and participatory strategic thinking that focuses on potential and alternative perceptions of the future. It is always based on the present knowledge that is collected and ennobled***

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<sup>34</sup> BIS & DEFRA (2011). Resource Security Action Plan: making the most of valuable materials.

<sup>35</sup> Centre for Strategic Futures & Civil Service College (2015). Foresight — A Glossary.

<sup>36</sup> Forward Thinking Platform (2014). A Glossary of Terms commonly used in Futures Studies.

***through different methods. When understanding different perceptions about future, the emergence of it can be influenced by our actions.*** <sup>37</sup>

Different definitions of foresight stress its systematic, participatory and multi-disciplinary nature. In reflection to forecasting, foresight can be placed closer to futures studies. There, one of the basic assumptions is that there are different kinds of futures such as possible, probable and preferable futures. <sup>37</sup> The plural - “futures” - emphasizes that the future may take different forms and there is uncertainty about what the future will hold<sup>36</sup>.

The future is often considered with a mid-to long term time horizon, usually between 10 to 50 years ahead. At the same foresight provides a space to different stakeholders and experts for systemic thinking and developing future-oriented knowledge. Foresight may explore future changes, developments and challenges both qualitatively and quantitatively, and simultaneously to support stakeholders to actively shape the future vision for today strategies and actions.<sup>36</sup>

### 1.5.3. Roadmap and roadmapping

***Roadmapping is a flexible technique that is used to support strategic and long-range planning. The approach provides a structured (and often graphical) means for exploring and communicating the relationships between evolving and developing markets, products and technologies over time.*** <sup>38</sup> ***The roadmapping process provides a way to identify, evaluate, and select strategic alternatives that can be used to achieve desired*** <sup>39</sup>. ***Roadmap can also be viewed as an approach giving answers to three questions: Where do we want to go? Where are we now? How can we get there?*** <sup>40</sup>.

Broadly, there can be identified two cultures of roadmapping. The first is the culture of technology roadmapping, in which roadmapping is approached as a normative instrument to identify relevant technologies and align them with explicit product plans and related action steps. In this culture the roadmapping process is a systematic practice aimed at product development. The second is the emerging culture of strategy roadmapping in which the roadmapping is perceived more as a dynamic and iterative process that produces weighed crystallizations of long-term vision, and short- to medium-term strategies to realize this vision. There, the roadmaps can be seen as knowledge umbrellas that depict a large-scale

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<sup>37</sup> Ahlqvist, T. (2015). Foresight. In: STRADA Decision-making and support of change in complex systems. Nieminen, M. & Hyytinen, K. (Eds.). VTT TECHNOLOGY 218.

<sup>38</sup> Phaal, R., Farrukh, C. & Probert, D. (2004). Technology roadmapping—A planning framework for evolution and revolution. *Technological Forecasting & Social Change* 71 (2004) 5–26.

<sup>39</sup> Kostoff, R. & Schaller, R. (2001). Science and Technology Roadmaps. *IEEE Transactions On Engineering Management*, Vol. 48, No. 2.

<sup>40</sup> Phaal, R. & Muller, G. (2009). An architectural framework for roadmapping: Towards visual strategy. *Technological Forecasting & Social Change* e 76 (2009) 39–49.

strategy picture of a system.<sup>41</sup>The following considerations are mainly constructed from strategic roadmapping point of view.

Phaal et al.<sup>38</sup> states, that the graphical form of the roadmap is a powerful communication mechanism. It can present information in a highly synthesized and condensed form, and as such it incorporates all key perspectives in a form that supports the strategic dialogue necessary for developing consensus and aligning action <sup>41</sup>. The figure 6 depicts an example of visual structure of a roadmap.

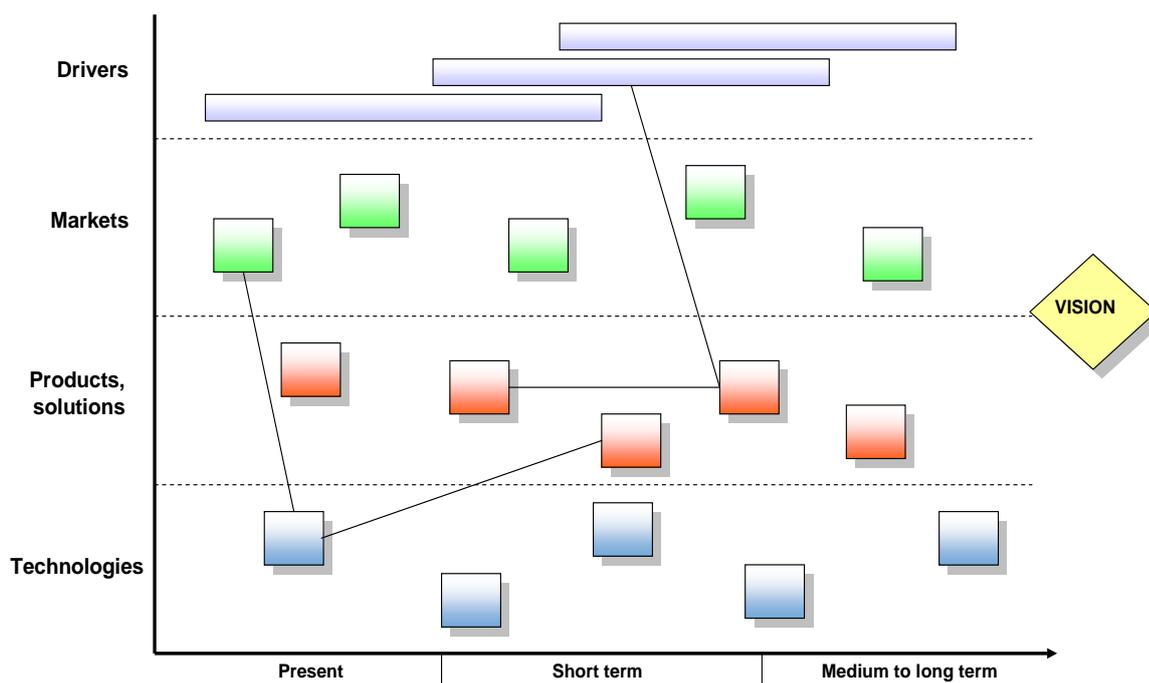


Figure 6: Generic, visual description of a roadmap

The roadmap architecture consists of two main dimensions<sup>40</sup>:

1. **Vertical timeframes** may include the past, short-, medium- and long-term perspectives. Future vision can also be seen to be included in this continuum. Short-term perspective typically covers one-year horizon. This part of the roadmap is the most important output, as it will be transformed into tangible plans and actions. Medium-term often takes three-year timeframe, linked to the strategic planning horizon, and highlighting the broader direction and options that influence the short-term decisions and plans. Long-term covers typically ten-year timeframe, providing a bridge between the medium-term strategy and the vision. In all, selected timeframes depend on the rate of change of a system in question. Extremes may range from 2 to 3 year horizons in fast-moving sectors (e.g. software business), to cover 100 years horizon in long-term energy futures.

<sup>41</sup> Ahlqvist, T., Valovirta, V. & Loikkanen, T. (2012). Innovation policy roadmapping as a systemic instrument for forward-looking policy design. Science and Public Policy 39 (2012) pp. 178–190.

2. **Horizontal layers** representing systems-based hierarchical taxonomy. The top layer relates to the trends and drivers that govern the overall goals or purpose of roadmap, including external market and industry trends and internal business trends and drivers, milestones, objectives and constraints. This type of information can be thought as ‘know-why’ dimension of knowledge. In picture’s example driver information is split into two top layers; general drivers and drivers describing the market changes. The middle layer (here: Products and solutions) generally relates to the tangible systems that need to be developed to respond to the drivers layer. Middle layer can also represent the development of services, infrastructure or other mechanisms for integrating technology, capabilities, knowledge and resources in a way that delivers benefits to stakeholders. This type of information can be thought of as representing the ‘know-what’ dimension of knowledge. The bottom layer (in an example: technologies) consists of the resources enabling products, services and systems to be developed. In addition to technologies, these may cover knowledge-based resources, skills and competences and other resources such as finance, partnerships and facilities. This type of information can be thought of as representing the ‘know-how’ dimension of knowledge.

Many of the benefits of roadmapping are derived from the process, rather than the roadmap itself. The roadmap process brings together the various key stakeholders and perspectives needed to develop understanding of complex systems and issues, building consensus about the way forward <sup>42</sup>. It also facilitates the development of a collective vision that can lead to action and collaboration.<sup>38</sup>

#### 1.5.4. Scenarios

***Scenarios are consistent and coherent descriptions of alternative hypothetical futures that reflect different perspectives on past, present, and future developments, which can serve as a basis for action.*** <sup>43</sup>

Scenarios were originally introduced by Herman Kahn in 1950s in connection with military and strategic studies<sup>44</sup>. In 1967 Kahn & Wiener <sup>45</sup> defined scenarios as hypothetical sequences of events constructed for the purpose of focusing attention on causal processes and decision points. Since then, scenarios have developed notably and today there is large diversity in the scenarios developed<sup>46</sup>. There is no consensus on the scenario typologies, however, several of them share the view that they explore possible, probable and /or preferable futures<sup>47</sup>. Presently, scenarios cannot be considered as predictions about the future rather as simulations of some possible futures<sup>43</sup>.

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<sup>42</sup> Blackwell, A., Phaal, R., Eppler, M. & Crilly, N. (2008). Strategy roadmaps: new forms, new practices. In Stapleton, G., Howse, J. and Lee, J. (Eds.). Diagrams 2008. Springer-Verlag, Berlin/Heidelberg, 127–140.

<sup>43</sup> van Notten, P. (2005) Writing on the Wall: Scenario Development in Times of Discontinuity.

<sup>44</sup> European Foresight Platform (2017). Scenario building.

[http://forlearn.jrc.ec.europa.eu/guide/2\\_scoping/meth\\_scenario.htm#Definition](http://forlearn.jrc.ec.europa.eu/guide/2_scoping/meth_scenario.htm#Definition)

<sup>45</sup> Kahn & Wiener (1967). The Year 2000: A Framework for Speculation on the Next Thirty-Three Years.

<sup>46</sup> Van Notten, P., Rotmans, J., van Asselt, M. & Rothman, D. (2003). An updated scenario typology. Futures 35, 423-443.

<sup>47</sup> Börjeson, L., Höjer, M., Dreborg, T. & Finnveden, G. (2006). Scenario types and techniques: Towards a user’s guide. Futures 38, 723-739.

To the decision makers scenarios offer a disciplined way to think about the future when making public decisions. Scenarios may for example, to help decision makers to consider the range of plausible futures, to articulate preferred vision, and to utilize some of the contents that has been achieved or learned during the scenario process. In other words, scenarios may help decision-makers to acquire knowledge and to understand their operational environment in an extended sense (contributed by future descriptions from the view point of specified dimensions, for example). To be effective, the stakeholders/participants must be convinced of the scenarios' soundness, relevance and the value of the process. Successful scenarios are plausible, consistent and offer true insights about the future.<sup>43</sup>

### 1.5.5. Vision and vision building

***Vision is a compelling image of a preferred future. Visioning is the process of creating a series of images or visions of the future.***<sup>48</sup>

Contrary to scenarios, which refer to alternative futures, the term vision is used to refer to a single and preferred future. In other words, vision is a carefully formulated and clearly articulated description of a future state of affairs that an individual or group finds desirable<sup>49</sup>. The motivation to formulate visions is that they underpin and promote change. Therefore, visions are usually formulated in participatory processes to create commitment to the desired change towards the vision.

Brien and Meadows<sup>49</sup> propose a seven phase participatory visioning methodology (see Table 3), which incorporates various approaches, such as visioning scenarios, stakeholder analysis, scenario planning and encouraging creativity in the visioning process. It can be noted that the visioning process can be combined with other foresight methodologies, as it includes scenario creation (in phase 4) and the final phase of action planning relates to roadmapping.

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<sup>48</sup> A Glossary of Terms commonly used in Futures Studies Full Version. Forward Thinking Platform and The Global Forum on Agricultural Research (GFAR), September 2014.

<sup>49</sup> Brien F. O. & Meadows M. (2007) Developing a visioning methodology: Visioning Choices for the future of operational research. *Journal of the Operational Research Society*, 58, 557–575.

*Table 3. Seven phases of the visioning methodology (by Brien and Meadows).*

Phase of the visioning process	Details of each phase
1. Defining the project	Identify project champion who invites representative participation onto steering group. Group meets to discuss drivers of need for change and project process
2. Identifying stakeholders	Identify key sectors and relevant stakeholder categories.
3. Exploring issues	Use primary and secondary data sources and a variety of research methods (e.g. interviews or focus groups) to consult stakeholder groups.
4. Preparing discussion materials	Analyse output from stage 3 and use the data to create 2–4 visioning scenarios such that the different perspectives and issues are interwoven to produce alternative views of the future. These visioning scenarios are used to promote dialogue in the next phase of the process.
5. Promoting dialogue and generating ideas	Stakeholder groups are encouraged to participate in visioning workshop(s). Distribute discussion materials (produced in step 4) – groups freely decide whether or not to use them. Groups develop action-oriented vision, encouraged to creatively present it.
6. Producing a shared vision	Gather material from groups and consolidate ideas for action under broad themes. Groups together discuss broad vision themes and creatively produce a shared vision, expressed in actionable concepts.
7. Planning for action	Stakeholders invited to commit to implement specific action components of the vision.

As visions can be influential and stimulate change, it is reasonable to consider the quality criteria for visions. Wiek and Iwaniec<sup>50</sup> have identified quality criteria for sustainability visions based on literature review. According to their analysis sustainability visions should be visionary, sustainable, systemic, coherent, plausible, tangible, relevant, nuanced, motivational and shared. Some of these characteristics are specific to sustainability visions, such as the first two normative quality criteria (visionary and sustainable), while others can be seen as general quality criteria to any vision. For example, a vision, which is relevant (composed of salient goals that focus on people, their roles and responsibilities), nuanced (detailed priorities, desirability), motivational (inspire and motivate towards the envisioned change) and shared

<sup>50</sup> Wiek A. & Iwaniec D. (2014) Quality criteria for visions and visioning in sustainability science. *Sustainability Science* 9:497–512.

(display a critical degree of convergence, agreement, and support by relevant stakeholders), has good transformational quality. The remaining four criteria contribute to the construct quality of a vision: systemic (holistic presentation, addressing complexity), coherent (composed of compatible goals), plausible (evidence-based, informed by empirical examples), and tangible (composed of clearly articulated and detailed goals).

## 2.Raw materials platforms and networks

### 2.1.Introduction

#### 2.1.1. Objective

The overall purpose of this chapter is to help delineate the current raw materials playing field, identifying the players and their teams and making explicit the setting of the game.

Two main tasks have been carried out:

- Identification of private, public and multi-stakeholder platforms and formal networks with a focus on raw material supply.
- Identification of current sectoral and horizontal policies at international, EU and MS level that might considerably affect (positively or negatively) the future availability of raw materials for the European industry at any point of the value chain (exploration, mining, production, trade, consumption, collection, reuse, remanufacturing, recycling). Special attention will be paid to international policies, as far as a clear link to, or potential effects on European policies can be established. The results of this tasks are presented in Chapter 3.

Regarding the geographical coverage of the study 7 countries have been selected within the EU and 8 countries in the international area. The selection covers countries rich in natural resources and those that are mainly importers of raw materials.

EU Members States	International scope
<ul style="list-style-type: none"><li>• Belgium</li><li>• Finland</li><li>• France</li><li>• Germany</li><li>• Netherlands</li><li>• Spain</li><li>• Sweden</li></ul>	<ul style="list-style-type: none"><li>• Australia</li><li>• Brazil</li><li>• Canada</li><li>• China</li><li>• Japan</li><li>• Korea</li><li>• South Africa</li><li>• United States</li></ul>

Regarding sectoral policies we tried to cover main economic sectors, this is construction and infrastructures, energy (in relation to materials used for generation and storage facilities, CRM), water, ICT, chemistry, bioeconomy (excluding energy and food), i.e. wood sector, extraction (mining), transport (automotive, aviation, maritime), manufacturing / processing and recycling / waste management.

The final objective of this report is not to make an exhaustive summary of strategy and policy documents from all countries. It is rather aimed at selecting, gathering and highlighting the main items within those documents related to the raw materials supply chain.

### 2.1.2. Methodology

The work does not start from scratch as several review exercises and documents have been made previously. Some of them have been used for this compilation. To name just a few<sup>51</sup>:

- A Review of National Resource Strategies and Research. DEFRA<sup>52</sup>
- The MIN-GUIDE project<sup>53</sup>
- The Intraw project<sup>54</sup>
- More from less — material resource efficiency in Europe. EEA European Environment Agency<sup>55</sup>

Later the desktop research followed with a web search exercise featuring a dual approach. On the one hand we interrogated free search engines like Google, Bing, and DuckDuckGo. On the other hand we browsed the websites of the main government's bodies, agencies and organizations with responsibilities about raw materials. Additionally an alert system was implemented using a commercial tool (Intelsuite) to be aware of new documents that could be published during the research process.

The information was used to populate an excel spreadsheet that contains several tables. One was devoted to gather policies and strategies and another one to networks, including their main characteristics. In the case of networks with a very large number of members they have not been listed.

A further analysis was carried out with policies in a third table (Analysis). There a series of indicators (*see Annex 1*) was used to describe policies and strategies in more detail. This further analysis is intended to be of interest for further use by other partners in the VERAM project, i.e. gap analysis. As a complement to the excel spreadsheet a report has also been produced.

Some strategy documents have not been reviewed due to language barriers. This is especially significant in the case of Asian countries. In some cases it has been possible to resort to secondary sources, as articles or other analysis reports. However the main option when primary documents were unavailable has been to discard the mentioned documents.

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<sup>51</sup> A more comprehensive list is included as annex II.

<sup>52</sup> [https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/69526/pb13722-national-resource-strategies-review.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/69526/pb13722-national-resource-strategies-review.pdf)

<sup>53</sup> <http://www.min-guide.eu/>

<sup>54</sup> <http://intraw.eu/publications/>

<sup>55</sup> <http://www.eea.europa.eu/publications/more-from-less/>

### 2.1.3. Structure of the report

Basically the report replicates the information gathered on table Networks and table Policies of the excel spreadsheets. In some cases a more detailed description of the objectives is added.

## 2.2. Networks

### 2.2.1. World

<b>Name:</b>	<b>APRA (Automotive Parts Remanufacturers Association)</b>
url:	<a href="https://apra.org/">https://apra.org/</a> <a href="http://www.apra-europe.org/main.php?target=whatisapra">http://www.apra-europe.org/main.php?target=whatisapra</a>
Leader:	
Partners:	More than 2,000 member companies. The membership consists of private, independent remanufacturers/rebuilders, component manufacturers and vehicle manufacturers.
Scope/Aim/Objectives	The Association's objective is to promote the general business interests of the remanufacturing industry and foster the spirit of recycling for a better environment. It also provides members with forums to interact and consult with each other on issues affecting the entire industry. APRA has a European Division, which is responsible for the content of this web site. It pursues the same objectives as the global association, but also focuses on issues more specific to Europe. The prevailing principle is "think globally and act locally".

<b>Name:</b>	<b>Belmont Forum</b>
url:	<a href="https://belmontforum.org/">https://belmontforum.org/</a>
Leader:	
Partners:	Commonwealth Scientific and Industrial Research Organisation (CSIRO), Austrian Federal Ministry for Science and Research (BMWFW), Sao Paulo Research Foundation (FAPESP), National Natural Science Foundation of China (NSFC), Ministry of Science and Technology (MOST), European Commission, National Alliance for Environmental Research (AllEnvi), Deutsche Forschungsgemeinschaft (DFG), Ministry of Earth Sciences (MOES), National Research Council (CNR-DTA), Ministry of Education, Culture, Sports, Science and Technology (MEXT), Japan Science and Technology Agency (JST), The Netherlands Organisation for Scientific Research (NWO), Research Council of Norway (RCN), Qatar National Research Foundation (QNRF), National Research Foundation (NRF), Swedish Secretariat for Environmental Earth System Sciences (SSEESS), National Science Foundation (NSF), The Swedish Research Council Formas

Scope/Aim/Objectives	<p>The Belmont Forum is guided by the charge embodied in the Belmont Challenge, which is a “funders' vision for the priority knowledge and capabilities derived from environmental research that society needs, and the underpinning research challenges over the next decade to deliver them.” The Forum support research programs as the “Transformations to Sustainability” which is structured around three themes:</p> <ol style="list-style-type: none"> <li>1. Governance and institutional dimensions of transformations to sustainability</li> <li>2. Economy and finance of transformations to sustainability</li> <li>3. Well-being, quality of life, identity, and social and cultural values in relation to transformations to sustainability</li> </ol>
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### 2.2.2. European Union

Name:	<b>BioSTEP</b>
url:	<a href="http://www.bio-step.eu">http://www.bio-step.eu</a>
Leader:	Ecologic Institute
Partners:	Aghetera, BIA (Bulgarian Industrial Association – Union of the Bulgarian Business), BIOCOM AG, European Policies Research Centre (EPRC), University of Strathclyde, Regional Association of Chambers of Commerce of Veneto, University of Nottingham, Wageningen Economic Research, WIP Renewable Energies.
Scope/Aim/Objectives	<p>The BioSTEP project is funded under the European Union’s Horizon 2020 research and innovation programme (Grant Agreement no. 652682) and runs from March 2015 until February 2018. The overall aim of the EU-funded project BioSTEP is to promote a public dialogue on the goals of the bioeconomy and the steps needed to move towards a sustainable economy and way of life.</p> <p>BioSTEP aims to engage citizens and various stakeholder groups in discussions about the future development of Europe’s bioeconomy. Its objective is to increase the overall awareness and understanding of the bioeconomy as well as its consequences and benefits by considering citizens' needs and concerns. In order to overcome the current lack of public knowledge on the bioeconomy, BioSTEP will make existing data on bio-based products and processes accessible to the general public and various stakeholder groups. In addition, BioSTEP will also identify and disseminate best practices on the participatory development of national and regional bioeconomy strategies.</p>

Name:	<b>Critical Raw Material Alliance</b>
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url:	<a href="http://criticalrawmaterials.org/">http://criticalrawmaterials.org/</a>
Leader:	
Partners:	Beryllium Science & Technology Association, Beta, Cobalt Development Institute, Ecophos, Euro Alliages, EuroFluor, International Magnesium Association, Imerys, Indium Corporation, International Precious Metals Institute, Innovative Semiconductors Materials, Less Common Metals
Scope/Aim/Objectives	The Critical Raw Materials Alliance (CRM Alliance) has been created by industry to advocate the importance of CRMs for the European economy and to promote a strong European CRM policy. It is the representative body of primary producers, traders and associations of CRMs. CRM Alliance also oversee an MEP Interest Group on Critical Raw Materials to connect industry with policy-makers through bi-annual political luncheon events.

