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Reflections on sustainable raw materials management

COBALT Opening Conference “Industry and Society’s needs for sustainable management of raw materials in Europe: Exploring solutions for future action”

Discussion paper

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LIST OF ABBREVIATIONS

BAT	Best Available Technologies
CSO	Civil Society Organisation
EIP	European Innovation Partnership
EITI	Extractive Industries Transparency Initiative
EU	European Union
GDP	Gross Domestic Product
HLSG	High Level Steering Group
NGO	Non-governmental Organisation
OG	Operational Group
SD	Sustainable Development
SIP	Strategic Implementation Plan
SME	Small and Medium Enterprise
UN	United Nations
UN GA	United Nations General Assembly

1 Executive summary

The COBALT project and opening conference

COBALT provides a platform for involving different stakeholders across the entire value chain of raw material supply and use, mainly business and industry, CSOs, EU and national level policy makers, national geological surveys, and public and private research organisations etc.

Raw material needs and, therefore, also perspectives towards sustainable raw materials management, inevitably differ between various stakeholder groups. This relates not least to the stage of the value chain that the stakeholder groups are dealing with and are most interested in. Therefore, the COBALT Opening Conference aims to initiate and foster debates, networking and exchange on a more sustainable raw materials management in the EU among a multitude of actors. The conference does so by exchanging viewpoints and enabling broad interactive discussions on the raw materials policy framework, international material use patterns, best practice examples, individual consumer needs and awareness, and skills and training.

A sustainable development perspective to raw materials management

Overall, Europe's economy and society's well-being largely depend on the secure supply and use of natural resources and raw materials in particular. However, population growth and growing affluence in industrialised countries does not only put a strain on resource availability but also influences the amount of waste and emissions produced. A sustainable development approach towards raw materials management tackles these challenges in a comprehensive way by taking into account 1) a balance of economic, environmental, and social aspects, 2) inter- and intra-generational equity, 3) ecological boundaries, 4) a life cycle perspective and 5) participation of relevant actors.

Challenges

Secure supply of raw materials and the emergence of critical materials in the EU depend on a series of different political, economic and technological factors: high dependency on imports and market distortions; rising global demand in emerging countries and for key enabling technologies; competition on different land use types.

Opportunities and enabling factors

Several EU policies and, in particular, the European Innovation Partnership for Raw Materials offer several, complementary ways to meet the various challenges: 1) increasing raw material sourcing within the EU through extraction and exploration of new deposits; 2) access to raw material sources outside of Europe; 3) increasing the resource efficiency of the EU economy; 4) Substituting an existing material by finding or developing alternative materials; and 5) creating an a circular economy where materials are continuously re-introduced into the economic system. Nevertheless, solutions need to be considered in the light of a growing and increasingly affluent global society and the depletion of high grade ores for easy access. In this regard, technological as well as non-technological innovations are necessary to tackle the challenges of sustainable, secure and efficient raw material management.

2 The COBALT project: a contribution to sustainable raw materials management in the EU

2.1 Overall aim and scope

The **COBALT** project addresses key challenges on the route towards more sustainable management of raw materials, including issues of raw materials supply and use. The project is embedded in the broader policy context of the Europe 2020 Strategy and its Innovation Union and Resource Efficiency Flagship Initiatives as well as the Raw Materials Initiative. More specifically, COBALT is supporting the work and objectives of the European Innovation Partnership on Raw Materials (EIP).

In the project context, the debate on sustainable raw materials management is framed around raw materials which are in the focus of the EIP on Raw materials: These include non-energy, non-agricultural raw materials (i.e. including metallic minerals, industrial minerals, construction materials, wood, natural rubber). Within this focus, the project integrates both raw materials with high environmental and social impacts, and a list of 14 economically important raw materials identified by the European Commission (European Commission, 2010).

Overall, COBALT provides a platform for involving different stakeholders across the entire value chain of raw material supply and use, mainly business and industry (e.g. industry associations and SMEs), CSOs (e.g. consumer associations and environmental NGOs), EU and national level policy makers, national geological surveys, and public and private research organisations etc..

The project's activities (European-wide conferences and workshops as well as regional workshops) have the following objectives

- mobilising public awareness on raw material issues and promote raw material substitution, replacement and recycling;
- facilitating European and regional dialogues on raw materials between civil society and industry in order to ensure mutual learning, awareness and partnership building;
- identifying shortages of skills that would enable more sustainable management of raw materials and develop strategies for addressing these shortages

COBALT is a project funded by the European Commission under FP7. The project runs from May 2013 until April 2015.

2.2 The COBALT opening conference

Within the context of the COBALT project, the opening conference aims to initiate (and foster existing) debate, networking and exchange on a more sustainable raw materials management in the EU among a multitude of actors from industry and business (including SME and larger businesses), civil society, geological surveys, policy making (EU, national and regional level) and academia.

The debate and exchange shall help exploring and discussing needs, opportunities and strengths related to sustainable raw materials supply and use in Europe.

Box 1. Aims of the COBALT opening conference

More specifically, the opening conference strives to

- address potential solutions along the value chain from extraction to consumption and recycling at end of product life;
- identify how industry and civil society can be best supported to
  - meet the challenge of complexly interwoven international value chains
  - and changing global material demands
  - respond to social and environmental needs in relation to raw material management.

In order to achieve these aims, the opening conference will feature, inter alia:

Table 1. Features of the COBALT opening conference

1. An update on the European raw materials policy framework, in particular as regards the European Innovation Partnership for raw materials;
2. Expert views on the challenges of existing and future global trends in raw materials management;
3. Expert presentations on the interlinkages between raw materials management and development, on future socio-economic challenges, on the role of exploration and data availability, and in the context of research and innovation;
4. Stakeholder panel discussions on sustainable raw materials management in the EU from environmental and consumer, resource processing, and Member State policy perspectives;
5. Interactive Working Groups for gathering the conference participants views on i. How to successfully implement the European Innovation Partnership on raw materials ii. Changes in international material use patterns and corresponding opportunities along value-chains iii. Learning from existing best practice along value-chains iv. EU consumer needs for household appliances and raw material awareness v. Skills and training for sustainable raw materials management.

2.3 Next steps after the opening conference

Through the interactive setting of the working groups and further interactive session elements, conference participants can help developing issues to be explored further by the project, and be fed into to the raw materials policy debate, especially the work of the European Innovation Partnership on Raw Materials.

The COBALT opening conference will help identify relevant issues. Main issues brought forward during the conference will be summarised in an opening conference report. In

addition, based on opening conference input and discussions, a working group on a COBALT Declaration will be set up, bringing together all relevant stakeholder groups identified above.

Box 2. Objective and purpose of a COBALT declaration

The main objective and purpose is to bring together different stakeholders to jointly draft a declaration calling for mutually agreeable goals concerning

- issues to tackle in relation to a more sustainable raw material management, e.g.
  i. reducing import dependencies by less raw material input need and substitution;
  ii. respecting existing social and environmental needs and capacities;
  iii. identifying related relevant research needs
  iv. improving and building up necessary skills;
- providing input to the debate on sustainable raw material management for further development and full implementation of the raw materials policy framework.

Both the report and the declaration working group processes will inform the work in the COBALT project, i.e.

1. Helping to identify issues to be further discussed in a) EU level and b) regional level Industry-Civil society Dialogues;
2. Providing pointers for tackling existing skill shortages by developing new ideas for training courses for different recipient groups and pilot testing selected courses.

Over the course of 2014, these issues will hence be further discussed and elaborated in workshops and pilot testing cases for skilling. These activities (i.e. European and Regional Dialogues) facilitate exchange between EU, national and regional policy makers, industry and business as well as civil society organisations. Issues discussed and elaborated during these activities will inform policy processes, as well as industry and civil society initiatives alike. Finally, the experience thus gathered and findings generated will be fed into

a) The COBALT final conference in terms of topics, session design and speakers;
b) A draft COBALT declaration being presented at the COBALT final conference.

The discussions and findings from the COBALT final conference will then be used to compile a final conference report and to finalise the COBALT declaration that will be made publicly available for signature to feed into political processes on sustainable raw materials management.

3 Sustainable development challenges in the context of the raw materials debate

Societal importance and challenges of raw materials management

Overall, the functioning of Europe's economy and society's well-being largely depend on the secure supply and use of natural resources and raw materials in particular. However, with world population projections estimating more than 9 billion people in 2050 and rapid economic growth in newly industrialising countries, raw material demand continues to rise strongly (UNEP, 2011; Dittrich et al., 2012). Furthermore, per capita raw material consumption is

currently substantially higher in industrialised nations than in less developed countries (EEA, 2012). Continuing population growth combined with increasing affluence does not only put strain on resource availability but also influences the amount of waste and emissions produced. In the long run these trends will lead to surpassing planetary boundaries and thus will also affect the well-being of people and the environment (Rockström et al., 2009; UN GA, 2012; UN, 2010).

Raw material challenges from a sustainable development perspective

Therefore, sustainable development – integrating economic development, protection of the environment, and equitable access to and distribution of resources – provides the baseline for continuous improvement of the quality of life and well-being for present and future generations (UN, 2012). With regard to raw materials we consider the following sustainable development principles crucial for a broader raw materials debate, beyond security of supply for raw materials for socio-economic development

- Balanced consideration of economic, environmental, and social aspects
- Taking into account future generations' needs (inter-generational equity)
- Tackling raw material challenges in a global context of fair and equitable access to use (intra-generational equity)
- Respecting ecological boundaries with regard to raw materials supply and use (Ecological planetary boundaries)
- Taking a life cycle perspective for raw materials management (a systemic approach)
- Participation of all societal stakeholders

Balanced consideration of economic, environmental, and social aspects

Arguably the most important principle of sustainable development is the principle of balancing environmental and social concerns (UN, 2012, para. 39) with issues for economic development (e.g. planning and policy making).

With regard to raw materials management, issues such as competitiveness and secure supply for economic progress cannot be considered in isolation from a sustainable development perspective. Essentially, a balanced consideration of economic, environmental, and social aspects throughout the entire raw materials value chain is required. More specifically this concerns, for example, reducing generation of mining waste and large tailings or socially acceptable conditions for affected communities on equal footing to economic considerations as part of the regulatory framework for licensing procedures for primary raw material extraction.

Long-term thinking or inter-generational equity

In broad terms, inter-generational equity takes into account future generations' needs (UN, 2012, para. 39). Essentially, it renders an important dimension of SD, as it implies long-term thinking and current commitment to safeguard against the likelihood of adverse future impacts.

More specifically, the notion of secure supply of raw materials inherently carries with it a future-oriented perspective as regards the long-term supply of raw materials for production purposes. However, going beyond supply issues a future-oriented perspective must also

incorporate (1) how raw materials are used within the socio-ecological system and, ultimately, (2) to what extent their use is contributing to societal well-being.