<b>Name:</b>	<b>Critical Raw Material Recovery</b>
url:	<a href="http://www.criticalrawmaterialrecovery.eu/">http://www.criticalrawmaterialrecovery.eu/</a>
Leader:	The Waste and Resources Action Programme (WRAP)
Partners:	EARN, the European Advanced Recycling Network, European Recycling Platform UK Limited (ERP UK Ltd), Knowledge Transfer Network Limited (KTN), Wuppertal Institute for Climate, Environment, Energy GmbH (WI),
Scope/Aim/Objectives	Critical Raw Material Closed Loop Recovery is an EU LIFE funded project that explores increasing the recovery of target CRMs from waste electronic products.

<b>Name:</b>	<b>CRM_InnoNet Critical Raw Materials Innovation Network</b>
url:	<a href="http://www.criticalrawmaterials.eu">http://www.criticalrawmaterials.eu</a>
Leader:	Knowledge Transfer Network (KTN)
Partners:	Aerospace and Defence Industries Association of Europe (ASD), Commissariat A L'Énergie Atomique et Aux Énergies Alternatives (CEA), Conseil Européen de l'Industrie Chimique (CEFIC), D'Appolonia, European Materials Research Society (EMRS), C-Tech Innovation, Federacion Empresarial de la Industria Quimica Espanola (FEIQUE), Fraunhofer ISI, Swerea Mefos, PNO Consultants, SEMI EUROPE, SINTEF, SP Sveriges Tekniska Forskningsinstitut, Tecnalía, TNO, Technische Universiteit Delft, VTT Technical Research Centre of

Scope/Aim/Objectives	<p>Finland</p> <p>The CRM_InnoNet Innovation Network is one of the objectives of the CRM_InnoNet project. It is a proactive and dynamic network of key stakeholders from industry, academia and other organisations interested in the substitution of critical raw materials. The network will provide an identity and focus for researchers and businesses with an interest in substitution, drawing together a community which contains representatives from different disciplines and sectors together with a focus on substitution for the first time.</p> <p>The Innovation Network has held three workshops for its members during the project and <b>Networking continues online.</b></p>
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Name:	<b>ECTP European Construction Technology Platform</b>
url:	<a href="http://www.ectp.org">http://www.ectp.org</a>
Leader:	
Partners:	There are more than 180 ECTP Member organisations. 17% of our Members come from Large Enterprises and approximately 20% from SMEs. In addition to this we have Universities, Research Organisations, Associations and Institutional Members
Scope/Aim/Objectives	The main mission of ECTP and its committees is to develop new R&D&I strategies (research and innovation agendas and roadmaps) to improve competitiveness, meet societal needs & take up environmental challenges through an Innovative Built Environment. ECTP facilitates research on current challenges and foresight for the future. Through engagement with stakeholders and members we are able to influence and respond to the research agenda of the European Commission, on behalf of the Built Environment sector.

Name:	<b>EFFRA European Factories of the Future Research Association</b>
url:	<a href="http://www.effra.eu">http://www.effra.eu</a>
Leader:	
Partners:	
Scope/Aim/Objectives	<p>The European Factories of the Future Research Association (EFFRA) is an industry-driven association promoting the development of new and innovative production technologies.</p> <p>EFFRA's key objective is to promote pre-competitive research on production technologies within the European Research Area by engaging in a public-private partnership with the European Union called 'Factories of the Future'.</p> <p>'Factories of the Future' brings private and public resources together by launching market-orientated cross-border projects through a progressive research and innovation agenda. These projects produce</p>

demonstrators and models which are applied in a wide range of manufacturing sectors.

Name:	<b>EIONET - European environment information and observation network</b>
url:	<a href="https://www.eionet.europa.eu">https://www.eionet.europa.eu</a>
Leader:	European Environment Agency (EEA)
Partners:	It consists of the EEA itself, six European Topic Centres (ETCs) and a network of around 1000 experts from 39 countries in up to 400 national bodies dealing with environmental information. These experts are the National Focal Points (NFPs) and the National Reference Centres (NRCs).
Scope/Aim/Objectives	<p>The European environment information and observation network (Eionet) aims to provide timely and quality-assured data, information and expertise for assessing both the state of the environment in Europe and the pressures and driving forces acting upon it. This enables policymakers to decide on appropriate measures for protecting the environment at national and European level and to monitor the effectiveness of existing policies and measures. The European Topic Centres (ETCs) are dealing with the following issues.</p> <ul style="list-style-type: none"> <li>• Air pollution and Climate Change mitigation</li> <li>• Biological Diversity</li> <li>• Climate Change impacts, vulnerability and Adaptation</li> <li>• ETC WMGE Waste and Material in Green Economy</li> <li>• Inland, Coastal and Marine waters</li> <li>• Urban, Land and Soil systems</li> </ul>

<b>Name:</b>	<b>European Innovation Partnership EIP Raw Materials</b>
<b>url:</b>	<a href="https://ec.europa.eu/growth/tools-databases/eip-raw-materials/en/content/european-innovation-partnership-eip-raw-materials">https://ec.europa.eu/growth/tools-databases/eip-raw-materials/en/content/european-innovation-partnership-eip-raw-materials</a>
<b>Leader:</b>	EU
<b>Partners:</b>	Representatives from EU, national governments, industry, public services, academia and NGOs
<b>Scope/Aim/Objectives</b>	<p>The EIP is the major EU initiative implementing the Raw Materials Initiative stakeholder platform that brings together EU countries, companies, researchers, and NGOs to promote innovation in the raw materials sector.</p> <p>The main objective of the Partnership is to help raise industry's contribution to the EU's GDP to around 20% by 2020 by securing its access to raw materials. It will also play an important role in meeting the objectives of the Commission's flagship initiatives Innovation Union and Resource Efficient Europe. It will do this by ensuring the sustainable supply of raw materials to the European economy whilst also increasing benefits for society as a whole.</p> <p>The EIP developed its Strategic Implementation Plan with 95 actions to foster innovative solutions. These may be technological or non-technological. Specific actions include Research and Development, addressing Policy Framework conditions, disseminating Best Practices, building a Knowledge Base, and fostering International Cooperation.</p>

<b>Name:</b>	<b>EIT Knowledge and Innovation Community (KIC) - EIT Raw Materials</b>
<b>url:</b>	<a href="https://eit.europa.eu/eit-community/eit-raw-materials">https://eit.europa.eu/eit-community/eit-raw-materials</a>
<b>Leader:</b>	
<b>Partners:</b>	EIT RawMaterials comprises of more than 100 partners of leading businesses, universities and research institutes from 22 EU Member States.
<b>Scope/Aim/Objectives</b>	<p>EIT Raw Materials was designated as an EIT Knowledge and Innovation Community (KIC) by the EIT Governing Board on 09 December 2014. The below provides some information on the challenges the KIC will address in the field of raw materials (sustainable exploration, extraction, processing, recycling and substitution) and the impact it will generate.</p> <p>EIT Raw Materials has the ambitious vision of turning the challenge of raw materials dependence into a strategic strength for Europe. Its mission is to boost the competitiveness, growth and attractiveness of the European raw materials sector via radical innovation and</p>



entrepreneurship. This KIC will integrate multiple disciplines, diversity and complementarity along the three sides of the knowledge triangle (business, education and research) and across the whole raw materials value chain.

<b>Name:</b>	<b>ERA-MIN: Network on the Industrial Handling of Raw Materials for European Industries</b>
url:	<a href="http://www.era-min-eu.org/">http://www.era-min-eu.org/</a>
Leader:	
Partners:	Finland (TEKES), France (CNRS & ADEME), Germany (BMBF, FZ Jülich), Hungary (MBFH), Ireland (GSI), Italy (ENEA), The Netherlands (M2i), Poland (NCBR), Portugal (FCT), Romania (UEFISCDI), Slovakia (SGUDS), Spain (CDTI), Sweden (VINNOVA, SGU), Turkey (TÜBITAK), and United Kingdom (ESKTN).
Scope/Aim/Objectives	<p>ERA-MIN is an ERA-NET program on the Industrial Handling of Raw Materials for European industries and is supported by the European Commission's 7th Framework Programme . It is aimed at setting up networks and mechanisms to foster research in the field of industrial production and supply of raw materials, in line with the “EU Raw Materials Initiative”.</p> <p>ERA-MIN focuses on the issues related to the three segments of the non-energy mineral resources: construction minerals, industrial minerals and metallic minerals. The topics addressed by ERA-MIN cover the entire raw materials value chain: from primary to secondary resources, substitution of scarce elements, as well as cross-cutting issues like the mitigation of environmental impacts and raising public awareness.</p> <p>It has now evolved into the Horizon 2020 ERA-NET Cofund on Raw Materials, ERA-MIN 2 (2016-2021) “Implement an European-wide coordination of research and innovation programs on raw materials to strengthen the industry competitiveness and the shift to a circular economy”</p>

<b>Name:</b>	<b>EREAN European Rare Earth (Magnet) Recycling Network</b>
url:	<a href="http://www.erean.eu/index.php">http://www.erean.eu/index.php</a>
Leader:	KU Leuven
Partners:	Level 1 Partners: Helsinki University, Chalmers University, TU Delft, University of Birmingham, Oeko, Fraunhofer IWKS, Umicore, Rhodia. Level 2 Partners: InsPyro, MEAB, Treibacher, Less Common Metals, Stena Metal, Magneti Ljubljani
Scope/Aim/Objectives	The aim of EREAN is to train 14 young researchers (11ESR+3ER) in the science and technology of rare earths, with emphasis on the recycling of these elements from permanent magnets. The full materials loop from urban mine to magnet is covered. Research challenges include the development of efficient extraction of rare-earth-containing materials from electronic waste scrap, removal of exogen elements (Fe, Ni, B) by pyro- and hydrometallurgical methods to produce a concentrate of rare earths, new separation methods, direct electrochemical reduction of rare-earth oxides into metals, and the preparation of new magnets.



<b>Name:</b>	<b>ERECON European Rare Earths Competency Network</b>
url:	<a href="https://ec.europa.eu/growth/sectors/raw-materials/specific-interest/erecon_en">https://ec.europa.eu/growth/sectors/raw-materials/specific-interest/erecon_en</a>
Leader:	European Commission's Directorate-General for Enterprise and Industry (DG ENTR)
Partners:	
Scope/Aim/Objectives	<p>To address the issue of rare earth elements' supply, the European Commission brought together experts to form a European Rare Earths Competency Network. The three Working Groups of ERECON were focused on:</p> <ul style="list-style-type: none"> <li>• opportunities and road blocks for primary supply of rare earths in Europe;</li> <li>• European rare earths resource efficiency and recycling;</li> <li>• European end-user industries and rare earths supply trends and challenges.</li> </ul> <p>Key findings of the network have been compiled into the report <a href="#">Strengthening of the European Rare Earths Supply Chain - Challenges and policy options</a>.</p>

<b>Name:</b>	<b>European Technology Platforms Promoting Innovation on Raw Materials commitment</b>
url:	<a href="https://ec.europa.eu/growth/tools-databases/eip-raw-materials/en/content/european-technology-platforms-promoting-innovation-raw-materials">https://ec.europa.eu/growth/tools-databases/eip-raw-materials/en/content/european-technology-platforms-promoting-innovation-raw-materials</a>
Leader:	The Forest-based Sector ETP
Partners:	European Technology Platform on Advanced Engineering Materials and Technologies (EuMaT) represented by Centro Sviluppo Materiali (CSM), WoodWisdom-Net+ represented by TEKES
Scope/Aim/Objectives	<p>European Technology Platforms are industry-led stakeholder forums which elaborate strategic research and innovation agendas (SRAs) for action at EU and national level to be supported by both private and public funding. While maintaining the flexibility and individual visions of each ETP network, the objective of this commitment is to strengthen the cooperation between the ETPs participating in the EIP on Raw Materials. Relevant research and innovation initiatives such as Public-Private Partnerships are also welcome to the commitment.</p> <p>More specifically:</p> <p>Fragmentation in the implementation of the EIP-RM SIP will be overcome</p> <p>Mutually beneficial information exchange will be encouraged</p> <p>cross-fertilization between actions undertaken by different raw material industries will be sought</p> <p>Exploitation of breakthrough innovations will be speeded up and facilitated</p>

<b>Name:</b>	<b>EUMINET European Minerals Information Network</b>
<b>url:</b>	<a href="https://ec.europa.eu/growth/tools-databases/eip-raw-materials/en/content/european-minerals-information-network">https://ec.europa.eu/growth/tools-databases/eip-raw-materials/en/content/european-minerals-information-network</a>
<b>Leader:</b>	EuroGeoSurveys
<b>Partners:</b>	Geologische Bundesanstalt (GBA) Austria, Hrvatski Geološki Institut - Croatian Geological Survey (HGI-CGS), Geological Survey Department (GSD) Cyprus, Czech Geological Survey (CGS), Geological Survey of Denmark and Greenland (GEUS), Geologian tutkimuskeskus (GTK) Finland, Bureau de Recherches Géologiques et Minières (BRGM) France, Bundesanstalt für Geowissenschaften und Rohstoffe (BGR) Germany, National Centre of Sustainable Development - Institute of Geology & Mineral Exploration (EKBA-IGME) Greece, Geological Survey of Ireland (GSI), Istituto Superiore per la Protezione e la Ricerca Ambientale (ISPRA) Italy, Servizio Geologico, Sismico e dei Suoli (SGSS) della Regione Emilia-Romagna Italy, Nederlandse Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek (TNO), Geological Survey of Norway (NGU), Polish Geological Institute - National Research Institute (PGI-NRI), Laboratório Nacional de Energia e Geologia (LNEG) Portugal, Štátny geologický ústav Dionýza Štúra (SGUDS) Slovakia, Geološka zavoda Slovenije (GeoZS) Slovenia, Instituto Geológico y Minero de España, Sveriges Geologiska Undersökning (SGU), Geoinform of Ukraine (GOI), British Geological Survey - Natural Environment Research Council (BGS),
<b>Scope/Aim/Objectives</b>	<p>This commitment is a contribution by National Geological Surveys, represented by their association EuroGeoSurveys, towards the European Union Raw Materials Knowledge Base.</p> <p>Building on the ongoing EGD-Scope and Minerals4EU projects, its general objectives are, by 2020, to stimulate investment in the exploration and exploitation of EU mineral resources assets, as well as to provide data, knowledge and tools for their sustainable management. Its specific objectives are:</p> <ul style="list-style-type: none"> <li>- Development of interoperable/harmonised data models and digital information services;</li> <li>- Development of a multilingual EU data infrastructure, compliant with the INSPIRE Directive, providing access to national/regional data assets;</li> <li>- Providing annual publications of an EU minerals yearbook and minerals foresight;</li> <li>- Set up a coordinating body to develop and manage the needed common data models and interoperability arrangements.</li> </ul>
<b>Name:</b>	<b>European Network for Sustainable Quarrying and Mining</b>
<b>url:</b>	<a href="http://ensgm.weebly.com">http://ensgm.weebly.com</a>
<b>Leader:</b>	CEMBUREAU European Cement Association , European Salt Producers' Association - EuSalt, IMA-Europe, UEPG European Aggregates Association, Spanish National Confederation of Rocks and Industrial Minerals Producers – COMINROC.
<b>Partners:</b>	

## Scope/Aim/Objectives

The European Network for Sustainable Quarrying and Mining is a [raw material commitment](#) under the European Innovation Partnership linked with the Strategic Implementation Action Plan under the non-technological pillar, Improving Europe's raw materials framework conditions, public awareness. Commitments are **joint undertakings** by several partners, who commit to activities aimed at achieving the European innovation Partnerships' (EIP) objectives. They aim to deliver innovative products, processes, services, technologies, business models or ideas that can be brought to the market or that would bring wider societal benefits.

The mission of the network comprises the following points.

- The European Network for sustainable quarrying and mining is a neutral network aiming at boosting sustainable mining and quarrying at national level by creating a culture of cooperation among all the stakeholders in the mining and quarrying sector at national level to open and manage mines and quarries in a sustainable way.
- At national level, the commitment could materialise in a national/local/regional forum within the framework of jointly agreed objectives and procedure between the stakeholders of the mining and quarrying sector.
- The ultimate goal would be that the European Network for Sustainable Quarrying and Mining becomes a reference for the sector because it takes into account economic, social and environmental values

At EU level with the support of the EU institutions, the European network of sustainable quarrying and mining will:

1. Promote open interaction and cooperation between all the stakeholders building trust and enabling the quicker solution of conflicts at national level;
2. Enhance sustainable quarrying and mining practices by strengthening the voluntary self-regulation mechanisms, for example the Canadian protocols on towards sustainable mining;
3. Comply with the legislation and improve law enforcement;
4. Exchange good practice on law enforcement between the partners of the European Network for Sustainable Mining and Quarrying;
5. Enhance dialogue with the local communities;
6. Protect and conserve biodiversity, natural and cultural heritage
7. Examples: develop biodiversity management plans, present industry projects supported through EU funded programme.
8. Cultural in heritage
9. Promote health and safety of our employees (eg Safer by Design)
10. Manage environmental and social impacts – good practice examples:
  - Water Management
  - European Minerals Day
  - Development of skills

At national level, the creation of the network will start with a national

forum followed afterwards by the formation of a platform for sustainable mining and quarrying.

<b>Name:</b>	<b>European Minerals Investment Platform</b>
<b>url:</b>	<a href="https://ec.europa.eu/growth/tools-databases/eip-raw-materials/en/system/files/ged/Discussion%20Paper%20EMIP_Finalweb_1.pdf">https://ec.europa.eu/growth/tools-databases/eip-raw-materials/en/system/files/ged/Discussion%20Paper%20EMIP_Finalweb_1.pdf</a> <a href="https://ec.europa.eu/growth/tools-databases/eip-raw-materials/sites/rawmaterials/files/10-EIP%20on%20Raw%20Materials_Session%20I_Roadmap%20to%20a%20European%20Minerals%20Investment%20Platform_A.Benkitsch.pdf">https://ec.europa.eu/growth/tools-databases/eip-raw-materials/sites/rawmaterials/files/10-EIP%20on%20Raw%20Materials_Session%20I_Roadmap%20to%20a%20European%20Minerals%20Investment%20Platform_A.Benkitsch.pdf</a>
<b>Leader:</b>	EIT Raw Materials & DG-GROW
<b>Partners:</b>	EIB, EIF
<b>Scope/Aim/Objectives</b>	Promoted by the EIT Raw Materials, the European Minerals Investment Platform is intended to the development of a frame agreement to co-invest on a deal by deal basis between the EIB, EIF and EIT-RM in raw materials supply projects, thereby contributing to securing supply for European

<b>Name:</b>	<b>European Recycling Platform</b>
<b>url:</b>	<a href="http://erp-recycling.org/">http://erp-recycling.org/</a>
<b>Leader:</b>	
<b>Partners:</b>	More than 2,700 in Europe, from small local companies to huge multinationals
<b>Scope/Aim/Objectives</b>	European Recycling Platform (ERP) was founded in 2002 as the first pan-European organization to implement the European Union's regulations on the recycling of electrical and electronic waste (WEEE Directive). ERP offers compliance and recycling services in 32 countries ERP currently operates 32 compliance schemes

<b>Name:</b>	<b>European Technology Platform for the Forest-based Sector (FTP)</b>
<b>url:</b>	<a href="http://www.forestplatform.org/en/about-ftp">http://www.forestplatform.org/en/about-ftp</a>
<b>Leader:</b>	CEPI (Confederation of European Paper Industries) , CEI-Bois (European Confederation of Woodworking Industries) , CEPF (Confederation of European Forest Owners ) and EUSTAFOR (European State Forest Association )
<b>Partners:</b>	22 National Support Groups and Supporting Companies BillerudKorsnäs, Holmen AB, Metsä (Metsäliitto) Group, Mondi AG, SAPPI Europe S.A., SCA Forest Products AB, Södra, Stora Enso Oyj, UPM Kymmene Corporation, Sveaskog .
<b>Scope/Aim/Objectives</b>	In common with other European Technology Platforms, FTP is charged with defining a strategic Vision Document on behalf of the forest-based sector and agreeing on research priorities, set out in the Strategic Research and Innovation Agenda (SRA). Achieving the vision targets in the renewed FTP Vision 2030, will require coordinated efforts in four Strategic Themes and 19 specific research and innovation areas (RIAs) for the period 2013-2020.

Through its extensive network of National Support Groups (NSG), currently active in 19 EU countries, plus Norway, Switzerland and Russia, FTP is able to maintain an active dialogue with its many stakeholders. The NSGs have a key role in securing national support for the platform and FTP is able to benefit them in the following ways:

- Engages all key stakeholders and provides a forum for public-private dialogue and partnership.
- Facilitates targeted investments in research and development.
- Mobilises and focuses existing research and development capabilities, thereby fostering a more efficient approach to innovation.
- Stimulates coordination of European and national research agendas.
- Supports the ongoing development of a relevant knowledge base for the sector.
- Contributes to the overall growth and competitiveness of the EU economy.