Thus, referring to (1), raw materials use along their entire life cycle should guarantee minimised impact on human well-being in terms of health and welfare as well as on the natural environment. Regarding (2), securing well-being for future generations means using existing stocks of non-renewable resources in a responsible and long-term oriented way. Consequently, this relates to the use of raw materials for investment in infrastructure such as renewable energy production systems or the use for eco-innovation applications. Contradictory, the wide-spread business focus on short-term maximization of economic profits and the return on investment, driven by financial markets and also shareholder interests, defies the ideas of considering the long-term or caring for future generations.

A Global perspective - intra-generational equity

Intra-generational equity refers to the fairness of distribution of resources (e.g. equitable access to raw materials and their use) and risks (e.g. minimisation of ecological burden shifting) within the current generation (UN, 2012, para. 19-20). Thus, a heterogeneous spatial distribution of resources and risks has social and economic implications, and, consequently impacts human well-being of the global society, predominantly affecting the poor in developing countries.

In particular, data on raw material use within the EU shows that while the EU's domestic material consumption has been shrinking in recent years (European Commission, DG Eurostat, 2012; EEA, 2010).This has come at the price of shifting a large part of resource extraction and environmental impact to upstream countries – therefore, at the global level an EU citizen's material 'footprint' is much more substantial (Dittrich et al., 2012).

In this regard, growing material imports have the potential to increase the global impacts of EU consumption patterns, affecting the environment and economy and public health of the exporting countries. Therefore, integrating social equity considerations into raw materials management at the global level means avoiding a shift of environmental and health impacts to other parts of the global society.

Ecological planetary boundaries

The functioning of the bio-geophysical system (i.e. provision of natural resources and raw materials, ecosystem services such as the ozone layer, and the absorption of waste originating from production as well as consumption processes) constitutes the material and immaterial basis for human development. Unsustainable raw material management contributes to climate change and the depletion of the non-renewable resource base which irreversibly deteriorate the bio-geophysical system's functions. Damaging this system beyond its regenerative capacity will constrain global society's capability to fulfil its basic needs for present as well as future generations.

Therefore, a more sustainable raw materials management might have to fundamentally question the way our production and consumption system works. Where there is uncertainty or lack of scientific knowledge about the actual thresholds and the interaction among ecological planetary boundaries (Rockström et al., 2009; UN, 2012), sustainable development applies the precautionary principle to safeguard against irreversible damage. The EU affirms the necessity to respect planetary boundaries to ensure prosperity and well-being of society overall (European Commission, 2012a, 2013).

A systemic approach

Complex and internationally linked value-chains and consumption and production patterns require adopting a holistic life cycle perspective of goods and embedded raw materials that addresses raw material extraction, production and distribution, final consumption, as well as disposal or reuse.

Therefore, both production and consumption systems need to shift towards more sustainable processes, products and services, individual consumers need to change towards more sustainable consumption choices and lifestyle. From a production perspective, products need to become, for example, less material intense and environmentally damaging, more durable and easier to dismantle and recycle. In addition, the context of consumption, the barriers preventing more sustainable consumer choices are made (such as psychological, economic and practical settings, e.g. infrastructure or technological lock-in) must be overcome.

Only by taking a comprehensive approach and by mutually reinforcing the relationship between producers and consumers, can consumption and production systems become more sustainable (UN, 2012, para. 58).

Participation of all societal stakeholders

Sustainable raw material management and its related decision-making processes necessitate the engagement and commitment of different stakeholder groups, including governments, industry, academia, Civil Society Organisations (CSOs) and individual consumers for the successful delivery of sustainable development objectives (UN, 2012, para. 43).

In particular, environmental and social issues are best handled with participation of all concerned citizens, at the relevant level. At the national level, each individual should have appropriate access to information that is held by public authorities, including information, for example, on hazardous materials, products and activities. Concerned stakeholders should have the opportunity to participate in decision-making processes in the policy as well as the societal sphere. In this regard, it is the main responsibility of governments to facilitate and encourage public awareness and enable participation by making information widely available and enable inclusive decision mechanisms possible. This concerns raw materials issues such as inclusive and open dialogue on mine operations between industry, local communities, public authorities, and other concerned stakeholders. Moreover, with regard to resource extraction in developing countries, industry and public authorities need to establish a dialogue for facilitating transparency and good governance in the sector of conflict minerals (e.g. by adopting EITI standards) (Intergovernmental Forum on Mining, Minerals, Metals and Sustainable Development, 2010).

4 Sustainable raw materials management

As the global economy grows and the demand for raw materials is skyrocketing worldwide, the European Union has acknowledged the importance of raw materials supply for our economy and society. Consequently, it initiated several policy strategies dealing with the political challenges regarding the issue of raw materials and resource efficiency: The Europe 2020 "Resource Efficiency Flagship Initiatives", "Raw Materials Initiative" as well as the "Roadmap to a Resource-Efficient Europe" are key policy documents shaping the European policy framework on raw materials and resource efficiency.

In this regard, resource-efficiency and sustainable raw material supply are essential for securing growth and jobs. Furthermore, they provide economic opportunity to improve productivity and boost competitiveness by developing new products, minimise waste, change consumption patterns and optimise production processes.

4.1 The EU raw materials policy framework

The strategic importance of secure supply and efficient and sustainable management of raw materials has started to emerge as EU policy field in 2008 through the **Raw Materials Initiative** (European Commission, 2008): Since then the EU has pursued a **3 pillar-based approach to improving access to raw materials for Europe** (see Figure 1) which got reinforced in a new strategy document in 2011 (European Commission, 2011). Within these 3 thematic areas the 2011 strategy **focuses on non-energy and non-agricultural raw materials** (i.e. including metallic minerals, industrial minerals, construction materials, wood, natural rubber). Another important element of this strategy engages in an international approach by embedding the EU raw materials policy agenda in the wider set of its external policies. In this regard it fosters good governance, human rights, conflict resolution, transparency of activities and creation of local value added in developing countries.

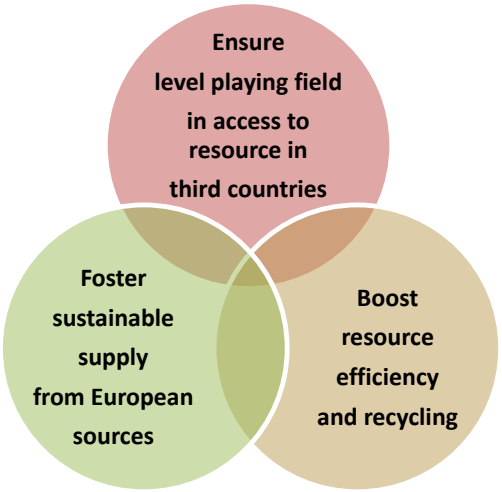

Figure 1: 3 pillar-based approach

The European Innovation Partnership: An innovation approach in the raw materials debate

The **European Innovation Partnership (EIP)** on raw materials is a new policy tool within the framework of the Europe 2020 Flagship Initiative "Innovation Union" as well as the Raw Materials Initiative to foster research and innovation. Essentially, the EIP **streamlines**, **simplifies and better coordinates existing instruments and initiatives and complements them** with new actions where necessary.

The common objective of this Partnership is to **reduce the EU's import dependency on raw materials by 2020**. The aim is to achieve this through accelerating innovations that ensure secure, sustainable supplies of both primary and secondary raw materials or prevent wastage of key raw materials during all their life cycle (European Commission, 2012b).

In a broader context the EIP addresses Europe 2020 objectives of the EU's Industrial Policy - increasing the share of industry to 20 % of GDP - and the objectives of the flagship initiatives "Innovation Union" and "Resource Efficient Europe". More specifically the EIP's targets are:

- Reduced import dependency;

- Promotion of production and exports by improving supply conditions from EU, diversifying raw materials sourcing and improving resource efficiency (including recycling) and finding alternative raw materials;
- Increased competitiveness of raw materials sectors and
- Mitigation of the related negative environmental, social and health impacts.

In addition, the EIP aims to bring together a **wide range of European stakeholders** (Member States' governments, companies, NGOs, research institutions, etc.) to develop joint strategies, pool together capital and human resources, and ensure the implementation and dissemination of innovative solutions within Europe. The two most important governance elements for the EIP are the **High Level Steering Group (HLSG)** and the **Operational Groups (OG)** ([1]): whereas the HLSG provides strategic guidance and support as well as guaranteeing political commitment, the OGs are responsible for content expertise as well as carry out the detailed planning for implementation (i.e. Strategic Implementation Plan).

These measures cover both the **demand and supply side engaging different stakeholders along the entire value-chain** (i.e. exploration, extraction, processing, refining, re-use, recycling, substitution) for sustainable raw materials management: On the supply side, the private sector is the main driving force for developing and implementing innovations increasing efficiency, recycling, and substitution of raw materials while reducing its environmental impacts along the entire value chain. On the demand side, for example the European Commission in collaboration with EU Member States is improving the raw materials regulatory framework in the EU (e.g. promoting best practices in defining a minerals policy or new models for incentivising consumers on recycling).

Implementing the European Innovation Partnership on Raw Materials

Following up the implementation of the EIP, a **Strategic Implementation Plan** (SIP, adopted in September 2013) outlines a detailed schedule with regard to **EIP objectives, targets and methodology and detailed action** for achieving its targets. It has been elaborated through a multi-stakeholder process involving industry, EU Member States, research organisations and other relevant stakeholders.

To make sure that proposed action areas contribute to achieving EIP objectives, they have been subject to an assessment carried out by a group of high level representatives (SHERPA Group). The criteria selected for evaluating the actions comprise economic benefits for the EU, level of innovation and implementation readiness as well as taking into account sustainability aspects (i.e. addressing economic, environmental and social sustainability).

The **action areas cover technological** (e.g. developing environmentally friendly and resource efficient technologies for raw material production)**, non-technological aspects** (e.g. improving public trust, communication and transparency for exploration, mining and after-mining activities) and **international aspects** (e.g. global raw materials governance; health, safety and environmental issues). More specifically, the individual actions cover a multitude of different areas such as research and development along the value chain, raw materials knowledge, exchange of best practice, improved implementation or revision of selected legislation, licensing steps, standardisation, and policy dialogues.

[1] Detailed governance structure of the EIP

These action areas depict a comprehensive picture in terms of i) a rationale and added value for the EU, ii) implementation measures including process and governance, and iii) an approach to overall response by stakeholders with timelines.

Raw material commitments – increasing outreach and impact of the EIP

Beyond the funding and collaboration structures coordinated through the EIP, it is launching an **open call for commitments**. These expected commitments will be located within the SIP action areas and consist of actors from the private, public and non-governmental sectors including academia. The ultimate goal of these commitments is to mobilise a substantial part of the European raw materials community and, therefore, extend the potential impact of the EIP.