<b>Name:</b>	<b>European Technology Platform on Sustainable Mineral Resources</b>
url:	<a href="http://www.etpsmr.org">http://www.etpsmr.org</a>
Leader:	
Partners:	Mineral Industry (large enterprises, SMEs, machinery providers, including the whole production and supply chain), sector's Associations (i.e. European Technology Platforms), Geological Surveys, Academia and Research institutes, EU Institutions, citizens, public institutions and bodies.
Scope/Aim/Objectives	<p>The ETP SMR is committed to provide a coordination function for the raw materials related research activities across the relevant ETPs and national technology platforms across the raw materials value chain in order to increase synergies and facilitate uptake of research results and innovation.</p> <p>The ETP SMR set 5 Strategic Ambitions:</p> <ol style="list-style-type: none"> <li>1. Exploration and Inventory of Resources</li> <li>2. Mineral Extraction from Land and Sea Bed Deposits</li> <li>3. Mineral Processing</li> <li>4. Metallurgy/Metals Recovery</li> <li>5. Recycling</li> </ol>

<b>Name:</b>	<b>European Union Raw Materials Knowledge Base (EURMKB)</b>
<b>url:</b>	<a href="https://ec.europa.eu/growth/sectors/raw-materials/specific-interest/knowledge-base_en">https://ec.europa.eu/growth/sectors/raw-materials/specific-interest/knowledge-base_en</a>
<b>Leader:</b>	DG-GROW
<b>Partners:</b>	
<b>Scope/Aim/Objectives</b>	<p>The European Union Raw Materials Knowledge Base (EURMKB) is a part of the European Innovation Partnership’s Strategic Implementation Plan. Its aim is to be a one-stop-shop for all information on raw materials in the EU. With the help of EU countries, the service will collect, store, maintain, upgrade, analyse, and disseminate information on the raw materials. This knowledge base will serve industry and policy makers as a valuable source of data.</p> <p>The main objectives of the knowledge base are</p> <ul style="list-style-type: none"> <li>• Data - the EURMKB will provide EU level data and information on raw materials from different sources in a harmonised and standardised way;</li> <li>• New activities – it will encourage activities in the raw materials sector such as exploration, extraction, processing, and recycling, as well as trade, development, skills, and education;</li> <li>• Increased supply – the base will increase the supply of raw materials, as well as strengthen Europe’s position on the forefront of the raw materials sector.</li> </ul>

<b>Name:</b>	<b>Green Growth Knowledge Platform (GGKP)</b>
<b>url:</b>	<a href="http://www.greengrowthknowledge.org">http://www.greengrowthknowledge.org</a>
<b>Leader:</b>	
<b>Partners:</b>	Global Green Growth Institute, the Organisation for Economic Co-operation and Development, the United Nations Environment Programme and the World Bank
<b>Scope/Aim/Objectives</b>	<p>The GGKP is a global network of international organisations, research institutes, and experts focused on promoting a green economy transition by:</p> <ul style="list-style-type: none"> <li>• Identifying major knowledge gaps in green growth theory, policy, and practice and addressing these gaps by promoting collaboration and coordinated research; and</li> <li>• Using world-class knowledge management and communication tools to provide practitioners, policymakers, and other experts with opportunities to access, share, and utilize green growth policy analysis, guidance, lessons learned, information, and data.</li> </ul>

<b>Name:</b>	<b>FORAM Project</b>
<b>url:</b>	<a href="http://cordis.europa.eu/project/rcn/206098_en.html">http://cordis.europa.eu/project/rcn/206098_en.html</a>
<b>Leader:</b>	WORLD RESOURCES FORUM ASSOCIATION
<b>Partners:</b>	EuroGeoSurveys - Egs, Federation Europeenne Des Geologues, United Nations University, Universiteit Leiden, , Hofmann-Antenbrink Margarethe, Technische Universitaet Clausthal, Universitaet Kassel, Gondwana Empreendimentos E Consultorias Limitada, Servicio Geologico Colombiano, Minpol Gmbh, La Palma Research Centre For Future Studies SI.
<b>Scope/Aim/Objectives</b>	Towards a World Forum on Raw Materials (FORAM) is working on an EU-based platform of international experts and stakeholders which will advance the idea of a World Forum on Raw Materials (WFRM) and enhance international cooperation on raw-material policies and investments. Global use of mineral resources has increased and supply chains have become ever more complex. A number of global initiatives and organisations have been contributing to information transfer, including the EC, UNEP International Resource Panel, the World Resources Forum, the World Material Forum, the OECD, and others.
<b>Name:</b>	<b>JONAS Joint Research Network on Advanced Materials and Systems</b>
<b>url:</b>	<a href="https://www.basf.com/en/company/research/collaborations/academia/JONAS.html">https://www.basf.com/en/company/research/collaborations/academia/JONAS.html</a>
<b>Leader:</b>	BASF
<b>Partners:</b>	I.S.I.S. Institute at Strasbourg University, Freiburg University, and ETH Zurich as academic partners, and BASF SE as industrial partner.
<b>Scope/Aim/Objectives</b>	The JONAS Joint Research Network is a close cooperation of three leading European universities with BASF that enables all partners to extend the scientific basis and their understanding of future materials and systems. The network has a capacity of about 25 postdocs per year. Depending on the research topic they are working in the university facilities in France, Germany, or Switzerland and the goal is to enhance BASF understanding of modern materials and to extend the international research network.
<b>Name:</b>	<b>MATCH Materials Common House Project</b>
<b>url:</b>	<a href="http://www.match-a4m.eu/">http://www.match-a4m.eu/</a>
<b>Leader:</b>	CENTRO SVILUPPO MATERIALI SPA
<b>Partners:</b>	Cefic, KMM VIN,IOM3, Euratex, NANO futures, Tecnalìa, EMRS, IK4-Tekniker, CEA, Emiri, List, CNR, Fraunhofer, FEMS, Spinverse, Uninova
<b>Scope/Aim/Objectives</b>	MATCH pushes for the creation of a strong, sustainable, inclusive network where any European Materials players (from Industry, Research, University) could feel comfortable and can gain real value for her/his own interest and expectations as far as Materials R&D&I is concerned. This partnership promotes the integration of concerted and strategic challenges of national, regional and European needs in the field.



Name:	<b>Minerals4EU - Minerals4EU foundation</b>
url:	<a href="http://www.minerals4eu.eu/">http://www.minerals4eu.eu/</a> <a href="http://minerals4eu.brgm-rec.fr/node/45539">http://minerals4eu.brgm-rec.fr/node/45539</a>
Leader:	Geological Survey of Finland
Partners:	EuroGeoSurveys - EGS (EGS) , SELOR EEIG (SELOR), INSTITUT ROYAL DES SCIENCES NATURELLES DE BELGIQUE (RBINS), NATURAL ENVIRONMENT RESEARCH COUNCIL (NERC), BUREAU DE RECHERCHES GEOLOGIQUES ET MINIERES (BRGM), BUNDESANSTALT FÜR GEOWISSENSCHAFTEN UND ROHSTOFFE (BGR), CESKA GEOLOGICKA SLUZBA (CGS), GEOLOGISCHE BUNDESANSTALT (GBA), GEOLOSKI ZAVOD SLOVENIJE (GeoZS), The Geological Survey of Denmark and Greenland (GEUS), INSTITUTUL GEOLOGIC AL ROMANIEI (IGR), Department of Communications, Energy and Natural resources (GSI), INSTITUTO GEOLÓGICO Y MINERO DE ESPAÑA (IGME), ETHNIKO KENTRO VIOSIMIS KAI AEIFOROU ANAPTYXIS (EKBA), Istituto Superiore per la Protezione e la Ricerca Ambientale (ISPRA), Laboratorio Nacional de Energia e Geologia I.P. (LNEG) , MAGYAR FOLDTANI ES GEOFIZIKAI INTEZET (MFGI), GEOLOGICAL SURVEY OF NORWAY (NGU), STATNY GEOLOGICKY USTAV DIONYZA STURA (SGUDS), SVERIGES GEOLOGISKA UNDERSOKNING (SGU), NEDERLANDSE ORGANISATIE VOOR TOEGEPAST NATUURWETENSCHAPPELIJK ONDERZOEK - TNO (TNO) , WUPPERTAL INSTITUT FUR KLIMA, UMWELT, ENERGIE GMBH. (WI), HRVATSKI GEOLOSKI INSTITUT (HGI-CGS), JRC - JOINT RESEARCH
Scope/Aim/Objectives	<p>Minerals4EU was a 2-year project (1.9.2013 – 31.8.2015) designed to meet the recommendations of the Raw Materials Initiative and to develop an EU Mineral intelligence network structure delivering a web portal, a European Minerals Yearbook and foresight studies.</p> <p>The network has provided data, information and knowledge on mineral resources around Europe, based on an accepted business model, making a fundamental contribution to the European Innovation Partnership on Raw Materials (EIP RM), seen by the Competitiveness Council as key for the successful implementation of the major EU2020 policies.</p> <p>It has now evolved into the <b>Minerals4EU foundation “Minerals Intelligence Infrastructure for Europe”</b>. Among its main services, the Foundation will coordinate the development of the European Union Mineral Resources Knowledge Base infrastructure, in support to European Union affairs, policies and action programmes, and will provide the best available EU expertise and information based on the knowledge of its Members, composing the European Minerals Intelligence Network. Moreover, the Minerals4EU Foundation will respond to specific requests from the European Union, or will formulate proposals for actions of interest to the EU.</p>

<b>Name:</b>	<b>MSP-REFRAM Multi-Stakeholder Platform for a Secure Supply of Refractory Metals in Europe</b>
<b>url:</b>	<a href="http://prometia.eu/msp-refram/">http://prometia.eu/msp-refram/</a>
<b>Leader:</b>	PROMETIA (Mineral Processing and Extractive Metallurgy for Mining and Recycling Innovation Association)
<b>Partners:</b>	5 industry/SMEs: AMPHOS21, E-Mines, ERAMET, IDENER, LGI 8 research and technology centres: CEA, CARTIF, BRGM, GTK, ICCRAM, IMN, MEFOS, VTT 6 academics: CHALMERS, UNIKL, LUT, LGC, NTUA, TUDELFT 1 public authority: Junta de Castilla y Leon – ADE 1 association: PROMETIA
<b>Scope/Aim/Objectives</b>	MSP-REFRAM aims to establish a durable multistakeholder platform that will carry out a comprehensive study of the entire value chain of key refractory metals including mining, processing, recycling and final applications (and potential substitution opportunities), and taking account of crosscutting aspects: policy/society, technology and market. This will strengthen the refractory metals supply chain in Europe.

<b>Name:</b>	<b>Network - ECO-INNOVERA</b>
<b>url:</b>	<a href="https://www.eco-innovaera.eu/home">https://www.eco-innovaera.eu/home</a>
<b>Leader:</b>	Forschungszentrum Jülich GmbH
<b>Partners:</b>	Federal Ministry of Education and Research, Germany (BMBF), French Agency for Environment and Energy Management (ADEME), National Agency for Research (ANR), Federal Office for the Environment (BAFU), German Aerospace Research Center (DLR), FINPIEMONTE SpA (FINPIEMONTE), National Research Fund (FNR), Swedish Research Council for Environment, Agricultural Sciences and Spatial Planning (FORMAS), Environmental Performance Agency of Basque Government (IHOBE), Agency for Innovation by Science and Technology, Flanders (IWT), Kommunalkredit Public Consulting (Kommunalkredit), Israeli Industry Center for Research and Development (MATIMOP-ISERD), Ministry of Science and Innovation (MICINN), Ministry of Education, Youth and Science (MON), Danish Ministry of Environment (MST), Ministry of Higher Education, Science and Technology (MVZT), National Centre for Research and Development (NCBIR), Regione Piemonte (Regione Piemonte), Ministry of Economic Affairs, The Netherlands (NL Energy and Climate Change), Finnish Funding Agency for Technology and Innovation (TEKES), Technology Strategy Board (TSB), Scientific and Technological Research Council of Turkey (TUBITAK) and Ministry of Infrastructure and the Environment (IenM).
<b>Scope/Aim/Objectives</b>	The ERA-Net ECO-INNOVERA is a project network under the EU Seventh Framework Programme working on boosting eco-innovation in research and dissemination by supporting the implementation of eco-innovations through Europe and along the whole value chains. To reduce the fragmentation of the European landscape in eco-innovation, the project has concentrated on pooling Europe's most

relevant research and innovation programmes on eco-innovation. ECO-INNOVERA is acting as a networking platform providing information for scientists, enterprises, research funders and policy makers in the field of environmental and innovation policies for promoting eco-innovation in Europe and beyond. Due to the importance of the topic of eco-innovation, the project has also developed a long-lasting network for funding projects in the field of eco-innovation. The funding opportunities will be also a part of the new self-sustaining network after the termination of the project. Through the identification of best practices for funding Eco-Innovation, ECO-INNOVERA supports research, innovation and environmental policy makers.

Name:	<b>New_Innonet - Near-zero European Waste INNOvation NETWORK</b>
url:	<a href="http://www.newinnonet.eu">http://www.newinnonet.eu</a>
Leader:	PNO Consultans
Partners:	Van Gansewinkel Groep BV, Tecnalía, VTT, Sintef, IVL Swedish Environmental Research Institute, Institute for Ecology of Industrial Areas, ARN, Plastics Recyclers Europe, European Plastics Converters, IHOBE, VITO,
Scope/Aim/Objectives	<p>New-InnoNet is the new stakeholder platform initiative by 12 European consortium members active as entrepreneurs, researchers and policy makers. These recognise that in order to reach a European near zero waste economy, all value chain stakeholders must cooperate, exchange generated knowledge, insights and hands-on experience and enforce changes to the value chain structure together. Previous initiatives were unable to achieve actual, large scale results towards a sustainable growth of the European economy. The reason is that they either focussed on a specific waste area or they lacked the involvement of the competent industries. This project includes various waste value chains which enable exchange of information and technology transfer from one chain to another. In addition, the consortium's network includes over 2000 relevant industrial stakeholders and several already expressed their interest in this new stakeholder platform, its goals and actions. During the project, key stakeholders will be mobilised to participate in the platform and road mapping workshops, as only an active involvement of industrial organisations will lead to the desired changes in the structure of the value chain. The many letters of support show the consortium's strength in mobilising stakeholders.</p> <p>NEW_InnoNet's main objective is to mobilise stakeholders towards building a circular economy by developing and reinforcing solid foundations for building the European Near-Zero Waste Platform through:</p> <ol style="list-style-type: none"> <li>1. Set-up and maintain near zero waste stakeholder platform</li> <li>2. Analyse selected waste streams and develop innovation roadmaps per waste stream</li> <li>3. Develop an integrated near zero waste strategic research and innovation agenda</li> </ol>

#### 4. Stakeholder mobilisation and interaction

<b>Name:</b>	<b>ProSUM Prospecting Secondary raw materials in the Urban mine and Mining wastes</b>
<b>url:</b>	<a href="http://www.prosumproject.eu/">http://www.prosumproject.eu/</a>
<b>Leader:</b>	WEEE Forum
<b>Partners:</b>	Bureau de Recherches Géologiques et Minières (French Geological Survey) C-Tech Innovation Limited Centraal Bureau Voor De Statistiek (Statistics Netherlands) Czech Geological Survey Chalmers University of Technology EuroGeoSurveys – Scientific Coordinator Empa (the Swiss Federal Laboratories for Material Science and Technology) Eucobat Geological Survey of Slovenia Geological Survey of Denmark and Greenland Recharge Geological Survey of Sweden Technische Universität Berlin Technische Universiteit Delft United Nations University – Scientific Coordinator WRAP
<b>Scope/Aim/Objectives</b>	The ProSUM project will gather data on WEEE, ELVs, batteries and mining waste known to have relatively high concentrations of CRMs. Methodologies will be developed to gather harmonised and standardised data, compliant with existing primary raw materials databases, to provide a general architecture for an inventory for secondary raw materials in the urban mine and mining waste. Access to the data inventory will be through the EU Urban Mine Knowledge Data Platform (EU-UMKDP) and a user friendly web portal. Working with partners through the ProSUM Information Network will assist in the development of the EU-UMKDP by sharing existing data and identifying ways of collecting harmonised data in future. The wide range of data network partners working together with the research partners will jointly deliver structured data, and standard methodologies for the sampling and analysis of CRM content in WEEE, ELVs, spent batteries and mining waste.

<b>Name:</b>	<b>SPIRE Sustainable Process Industry through Resource and Energy Efficiency Public Private Partnership</b>
<b>url:</b>	<a href="https://www.spire2030.eu/">https://www.spire2030.eu/</a>
<b>Leader:</b>	
<b>Partners:</b>	A.SPIRE is the European Association which is committed to manage and implement the SPIRE Public-Private Partnership. It represents innovative process industries, 20% of the total European

Scope/Aim/Objectives	<p>manufacturing sector in employment and turnover, and more than 130 industrial and research process stakeholders from over a dozen countries spread throughout Europe. SPIRE brings together cement, ceramics, chemicals, engineering, minerals and ores, non-ferrous metals, steel and water sectors, several being world-leading sectors operating from Europe.</p> <p>SPIRE is a contractual Public-Private Partnership dedicated to innovation in resource and energy efficiency enabled by the process industries. SPIRE aims at integrating, demonstrating and validating systems and technologies capable of achieving two key resource and energy efficiency targets across all SPIRE sectors:</p> <ul style="list-style-type: none"> <li>• a reduction in fossil energy intensity of up to 30% from current levels through a combination of, for example, introduction of novel energy-saving processes, process intensification, energy recovery, sustainable water management, cogeneration heat-power and progressive introduction of alternative (renewable) energy sources within the process cycle</li> <li>• a reduction of up to 20% in non-renewable, primary raw material intensity compared to current levels, by increasing chemical and physical transformation yields and/ or using secondary and renewable raw materials</li> <li>• a significant contribution to the political and societal objectives of drastic efficiency improvement in CO<sub>2</sub>-equivalent of up to 40%</li> </ul>
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Name:	<b>STRADE Project- Strategic Dialogue on Sustainable Raw Materials for Europe</b>
url:	<a href="http://stradeproject.eu/index.php?id=3">http://stradeproject.eu/index.php?id=3</a>
Leader:	Oeko-Institut
Partners:	SNL Financial AB, Projekt-Consult GmbH, University of Dundee – Centre for Energy, Petroleum and Mineral Law and Policy (CEPMLP), DMT Kai Batla (Pty) Ltd., GEORANGE, The University of the Witwatersrand
Scope/Aim/Objectives	<p>The "Strategic Dialogue on Sustainable Raw Materials for Europe" (STRADE) addresses the long-term security and sustainability of the European raw-material supply from European and non-European countries.</p> <p>Using a dialogue-based approach, the project brings together governments, industry and civil society to deliver policy recommendations for an innovative European strategy on future EU mineral raw-material supplies.</p>

<b>Name:</b>	<b>Strategic Forum for International S&amp;T Cooperation (SFIC)</b>
<b>url:</b>	<a href="http://ec.europa.eu/research/iscp/index.cfm?pg=sfic-general">http://ec.europa.eu/research/iscp/index.cfm?pg=sfic-general</a>
<b>Leader:</b>	European Commission
<b>Partners:</b>	Member States
<b>Scope/Aim/Objectives</b>	<p>The Strategic Forum for International Science and Technology Cooperation (SFIC) is an advisory group to the Council and the European Commission in the field of International Cooperation in Science &amp; Technology (S&amp;T). Main tasks</p> <ul style="list-style-type: none"> <li>• Systematically sharing and structuring information on S&amp;T cooperation activities and objectives (whether ongoing or planned) of the various partners</li> <li>• Pooling relevant knowledge concerning third countries, in particular analyses of their S&amp;T resources and capabilities</li> <li>• Ensuring regular consultation between the partners in order to identify their respective objectives and common priorities in terms of S&amp;T cooperation with third countries ("what and with whom?")</li> <li>• Where appropriate, coordinating activities of a similar nature implemented by Member States and the European Union (with variable geometry)</li> <li>• If necessary, proposing initiatives to be implemented with appropriate ways and means</li> <li>• Networking of Member States' and the Commission's scientific advisors in key third countries</li> </ul>

<b>Name:</b>	<b>WEEE forum</b>
<b>url:</b>	<a href="http://www.weee-forum.org">http://www.weee-forum.org</a>
<b>Leader:</b>	
<b>Partners:</b>	32 WEEE producer responsibility organisations
<b>Scope/Aim/Objectives</b>	<p>The WEEE Forum – WEEE stands for ‘waste electrical and electronic equipment’ – is a not-for-profit association of 32 WEEE producer responsibility organisations (or ‘producer compliance schemes’) in Europe. It was founded in April 2002 preceding the entry into force of Directive 2002/96/EC on WEEE. The WEEE Forum provides a platform for producer responsibility organisations to take on the challenge of electrical and electronic waste in Europe by fostering ideas and sharing best practices whilst optimising environmental performance through a proper management of WEEE.</p>

### 2.2.3. EU Member States

#### Belgium

Name:	<b>The Policy Research Centre studies Sustainable Materials Management (SMM)</b>
url:	<a href="http://steunpuntsumma.be/english">http://steunpuntsumma.be/english</a>
Leader:	
Partners:	KU Leuven, University of Antwerp, Ghent University, Hasselt University and VITO.
Scope/Aim/Objectives	<p>from a transition management perspective. Since SMM is a cornerstone of the future green economy, behavior in society should be shifted in a way that current material needs can be fulfilled without destabilizing the natural system nor mortgaging its future. The Policy Centre will investigate and foster the role that policy can and should play in this transition towards SMM.</p> <p>The mission of the Policy Research Centre is:          To create and gain more in-depth scientific insights in actual and future sustainable materials management issues relevant for policy          To give scientific support with an integrated interdisciplinary approach to SMM 'practitioners', Flemish governmental agencies, civil society, industry and others          To create a knowledge platform for interdisciplinary collaboration between SMM stakeholders</p>

Name:	<b>SIM Strategic Initiative Materials in Flanders</b>
url:	<a href="http://www.sim-flanders.be/about-sim-flanders">http://www.sim-flanders.be/about-sim-flanders</a>
Leader:	
Partners:	Agfa, UGent, KU Leuven, UAntwerpen, NV Bekaert SA, VUB, Recticel N.V., UHasselt, OCAS, Centexbel, Umicore, Sirris, AGC, Agoria, ArcelorMittal, Devan Chemicals, Solvay, VITO, Nucomat, FiSCH, Flanders' Plastic Vision, 3D Systems Leuven, Soeries Elite, Metalogic, Flipts & Dobbels, Allard, EPSI, Vanacker Rumbeke, Siemens Industry Software NV, MEAM, SGS Intron, Envisan.
Scope/Aim/Objectives	<p><b>SIM Mission Statement</b></p> <p>SIM contributes to the competitive position of the materials industry in Flanders by means of:</p> <ol style="list-style-type: none"> <li>1. strengthening the scientific base and building technology platforms in relevant areas, and</li> <li>2. by generating an open innovative environment for close collaboration between industry &amp; academia</li> </ol>

#### Therefore we do

- Focus on world class, demand driven precompetitive materials research
- Focus on a limited number of [research themes](#): innovative materials technology for applications in energy, in durable structural materials and recyclable materials.
- Developing Nanotechnology and Advanced Modelling and Characterization Technologies as important enablers.
- Maximize interaction between industry and knowledge centers within the [research programs](#) in which the projects are executed in an open innovation environment.
- Install unique technology platforms with scientific excellence with increased valorization potential in different market sectors.