4.2 Security of supply and criticality

Besides tackling environmental and social impacts of raw material management, one of the major challenges in the raw materials policy debate is to achieve a secure supply base. Raw material shortages are an imminent threat to the EU's secure supply and availability. Such threats regarding secure supply of raw materials and the emergence of critical materials in the EU **depend on a series of different political, economic and technological factors**. An overview on the supply of certain raw material groups is provided in the box below.

Box 3. An overview on the supply of certain raw materials

The EU is self-sufficient in the production of **construction minerals**, including aggregates (sand, gravel, and crushed natural stone), various brick clays, gypsum and natural ornamental or dimension stone.

The EU also has a large production of **industrial minerals** supplying a very wide range of industries. For some minerals, such as magnesite, fluorspar, bentonite, kaolin and potash, Europe is an important global producer. The EU however is a net importer for many of these industrial minerals.

The European economy is highly dependent on **ores and metals** imports. Only a small number of metal ores are extracted within the EU, which is still a relatively important producer for some, such as chromium, copper, lead, silver and zinc.

Regarding **wood-based raw materials,** the EU is, to a large extent, self-sufficient. However, there is a growing necessity to secure its sustainable supply, partly due to increasing demand from other EU end-users, notably bio-energy, and also demand from outside the EU. Conversely, EU industry relies completely on imports of natural rubber.

Source: Strategic implementation plan for the European Innovation Partnership on raw materials, FINAL VERSION - 18/09/2013.

High dependency on imports and market distortions

Among the most crucial ones is the EU's **high dependency on raw material imports.** In 2011, the EU trade balance (EEA, 2012) for fuel and mining products showed an immense asymmetry between imports and exports (i.e. the EU imported over six times more fuel and

mining materials than it exported). In this regard geographic distribution of minerals, for example, is very uneven and, therefore, access is politically sensitive and security of supply is a concern (Nagasaka et al., 2008).

Furthermore, the EU's import dependency is subject to a range of different aspects: Price volatility of certain raw materials, as well as the interaction (i.e. distortions through in-transparency and speculation) between physical and financial commodities markets put a strain on their availability. Furthermore, there is growing concern for market distortions created by some countries through export restrictions or privileged access to raw materials for their domestic industry. (European Commission, 2011)

Rising global demand and competition for different land use types

Moreover, the **physical raw material demand, in particular in emerging national economies** and the **development and rapid diffusion of key enabling technologies** in the future will additionally contribute to these trends (European Commission, 2012b).

Beyond these international aspects, **competition on different land use types** (recreation, agriculture, built-up land) might further restrict the access to European raw material sources (European Commission, 2012b).

4.3 The rationale behind strategies to tackle the economic, environmental and social challenges of the EU's material demand.

The EU policies and partnerships described above offer several, complementary ways to meet the various challenges which this background note describes.

Security of supply can be approached from various different angles along different stages of the raw material value chain (i.e. exploration, extraction, processing, refining, re-use, recycling, and substitution).

From the angle of **raw material sourcing perspective within the EU**, increased efforts for raw materials extraction through exploitation of existing and exploration of new deposits might contribute to domestic and European supply. In this regard, the EIP engages in efforts for new concepts and technologies for land and sea-bed exploration as well as innovative clean and safe extraction methods.

Considering an international angle, the **access to raw material sources outside of Europe** is an essential approach due to the global nature of value chains and geological availability of certain raw materials. This aspect tackles geopolitical issues, such as fair and un-distorting trade policies or any form of international co-operation. The EIP promotes good governance and dialogue to third countries through sharing best practice and capacity building on sustainable mineral policies and mining activities such as the Extractive Industries Transparency Initiative (EITI).

Risks of security of supply, the competitiveness impacts of rising material costs and the environmental and social impacts of material demand can be mitigated by **increasing the resource efficiency of the EU economy**, and the global value chains on which it depends for materials. There are different aspects to resource efficiency, but the primary goal is to allow the EU to produce more value with fewer resource inputs, through increases in material productivity. Through this greater productivity, competitiveness can be improved and demand

for materials reduced - which brings corresponding decreases in environmental and social harm.

The concept of improving resource efficiency - already embedded in the Europe 2020 goals and the EIP - is twofold: to improve the productivity of material use in the EU, and to reduce the costs of provision of materials over the life-cycle, including the short and long-term environmental costs which are often not factored into market prices. It acknowledges that a stable climate is a valuable resource for society (and the economy) and that the use of fossil-fuel energy during material supply can be made more efficient. The first goal of resource efficiency can be seen as improving the productivity of each unit of material used, and the second as reducing the total impact (or cost) of the material supplied.

Both of these increases in productivity appear essential for meeting citizens' desires for a high-quality of life and enhanced well-being, because of the economic and environmental constraints facing the EU, and the global economy more widely.

The research behind the resource efficiency agenda takes into account the **rebound effect** - the widely observed phenomenon that the use of materials can increase as productivity increases, or will at least not decrease at the rate of productivity gains. This 'rebound effect' was first noticed in the use of coal in steam-engines, and comes about because productivity gains can reduce the price of materials in comparison to substitutes, inducing greater use. This effect can negate productivity improvements, in the sense that they would not so significantly improve security of supply for the economy as a whole, nor so significantly reduce environmental effects. Sustainable materials management requires a complementary set of policies which tackle the rebound effect, and so help the EU economy as a whole to produce greater value from the consumption of fewer materials.