#### Therefore we organize SIM as

- A non-profit organization
- A virtual research center supporting existing research groups
- A strategic research center governed by industry and academia

### [Finland](#)

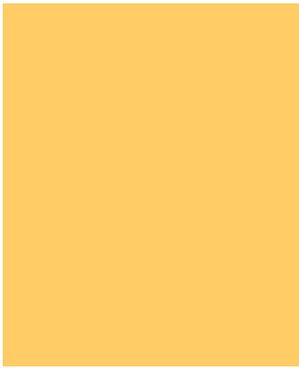
Name:	<b>Technology Platform for Fiber Products</b>
url:	<a href="http://www.foresttech.fi/news/news/1236-technology-platform-for-fiber-products-join-the-program#.WIX3YH2LycF">http://www.foresttech.fi/news/news/1236-technology-platform-for-fiber-products-join-the-program#.WIX3YH2LycF</a>
Leader:	VTT
Partners:	Albany International, Lenzing, MetsäBoard, Billerudkorsnäs, Sappi, Moorim, Smurfit Kappa, Domtar, Internatinonal Paper, Sofidl, Storgenso, UPM, Kimberly-Clark, Irving, Sulzer, Pixact, Keski-Suomen Liitto, Kuraray, Valmet, Wetend.
Scope/Aim/Objectives	VTT has been successfully running the foam forming program with 20 companies for almost 2 years and is now planning its continuation. The next phase targets at taking a leap in the resource-efficiency as well as helping the renewal of forest industry companies through expanding the product portfolio using existing assets. Companies are invited to join and influence the content of the program being prepared by VTT. The program is estimated to start in June 2017, and last for 2.5 years with a budget of 2.5-3.5M€.

## France

<b>Name:</b>	<b>Committee for Strategic Metals</b>
<b>url:</b>	<a href="http://www.mineralinfo.fr/page/comite-metaux-strategiques">http://www.mineralinfo.fr/page/comite-metaux-strategiques</a>
<b>Leader:</b>	Ministry of Industry
<b>Partners:</b>	
<b>Scope/Aim/Objectives</b>	<p>The mission of the Committee is to assist the Minister of Mines in the development and implementation of the Strategic Metals Management Policy with a view to enhancing the security of supply necessary for the sustainable competitiveness of the economy. The Committee, which is made up of representatives from research institutes and industry from across the metals sector, has set up for working groups to consider the following themes</p> <ol style="list-style-type: none"> <li>1. Understand industrial needs with respect to critical metals.</li> <li>2. Identify the most critical resources and update the mining inventory with a view to starting new prospecting, in both land and sea.</li> <li>3. Accelerate implementation of recycling projects. Increase R&amp;D efforts, in particular on substitution.</li> <li>4. Develop necessary European and international co-operations.</li> </ol>

## Germany

<b>Name:</b>	<b>German Chamber of Commerce - Competence Centers Network</b>
<b>url:</b>	<a href="http://www.canadian-german-mining.com/network.php?mining">http://www.canadian-german-mining.com/network.php?mining</a> <a href="http://www.germanmining.net/">http://www.germanmining.net/</a>
<b>Leader:</b>	Association of German Chambers of Commerce and Industry (Deutscher Industrie- und Handelskammertag, DIHK).
<b>Partners:</b>	Australia, Canada, Chile, and South Africa. Peru and Brazil
<b>Scope/Aim/Objectives</b>	<p>Since 2010, the German Federal Ministry of Economic Affairs and Energy (BMWi) supports the establishment of Competence Centres for Mining and Mineral Resources in selected, strategically relevant countries: Australia, Canada, Chile, and South Africa. Peru and Brazil have recently completed comprehensive market studies and are now under way to set up Competence Centres for Mining and Mineral Resources as well. The Centres aim to foster bilateral business relationships in the mining sector and to provide industry and market expertise to the German mining and manufacturing sector.</p>



Name:	<b>German Federation of International Mining and Mineral Resources FAB</b>
url:	<a href="http://www.consulting-fab.de/index.php?article_id=1&amp;clang=1">http://www.consulting-fab.de/index.php?article_id=1&amp;clang=1</a>
Leader:	FAB / German International Consulting Group
Partners:	
Scope/Aim/Objectives	<p>The German Federation of International Mining and Mineral Resources FAB in the Vereinigung Rohstoffe und Bergbau e.V. is a federation of German companies that are active in international mining and related activities or that are intending to do so in the future.</p> <p>The FAB presents a platform for the exchange of information about the mining activities of their members abroad as well as for the articulation of their common interests in the dialogue with German and foreign institutions.</p> <p>The <b>FAB</b> is particularly acquainted with the following topics and tasks:</p> <ul style="list-style-type: none"> <li>• Development in the international mineral industries and international resources policy</li> <li>• Exploitation of natural resources</li> <li>• Mining consulting and services; geological and environmental technologies</li> <li>• Foreign investments and project financing</li> <li>• Intermediation of contacts, lectures and cooperation events</li> </ul>

## 2.2.4. Rest of the world

### Australia

<b>Name:</b>	<b>CSIRO Mineral Resources / Minerals Down Under Flagship (until 2014)</b>
<b>url:</b>	<a href="http://www.csiro.au/en/Research/MRF">http://www.csiro.au/en/Research/MRF</a>
<b>Leader:</b>	CSIRO
<b>Partners:</b>	
<b>Scope/Aim/Objetives</b>	To promote industry-university-community linkages and thus to further technology and innovation solutions for more efficient development of country's mineral resource across the entire value chain

<b>Name:</b>	<b>The Minerals Council of Australia</b>
<b>url:</b>	<a href="http://www.minerals.org.au/">http://www.minerals.org.au/</a>
<b>Leader:</b>	
<b>Partners:</b>	MCA member companies account for more than 85 per cent of Australia's annual mineral production and 90 per cent of mineral export earnings.
<b>Scope/Aim/Objetives</b>	<p>The Minerals Council of Australia represents Australia's exploration, mining and minerals processing industry, nationally and internationally, in its contribution to sustainable development and society.</p> <p>Australia's minerals industry is innovative, technologically advanced, capital intensive, and environmentally and socially progressive. The industry is a major contributor to national income, investment, high-wage jobs, exports and government revenues in Australia.</p> <p>The MCA represents the minerals industry with a common purpose in:</p> <ul style="list-style-type: none"> <li>• Advocating pre-competitive or generic public policy for a socioeconomic environment conducive to growth and prosperity</li> <li>• Identifying and promoting leading operation principles</li> <li>• Engaging with opinion leaders and other stakeholders building a public presence that reflects the industry's contribution to the sustainable economic benefit of all Australians.</li> </ul>

## Brazil

<b>Name:</b>	<b>Centro de Competência de Mineração e Recursos Minerais</b>
<b>url:</b>	<a href="http://www.ahkbrasiliem.com.br/pt/a-camara/departamentos/mineracao-e-recursos-minerais/">http://www.ahkbrasiliem.com.br/pt/a-camara/departamentos/mineracao-e-recursos-minerais/</a>
<b>Leader:</b>	AHK Câmara Brasil-Alemanha
<b>Partners:</b>	
<b>Scope/Aim/Objetives</b>	<p>The Competence Center articulates the German industry with the Brazilian extractive industry. In this context, the Center carries out the following activities:</p> <ul style="list-style-type: none"> <li>• Organization of technical events;</li> <li>• Market studies;</li> <li>• Support in contacts with public agencies and companies;</li> <li>• Intermediation of business partners;</li> <li>• Travel for fair participation;</li> <li>• Trips of delegations;</li> <li>• Experience exchange group with quarterly meetings.</li> </ul> <p>The Competence Center is part of a worldwide network. In addition to Brazil, there are specialized mining and mineral resource centers in Australia, Chile, Canada, Peru and South Africa.</p>

## Canada

<b>Name:</b>	<b>The Canadian International Resources and Development Institute (CIRDI)</b>
<b>url:</b>	<a href="http://cirdi.ca/about/">http://cirdi.ca/about/</a>
<b>Leader:</b>	
<b>Partners:</b>	CIRDI is a coalition of the University of British Columbia (UBC), Simon Fraser University (SFU) and École Polytechnique de Montréal (EPM), working in partnership with the Canadian Government, civil society and industry.
<b>Scope/Aim/Objetives</b>	<p>The mission of CIRDI is to improve, in a measurable way, the ability of developing countries to manage and benefit from their extractive sectors in order to catalyze sustainable economic growth and reduce poverty.</p> <p>CIRDI works closely with all stakeholders involved in resource development to identify better ways to use these natural resources to achieve prosperity.</p> <p>Within a larger set of priority countries, CIRDI has focused the majority of its resources in the following regions:</p> <ul style="list-style-type: none"> <li>• West Africa (Burkina Faso, Senegal, Mali)</li> <li>• East Africa (Ethiopia)</li> </ul>

- The Andean region of South America (Peru, Ecuador)
- Central Asia (Mongolia)

<b>Name:</b>	<b>Canadian Council of Forest Ministers (CCFM)</b>
<b>url:</b>	<a href="http://www.ccfm.org/english/index.asp">http://www.ccfm.org/english/index.asp</a>
<b>Leader:</b>	
<b>Partners:</b>	<p>The CCFM is composed of fourteen federal, provincial and territorial ministers (elected officials). The secretariat for the Council is provided by Natural Resources Canada's Canadian Forest Service. Each year, the role of Chairing this Council rotates across jurisdictions according to a pre-determined schedule. The 2016-2017 CCFM Chair is Canada:</p> <p><b>The Honourable James Carr</b></p> <p>Minister of Natural Resources Canada</p> <p>Government of Canada</p> <p>580 Booth Street</p> <p>Ottawa, ON K1A 0E4</p> <p>Tel: (343) 292-6837</p> <p>Fax: (613) 996-4516</p> <p><a href="mailto:Minister.Ministre@nrcan-rncan.gc.ca">Minister.Ministre@nrcan-rncan.gc.ca</a></p>
<b>Scope/Aim/Objetives</b>	<p>Created in 1985, the CCFM brings together provincial, territorial and federal governments with interest in the forest sector to address issues relevant across jurisdictions. Given the distribution of forest sector mandates across governments, the CCFM provides a key forum for collaboration and information sharing – helping to align efforts across jurisdictions and unite perspectives and messaging to external stakeholders. Functionally, the CCFM consists of multiple committees, including topic-focussed working groups and the Forest in Mind program which seeks to enhance international recognition of Canada's strong record of sustainable forest management. CCFM activities are funded via contributions from member governments.</p>

<b>Name:</b>	<b>The Forest Products Association of Canada</b>
<b>url:</b>	<a href="http://www.fpac.ca/">http://www.fpac.ca/</a>
<b>Leader:</b>	
<b>Partners:</b>	<p>FPAC is composed by members (product companies) and partners (political, economic and educational institutions).</p>

Scope/Aim/Objectives	<a href="http://www.fpac.ca/about-forest-products/companies/">http://www.fpac.ca/about-forest-products/companies/</a>
	<a href="http://www.fpac.ca/about-forest-products/partners/">http://www.fpac.ca/about-forest-products/partners/</a>
	FPAC provides a voice for Canada’s wood, pulp and paper producers nationally and internationally in government, trade, and environmental affairs. Canada’s forest products industry is a \$65 billion dollar a year industry that represents 2% of Canada’s GDP. The industry is one of Canada’s largest employers, operating in 200 forest-dependent communities from coast to coast, and directly employing 230,000 Canadians across the country.

### China

Name:	
url:	
Leader:	
Partners:	
Scope/Aim/Objectives	

### Japan

Name:	<b>JOGMEC (Japan Oil, Gas and Metals National Corporation)</b>
url:	<a href="http://www.jogmec.go.jp/english/index.html">http://www.jogmec.go.jp/english/index.html</a>
Leader:	
Partners:	
Scope/Aim/Objectives	Japan Oil, Gas and Metals National Corporation (JOGMEC) was established on February 29, 2004 pursuant to the Law Concerning the Japan Oil, Gas and Metals National Corporation, which was promulgated on July 26, 2002. JOGMEC integrates the functions of the former Japan National Oil Corporation, which was in charge of securing a stable supply of oil and natural gas, and the former Metal Mining Agency of Japan, which was in charge of ensuring a stable supply of nonferrous metal and mineral resources and implementing mine pollution control measures.

### Korea

Name:	<b>Energy and Mineral Resources development association of Korea</b>
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url:	<a href="http://www.emrd.or.kr/english/">http://www.emrd.or.kr/english/</a>
Leader:	
Partners:	EMRD is an association held privately and consists of 72 member companies including KNOC, KOGAS, KORES, SK Energy, Samsung, etc.
Scope/Aim/Objectives	<p>Main Business</p> <ul style="list-style-type: none"> <li>• Support members on cooperation and joint participation in overseas resources development projects</li> <li>• Collect, analyze and provide information of resources development business</li> <li>• Offer policy advice and support for overseas resources development</li> <li>• Conduct research on government policies on resources development and make recommendations</li> </ul>

Name:	<b>Korea Environment Corporation (Keco)</b>
url:	<a href="https://www.keco.or.kr/en/main/index.do">https://www.keco.or.kr/en/main/index.do</a>
Leader:	Korean Government
Partners:	
Scope/Aim/Objectives	<p>Korea Environment Corporation (Keco) is a quasi-governmental organization under the Ministry of Environment and it is aimed at becoming a global, total environment services provider. Based on its mission to contribute to the eco-friendly national development through the improvement of the environment and promotion of resource recycling, Keco carries out nationwide works related to climate, air, water, soil, waste treatment, resource circulation, environmental health and environmental facilities.</p> <p>Among its main strategic targets we can highlight the 3<sup>rd</sup> one.</p> <p><b>Building a society that sustainably re-circulates resources</b></p> <ul style="list-style-type: none"> <li>▪ Improved operation of a resource circulation system</li> <li>▪ Establishment of a waste management system based on ICT</li> <li>▪ Laying the foundation for energy recovery from wasted resources</li> </ul>

Name:	<b>Korea Resources Corporation (KORES)</b>
url:	<a href="https://www.kores.or.kr/">https://www.kores.or.kr/</a>
Leader:	Korean Government

Partners:
Scope/Aim/Objectives

Korea Resources Corporation, KORES, is a wholly owned company by the government that has its mission to secure mineral resources supply to meet the needs of the Korean industry. KORES has two major roles to act on behalf of the Korean government. First, its role is to work with the government to optimize the supply of the mineral resources that Korea needs. Secondly, it has another critical role to encourage the Korean companies for mineral resources development by supporting them on various aspects.

South Africa

United States

Name:	<b>The Critical Materials Institute</b>
url:	<a href="https://cmi.ameslab.gov/about">https://cmi.ameslab.gov/about</a>
Leader:	The Ames Laboratory
Partners:	Idaho National Laboratory, Lawrence Livermore National Laboratory, Oak Ridge National Laboratory, Brown University, University of California-Davis, Colorado School of Mines, Florida Industrial and Phosphate Research Institute, Iowa State University, Rutgers, The State University of New Jersey, Advanced Recovery, Cytec, Eck Industries, GE, Molycorp, OLI, Simbol Materials, United Technologies Research Center (UTRC)
Scope/Aim/Objectives	<p>The Critical Materials Institute focuses on technologies that make better use of materials and eliminate the need for materials that are subject to supply disruptions. More precisely they work in four areas:</p> <ol style="list-style-type: none"> <li>1. Diversifying supplies. If one source goes offline, we can rely on a different source.</li> <li>2. Developing substitute materials that can meet needs without using the materials we use today.</li> <li>3. Using the available materials more efficiently: reducing waste in manufacturing processes, and increasing the adoption of recycling.</li> <li>4. Forecasting what materials might become critical in the future.</li> </ol>

## 3. Policy and Strategy Documents

### 3.1. European Union

#### 3.1.1. Belgium

Strategy/programme title:	<b>Bioeconomy in Flanders</b>
Owner Implementing body	Government of Flanders
date:	2013
Geographical scope	Flanders
url:	<a href="https://biobs.jrc.ec.europa.eu/sites/default/files/generated/files/policy/Bioeconomy%20in%20Flanders.pdf">https://biobs.jrc.ec.europa.eu/sites/default/files/generated/files/policy/Bioeconomy%20in%20Flanders.pdf</a>
Aim/Goals:	<p>Flanders has opted to develop a sustainable bioeconomy as a transition strategy to respond to the threat presented by the exhaustion and use of fossil raw materials.</p> <p>The bioeconomy includes both the production of renewable biological resources and the use of those resources and residual streams and must respect the ecological and social capacity of the earth, by embedding socio-economic development in a smart, material- and energy-efficient circular system.</p> <p>The switch to an economy based on renewable raw materials requires a transition.</p> <p>Although Biomass as an important factor in the energy mix available biomass streams in the Flemish bio economy will be used according to an accepted cascade. The starting point is that biomass from primary production as well as from residual and waste streams must firstly be responsible for guaranteeing food safety (food and animal feed), secondly for use as a raw material, and thirdly for use as an energy source. When using biomass, the entire life cycle must always be taken into consideration.</p> <p>Main objectives of the strategy are:</p> <ul style="list-style-type: none"> <li>• The development of a coherent Flemish policy that supports and facilitates a sustainable bioeconomy.</li> <li>• To put Flanders at the top for education and training and research and innovation in future-oriented bioeconomy clusters.</li> <li>• Biomass is optimally and sustainably produced and used across the entire value chain.</li> <li>• Strengthening of markets and competitiveness of bioeconomic sectors in Flanders.</li> </ul>

- Flanders is a key partner within European and international joint ventures.

<b>Strategy/Programme Title:</b>	<b>Sustainable use of and creation of value from renewable raw materials for biobased industrial production such as biomaterials and green chemicals in Flanders</b>
<b>Owner / Implementing Body</b>	Department Economy, Science and Innovation, Flemish government
<b>Date:</b>	2013
<b>Geographical Scope</b>	Flanders
<b>URL:</b>	<a href="https://biobs.jrc.ec.europa.eu/sites/default/files/generated/files/policy/Flanders_Biobased%20uses%20in%20Flanders.pdf">https://biobs.jrc.ec.europa.eu/sites/default/files/generated/files/policy/Flanders_Biobased%20uses%20in%20Flanders.pdf</a>
<b>Aim/Goals:</b>	<p>The aim of this study is to support the Government of Flanders in developing its own strategy for a biobased economy (BBE) and to draft recommendations for an integrated and sustainable economic innovation policy.</p> <p>Firstly, there is a clear need for an integrated approach, in which policy areas such as research and innovation, economy, agriculture, energy, environment and education are important, and it is also vital that all stakeholders are involved (agricultural organisations, the research community, industry, NGOs, etc.). In order to achieve all this, it is proposed that a “Vlaamse Raad voor de Bio-economie” (Flemish Council for the Bioeconomy) be established.</p> <p>☐ Research and innovation, across the entire value chain (from feedstock to application), is one of the most important resources for building a competitive and sustainable BBE in Flanders. Although Flanders already possesses many assets in this respect, they are too fragmented and there is little cooperation between the various industrial sectors. By analogy with our neighbouring countries, it is necessary to increase visibility and efficiency by setting up a clearly visible - inside and outside of Flanders - Flemish public-private partnership for the BBE and to support it financially as well. In the longer term, it must also be possible to establish cooperation partnerships with other regions (such as the Netherlands, Germany, France and Wallonia) and to attract research projects and investors. In addition, Flanders needs a bio-incubator and a new financing instrument for valorisation and demonstration projects for the biobased economy. It is also recommended to bring possible partners and stakeholders from different sectors together in new innovative value chains. Finally, due to its high industrialisation and CO<sub>2</sub> emissions, Flanders has to analyse the possibility to transform CO<sub>2</sub> into fuel or chemical building blocks.</p> <p>☐ It is also necessary to promote the optimal utilisation of biomass. In the future, Flanders must focus more effectively on the valorisation of secondary streams from biomass-related industries such as food, animal fodder, wood, and paper before transforming them to energy at the end of the life cycle; maximum use must be made of existing and new waste streams. Agricultural research must also be encouraged, for example, to increase yields of existing crops, cultivate new crops in line with the BBE, develop efficient biorefinery techniques, etc.</p> <p>☐ In terms of logistics, Flanders has a number of assets that must be</p>

developed as extensively as possible, such as two major ports whereby Ghent could be further developed as a “bioport” and Antwerp as a “CO2 conversion platform”.

☑ There is certainly a need for a regulatory framework to promote the use of renewable feedstocks in materials and the promotion of biobased products following on from this. In this way biobased products could be supported just like bioenergy, for example, on the basis of their greenhouse gas emission benefits, or could be included in a “sustainable public procurement” programme.

Lastly, it is necessary to make the opportunities and benefits of the bio-based economy more visible to both policymakers and consumers and within the industry itself. Flanders Investment and Trade could promote Flanders as a “centre of expertise for the biobased economy”, and organise specific missions to other regions in order to attract research projects and foreign investors.

Strategy/programme title:	<b>Plan Marshall 4.0</b>
Owner Implementing body	Walloon Government
date:	2015
Geographical scope	Wallonia
url:	<a href="http://planmarshall.wallonie.be/sites/default/files/Plan%20Marshall%204.0_ANGLAIS.pdf">http://planmarshall.wallonie.be/sites/default/files/Plan%20Marshall%204.0_ANGLAIS.pdf</a>
Aim/Goals:	<p>The new Marshall Plan 4. Includes five priorities areas</p> <ol style="list-style-type: none"> <li>1. Turning human capital into an asset</li> <li>2. Support the development of industry through a policy of innovation and business growth</li> <li>3. Mobilise the territory for economic development</li> <li>4. Support efficiency, energy transition and the circular economy</li> <li>5. Support digital innovation</li> </ol> <p>The fourth area is the main one concerned with resources and focuses on the promotion and development of the circular economy, with emphasis in secondary materials. Policy objectives include:</p> <ul style="list-style-type: none"> <li>• identifying new sources of growth for the circular economy through the Walloon Waste Plan and an ambitious environmental policy: <ul style="list-style-type: none"> <li>○ prevention (eco-design, optimised use of products and by-products, pooling of tools and provision of services instead of products),</li> <li>○ reduction of waste (including re-employment, repair and reuse),</li> <li>○ reclassification of waste as by-products or products,</li> </ul> </li> </ul>

- effective sorting with a view to efficient recycling,
- maximum recycling;
- promoting the emergence of industrial projects by matching supply and demand:
  - setting up channels for the collection of waste/raw materials that will be used by industry,
  - creating exchange platforms (e.g. "Clic Recup"),
  - creating a standard contract for stakeholders,
  - expanding the "Reverse Metallurgy" project by investigating and creating other channels,
  - placing the NEXT programme cross-functionally in the network of competitiveness clusters (see Priority Area II), with the support of the clusters (Tweed, Cap 2020 and Eco-Construction).
- carrying out economic promotion actions throughout the region to encourage businesses to normalise partnerships for the recovery and exchange of by-products or different flows (hot water, gas, etc.) in coherent territorial zones;
- recover agricultural and industrial waste to increase the reuse of waste or by-products as a new resource. Multi-stakeholder (farmers, local authorities, businesses, etc.) biomethanation projects will be encouraged for organic products;
- develop territorial synergies:
  - strengthen the business of designing new zones by creating the role of main contractor on sites with specific characteristics favourable to the emergence of collaborative inter-business projects,
  - integrate a "circular economy" aspect into the construction and/or construction materials aspects of specifications for new district or city projects.

### 3.1.2. Finland

Strategy/Programme	<b>Finland's Minerals Strategy</b>
Title:	
Owner / Implementing Body	The Ministry of Employment and the Economy
Date:	2010
Geographical Scope	Finland
URL:	<a href="http://projects.gtk.fi/minerals_strategy/index.html">http://projects.gtk.fi/minerals_strategy/index.html</a>
Aim/Goals:	The long-term goal of Finland's minerals strategy is an active minerals sector which is globally competitive, secures Finland's raw material supply, supports regional development and promotes responsible use of natural resources. This vision for the minerals strategy is therefore

based on promoting knowledge and skills enhancement coupled with innovation research and development, as a basis for sustained and sustainable growth in the sector.

The concept of sustainability with respect to the use of natural resources must become an accepted and integral part of the educational system, in order to promote a wider understanding of the importance of raw materials and their geological context, alongside other teaching in the natural sciences.

Strategic objectives:

- Promoting domestic growth and prosperity
- Solutions for global mineral chain challenges
- Mitigating environmental impact

The themes of the action proposals:

- Strengthening minerals policy
- Securing the supply of raw materials
- Reducing the environmental impact of the minerals sector and increasing its productivity
- Strengthening R&D capabilities and expertise

Strategy/Programme Title:	<b>Making Finland Leader in Sustainable Extractive Industry Action Plan</b>
Owner / Implementing Body	The Ministry of Employment and the Economy
Date:	2013
Geographical Scope	Finland
URL:	<a href="http://tem.fi/documents/1410877/3437254/Making+Finland+a+leader+in+the+sustainable+extractive+industry+04072013.pdf">http://tem.fi/documents/1410877/3437254/Making+Finland+a+leader+in+the+sustainable+extractive+industry+04072013.pdf</a>
Aim/Goals:	<p>The extractive industry is viewed as a source of opportunities for Finland, provided that it is developed in a way that is economically, socially and environmentally sustainable.</p> <p>The plan includes measures to be taken by the industry to obtain society's support for its activities. Proposals for improving the operating conditions for the extractive industry are made with regard to administration, training and infrastructure. In addition, the action plan proposes more active, open exchange of information and experiences, along with ongoing dialogue regarding the action plan's implementation and development within the industry.</p> <p>The efficient use of materials streams from extractive operations requires knowledge and consideration of the life cycle (material circulation) of materials in primary production, recycling and product planning. The goal must be a continuous circulation of material (raw material – product – recycling- product), producing the minimum amount of unusable waste and creating new applications for side and waste materials.</p> <p>The exploitation of existing side materials and waste stockpiles must be promoted. Increasing overall resource efficiency requires the</p>

elimination of obstacles to recycling and reuse, development of procurement procedures and innovative research and development work.

Strategy/Programme Title:	The Finnish Bioeconomy Strategy
Owner / Implementing Body	The Ministry of Employment and the Economy
Date:	2014
Geographical Scope	Finland
URL:	<a href="http://biotalous.fi/wp-content/uploads/2014/08/The_Finnish_Bioeconomy_Strategy_110620141.pdf">http://biotalous.fi/wp-content/uploads/2014/08/The_Finnish_Bioeconomy_Strategy_110620141.pdf</a>
Aim/Goals:	<p>The objective of the Finnish Bioeconomy Strategy is to generate new economic growth and new jobs from an increase in the bioeconomy business and from high added value products and services while securing the operating conditions for the nature's ecosystems. The bioeconomy is not a new industry; it is a combination of several primary production and refining sectors and end product markets. Typical features of the bioeconomy include the use of renewable, bio-based natural resources, environmentally friendly clean technologies and efficient recycling of materials. It is justified to refer to the transition from a fossil economy to a bioeconomy as the new wave of economic development</p> <p>The strategic goals of the Bioeconomy Strategy are:</p> <ol style="list-style-type: none"> <li>1. A competitive operating environment for the bioeconomy: a competitive operating environment will be created for bioeconomy growth</li> <li>2. New business from the bioeconomy: new business will be generated in the bioeconomy by means of risk financing, bold experiments and the crossing of sectoral boundaries,</li> <li>3. A strong bioeconomy competence base: the bioeconomy competence base will be upgraded by developing education, training and research,</li> <li>4. Accessibility and sustainability of biomasses: availability of biomasses, well-functioning raw material markets and sustainability of the use of biomass will be secured.</li> </ol> <p>The greatest opportunities for growth will be found in new products and materials, in particular in forest, chemical and energy industries, and technologies and services that support them.</p> <p>In a sustainable bioeconomy, wastes and industrial side streams will play an even more significant role as raw materials. They will complement the raw material base of the bioeconomy and contribute to replacing natural biomasses, thus also reducing environmental loading. Regional cooperation, interaction between industrial sectors and new services that support the exploitation of surplus materials will enable efficient use of materials close to where they are produced.</p> <p>Some actions (for all sectors):</p>

Providing incentives for the replacement of non-renewable natural resources by renewable ones in public procurement  
Promoting demand for bioeconomy products and services  
Promoting the standardisation and certification of bioeconomy solutions

Strategy/Programme	<b>National Forest Strategy 2025</b>
Title:	
Owner / Implementing Body	Ministry of Agriculture and Forestry
Date:	2015
Geographical Scope	Finland
URL:	<a href="http://mmm.fi/documents/1410837/1504826/National+Forest+Strategy+2025/197e0aa4-2b6c-426c-b0d0-f8b0f277f332">http://mmm.fi/documents/1410837/1504826/National+Forest+Strategy+2025/197e0aa4-2b6c-426c-b0d0-f8b0f277f332</a>
Aim/Goals:	<p>The vision of the Forest Strategy is "Sustainable forest management is a source of growing welfare". Based on the vision the objectives set in the Forest Policy report are:</p> <ol style="list-style-type: none"> <li>1. Finland is a competitive environment for forest-based business</li> <li>2. Forest-based business and activities and their structures are renewed and diversified</li> <li>3. Forests are in active, economically, ecologically and socially sustainable and diverse use.</li> </ol> <p>The first objectives is implemented by supporting the growth and development of the current and new enterprises in the forest sector and access to raw material supplies and by influencing the EU and international forest-related policies. Work on the second objective is done by developing a diverse knowledge base and skills according to the needs and by reinforcing the forest-related governance. The third objective is focused on the sustainable management and use of forests.</p> <p>Large actors together with SMEs will form new industrial ecosystems where wood and production side streams will be processed into end products for various uses and where the value added and resource efficiency of production will increase. The significance of production waste and side streams as raw materials will increase, and they will also become more important as a factor of competition. Closed cycle industries will also improve the resource efficiency of forest-based business and activities.</p> <p>Exploitation of the raw material reserves yielded by the forests must increasingly be based on solutions that emphasise material and resource efficiency.</p> <p>The definitions of by-products, residues and wastes from forest management and wood processing in EU material efficiency and recycling policies will have a bearing on the possibilities of using and potential uses of wood-based raw materials in the future. By means of trade policy, Finland will strive to remove trade barriers and promote the compatibility and recognition of technical standards.</p>

Strategy/Programme Title:	Leading the cycle Finnish road map to a circular economy 2016–2025
<p>Owner / Implementing Body</p> <p>Date:</p> <p>Geographical Scope</p> <p>URL:</p> <p>Aim/Goals:</p>	<p>Sitra</p> <p>2016</p> <p>Finland</p> <p><a href="http://www.sitra.fi/sites/default/files/sitra_leading_the_cycle_report.pdf">http://www.sitra.fi/sites/default/files/sitra_leading_the_cycle_report.pdf</a></p> <p>From the environment perspective Finland will become a model country for the challenge of scarcity</p> <ul style="list-style-type: none"> <li>• Resource efficiency will improve significantly.</li> <li>• Material cycle will become more efficient, non renewable natural resources will be replaced by renewables and we will move towards a carbon neutral and waste-free society.</li> <li>• A circular economy will improve Finland’s ecological sustainability.</li> <li>• Control of environmental impacts, such as emissions and the pollution load, will improve.</li> </ul> <p>Five areas of growth are envisaged, some of them specially significant for raw materials supply chain:</p> <ol style="list-style-type: none"> <li>1. Sustainable food system</li> <li>2. Forest-based loops</li> <li>3. Technical loops: Minimising the use of virgin raw materials creates a competitive edge. At the same time, we will maximise the length of material and product life cycles and opportunities for reuse.</li> <li>4. Transport and logistics</li> <li>5. Common action</li> </ol> <p>Focusing on Technical loops the goal is for Finland to build its competitiveness by means of sustainable material use as follows: by minimising the need for virgin raw materials and maximising the length of the material and product loop as well as utilising opportunities for reuse. The same applies to the design of products manufactured from secondary materials. They must also continue to be repairable and recyclable. We cannot compromise on product and quality requirements in circular economy products.</p> <p>All industrial sectors, including mining, process, chemical and</p>

manufacturing, are participating in the technical loops area of circular economy work. New business opportunities will be created for, among others, companies specialising in side stream utilisation. Ensuring that supply meets demand and the role of material development and product design are absolutely essential in terms of achieving this change. Customers must demand products suitable for a sustainable circular economy and industry must offer them.

### 3.1.3. France

Strategy/Programme Title:	<b>Energy Transition for Green Growth Act</b>
Owner / Implementing Body	Ministry of Ecology, Sustainable Development and Energy
Date:	2015
Geographical Scope	France
URL:	<a href="http://www.developpement-durable.gouv.fr/-La-loi-relative-a-la-transition-.html">http://www.developpement-durable.gouv.fr/-La-loi-relative-a-la-transition-.html</a>
Aim/Goals:	<p>The Energy Transition for Green Growth Act introduced a material productivity target target (+ 30 % between 2010 and 2030) and a resource hierarchy into the Environment Code. Priority should be given to the efficient and responsible use of natural resources, then to resources which stem from recycled materials or from renewable resources, then to recyclable materials, and lastly to other materials, in light of their environmental footprint over their life cycle.</p> <p>Five general objectives have been set for policies related to the efficient use of resources, particularly materials:</p> <ul style="list-style-type: none"> <li>• reducing external dependency;</li> <li>• raising business competitiveness;</li> <li>• creating jobs and value-addition;</li> <li>• preserving industrial know-how;</li> <li>• reducing environmental impact.</li> </ul> <p>It also stipulates the development of a national circular economy strategy including a programming plan on natural resources.</p> <p>Extract from More from less —material resource efficiency in Europe</p>
Strategy/Programme Title:	<b>Contrat de la filière Industries extractives et première transformation</b>
Owner / Implementing Body	Comité Stratégique de Filière Industries extractives et première transformation

Date:	2014
Geographical Scope	France
URL:	<a href="http://www.mineralinfo.fr/sites/default/files/upload/documents/csf_iept_contrat_de_filiere_19_06_2014_vf.pdf">http://www.mineralinfo.fr/sites/default/files/upload/documents/csf_iept_contrat_de_filiere_19_06_2014_vf.pdf</a>
Aim/Goals:	<p>The contract is structured around five major axes, some of them of great significance from the raw materials point of view.</p> <ul style="list-style-type: none"> <li>• Strengthen and secure the supply of primary raw materials throughout the industrial value chain: with the aim to secure supplies and reduce dependence on foreign countries.</li> <li>• Development of a more efficient industry in the use of resources from the perspective of a circular economy: in order to do so, the extractive and primary processing industry must strengthen and promote the approaches linked to the circular economy, promote Ecodesign, promote the development of eco-efficient products and processes, make better use of its waste and continue reducing the ecological footprint of its energy consumption.</li> <li>• Stimulate investment and innovation.</li> <li>• Ensure an ecosystem favorable to the development of the sector.</li> <li>• Improve the image of the sector and increase its attractiveness.</li> </ul>

Strategy/Programme	<b>Stratégie nationale pour la gestion durable des granulats terrestres et marins et des matériaux et substances de carrières</b>
Title:	<b>Stratégie nationale pour la gestion durable des granulats terrestres et marins et des matériaux et substances de carrières</b>
Owner / Implementing Body	Ministère de l'écologie, du développement durable, des transports et du logement and Ministère de l'industrie, de l'énergie et de l'économie numérique
Date:	2012
Geographical Scope	France
URL:	<a href="http://www.mineralinfo.fr/sites/default/files/upload/documents/document_cadre_version_finale.pdf">http://www.mineralinfo.fr/sites/default/files/upload/documents/document_cadre_version_finale.pdf</a>
Aim/Goals:	<p>La stratégie se décline en 4 axes non hiérarchisés:</p> <ul style="list-style-type: none"> <li>• Répondre aux besoins et optimiser la gestion des ressources de façon économe et rationnelle : renforcer l'adéquation entre usage et qualité des matériaux et entre besoins et réserves autorisées, tout en favorisant les approvisionnements de proximité ;</li> <li>• Inscrire les activités extractives dans le développement durable : concilier les enjeux environnementaux, sociaux et</li> </ul>

économiques liés à l'extraction de matériaux et à la chaîne logistique associée en concertation avec l'ensemble des autres acteurs des territoires, y compris les acteurs du milieu marin ;

- Développer le recyclage et l'emploi de matériaux recyclés : faire évoluer la part de matériaux recyclés actuellement évaluée à environ 6 % à au moins 10% de la production nationale dans les 10-15 prochaines années ;
- Encadrer le développement de l'utilisation des granulats marins dans la définition et la mise en œuvre d'une politique maritime intégrée.

This strategy aims to provide a framework for security of supply and effective access to resources while meeting all the challenges of the land management, in a logic of sustainable development, efficient management of a non renewable resource, and taking into account ongoing environmental, economic and social policies, with other local stakeholders. The final aim is to promote projects acceptability and quality.

### 3.1.4. Germany

Strategy/Programme	<b>The German Government's Raw Materials Strategy</b>
Title:	
Owner / Implementing Body	Federal Ministry of Economics and Technology
Date:	2010
Geographical Scope	Germany
URL:	<a href="http://www.bmwi.de/English/Redaktion/Pdf/raw-materials-strategy.property=pdf,bereich=bmwi2012,sprache=en,rwb=true.pdf">http://www.bmwi.de/English/Redaktion/Pdf/raw-materials-strategy.property=pdf,bereich=bmwi2012,sprache=en,rwb=true.pdf</a>
Aim/Goals:	<p>The German raw materials strategy aims to describe the financial and political support that will be made available to German companies with regards to dealing with bottlenecks in supply (Federal Ministry of Economics and Technology, 2010).</p> <p>The main aims of the strategy are:</p> <ul style="list-style-type: none"> <li>• To promote domestic exploration, extraction and reprocessing of raw materials in order to develop an integrated industrial structure with a great depth of manufacturing that will be less prone to market disruptions;</li> <li>• To promote foreign investment in mining projects;</li> <li>• To focus on research and development (R&amp;D) for resource efficiency and recycling;</li> <li>• To increase education and information diffusion; and</li> <li>• To establish partnerships with various producer countries.</li> </ul>

In greater detail, the actions that the German government aims to take with regards to raw materials can be divided into four main groups.

- Diversification of supply sources of materials
- Material efficiency, recovery and recycling
- Information and education
- Provide political support to German companies

Strategy/Programme Title:	<b>Supply of raw materials for High-tech German industries – specifying and further developing germany’s raw materials strategy</b>
Owner / Implementing Body	Office of Technology Assessment – German Bundestag
Date:	2012
Geographycal Scope	Germany
URL:	<a href="https://www.tab-beim-bundestag.de/en/pdf/publications/summaries/TAB-Arbeitsbericht-ab150_Z.pdf">https://www.tab-beim-bundestag.de/en/pdf/publications/summaries/TAB-Arbeitsbericht-ab150_Z.pdf</a>
Aim/Goals:	<p>The report addresses various policy issues:</p> <p><u>Security of supply</u> Germany will continue to rely on the supply of primary raw materials from abroad and companies actively involved in mining abroad will continue to play a major role. Improving the framework conditions for recycling is one of the few regulative approaches which are connected to the objective of security of supply as this could improve the availability of secondary raw materials in Germany.</p> <p><u>Price stability, market transparency and non-discrimination</u> Proposals by the EU Commission to regulate the trade with derivatives can contribute to increasing market transparency and price stability as the speculative influence on pricing is recognized more easily when the trade with derivatives is made more transparent.</p> <p><u>Lower consumption of raw materials</u> Due to the strong increase in raw material prices commercial incentives to increase resource efficiency and the awareness of the future relevance of resource efficiency in competition are currently very high which opens a “window of opportunity”. There should also be a focus on the development of standards.</p> <p><u>Responsible, sustainable cooperation on development policies to secure raw materials</u></p>

Strategy/Programme Title:	<b>Raw materials of strategic economic importance for high-tech made in Germany</b>
Owner / Implementing Body	Federal Ministry of Education and Research FONA
Date:	2012
Geographycal Scope	Germany

URL:	<a href="https://www.fona.de/mediathek/pdf/Strategische_Rohstoffe_EN.pdf">https://www.fona.de/mediathek/pdf/Strategische_Rohstoffe_EN.pdf</a>
Aim/Goals:	<p>The aim of the “Raw materials of strategic economic importance for high-tech made in Germany” programme is to expand research, development and education along the value chain of non-energy mineral raw materials over the next five to ten years. It covers research needs in the primary and secondary raw materials sector.</p> <p>Applied research up to demonstration level, combined with basic research + education</p> <p>Emphasizes further need for substitution of raw materials of strategic economic importance through new material and technology developments</p>

<b>Strategy/Programme Title:</b>	<b>National Policy Strategy on Bioeconomy</b>
Owner / Implementing Body	Federal Ministry of Food and Agriculture
Date:	2013
Geographical Scope	Germany
URL:	<a href="https://biobs.jrc.ec.europa.eu/sites/default/files/generated/files/policy/Germany%20National%20Policy%20Strategy%20on%20Bioeconomy.pdf">https://biobs.jrc.ec.europa.eu/sites/default/files/generated/files/policy/Germany%20National%20Policy%20Strategy%20on%20Bioeconomy.pdf</a>
Aim/Goals:	<p>The strategy main focus are biomass for energy and food, however it offers also some insight about wood biomass.</p> <p>The classic use of wood continues to offer growing market opportunities for the domestic forestry, wood and paper sectors. In the context of the Federal Government's Forestry Strategy 2020, approaches to solutions were drawn up which are aimed at ensuring internal coordination among the broad range of requirements that the forest must meet and also at resolving any conflicts of goals between protection and use of the forests. For this, it is necessary to mobilise the existing and sustainably usable potential in terms of raw materials. Short-rotation plantations not forming part of forests can also contribute to the supply of wood.</p> <p>The measures are aimed at climate protection and adaptation of the forests to climate change, securing and expanding the value added, efficient use of raw materials, biodiversity and nature protection in the forest, structuring of the forest and hunting, soil protection, water management, recreation, tourism, research and education, and also public information.</p> <p>In terms of non-forest resources, the following wood can contribute to the bioeconomy's raw-materials base: wood produced in short-rotation plantations located on utilised agricultural areas; recycling wood; wood intended for landscape-maintenance uses; and wood imported from sustainable and legal forestry operations. The significance of targeted information and specialist consultation provided to the owners of forests will continue to grow.</p>

Strategy/Programme Title:	<b>German Forest Strategy 2020</b>
Owner / Implementing Body	Federal Ministry of Food, Agriculture and Consumer Protection
Date:	2011
Geographical Scope	Germany
URL:	<a href="http://www.bmel.de/SharedDocs/Downloads/EN/Publications/ForestStrategy2020.pdf?__blob=publicationFile">http://www.bmel.de/SharedDocs/Downloads/EN/Publications/ForestStrategy2020.pdf?__blob=publicationFile</a>
Aim/Goals:	<p>Requirements made of forests regarding climate, biodiversity, raw materials, recreation and energy, Chapter devoted to Raw materials, use and efficiency</p> <p>The production of timber from sustainable forestry is to be ensured and the framework conditions improved for the sustainable provisioning of raw materials for the timber, paper and energy industry. After 2020 as well, the growing domestic demand for timber is to be mainly covered from indigenous supplies and from the sustainable exploitation of other raw material sources.</p> <p>Wood resources include raw wood, waste wood (recovered wood), landscape management materials as well as industrial wood residues that also come under the category raw wood.</p> <p>Although the main focus of the Strategy lies on the energy utilization questions about material efficiency and cycle management take on increasing importance. The timber and paper industry has demonstrated how economic advantages can be combined with ecological ones. This applies equally to the material usage of industrial wood residues and old stand in timber-based material and pulp technologies and the increased use of wood residues for heat and energy generation in timber companies' own production cycles.</p> <p>The essential pre-requisite for increasing resource efficiency is the avoidance of waste and the return of recyclable materials from waste to the economic cycle. In principle, the sensible cascaded use of scarce resources in the timber and paper industry should be increased further. Here, there are additional reserves which can be tapped with the help of research.</p>

Strategy/Programme Title:	<b>National Research Strategy BioEconomy 2030. Our Route towards a biobased economy</b>
Owner / Implementing Body	Federal Ministry of Education and Research
Date:	2011
Geographical Scope	Germany
URL:	<a href="https://biobs.jrc.ec.europa.eu/sites/default/files/generated/files/policy/German%20bioeconomy%20Strategy_2030.pdf">https://biobs.jrc.ec.europa.eu/sites/default/files/generated/files/policy/German%20bioeconomy%20Strategy_2030.pdf</a>
Aim/Goals:	The research strategy lays out five priority fields of action for further development towards a knowledge-based, internationally competitive bioeconomy. These are: global food security, sustainable

agricultural production, healthy and safe foods, the industrial application of renewable resources, and the development of biomass-based energy carriers.