One key aspect of resource efficiency is substitution. **Substituting an existing material** by finding or developing alternative materials. It can involve the development of new materials, with better qualities - for example greater strength - despite using less input materials. Wise substitution reduces the demand for rare materials, or materials with particularly life-cycle impacts to more attractive, or common materials. The development of new materials can go hand in hand with the development of new products, which in themselves can reduce other forms of material use. The development of new chemicals for use in industrial processes, can for instance, significantly reduce energy and material use in production processes. In the longer-term, however, the problem is shifted towards another material which might be affected in its availability and accessibility due to increased usage.

Substitution is subject to various degrees and different approaches covering 1) absolute material reduction while keeping the same level of functionality for a given product, 2) finding an alternative material replacing another, or 3) replacing the whole product by developing a new technology/product or replacing it through a services achieving the same result (Brehmer et al., 2011). The EIP is pursuing a portfolio of different approaches for highly economic important applications such as materials for green technologies, electronic devices, and under extreme conditions.

Another important element for securing raw material supply is to follow the **principle of a circular economy** (Aldersgate Group, 2012). In such a system materials are re-introduced into the economic system while waste is safely returned to the biosphere. The cornerstones of such a system are activities and technologies fostering recycling and re-use of materials, on the one hand, and increasing durability and recyclability of products on the other hand. Actions such as improving the eco-design directive with regard to raw materials and material

efficiency as well as optimising material recovery through increased and higher quality recycling rates under the EIP tackle this issue.

A critical perspective on raw materials management

Nevertheless, even if materials are kept in use or in an accessible form, particular concern is given to the fact that the amount of resources available is limited compared to the potential demand of a growing and increasingly affluent society (Andersson & Råde, 2011). Moreover, the depletion of high grade ores, for example, has been of significant concern and scenarios of future collapse of industrial production (Meadows, D. et al., 2004).

4.4 The role of research and innovation

Research and innovation are at the heart of the European Innovation Partnership on raw materials. In that sense, it will strengthen the EU's industrial base and competitiveness by translating new ideas into product, procedures and services. As a consequence those new applications will help to tackle challenges such as sustainable, secure and efficient raw material management, on the other hand.

The importance of non-technological next to technological innovation

Besides technological innovation in the form of new products and processes such as more environmentally processing or extraction applications, the concept of innovation encompasses a broader meaning (i.e. non-technological innovations). Basically, it refers to the capacity of a company, economy or society overall, to adapt to changing environments and circumstances beyond technological means. Thus, innovation in the social system that addresses ways society organises itself through its institutions is equally important. More specifically, it accounts for radical changes of how policy tools are positioned and designed to steer towards less material intense production processes as well as how materials are circulating in the economic system (i.e. safely returning waste to the environment or re-introducing materials into the value-chain). Moreover, next to changes in the way society produces, social innovation changing the way consumers purchase and use products are of equal importance: For example, new models of product ownership such as take-back or leasing schemes will have substantial influence on product design (e.g. more easily recyclable and less material intense) and how the product is used by consumers (e.g. more responsible usage).

Eco-innovations: innovation tackling raw material challenges

With regard to new application for tackling societal challenges such as secure supply, efficient and environmentally-sound use of raw materials, the concept of eco-innovation plays a major role. It comprises any innovation that reduces the use of natural resources and decreases emissions of harmful substances. Besides its environmental and health benefits, eco-innovation means bringing new products to the market and therefore increasing economic productivity and job creation (Eco-innovation Observatory, 2011).

4.5 Different challenges along the value chain

The whole cycle and chain of supply and demand of the raw material comprises exploration, extraction, processing or refining, final consumption and recycling. Even though the numerous

stages face various challenges across EU Member States, common features can be identified ([2]). Among them are high investment costs, generation of waste, safety of operations and efficient transport and logistics, the major general challenges are to avoid losses appearing in different recovery steps and ensure recycling of high quality. In order to exhibit these issues in more detail, the following examples shall shed light on explicit challenges along single stages of the value chain:

As far as the **exploration** of raw materials is concerned, the related problems are geological uncertainty, technological and economic feasibility of mine development, high and growing costs for exploration. Thus, on average only one of about thousand exploration projects ever leads to a producing mine. Furthermore, difficult operation conditions in densely populated areas and access to land also represent crucial challenges.

Challenges faced in **extraction** are manifold and of economic, technological and environmental nature. They comprise, for example, high investment costs, reducing waste generation and large tailings, identifying and addressing environmental impacts on ecosystems, and automation and safety of operations.

Challenges related to logistics and complex material feeds are faced during **processing and refining** activities, the third stage of the value chain. More specifically, limited availability of water in certain areas requires new processes for reduced consumption. Moreover, geographic distribution of raw material sources and the resulting complexity of supply logistics often present economic constraints.

Regarding **recycling**, the increasing complexity of products, in particular those containing technological and critical metals often make recycling cumbersome or even hinder it. Moreover, the recycling industry lacks information on the presence of critical raw materials in products or on how they may be recovered. Therefore, proper and thorough monitoring of waste flows is an desirable goal.