Biomass also represents the only renewable carbon source for use as an industrial raw material. Furthermore, biological resources hold a vast reservoir of natural materials for industrial purposes, which can be produced using limited resources

Biobased products, which combine biotechnical, chemical, thermal, or mechanical methods in their manufacturing process, not only help protect nature, the environment, and the climate, but also enable greater independence from fossil raw materials. Furthermore, they make a significant contribution to the structural change from a petroleum-based to a biobased industry with related opportunities for growth and employment. Industrial biotechnology, also known as white biotechnology, is an important driving force in this transition. This field of activity is given high priority in the federal Government. In the future, the various biomass raw materials can be further processed into high-quality products, among other things through cascading and coupling. In analogy to petrochemical refineries, the term biorefinery is used when all the components of various plants and/or waste, as well as residual materials, are used to as great an extent as possible (zero waste). There are many research topics to be worked through towards the concept of biorefineries, for example on the decomposition, processing, and conversion of biomass, in particular of wood (lignocellulose), and on product purification. All of these must be incorporated in a project plan (roadmap) for biorefinery development.

Plant raw materials, in particular those not used as animal/human nutrition, can already be optimised in development, e.g. through plant selection, cultivation and breeding

### 3.1.5. Netherlands

Strategy/Programme	Policy Document on Raw Materials
Title:	
Owner / Implementing Body	Dutch Ministry of Foreign Affairs
Date:	2011?
Geographical Scope	The Netherlands
URL:	<a href="https://ec.europa.eu/growth/tools-databases/eip-raw-materials/en/system/files/ged/46%20mss-netherlands_en.pdf">https://ec.europa.eu/growth/tools-databases/eip-raw-materials/en/system/files/ged/46%20mss-netherlands_en.pdf</a>
Aim/Goals:	The Government's first concern is to preserve the free trade system. Free trade is crucial to the Netherlands, as a major transit route. The scarcity of raw materials is also seen as an explicit opportunity. The Government hopes to encourage innovation, re-use and substitution so that we can take a leading role in this field in Europe. This can strengthen the economy and our trading position. Solutions are sought at European level where possible, and at national level where

necessary.

In formulating solutions the Government has assumed that primary responsibility lies with trade and industry, and that the role of government is to facilitate, encourage, create frameworks and coordinate. Three agendas have been elaborated:

Agenda 1: secure and increase supply and improve sustainability of supply. This will be achieved by removing any rules and regulations that pose unnecessary barriers for industry.

Agenda 2: limit demand and where possible improve sustainability of demand.

The Dutch government aims to lead by example when it comes to raw materials by paying more attention to raw materials when it comes to government purchasing and by improving its own management operations. This includes making chain agreements about product design, better use of waste flows, the purchase of services instead of products and the recovery of phosphates from waste water.

Agenda 3: improve the sustainability and efficiency of raw materials consumption. Due to price rises alternatives to extraction, such as recycling and raw materials innovation become more favourable. Therefore, the government aims to promote close-loop and high quality recycling of raw materials.

Strategy/Programme Title:	<b>A circular economy in the Netherlands by 2050</b>
Owner / Implementing Body	The Ministry of Infrastructure and the Environment and the Ministry of Economic Affairs
Date:	2016
Geographical Scope	The Netherlands
URL:	<a href="https://www.government.nl/documents/policy-notes/2016/09/14/a-circular-economy-in-the-netherlands-by-2050">https://www.government.nl/documents/policy-notes/2016/09/14/a-circular-economy-in-the-netherlands-by-2050</a>
Aim/Goals:	<p>Currently, we still use our raw materials and fossil fuels too often as if they are inexhaustible. We make products as cheap as possible and too frequently throw them away after use. In a circular economy, we will deal with our resources in a much smarter way. We will use and consume as little as possible, and we will maximise the reuse of raw materials. We will develop products that are more durable and find new, smart ways to produce them. And we will use them more intelligently by sharing them and passing them on. By doing that, we will build a circular economy together. By 2050, this circular economy must be a reality in the Netherlands.</p> <p>To accelerate the transition of the current Dutch economy into a circular economy, we have formulated three strategic objectives in the Government-wide programme:</p> <ol style="list-style-type: none"> <li>1. Raw materials in existing supply chains must be used in a high-</li> </ol>

quality manner. This gain in efficiency can lead to a reduced need for raw materials in existing chains.

2. In case new raw materials are necessary, fossil-based, critical and non-sustainably produced raw materials must be replaced by sustainably produced, renewable and generally available raw materials. In this way, we make our economy not only more future-proof, but also less dependent on fossil sources and the import of these resources. We also retain our natural capital as a result.
3. We must develop new production methods, design new products, and re-structure sectors. We must also promote new ways of consumption. This leads to other chains that give additional impetus to the desired reduction, replacement and utilisation.

To achieve these ambitions and to create good conditions for the intended transition, the Cabinet will deploy five instruments for the priority sectors, wherever such is

necessary and useful:

1. Fostering legislation and regulations;
2. Intelligent market incentives;
3. Financing;
4. Knowledge and innovation;
5. International cooperation.

In addition to a generic approach, the transition to a circular economy calls for a change strategy specifically geared to each sector or raw materials value chain. The five priorities are:

- Biomass and food
- Plastics
- Manufacturing industry
- Construction sector
- Consumer goods

### 3.1.6. Spain

Strategy/Programme Title:	<b>Critical metals: risks and opportunities for Spain</b>
Owner / Implementing Body	Instituto ElCano
Date:	2013
Geographical Scope	Spain
URL:	<a href="http://www.realinstitutoelcano.org/wps/wcm/connect/179e09804f460304840c9f8c9edeb290/AR12-2013-Solera-Critical-Metals-risks-opportunities-Spain.pdf?MOD=AJPERES&amp;CACHEID=179e09804f460304840c9f8c9edeb290">http://www.realinstitutoelcano.org/wps/wcm/connect/179e09804f460304840c9f8c9edeb290/AR12-2013-Solera-Critical-Metals-risks-opportunities-Spain.pdf?MOD=AJPERES&amp;CACHEID=179e09804f460304840c9f8c9edeb290</a>

**Aim/Goals:**

The Elcano Royal Institute is a think-tank for international and strategic studies that analyses world events and trends from a Spanish, European and global perspective. The paper highlights the lack of a Spanish strategy for critical materials and some outlines some opportunities.

It is essential to adopt measures both to enable the national renewable technology industry to overcome potential barriers and bottlenecks in the manufacturing metal supply, and to mitigate the widespread perception that sectoral R&D and innovation initiatives are only of marginal interest in the national political arena.

Due to its solid renewable technology manufacturing base, Spain is in a position to implement some of the measures already adopted in other countries, including:

- Acquiring strategic knowledge of those metals which have the greatest impact on the Spanish low carbon technology industry.
- Creating public advisory agencies to advise both the government and private companies in the adoption of adequate critical metal supply policies.
- Promoting research into mineral and metalliferous resource technologies with applications for low carbon technologies.
- Promote the exchange of sectoral information, as well as training, education and standards development.
- Developing targeted raw materials diplomacy

Spain should also take advantage of its solid technological stand and ample market experience in order to maximise opportunities arising from niche innovation markets. In this regard, research into new materials, optimised resource efficiency, closed-loop recycling and re-use processes should all, in conjunction with appropriate standardisation, be strongly reinforced through the combined efforts of the Spanish government and private partners as a main prerequisite for pioneering market advantage.

### 3.1.7. Sweden

Strategy/Programme  
Title:

**Strategic research and innovation agenda for the swedish mining and metal producing industry (strim)**

<p>Owner / Implementing Body Date: Geographical Scope URL: Aim/Goals:</p>	<p>Vinnova</p> <p>2013</p> <p>Sweden</p> <p><a href="http://www.sipstrim.se/wp-content/uploads/2014/06/Agenda-STRIM-LTU-Vinnova.pdf">http://www.sipstrim.se/wp-content/uploads/2014/06/Agenda-STRIM-LTU-Vinnova.pdf</a></p> <p>The STRIM Agenda covers the entire primary resources value chain by incorporating the early stages of the value chain, i.e. exploration, and the downstream parts of the primary value chain, i.e. metallurgy. It also addresses the secondary resources by proposing a research and innovation programme for recycling and how the mining and metal producing industry can contribute to a sustainable development of the society.</p> <p>Actions to be carried out are distributed in seven Agenda areas related to primary and secondary resources:</p> <ul style="list-style-type: none"> <li>• Deep Innovative Exploration</li> <li>• Mining</li> <li>• Mineral Processing</li> <li>• Recycling and Metallurgy</li> </ul> <p>The future challenges of raw materials supply can only be met by enhanced resource productivity. To meet the need for increased resource and energy efficiency, the following challenges will be addressed:</p> <ul style="list-style-type: none"> <li>• Maximising recovery of the value-bearing minerals through innovations in mining and mineral and refining processing technology. New technology would enable the viable primary extraction of complex low-grade mineralisations.</li> <li>• Innovations in recycling technology to maximise the recovery of value-bearing minerals.</li> <li>• Methods to increase energy efficiency. Of special importance are new or radically improved methods for minimising the energy needed for grinding.</li> </ul> <p>The STRIM Agenda areas Metallurgy and Recycling have been evaluated against the agenda for the Swedish steel industry developed by Jernkontoret – the Swedish Steel Producers Association.</p> <ul style="list-style-type: none"> <li>• Reclamation/Environmental Performance</li> <li>• Attractive Workplaces</li> <li>• Gender Equal Mining</li> </ul> <p>All Agenda areas have defined short- and medium-term measures that can be implemented within national and international RDI initiatives.</p> <p>Other sectors where actions are needed for growth in the Swedish mining industry are Transport and Energy.</p>
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<p>Strategy/Programme Title:</p>	<p><b>Sweden's Minerals Strategy</b></p>
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Owner / Implementing Body	Swedish Ministry of Enterprise, Energy and Communications
Date:	2013
Geographical Scope	Sweden
URL:	<a href="http://www.government.se/contentassets/78bb6c6324bf43158d7c153ebf2a4611/swedens-minerals-strategy.-for-sustainable-use-of-swedens-mineral-resources-that-creates-growth-throughout-the-country-complete-version">http://www.government.se/contentassets/78bb6c6324bf43158d7c153ebf2a4611/swedens-minerals-strategy.-for-sustainable-use-of-swedens-mineral-resources-that-creates-growth-throughout-the-country-complete-version</a>
Aim/Goals:	<p>In the minerals strategy, the Government identifies five strategic objectives that are considered to be of particular importance in order to reach the strategy’s vision. These objectives and their related action areas are:</p> <ul style="list-style-type: none"> <li>• A mining and minerals industry in harmony with the environment, cultural values and other business activities. <ul style="list-style-type: none"> <li>○ Greater resource efficiency</li> <li>○ Better dialogue and synergy with other industries</li> <li>○ Mining communities with attractive natural and cultural environments</li> </ul> </li> <li>• Dialogue and cooperation to promote innovation and growth. <ul style="list-style-type: none"> <li>○ Promotion of societal development and regional growth</li> <li>○ Clearer distribution of responsibility and better flow of information among actors in the industry</li> </ul> </li> <li>• Framework conditions and infrastructure for competitiveness and growth. <ul style="list-style-type: none"> <li>○ A clearer and more effective regulatory framework</li> <li>○ Infrastructure investments for growth in the mining industry</li> </ul> </li> <li>• An innovative mining and minerals industry with an excellent knowledge base. <ul style="list-style-type: none"> <li>○ Research and innovation that create growth and competitiveness</li> <li>○ Skills supply that meets the needs of the industry and the regions</li> </ul> </li> <li>• An internationally renowned, active and attractive mining and minerals industry. <ul style="list-style-type: none"> <li>○ A good supply of capital and promotion of investment</li> <li>○ Greater participation in the international arena.</li> </ul> </li> </ul>

Strategy/Programme Title:	<b>Swedish Research and Innovation Strategy for a Bio-based Economy</b>
Owner / Implementing Body	Swedish Government
Date:	2012
Geographical Scope	Sweden
URL:	<a href="http://www.formas.se/PageFiles/5074/Strategy_Biobased_Ekonomi_hela.pdf">http://www.formas.se/PageFiles/5074/Strategy_Biobased_Ekonomi_hela.pdf</a>
Aim/Goals:	<p>Bio-based economy (bioeconomy) is an economy based on:</p> <ul style="list-style-type: none"> <li>• A sustainable production of biomass to enable increased use within a number of different sectors of society. The objective is to reduce climate effects and the use of fossil based raw materials.</li> </ul>

- An increased added value for biomass materials, concomitant with a reduction in energy consumption and recovery of nutrients and energy as additional end products. The objective is to optimize the value and contribution of ecosystem services to the economy.

The following research and development needs are defined.

- The replacement of fossil-based raw materials with bio-based raw materials 23
- Smarter products and smarter use of raw materials 26
- Change in consumption habits and attitude

<b>Strategy/Programme Title:</b>	<b>Made in Sweden 2030. Strategic Agenda for Innovation in Production</b>
<b>Owner / Implementing Body</b> <b>Date:</b> <b>Geographical Scope</b> <b>URL:</b>	Association of Swedish Engineering Industries & Swerea 2013 Sweden <a href="https://www.teknikforetagen.se/globalassets/i-debatten/publikationer/produktion/made-in-sweden-2030-engelsk.pdf">https://www.teknikforetagen.se/globalassets/i-debatten/publikationer/produktion/made-in-sweden-2030-engelsk.pdf</a>
<b>Aim/Goals:</b>	From the six key areas two are especially important from the point of view of raw materials. <ul style="list-style-type: none"> <li>• Environmentally sustainable production. The overall challenges for environmentally sustainable production in Sweden are to minimize resource consumption and environmental impact of production systems and products. Sweden has acquired a strong international position in development of environmentally sustainable production. Important challenges are for example efficient use of materials, lightweight structures, energy optimization, remanufacturing, and advanced methods for recycling</li> <li>• Integrated product and production development. Integrated processes requires parallel development of the product, manufacturing and production processes, and marketing systems, aftermarket offerings, and systems for recycling and reuse when the product is finally unusable. All processes must involve life-cycle thinking.</li> </ul>

## 3.2. Rest of the world

### 3.2.1. Australia

Strategy/Programme Title:	<b>Critical commodities for a high-tech world: Australia's potential to supply global demand</b>
Owner / Implementing Body	Geoscience Australia
Date:	2013
Geographical Scope	Australia
URL:	<a href="http://www.ga.gov.au/metadata-gateway/metadata/record/gcat_76526">http://www.ga.gov.au/metadata-gateway/metadata/record/gcat_76526</a>
Aim/Goals:	<p>The purpose of this report is to:</p> <p>Provide an assessment of resource potential for metal, non-metal and mineral commodities in Australia;</p> <p>Present technical information on the geological occurrence of critical commodities, and of Australia's resources and potential for discovery of new resources; and</p> <p>Guide mineral exploration companies towards the geological settings in Australia where resources of the critical commodities are either known, likely to be present, or have category one resource potential to be discovered.</p> <p>This report provides contextual and geological background to existing production and opportunities for potential production of critical commodities. Critical commodities are defined as mineral commodities for which uses are both economically important and have a high risk of supply disruption. Based upon a compilation of reports defining commodities considered critical by our major trading partners (UK, EU, USA, Japan and Korea), a suite of commodities were identified that can be considered critical. Mineral systems analysis was undertaken to determine which of these commodities are currently produced or have potential for production in Australia. Using the data and the potential size of export markets, the report identifies potential in four areas: (1) deposits associated with mafic-ultramafic magmatism (for Co, Cr, Ni, PGE); (2) deposits associated with granitic and alkaline magmatism (for Be, Bi, Li, Mo, Nb, REE, Sn, Ta, W); (3) heavy mineral sands deposits (for REE, Th, Ti, Zr); and (4) trace elements in ores and concentrates from existing mines (Cd, Ga, Ge, In, Sb, Se, Te).</p>

Strategy/Programme Title:	<b>National Minerals Exploration Strategy</b>
Owner / Implementing Body	SCER - Australian Government
Date:	2012
Geographical Scope	Australia
URL:	<a href="https://scer.govspace.gov.au/files/2012/12/National-Mineral-Exploration-Strategy.pdf">https://scer.govspace.gov.au/files/2012/12/National-Mineral-Exploration-Strategy.pdf</a>

Aim/Goals:	This National Mineral Exploration Strategy focuses on the acquisition and delivery of pre-competitive geoscience, applied geoscience research initiatives to assist exploring undercover and a mineral exploration investment attraction plan. Supporting activities associated with the strategy aimed at cross-jurisdictional collaboration on regulatory reform are also underway. The strategy will not address the financial challenges facing the minerals sector.
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Strategy/Programme Title:	<b>Vision 2040 Mining, Minerals and Innovation A vision for Australia's mineral future</b>
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Owner / Implementing Body	Mineral Futures Collaboration Cluster (CSIRO)
Date:	2011
Geographical Scope	Australia
URL:	<a href="https://www.uts.edu.au/sites/default/files/final_vision_final_aug2011.pdf">https://www.uts.edu.au/sites/default/files/final_vision_final_aug2011.pdf</a>
Aim/Goals:	<p>In this vision, Australia develops a national strategy for the development of its mineral resources that will guide future development and ensure long-term benefit to the national community.</p> <p>More precisely the document addresses the following issues.</p> <p>Building long-term benefit for Australia. Problem: Economic, social and environmental impacts are affecting the productivity of mining in Australia, and future benefits. Solutions: Sovereign wealth fund to support diversification, infrastructure and innovation.</p> <p>Looking ahead to get ahead. Problem: Declining mineral deposits are creating greater impacts during operations and upon closure. Solutions: Embedding best practice mine closure, and post-mining transitions, in planning and daily operations. Exporting this knowledge globally.</p> <p>Brand Australia: responsible minerals. Problem: Social licence to operate is extending to sustainable and ethical supply chains for consumer products and infrastructure. Solutions: Developing and applying accredited standards for mining operations; Link mining to clean energy.</p>

A National Mining Strategy Problem. Limited information and coordination reduces strategic competitiveness and opportunities for innovation. Solutions: Measuring and managing above and below-ground stocks to guide technology and policy development.

### 3.2.2. Brazil

Strategy/Programme Title:	<b>National Mining Plan 2030 / Plano Nacional de Mineração 2030</b>
Owner / Implementing Body	Ministério das Minas e Energia – MME
Date:	2011
Geographical Scope	Brazil
URL:	<a href="http://www.mme.gov.br/documents/1138775/1732821/PNM-2030.doc/1051942e-45a2-48d1-86a1-ac0ea5d03311">http://www.mme.gov.br/documents/1138775/1732821/PNM-2030.doc/1051942e-45a2-48d1-86a1-ac0ea5d03311</a>
Aim/Goals:	<p>Brazil is in the process of overhauling its mining sector policy. The plan of a new mining policy was first announced in 2009 and a National Mining Plan 2030 (Plano Nacional de Mineração 2030) was published in 2011. In June 2013, the Brazilian Government submitted a bill of law (PL 5807) to the National Congress for replacing the current mining code. However, the approval of the bill was stalled for various reasons including contestation of provisions to increase royalties, quick timeframe for implementation, the intended auction process, etc.</p> <p>The new mining code, if approved, will have introduced substantial changes to the provisions of the current mining code, which include:</p> <ul style="list-style-type: none"> <li>• Creation of the National Council for Mining Policy (CNPM) to assist the president in strategic decision</li> <li>• Increase in the royalties charged for the exploration of natural resources</li> <li>• Unification of the current exploration and exploitation licenses under a single mining license.</li> <li>• Dissolve the National Department of Mining Policy (DNPM) and create a regulatory agency, the National Mining Agency (NMA) that will be provided with the authority not only to regulate and supervise the mining sector, but also to organize public bidding for the concession of new mineral rights.</li> </ul> <p>On November 11, 2013, an amended bill of law was released. The passage of the bill was delayed due to the opposition’s protests on various provisions of the bill and the national elections in 2014.</p> <p>Regarding Critical materials the new policy identifies “strategic minerals” that are “essential” or “critical” The strategy makes explicit references to the following CRM: Niobium, phosphate, graphite, chromium, tungsten, manganese.</p>

Funding of research directed at CRM is included in the National Mining Plan 2030, but not in terms of substitution.