Although **final consumption** is not a value chain issue, but, nevertheless, it is an important aspect considering the whole life-cycle of a product or its embedded materials. Taking into account **a consumers' perspective** certain issues are of particular importance: Low collection rates for end-of-life consumer products represent a major challenge due to low incentives to recycle critical materials in small amounts. Furthermore, the detrimental design of products makes their life-time shorter and repairing or dismantling difficult or uneconomic.. The following example exhibits some relevant challenges:

Across the EU, only one third of generated electrical waste is properly collected and recycled preventing end-of-life consumer products entering the recycling chain. Insufficient economic incentives for collection and recycling of certain valuable and critical materials are one of the main reasons. Furthermore, there is insufficient understanding of the factors that influence consumer acceptance of new ownership models and other product service systems such as leasing or end-of-life take back schemes.

[2] The following examples are based on challenges identified in: Strategic implementation plan for the European Innovation Partnership on raw materials, FINAL VERSION - 18/09/2013.

5 Viewpoints on sustainable raw materials management

Raw material needs and, therefore, also perspectives towards sustainable raw materials management, inevitably differ between various stakeholder groups. This relates not least to the stage of the value chain that the stakeholder groups are dealing with and are most interested in.

The following table serves as a coarse overview of likely raw material needs and the potential focus of sustainable raw materials management held by the main COBALT stakeholder groups, based on literature review.

Table 2. Overview of likely raw materials needs and potential focus of sustainable raw material management of different stakeholder groups

Stake-holder group	Raw material needs	Potential focus of sustainable raw materials management
Industry/business	Sector specific (virgin or secondary) and life-cycle stage specific (from extraction through to recycling and waste management) raw material needs, including e.g. steel, copper, rare earths	Resources sector: Increasing the security of supply and reducing import dependencies and impacts of price volatilities; exploring the potential for further, more sustainable primary production of raw materials within Europe by use of Best Available Technologies (BAT) and respecting existing social and environmental standards Manufacturing: Increasing the security of supply and reducing import dependencies and impacts of price volatilities (including through substitution of critical/hazardous raw materials); contributing to technological innovation towards sustainable raw materials management and a green economy Recycling sector: Improving design for recyclability and fostering circular economy
CSOs	No major specific raw material needs – raw material needs as citizens	Consumer associations: guaranteeing economically, socially and environmentally sustainable products, providing information on **sustainable consumption choices** Environmental NGOs: Socially and **environmentally sustainable production processes** (including extraction, processing, manufacturing, end-of-life treatment) without use of hazardous materials harming the environment; environmentally aware consumers looking for environmental product information to base purchasing decisions on; reduction of the consumption of virgin raw materials Labour unions: Socially just and health-respecting **working conditions** providing sufficient **income** for

Stake-holder group	Raw material needs	Potential focus of sustainable raw materials management
		workers; respecting and complying with health standards and **worker's rights**
Policy makers	No major specific raw material needs – raw material needs according to industrial policy needs and as citizens	Prevention of mining accidents; provisioning of safe jobs in extraction, processing, manufacturing; fostering innovation and competitiveness for reducing import dependencies; ensuring secure supply of needed raw materials through bi-/multilateral agreements; increasing sustainable production processes
Academia	No major specific raw material needs – raw material needs as citizens	Developing innovative, cleaner and more efficient technologies as BAT for resource extraction, processing, manufacturing and recycling Identifying substitution potential of hazardous and critical materials Reducing the consumption of virgin raw materials and fostering a circular economy Reducing the consumption of materials in general and promoting growth in well-being over growth in GDP Understanding consumption behaviour (e.g. final consumption in the sense of product purchasing and use and disposal) influenced by wider socio-economic as well as psychological factors
Geological surveys	No major specific raw material needs – raw material needs as citizens	Exploring resource deposits (also for substitution materials) to reduce import dependencies; minimising potentially adverse geological/ecological implications from resource extraction by use of BAT

Source: Compilation based on ANEC/BEUC (2011), Dittrich et al. (2012), EEA (2013), Ellen MacArthur Foundation (2012, 2013), EuroGeoSurveys (2012), European Commission (2011, 2012, 2013b, c), FoEE (2010), ILO (2012), McKinsey Global Institute (2011, 2012), Rockström et al. (2009), Steffen et al. (2011), UNEP (2010, 2011, 2012, 2013b, c), van den Bergh (2012).

The table above shows that sustainable raw materials management involves and translates into different actions for a multitude of stakeholders along the entire life-cycle and value chain.

Nevertheless, there seem to be many avenues for joint action and collaboration between industry/business and civil society, in particular as regards more socially and environmentally sustainable primary production as well as fostering recycling. However, the issues of substitution and especially calls for reducing the use of virgin materials are likely to confront clashing interests. In this regard, the COBALT opening conference is an important avenue for exchange of perspectives and for exploring joint future ideas for actions.

6 Challenges for sustainable raw materials management, for EU policy, society and business: Working group discussions

This chapter outlines the general focus and content topics of the five working groups at the Opening Conference. Conference participants will be invited to join one of the working groups and bring in their experiences and expertise to debate with their colleagues in an informal setting. Each working group will be introduced by expert views on the respective topic and facilitated by COBALT team members. The results of each working group will be presented in the plenary.

6.1 Working Group 1: Complementing the policy framework – how to successfully implement the European Innovation Partnership on raw materials

The European Innovation Partnership (EIP) on raw materials is a new policy tool to foster research and innovation for securing raw material supply, increased competitiveness of raw materials sectors and tackling related negative environmental, social and health impacts.

Following up on the implementation of the EIP, a Strategic Implementation Plan (SIP) outlines a detailed schedule with regard to EIP objectives, targets and methodology and explaining detailed action.