Strategy/Programme Title:	<b>Brazil Biotechnology Strategy</b>
Owner / Implementing Body	Governo Federal do Brazil
Date:	2007
Geographical Scope	Brazil
URL:	<a href="https://biobs.irc.ec.europa.eu/policy/brazil-biotechnology-strategy">https://biobs.irc.ec.europa.eu/policy/brazil-biotechnology-strategy</a>
Aim/Goals:	<p><i>The Brazil Biotechnology Strategy</i> supports the comprehensive development of biosciences and biotechnology. Although the biotech policy addresses the full range of biotechnology applications, there is a focus on advancements in medical biotechnologies (including the wider healthcare sector), agricultural (including animal health) and biofuel applications.</p> <p>The recent development of the biobased industry is mostly industry driven. In 2011, The National Confederation of Industry (CNI) launched its <a href="http://gbs2015.com/fileadmin/gbs2015/Downloads/Bioeconomy-Policy_Part-II.pdf">agenda</a> for stimulating innovation in Brazil, which defines the life sciences, biotechnology and biodiversity as key factors for success.</p> <p><a href="http://gbs2015.com/fileadmin/gbs2015/Downloads/Bioeconomy-Policy_Part-II.pdf">http://gbs2015.com/fileadmin/gbs2015/Downloads/Bioeconomy-Policy_Part-II.pdf</a> .</p> <p><a href="http://arquivos.portaldaindustria.com.br/app/conteudo_24/2013/10/18/411/20131018135824537392u.pdf">http://arquivos.portaldaindustria.com.br/app/conteudo_24/2013/10/18/411/20131018135824537392u.pdf</a></p>

### 3.2.3. Canada

Strategy/Programme Title:	<b>The Minerals and Metals Policy of the Government of Canada</b>
Owner / Implementing Body	Minister of Public Works and Government Services Canada
Date:	1996
Geographical Scope	Canada
URL:	<a href="http://www.nrcan.gc.ca/sites/www.nrcan.gc.ca/files/mineralsmetals/pdf/mms-smm/poli-poli/pdf/mmp-eng.pdf">http://www.nrcan.gc.ca/sites/www.nrcan.gc.ca/files/mineralsmetals/pdf/mms-smm/poli-poli/pdf/mmp-eng.pdf</a>
Aim/Goals:	<p>Provincial governments are responsible for mining within their respective jurisdictions. In this context, the Government's role in minerals and metals has been more sharply focused on core federal responsibilities, including international trade and investment, science and technology, environmental protection, and Aboriginal affairs.</p> <p>The policy wants to ensure the competitiveness of Canada's minerals and metals industry within a sustainable development approach. Promotion of products, markets and stewardship will be key tools for these objectives.</p> <p>Recycled minerals and metals constitute an important source of</p>

secondary materials for industry, and generate environmental benefits. As a consequence, the Government will work to: enhance the efficiency and effectiveness of regulations; promote a more efficient metals recycling industry in Canada; advance recycling as a feature of product design; and, at the international and domestic levels, promote common approaches to the definition of waste (including a distinction between metal-bearing recyclables destined for recovery and wastes destined for final disposal).

Land access for mineral exploration and development is necessary if the minerals and metals industry is to continue to contribute to Canada's economic and social well-being. In regard to Canada's ocean territory, that access will be determined through an integrated oceans governance strategy adopted by the Government. In addition to land access, governments must provide reasonable certainty to the industry that when it finds a mineral deposit, it can develop that deposit.

Strategy/Programme Title:	<b>A Vision for Canada's Forests 2008 and Beyond</b>
Owner / Implementing Body	Natural Resources Canada
Date:	2008
Geographical Scope	Canada
URL:	<a href="http://www.ccfm.org/pdf/Vision_EN.pdf">http://www.ccfm.org/pdf/Vision_EN.pdf</a>
Aim/Goals:	<p>Sustainable forest management is the overarching basis for realizing the Vision.</p> <p>This Vision highlights two current priorities of national importance, both of which require innovative policies and actions: forest sector transformation and climate change. Forest sector transformation is needed to maintain a prosperous and sustainable future for Canada's entire forest sector. Climate change adaptation and mitigation strategies will reduce the effects of climate change on forests and communities.</p> <p>Some desired outcomes related to forest sector transformation:</p> <ul style="list-style-type: none"> <li>• New ideas, technologies, processes, and markets are developed through the systematic engagement of science and technology organizations in collaborative research and public-private partnerships;</li> <li>• Economic value from forest resources is maximized including through the diversification of uses;</li> <li>• Products from Canada's forests are recognized as an environmentally and socially responsible choice for consumers around the world;</li> <li>• The provision of environmental goods and services is taken into account in the sustainable management of Canada's forest resources, including through the development of new markets;</li> </ul>

- Highly skilled workers contribute to the expansion of knowledge-based forest industries through education and training;
- Creative public policies are in place that facilitate forest sector transformation.

The Vision covers forest as a source of raw materials but does not overlook other services as tourism, recreational activities or rural development.

While forest commodity producers will continue to significantly contribute to the country's economic well-being, other forest sector members will use forest resources to different ends. For example, forests are a source of many current and potential non-timber forest products and services, such as resins, oils, mushrooms, berries, fish and game, tourism, and recreational pursuits, and bioproducts, such as antibiotics, bioplastics, adhesives, biopesticides, plant-derived pharmaceuticals, biochemicals, and industrial enzymes. The development of a renewable bioeconomy, including bioplastics and biochemicals, presents interesting opportunities and benefits in terms of both sector transformation and climate change. Some of these products come not only from the forest itself but from the use of residues from wood processing and harvesting. These residues can be converted into value-added products, such as ethanol, artificial flavorings, and fertilizers, and renewable fuels, such as solid biofuels. These biofuels have the potential to contribute to the rural economy, to positively affect the environment by reducing greenhouse gas emissions, and to improve Canada's energy security.

Strategy/Programme	Forest Federal Programs
Title:	
Owner / Implementing Body	Natural Resources Canada
Date:	201??
Geographical Scope	Canada
URL:	<a href="http://www.nrcan.gc.ca/forests/federal-programs/13123">http://www.nrcan.gc.ca/forests/federal-programs/13123</a>
Aim/Goals:	<p>The federal government offers several funding programs to develop the forestry sector.</p> <p><u>Expanding Market Opportunities Program</u> increase market opportunities for the Canadian forest industry in offshore markets and non-residential construction and mid-rise segments in North American markets.</p> <p><u>Forest Innovation Program</u> supports research, development and technology transfer activities in Canada's forest sector.</p> <p>Investments in Forest Industry Transformation Program aims to support Canada's forest sector in becoming more economically competitive and environmentally sustainable through targeted investments in advanced technologies.</p>

Pulp and Paper Green Transformation Program sought to improve the environmental performance of Canada's pulp and paper industry.

The Expanding Market Opportunities Program (EMO) has two components:

- an Offshore Markets component, the goal of which is to maintain and grow international forest product markets while promoting Canadian forest products as an environmentally responsible choice;
- a North American component, the goal of which is to expand wood use in the North American non-residential and mid-rise construction market and position Canada as a world leader in sustainable forest management and a preferred source of sustainable forest products.

### 3.2.4. China

Strategy/Programme Title:	China's Policy on Mineral Resources
Owner / Implementing Body	The Information Office of the State Council of the People's Republic of China
Date:	2003
Geographical Scope	China
URL:	<a href="http://www.china.org.cn/english/2003/Dec/83092.htm">http://www.china.org.cn/english/2003/Dec/83092.htm</a>
Aim/Goals:	<p>Main points of the 2003 white paper are on securing supply, on improving environmental conditions, on the creation of markets and on improving the cooperation with other countries. Chapters:</p> <ol style="list-style-type: none"> <li>I. Present Situation of Mineral Resources and Their Exploration and Exploitation</li> <li>II. Targets and Principles for Mineral Resources Protection and Rational Utilization</li> <li>III. Increasing the Domestic Capability of Mineral Resources Supply</li> <li>IV. Widening the Opening of, and Cooperation in, Mineral Resources Exploration and Exploitation</li> <li>V. Achieving the Coordinated Development of Mineral Resources Exploitation and Environmental Protection</li> <li>VI. Improving the Management of Mineral Resources</li> </ol> <p>The document sets a vision where China will depend mainly on the exploitation of its own mineral resources to guarantee the needs of its modernization program. The Chinese government encourages the exploration and exploitation of the mineral resources in market demand, especially the dominant resources in the western regions, to increase its domestic capability of mineral resources supply. At the same time, it is an important government policy to import foreign capital and technology to exploit the country's mineral resources, make use of foreign markets and foreign mineral resources, and help Chinese mining enterprises and mineral products enter the international market.</p>

Strategy/Programme Title:	China Minerals Resources 2015
Owner / Implementing Body	Ministry of Land and Resources People's Republic of China
Date:	2016
Geographical Scope	China
URL:	<a href="http://en.cgs.gov.cn/upload/201510/20151030/China%20Mineral%20Resources%202015-English%20Version.pdf">http://en.cgs.gov.cn/upload/201510/20151030/China%20Mineral%20Resources%202015-English%20Version.pdf</a>
Aim/Goals:	This report gives an overview of the situation of mineral resources, emphatically introduces the main progress in surveys and evaluations of geology and mineral resources, exploration, development and

utilization of mineral resources, mine ecological civilization construction and management of mineral resources in China since 2014; reflects the dynamic state of mineral resources management from the perspectives of mineral resources planning, exploration & mining rights, reserves, exploration, supervision and so on; expounds the reform progress and essential policies from the perspectives of the construction of policy system, reform of taxes and charges; presents the latest progress of China's technical innovation of geology and mining from the perspectives of geological theories and technologies of exploration and exploitation; summarizes the situation of international cooperation on mineral resources. The report highlights that China has dropped some decade-old quotas limiting exports of strategically important minerals that sparked a global trade dispute and led some countries to reduce their reliance on Chinese supplies.

Strategy/Programme Title:	<b>Green Fence Policy</b>
Owner / Implementing Body	China Customs
Date:	2013
Geographical Scope	China
URL:	<a href="https://www.thebalance.com/operation-green-fence-impacts-2878038">https://www.thebalance.com/operation-green-fence-impacts-2878038</a>
Aim/Goals:	<p>Operation Green Fence was a crackdown undertaken by the Chinese environmental and customs officials to more robustly inspect all the shipments of secondary commodities such as scrap metals, plastics, paper, textiles and rubber from Europe, North America and elsewhere from February 2013 to November 2013. More specifically, it was a 10 month effort by the national custom agency of China to prohibit the import of unwashed and contaminated materials into China.</p> <p>As stated by Wang Jiwei, Secretary General and Vice President of the China Nonferrous Metals Industry Association Recycling Metal Branch (CMRA) the intention of the OGF was to bring psychological changes to all the shippers and make them know that every shipment into China would be strictly examined and their import application and license could be canceled if caught sending sub-standard materials to China.</p>

### 3.2.5. Japan

Strategy/Programme Title:	<b>Biomass Industrialization Strategy</b>
Owner / Implementing Body	The Ministry of Agriculture, Forestry and Fisheries (MAFF)
Date:	2012

Geographical Scope	Japan
URL:	<a href="http://www.maff.go.jp/e/pdf/reference6-8.pdf">http://www.maff.go.jp/e/pdf/reference6-8.pdf</a>
Aim/Goals:	Previous biomass policies have been focused in the use of biomass resources to strength an independent and distributed energy system. This attention has become even more important after the Great East Japan Earthquake and Fukushima nuclear power plant accident happened. Thus the Biomass Industrialization Strategy was drawn up as principles to achieve the targets of the National Plan by creating regional green industry and fortifying, independent and distributed energy supply system.

<b>Strategy/Programme</b>	<b>Japanese Guidelines for securing natural resources</b>
Title:	
Owner / Implementing Body	The Ministry of Economy, Trade and Industry (METI)
Date:	2010
Geographical Scope	Japan
URL:	<a href="http://www.meti.go.jp/english/newtopics/data/pdf/080328Guidelines.pdf">http://www.meti.go.jp/english/newtopics/data/pdf/080328Guidelines.pdf</a>
Aim/Goals:	<p>Although the Guidelines are primarily focused on energy resources (oil, coal, natural gas,) key resource acquisition projects include also, uranium, rare metals and other mineral resources. They must meet the following criteria:</p> <ul style="list-style-type: none"> <li>(i) Projects to acquire exploration or development interests</li> <li>(ii) Projects related to long-term supply contracts that contribute to supplying the above resources to users in Japan.</li> </ul> <p>Substitution is explicitly named as one of the now five (opposed to four in previous METI documents), pillars of material security, next to warehousing, recycling, off-shore exploration, and bilateral cooperation with raw material producing countries. It is recognised that often Japanese companies wishing to acquire exploration or development interests overseas are faced with the need to negotiate with the target country's government or state-run companies</p>

<b>Strategy/Programme</b>	<b>Meti Recycling Guidelines</b>
Title:	
Owner / Implementing Body	The Ministry of Economy, Trade and Industry (METI)
Date:	2004
Geographical Scope	Japan
URL:	<a href="http://www.meti.go.jp/policy/recycle/main/english/council/guidelines.html">http://www.meti.go.jp/policy/recycle/main/english/council/guidelines.html</a>
Aim/Goals:	METI's Recycling Guidelines (By Product Category, By Industry Sector) have the aim of promoting voluntary initiatives by businesses, and are a summary of the items that businesses should tackle in terms of waste handling and recycling. First established in December 1990 by the Industrial Structure Council, they have been revised eight times,

with the most recent revision done on 13 October 2005.  
At present, the guidelines cover 35 categories and 18 sectors, which together cover about 70% of general, and about 40% of industrial waste volume.

Strategy/Programme Title:	<b>3rd Fundamental Plan for Establishing a Sound Material-Cycle Society</b>
Owner / Implementing Body	The Ministry of Environment
Date:	2013
Geographical Scope	Japan
URL:	<a href="http://www.env.go.jp/en/recycle/smcs/3rd-f_plan.pdf">http://www.env.go.jp/en/recycle/smcs/3rd-f_plan.pdf</a>
Aim/Goals:	<p>Japan has developed a Fundamental Plan for Establishing a Sound Material-Cycle Society, based on the Basic Act for Establishing a Sound Material-Cycle Society (Law number 110 of the year 2000) and has implemented related measures in a comprehensive and structured manner, in order to develop a “sound material-cycle society” where the consumption of natural resources is reduced and the environmental load is minimized to the extent possible. It can be said that policy issues to establish a sound material-cycle society are progressing from a stage where recycling, measured quantitatively, is carried out with an emphasis on reduction of waste generation, to a new stage where recycling is measured both quantitatively and qualitatively, waste is used more effectively as valuable resources and energy sources to raise resource productivity and consumption of natural resource in danger of depletion is curbed, all based on the premise of environmental conservation, safety and security.</p> <p>The Plan is aiming at promoting recycling, but also reinforcing reduce and reuse, focussing on the recovery of useful metals and forcing initiatives for security and safety as well as international cooperation for 3R initiatives. The plan mentions the importance on the view point of LCA.</p>

### 3.2.6. Korea

Strategy/Programme Title:	<b>Act on Promotion of Transition to Resource - Circulation Society</b>
Owner / Implementing Body	Ministry of Environment
Date:	2014
Geographical Scope	Korea
URL:	<a href="http://www.law.go.kr/DRF/lawService.do?OC=iaa806&amp;target=elaw&amp;MST=150502&amp;type=HTML&amp;mobileYn=">http://www.law.go.kr/DRF/lawService.do?OC=iaa806&amp;target=elaw&amp;MST=150502&amp;type=HTML&amp;mobileYn=</a>
Aim/Goals:	The purpose of this Act is to contribute to the preservation of the environment and sound development of the national economy by facilitating the use of recycled resources by means of controlling the

generation of wastes and facilitating recycling.

The act contains measures to promote the transition to a resource circulation society, which include free pickup services for large-scale waste home appliances, securement of the collection, transportation and classification of recycling resources, expansion of waste to energy facilities, creation of a recycling market, etc.

<Table 7-1> Paradigm Shift of Waste Management Policy

Category	Previous Policy Direction	New Policy Direction
Motivation	Worsened environmental pollution due to waste	Climate change, Raw material and energy exhaustion
Objective	Create clean living conditions	Construct a resource circulation society
Implementation strategy	Reduction → Recycling → Treatment	Efficient Production/Consumption → Material recycling → Energy harvesting → Advancing treatment
Main Tasks	Volume-based waste fee system, EPR, and building the treatment facilities	Resource recyclability evaluation, Recycled product quality certification, Waste-to-Energy, Merger of treatment district
Core concept	'Waste'	'Resource (Circulation/Natural)'

### 3.2.7. South Africa

Strategy/Programme Title:	<b>A Beneficiation Strategy for the Minerals Industry of South Africa</b>
Owner / Implementing Body	Department of Mineral Resources
Date:	2011
Geographical Scope	South Africa
URL:	<a href="http://www.eisourcebook.org/cms/South%20Africa%20Mineral%20Beneficiation%20Strategy.pdf">http://www.eisourcebook.org/cms/South%20Africa%20Mineral%20Beneficiation%20Strategy.pdf</a>
Aim/Goals:	<p>Government recently adopted the New Growth Path (NGP), which seeks to create more inclusive economic growth by systematically encouraging more labour absorptive economic activities. The objectives of the NGP are clear and developmental focussed. It sets a target of 5 million new jobs by 2020 and identifies six priority sectors, focussed on infrastructure and rebuilding the productive sectors of the economy. The NGP identifies mineral beneficiation as one of the priority growth nodes for job creation. Beneficiation entails the transformation of a mineral (or a combination of minerals) to a higher value product, which can either be consumed locally or exported. The term is used interchangeably with “value-addition”.</p> <p>The Beneficiation strategy is aligned to a national industrialisation programme, which seeks to enhance the quantity and quality of exports, promote creation of decent employment and diversification of the economy, including promotion of the green economy. The strategy identifies several instruments that constitute an enabling environment for beneficiation (policies, legislation, incentives etc.). Furthermore, it illuminates prevailing constraints to the effective implementation of beneficiation that require an integrated approach to mitigate. These include, albeit not limited to access to raw materials at developmental prices, infrastructure (access, costs and</p>

logistics), limited innovation and more broadly R&D and shortage of required critical skills. Synchronously, the strategy recommends a set of integrated solutions to mitigate identified binding constraints and leverage on existing national processes, such as the New Growth Path and the national infrastructure programme. The strategy outlines ten strategic mineral commodities, from which five value chains are selected. The value chains specified herein are intended to indicate the inherent value for South Africa in embracing beneficiation for all strategic mineral commodities.

Selected value chains

1. Energy Commodities
2. Iron and Steel
3. Pigment and Titanium Metal Production
4. Autocatalytic Converters and Diesel Particulate Filters
5. Jewellery Fabrication

Strategy/Programme	<b>DMR Strategic Plan 2014-2019</b>
Title:	
Owner / Implementing Body	DRM Department of Mineral Resources
Date:	2014
Geographical Scope	South Africa
URL:	<a href="http://www.dmr.gov.za/publications/summary/232-strategic-plan-2014-2019/1192-dmrstrategicplan201419lowres.html">http://www.dmr.gov.za/publications/summary/232-strategic-plan-2014-2019/1192-dmrstrategicplan201419lowres.html</a>
Aim/Goals:	<p>The DMR, in collaboration with other government departments and institutions, will continue to promote mineral value addition to strengthen the interface between extractive industries and national socio-economic developmental objectives as outlined in the NDP and contribute towards decent employment, inclusive growth and industrialisation of South Africa.</p> <p>This plan, rich in detail and attainable targets, sets out how we shall go about ensuring the non-negotiable objectives related to safety, skills and jobs in this pivotal sector. These goals are crucial for our success as a nation and, as such, they need to be pursued with utmost vigour in the years ahead.</p> <p>The firm foundation for a sustainable mining industry requires a robust investment environment that continuously addresses emerging impediments such as infrastructure limitations, skills shortages and investments in exploration. These constraints will be addressed through policy and regulatory interventions such as the infrastructure development programme of government, skills development programmes, and research and development programmes. Accordingly, the process of reviewing the existing mining strategy will commence during the 2014/15 financial year, and will be aligned with the National Development Plan objectives.</p> <p>Main objectives of Mineral Policy and Promotion</p> <ul style="list-style-type: none"> <li>• Promote investment in the mining sector. Facilitate fixed capital investment in the mining sector.</li> </ul>

- Promote sustainable resource use and management. Ensure improvement in mine environmental management practices and rehabilitate ownerless and derelict mines.
- Facilitate transformation in the mining and mineral sector. Review the transformation regulatory framework.
- Implement robust internal processes. Develop and review internal processes and improve turnaround times.
- Promote corporate governance. Reduce internal and external audit findings, implement risk management strategies and promote compliance.

Strategy/Programme Title:	South Africa Bioeconomy Strategy
Owner / Implementing Body	Department of Science and Technology (DST)
Date:	2013
Geographical Scope	South Africa
URL:	<a href="https://biobs.jrc.ec.europa.eu/policy/south-africa-bioeconomy-strategy">https://biobs.jrc.ec.europa.eu/policy/south-africa-bioeconomy-strategy</a>
Aim/Goals:	<p>The vision is for South Africa’s bio-economy to be a significant contributor to the country’s economy by 2030 in terms of the gross domestic product (GDP). This is to be achieved through the creation and growth of novel industries that generate and develop bio-based services, products and innovations. Such endeavours should translate into a corresponding increase in new companies and growth of existing companies that provide and utilise these solutions.</p> <p>The Bio-economy Strategy is the successor to the National Biotechnology Strategy of 2001. It is a science-based strategy that seeks to place bio-innovation as an essential arm of various departments, specifically Health; Agriculture, Forestry and Fisheries; Environment; Trade and Industry; Rural Development and Land Reform; Energy and Mineral Resources.</p> <p>Within the South African Strategy the term “Bio-economy” may include, but is not limited to, technological and non-technological exploitation of natural resources such as animals, plant biodiversity, micro-organisms and minerals to improve human health, address food security and subsequently contribute to economic growth and improved quality of life.</p> <p>Vital pillars of the strategy are research and coordination among a wide range of role players that include government departments, established industry, venture capital and the broader public; and on</p>

interacting with life-science role players, academics, researchers and private sector entrepreneurs to create value.

Three sectors are identified as crucial elements of the bio-Economy: Agricultural, Health and Industry and the environment. Regarding the later key objectives are to prioritise and support research, development and innovation in biological processes for the production of goods and services, while enhancing water and waste-management practices in support of a green economy. The position of South Africa as a provider of raw materials is also emphasised.

### 3.2.8. United States

Strategy/Programme Title:	Critical Materials Strategy
Owner / Implementing Body	DOE Department of Energy
Date:	2011
Geographical Scope	U.S.A.
URL:	<a href="http://energy.gov/sites/prod/files/DOE_CMS2011_FINAL_Full.pdf">http://energy.gov/sites/prod/files/DOE_CMS2011_FINAL_Full.pdf</a>
Aim/Goals:	<p>The 2011 strategy is an update of 2010 Strategy and it reconsiders its criticality assessments and provided in-depth market and technology analyses in response to important developments during the year. The 2010 strategy was mainly concerned with diversifying the supply of critical materials for U.S. industry, developing substitutes for the critical materials and improving recycling, reuse and more efficient use of these materials. These three principal goals were expanded to create the eight main points for policy direction with regards to critical materials in the U.S.</p> <ul style="list-style-type: none"> <li>Research and Development.</li> <li>Information gathering</li> <li>Permitting for domestics consumption</li> <li>Financial assistance for domestics production and processing</li> <li>Stockpiling</li> <li>Reciclyng policy</li> <li>Education and workforce training</li> <li>Diplomacy</li> </ul> <p>The 2011 strategy also contains a detailed description of DOE’s R&amp;D programmes. Most research effort has focussed on developing substitutes, specifically for rare earths in permanent magnets for motors and generators, as well as for photovoltaic cells, batteries and phosphors.</p>

Strategy/Programme Title:	Bioeconomy Blueprint
Owner / Implementing Body	The White House
Date:	2012
Geographical Scope	U.S.A.
URL:	<a href="https://www.whitehouse.gov/sites/default/files/microsites/ostp/national_bioeconomy_blueprint_april_2012.pdf">https://www.whitehouse.gov/sites/default/files/microsites/ostp/national_bioeconomy_blueprint_april_2012.pdf</a>
Aim/Goals:	<p>The Bioeconomy Blueprint is a comprehensive approach to harnessing innovations in biological research to address national challenges in health , food, energy, and the environment.</p> <p>The National Bioeconomy Blueprint describes a number of key elements that will contribute to achieving the potential of the US</p>

bioeconomy. They are:

- a full spectrum of basic and applied R&D activities performed by academic, government, and private sectors
- public-private partnerships
- a supportive commercialization system for bioinventions
- innovative regulatory policies that reflect government awareness of needs for and impediments to progress
- a skilled and creative workforce
- public support for technological advances
- flexibility to accommodate the evolving needs, discoveries, and challenges

### 3.3.Sectoral Policies Documents

**Sectoral policies about raw materials are not widespread in the private sector. Companies prefer to lobby before EU or national governments setup raw materials policies, thus position papers are easier to find rather than sectoral strategic documents...**

i.e. Coordinating EU lobbying campaigns. UEPG develops targeted advocacy strategies and acts as a coordinator in their implementation. Examples include ensuring the sustainable supply of aggregates in Europe, by supporting the EU Raw Material Strategy and improving the legal framework conditions for sustainable access to resources within Europe. UEPG demonstrates that the Aggregate Industry is an essential part of the Circular Economy.

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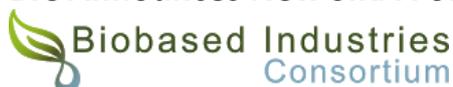
[http://www.uepg.eu/uploads/Modules/Publications/uepg-ar2016-17\\_32pages\\_v04\\_small.pdf#page=23](http://www.uepg.eu/uploads/Modules/Publications/uepg-ar2016-17_32pages_v04_small.pdf#page=23)

In other countries, like France , are well established structures for that lobbying or coordination actions. I.e. French “Comités stratégiques de filière” . Most sectors are represented and several of them, as “Chimie et Matériaux” or “Industries extractives et de première transformation” address raw materials issues within their strategic documents (contract de filière). Others as “Aéronautique” or “Automobile” integrate these issues within other priorities as lightweighting or circular economy.

<http://www.entreprises.gouv.fr/conseil-national-industrie/comites-strategiques-filiere>

Not exactly a sectoral policy, but for biorefineries this is the newest:

### BIC Announces New SIRA For Europe’s Bioeconomy (23 JUNE 2017)



To help build a resource-efficient, circular and bio-based economy, the [Biobased Industries Consortium \(BIC\)](#) has just launched its [new Strategic and Research Agenda \(SIRA\)](#). The SIRA identifies the activities needed to speed up the development of sustainable and competitive biobased industries in Europe – an aim that SusChem wholly supports and has helped to foster for many years.

<http://suschem.blogspot.com.es/2017/06/bic-announces-new-sira-for-europes.html>

### Global

Strategy/Programme Title:	<b>Position Paper on Circular Economy from 12 EU resource manufacturing industries</b>
Owner / Implementing Body	
Date:	2015
Geographical Scope	Europe
URL:	<a href="http://www.ima-europe.eu/sites/ima-europe.eu/files/publications/2015%2004%2002%20Circular%20Economy%20from%2012%20EU%20resource%20manufacturing%20industries....pdf">http://www.ima-europe.eu/sites/ima-europe.eu/files/publications/2015%2004%2002%20Circular%20Economy%20from%2012%20EU%20resource%20manufacturing%20industries....pdf</a>

Aim/Goals:	<p>Access to resources is crucial for all economic sectors of the EU. We therefore want to play a central role in deploying key actions to enhance the sustainable and efficient management of resources all along the value chain. We welcome the ambitions of the Commission in developing a new Circular Economy Package. As we have said in the past, and wish to repeat here, we strongly support the concept of a resource efficient low-carbon economy incorporating efficient re-use, repair, refurbishment, recovery and recycling of products. Technical, economic and environmental limitations nevertheless do exist, as do sector specificities and local contingencies. We highlighted these limitations in recent debates about potential resource efficiency targets and indicators.</p> <p>We will support a package taking into account successful pilot experiences as well as country, sector and value-chain specificities leading to a better, smarter use of resources globally. We consider the following aspects as essential for a successful circular economy uptake, coherent with the EU industrial policy:</p> <ul style="list-style-type: none"> <li>• Primary raw materials will remain essential to Europe’s growth</li> <li>• The technical and economic limits of a circular model require a specific value chain approach</li> </ul>
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	<ul style="list-style-type: none"> <li>• A coherent policy framework</li> <li>• Target setting should not be an end in itself</li> <li>• Life-cycle thinking</li> <li>• A full supply chain approach should apply</li> <li>• A sectoral approach to the benefits of the circular economy</li> <li>• Definitions should be broad enough to encompass all aspects of waste management</li> <li>• Subsidiarity should apply down to the relevant local level</li> <li>• Proportionality</li> </ul>
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## Automotive

Strategy/programme title:	<b>ACEA Position on the Commission’s Initiatives on Raw Materials, and the Flagship Initiative for a Resource Efficient Europe</b>
Owner Implementing body	ACEA European Automobile Manufacturers Association
date:	2012
Geographical scope	Europe
url:	<a href="http://www.acea.be/publications/article/position-paper-ec-initiatives-on-raw-materials">http://www.acea.be/publications/article/position-paper-ec-initiatives-on-raw-materials</a>
Aim/Goals:	<p>ACEA welcomes the inclusion of strategic research for material substitution and resource efficiency in the road maps and initiatives. However, ACEA calls on the EU Commission to re-focus the other items of the road map for resource efficiency towards the real problems as more comprehensively addressed in the wider raw materials initiative. Instead of traditional approaches it should be acknowledged that economies are already sufficiently driving resource efficiency unless markets are either overruled by speculation, oligopolies or trade restrictions.</p> <p>ACEA suggest the following recommendations. The EU should:</p> <ul style="list-style-type: none"> <li>• Ensure fair global market conditions and a level playing field using the following means, including: <ul style="list-style-type: none"> <li>□ Enforced WTO rules against any import restrictions but also no exports restrictions (neither primary nor secondary materials) e.g. by including binding disciplines against those restrictions in FTA negotiations and address access to raw materials in bilateral discussions and other measures based on a fair level playing field.</li> <li>□ No monopolistic/oligopolistic structures in the raw material markets.</li> <li>□ No speculation but predictable price signals (triggering both research for substitution and enabling the business case for recycling).</li> </ul> </li> <li>• Strive for a level playing field for the access to raw materials in third countries.</li> <li>• Use the leverage of the FTA negotiations and the political dialogues to raise the questions of fair and secure strategic access to raw materials.</li> <li>• Support scientific work to further develop a common</li> </ul>

	<p>understanding on what ‘resource efficiency’ really is. • Study resource efficiency of different world regions, to lead policy actions into the right direction and to promote an exchange of best practices.</p> <ul style="list-style-type: none"> <li>• Stimulate strategic research initiatives for finding substitutes for scarce raw materials within the context of the EU raw material initiative as well as the promotion of clean and fuel efficient vehicles. ACEA welcomes the activities to set up an Innovation Partnership on Raw Materials and is interested in taking part in the partnership.</li> </ul> <p>The EU should not:</p> <ul style="list-style-type: none"> <li>• Impose additional unilateral legislation or taxes on our industry to avoid market distortions.</li> <li>• Focus on traditional regulatory focus around recycling, raw materials and efficient use of resources as these are already sufficiently regulated (e.g. ELV recycling)</li> <li>• Focus on setting targets such as the lead indicators currently discussed that implicitly favour an economic model with less industry and more financial services with the risk of financial crisis which we are currently facing.</li> </ul>
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## Forest

Strategy/Programme Title:	The world’s leading forest cluster 2030
Owner / Implementing Body	Finnish Forest Industries
Date:	2017
Geographical Scope	Finland
URL:	<a href="https://www.metsateollisuus.fi/uploads/2017/03/30041804/890.pdf">https://www.metsateollisuus.fi/uploads/2017/03/30041804/890.pdf</a>
Aim/Goals:	<p>Focal points of research</p> <ol style="list-style-type: none"> <li>1.- Customer and user as drivers of development</li> <li>2.- Possibilities offered by new materials, services and business models</li> </ol> <p><b>NEW MATERIALS AND PRINTED INTELLIGENCE</b></p> <ul style="list-style-type: none"> <li>• Entirely new products based on renewable raw materials and new production technologies are developed.</li> <li>• Competition between different materials is under control and the opportunities of wood-based products are recognised.</li> <li>• New material solutions are sought systematically.</li> </ul> <p><b>BUSINESS MODELS AND SERVICES</b></p> <ul style="list-style-type: none"> <li>• New companies and business models are developed for the industry</li> <li>• Offering services as part of the product business has become common practice.</li> <li>• The ability to produce larger entities that meet customer</li> </ul>

	<p>needs has been developed. This “system integrator” model is utilised especially in wood products and packaging</p> <p>3.- Forest cluster as a builder of a sustainable bioeconomy</p> <p><b>BIOENERGY</b></p> <ul style="list-style-type: none"> <li>• Substantial availability of forest biomass for energy use</li> <li>• Functional balance in the use of energy and other raw materials</li> <li>• Finnish forest cluster is a leading actor and expert in forest biomass energy applications</li> <li>• Policy instruments are efficient.</li> </ul> <p><b>BIOREFINERY OPERATING MODELS</b></p> <ul style="list-style-type: none"> <li>• Business practices and production models have been developed for versatile biorefineries. Refinery products combine existing wood products and chemical forest industry products with new materials, chemicals and energy.</li> <li>• Finland is a world leader in refinery production expertise, the manufacture of production equipment and chemicals, and expert services. Expertise in both large-scale integration and smaller scale applications.</li> </ul> <p><b>SUSTAINABLE DEVELOPMENT METHODS</b></p> <ul style="list-style-type: none"> <li>• Requirements for the sustainable development of a bioproduct economy evolve into methods and standards, which support business in all product categories. The reviews extend from the forest and forest management issues through production to products and their use.</li> <li>• Finland plays a globally leading role in standardisation and norms</li> </ul>
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Strategy/Programme Title:	A forerunner in the bioeconomy
Owner / Implementing Body	Finnish Forest Industries
Date:	2017
Geographical Scope	Finland
URL:	<a href="https://www.metsateollisuus.fi/uploads/2017/03/30041812/893.pdf">https://www.metsateollisuus.fi/uploads/2017/03/30041812/893.pdf</a>
Aim/Goals:	<p>In Finland, forest industry production is based on the domestic supply of a raw material extracted from sustainably managed forests. Certification is a good way of demonstrating that forests are managed well and in a sustainable way. At the moment, only about 7% of the world’s forests are certified. Half of the forests of Europe have been certified, whilst in Finland the figure is 96%.</p> <p>RECREATIONAL AND COMMERCIAL FOREST UTILISATION GO HAND IN HAND</p> <p>MORE STRICTLY PROTECTED FORESTS THAN IN ANY OTHER EUROPEAN COUNTRY</p> <p>BIODIVERSITY IS SAFEGUARDED IN MANY WAYS</p>

FINLAND'S FOREST INDUSTRY KNOWS THE ORIGIN OF ITS RAW MATERIALS  
FINNS AMONG THE WORLD LEADERS IN PAPER RECOVERY AND RECYCLING

## 4. Summarizing conclusions on policies

For the purpose of the analysis of raw material policies, a relevant number of policies and strategies have been identified and reviewed as seen in the sections above. The policies identified are covering EU member states as well as non EU countries. Those non EU countries may play a key role in raw material landscape at world level (essentially as main supplier of raw materials for the world economies) or these countries may represent good practices in relation with raw material policies.

The policies identified address both general aspects or more specific objectives. Depending on the countries' specificities and relation towards raw materials (i.e. rather essentially suppliers, suppliers and consumers, or essentially importer of raw materials) it is not surprising that policies are addressing different aspects with relation to raw materials. Beyond these differences some commonalities among policies, essentially those policy bodies issued more recently seem to indicate some convergence in their aims. Indeed, there seems to exist a trend at global level, maybe even more strongly expressed in some countries than others (estimation is based on reviewed policies) expressed by a willingness of accelerating the transition of economies towards more sustainability and circularity. In relation to raw materials, this tendency is expressed by the policies intending to set the necessary frameworks for their respective countries to become more competitive and leader in their respective domains, i.e. mining, refining, metallurgy, manufacturing, recycling and other end of life management options. At individual country level, policies are emerging that seek to achieve better integration of sectoral policies, i.e. biomass across food, feedstock, energy, bio-chemicals sectors. The drivers for such policy developments may be different case per case but it is estimated that overarching objectives are essentially i) to achieve more efficient use of raw materials and ii) create the necessary conditions for growth and job creation. The later objective is often linked with the opportunity of creating skilled work forces through the breakthrough of innovative technologies along the whole value chain of the respective raw materials. These innovations may address raw material exploration, extraction/mining, refining (i.e. more efficient processes, particular concern about energy efficiency in extractive industries), recycling in the primary sector, industry (i.e. bio-economy and bio-chemicals...) manufacturing (i.e. promotion of innovation in product design), recycling, remanufacturing, reuse and promotion of new, more sustainable/responsible consumption patterns. Many countries have identified the high opportunities of being able to better exploit primary raw material resources and also secondary resources. Both fields are estimated to be able to create wealth and skilled jobs, hence, policies are intended to reinforce these potentials by setting the appropriate playing field. Based on the observed foci of the different policy bodies identified, it is estimated that in general the 3 following pillars are repeatedly addressed, either separately or together. These are:

- Primary resources oriented policy bodies

- Industry and economies oriented policy bodies
- Secondary resources oriented policy bodies

As mentioned above, all three pillars seem to represent areas in which expectations of growth and generation of skilled jobs are motivating the development of policies aimed at accelerating the transition towards efficiency and circular economies. The general and shared objective to “do more with less” is the common denominator which drives countries in defining their respective policy frameworks in relation to a transition towards efficient resource management and circular economy. The means to achieve these transitions are manifold, but RTD, education, innovation, economy (i.e. economic drivers, trade regulation), regulation and cooperation are estimated to be the key vectors for achieving them. It is estimated that if these means are not available or hampered the transition may be jeopardized and the overall objectives not achievable. While some key aspects may easily be addressed at national level and relatively independently, i.e. RTD, education, innovation, other aspects will rely on more cooperation with other countries, i.e. harmonization of regulation in relation to waste (i.e. waste as a resources and free shipment of these materials between countries –trade), trade agreements etc. Concerning secondary resources, the full technological potential still needs to be unfolded. This may require considerable RTD investments but will also need better collaboration across sectors as still today many activities in this area are sectoral approaches. It is expected better achievements could be attained if industrial symbiosis would be pushed forward. This also would require logistic, organizational and cultural changes. From the policy bodies identified, these barriers are yet only partially addressed. Major driver for investments, either in RTD or innovation at the different stages of the raw materials value chains is the capacity for investors to evaluate risks and take decisions based on these. In this context, the more polices will be able to establish clarity on objectives and means to achieve them, hence clearly defining the playing fields, the more investors will be likely to accompany and boost the expected transition as value and benefits generated can be considerable. *The current Global Governance system can be characterized as highly fragmented and unstable. So far, there is no international organization providing a platform for promoting the resource use issue on the political agenda within multilateral processes as well as at the regional level. Furthermore, the future development of global policy frameworks for a sustainable use of natural resources will also depend on the particular conditions at the local or national level* <sup>56</sup>. Joint efforts and harmonization of policies among countries would greatly help developing a context of trust and favourable playing field for growth and sustainability in relation to raw materials economy.

In general the objectives and targets set in the policy bodies identified are much in line with several key targets set in the Sustainable Development Goals.

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[https://sustainabledevelopment.un.org/content/documents/1047072\\_Buczko\\_Towards%20SDG%20implementation-The%20role%20of%20global%20resource%20policy%20and%20resource%20targets.pdf](https://sustainabledevelopment.un.org/content/documents/1047072_Buczko_Towards%20SDG%20implementation-The%20role%20of%20global%20resource%20policy%20and%20resource%20targets.pdf)



Figure 7: Sustainable Development Goals: source: <https://sustainabledevelopment.un.org/?menu=1300>

In particular, we estimate there are potential synergetic relations towards the following:

- **Goal 1: No poverty:** clearly, some policy bodies identified relate directly the growth potentials that more efficient raw material management may bring to their societies, thus contributing in improving citizens' life by providing jobs and incomes. Better economies through improved raw materials management may also contribute to develop social programs in favour of the poorest in the respective countries, i.e. raw materials providing countries. As expressed under target 1.4 citizens should be given the rights to have access to natural resources as well as they have for any economic resources and other types of services. Economic wealth could help achieving this target. The policies identified tend to address wealth as an objective through the means of sustainable resource management.
- **Goal 4: Quality Education:** through the analysis of policy instruments education will be a need in order to support the transition of economies towards a more efficient use of raw materials either in the primary sector and the manufacturing and recycling sector. Hence, raw materials could act as a booster for quality education.
- **Goal 6: Clean water and sanitation:** better mining practices for raw materials extraction may greatly contribute to achieving this goal. Further in the value chain, proper management of waste in all stages of production/manufacturing and end-of life should further contribute in more efficient use of raw materials as well as less impacts on water.
- **Goal 7: Affordable and clean energy.** Especially concerning target 7.3 which aims at doubling the global rate of improvement in energy efficiency is very much in line with several policies aiming at improving the whole value chain in terms of energy efficiency. Achieving this objective would

significate that greater value could be generated by stakeholders all along the value chain as many processes are today highly energy intensive and therefore can be improved in terms of costs.

- **Goal 8: decent work and economic growth:** many policies have addressed the raw materials issue from the perspective of enhancing economic growth in their countries. This is suggested to be achieved with improving resource efficiency which in turn is achieved by innovation (see also above). This is especially addressed under target 8.4 - *Improve progressively, through 2030, global resource efficiency in consumption and production and endeavour to decouple economic growth from environmental degradation, in accordance with the 10-year framework of programmes on sustainable consumption and production, with developed countries taking the lead*. From the review of policy instruments, we estimate that efforts are made for achieving this goal. In fact, this is one of the major pillars for boosting efficient management of raw materials.
- **Goal 9: Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation:** very much in line with the majority of objectives set in the policy instruments identified within this review.
- **Goal 11: Sustainable cities and communities:** special relation with following SDG targets: target 11.6: By 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management – target 11.B: By 2020, substantially increase the number of cities and human settlements adopting and implementing integrated policies and plans towards inclusion, resource efficiency, mitigation and adaptation to climate change, resilience to disasters. Target 11.C: Support least developed countries, including through financial and technical assistance, in building sustainable and resilient buildings utilizing local materials.
- **Goal 12: Responsible consumption and production:** clearly, policies address the issue of production as a key for improving material efficiency. Consumption patterns, even yet not clearly addressed in many raw material policies are gaining interest as there is a growing intention to address raw materials issues from a broader value chain perspective, i.e. including different patterns of consumption of goods and services which in turn affect product design and manufacturing.
- **Goal 13: Climate action.** A few policy instruments have addressed this issues, though yet not as a primary concern in relation with raw material policies. It is estimated that sustainable use of raw materials may contribute in achieving this goal as more renewable energy sources and more energy efficient processes emitting less GHG may be used in raw materials value chains.
- **Goal 14: Conserve and sustainably use the oceans, seas and marine resources for sustainable development.** Related to sustainable exploitation of natural resources, i.e. mining sector essentially
- **Goal 15: Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss** – this goal is very much aligned with many of the policies in EU countries related to the sustainable management of forest as support for the development of forest based industries and further bio-economy. Beyond the bio-economy sector, this goal is also very much related with sustainable exploitation of natural resources, hence it relates to many policy instruments identified aimed at promoting a transition towards more efficient raw material mining sector generating less impact on its environment. In particular the following targets are of relevance with this respect: target 15.2 – 15.5 – 15B.

Achieving the SDG targets and merging with the improvement of raw materials resources management may depend on being able to overcome some barriers/challenges at the short or long term. Without being exhaustive, these could be the following:

- Development, refinement and differentiation of global resource targets
- Integration and further specification of resource targets into SDG implementation processes
- Radical reduction of resource consumption levels and transformation of production processes towards circular economy
- Development and application of common tools and indicators



## Annex 2. Reference materials about raw materials policies

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