This working group explores prospective steps for a range of diverse SIP action areas (see box below). Participants in this working will (i) prioritize individual actions in the respective action areas, (ii) identify most important next steps in the implementation process, and (iii) specify concrete roles of different stakeholders in the implementation. Background information on the SIP and its actions areas will be provided in the working group by a short presentation and printouts of the original SIP parts.

Speaker: Patrice Millet, DG Enterprise and Industry

Box 3. Pre-selected SIP actions areas and testing ground for call for commitments

The COBALT Opening Conference specifically discusses a number of EIP action areas in one of its working groups:

- Action area I.1: Improving R&D&I coordination in the EU
- Action area I.3: Innovative extraction of raw materials
- Action area II.1: Minerals Policy Framework
- Action area II.3: Public Awareness, Acceptance and Trust
- Action area II.5: Optimised waste flows for increased recycling
- Action area III.2: Global Raw Materials Governance and Dialogues

Source: Strategic implementation plan for the European Innovation Partnership on raw materials, FINAL VERSION - 18/09/2013.

6.2 Working Group 2: Changes in international material use patterns and the corresponding opportunities along value-chains

Technological change is one driver of change in material use patterns. But it may not be the biggest. As an addition 3 billion people will join the world population in the next 35 years, as average consumption levels for the global population increases - with perhaps 3 billion more people enjoying 'middle class' consumption levels by 2030, and as environmental and physical limits constrain resource supply, patterns of material demand and use are certain to change.

This offers significant opportunities for those firms able to foresee future demands and constraints, and respond innovatively, whether through: ways to expand supply within constraints, to design products able to substitute problematic materials, or to develop substitute materials. With global value-chains and global markets, the opportunities seem likely to involve simultaneous change in demand and supply.

This Working Group will discuss the potentially significant changes, and the opportunities which could result, looking at:

- Business opportunities in relation to changing global material availability and use
- Promising areas of innovation and co-operation to seize opportunities
- Socially and economically sustainable pathways to increasing supply
- Costs and benefits from reducing consumption of primary raw materials

Speaker: (tbc)

6.3 Working Group 3: Learning from existing best practice sustainable raw materials management along value-chains

Every value chain originates with the demand for a material which delivers a particular function. Although each value chain is different, within each lies the possibility to increase security that the function can be met by sufficient supply of an appropriate material in the future, and that the economic, environmental and social costs of doing so can be reduced.

The opportunities for these improvements can lie within: extraction, recycling, processing, logistics, substitution, design, and manufacturing processes. Evidence suggests that many of the potential wins can only be realised by planning and co-operation between partners in the supply chain.

This Working Group will discuss best practice examples where technical or organisational innovation has reduced economic, environmental or social costs whilst securing supply. It will consider, in particular:

- Successful business models for changing materials management
- Identifying the enabling framework conditions and drivers for achieving best practice
- Which policy support can help industry/business (including SMEs) to adopt best practices

To promote interaction with best practice examples, this working group shall split participants into 4 – 5 smaller groups, which each will discuss examples with the respective speakers below in a world café setting, moving to another speaker after 15 minutes. After 1 hour, the full group will discuss key insights and main recommendations for sustainable raw materials management.

Case presenters:

Marco Van Bergen, Desso - Recycling floor tiles to provide material for new floor tiles

Aurela Shtiza/Michelle Wyart-Remy, IMA-Europe – Sustainable Process Industry through Resource and Energy Efficiency (SPIRE) Public-Private Partnership (A.SPIRE PPP)

Betrand Schutz, ERAMET – Metal recycling

Karl Edsjö, Electrolux – material savings in household appliances

6.4 Working Group 4: What do EU consumers need? Household appliances and raw material awareness

The consumer is king. But in terms of raw material needs of consumed products often a blind one. Product information as regards embedded raw materials is lacking, insufficient or even misleading. In addition, very few consumers understand the material demand they generate through their consumption choices: This lack of understanding relates to the type and quantity of materials required, or the social and environmental impacts along the value chain of extraction and manufacturing. Yet when these issues are attracting consumers' attention, they can generate strong feelings that reflect underlying needs and preferences.

This Working Group will look at the full range of EU consumer needs, from access to social justice, at ways to simultaneously meet those needs in the future, and at the roles consumers could play in supporting change. It will include discussion of:

- Drivers of EU citizens' consumption of materials, for example in ICT equipment
- Current levels of awareness of EU citizens in relation to embedded raw material demand
- The potential role of consumer awareness and future change in consumption patterns

Speaker: Sorin Mierlea, National Association for Consumers' Protection and Promotion of Programs and Strategies

6.5 Working Group 5: Skills and training for sustainable raw materials management – where we stand and what we need

The global economy is continuously increasing its material demand, across a range of materials. Whichever way this demand is met, the sectors which play a role in meeting final consumption demand (i.e. extraction, processing, material innovation, manufacture, design, waste logistics and recycling) will be required to expand and innovate. For most sectors, individuals and firms, this innovation will need the application of new skills or an expanded, skilled workforce.

This Working Group will identify which skills are needed and to think strategically about where gaps in skills need to be addressed. It will consider how, in practice, the partnerships that could deliver the right skills training could come about. The discussion will include:

- Views on existing and future skills gaps along the value-chain
- Evidence on the effect of skills gaps on future sustainability and competitiveness of businesses
- Target groups and format for skilling/training policies, and identification of how, in practice, to change existing skills delivery to meet future needs.

Speaker: Jan Rosenkranz, Luleå University of Technology

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