SUPRIM

Sustainable management of primary raw materials

NEWSLETTER

May 2019

SUstainable management of PRIMary raw materials through a better approach in Life Cycle Sustainability Assessment (SUPRIM)

Authors: Johannes Drielsma, Veronika Sochorová, Euromines

Sustainable management of primary raw materials is now more than ever on the European agenda, thanks to concerns about responsible sourcing of the metals and minerals we need and an increasing awareness of potential impacts related to mining operations.

In order to better understand the sustainability of natural resource use, a life cycle approach should be applied. Life Cycle Assessment (LCA) has significantly developed over the last two decades, and Life Cycle thinking has become an essential basis for industry in a wide variety of sectors to quantify environmental performance.

Life Cycle Assessment currently seeks to quantify the environmental impact of production and consumption chains on three so-called areas of protection: natural ecosystems, human health and natural resources. Scientifically, the two former areas are already reasonably developed with well-established cause and effect chains and implementation of Life Cycle Impact Assessment (LCIA) methods in the market.

However, the Natural Resources area of protection and the impact of human activities upon it are for the moment poorly developed in LCA. One consequence of this is that value-chains are currently confronted with a lack of well-developed impact models to assess the environmental impacts of using natural resources; and with non-representative and out-dated data inventories for mining operations.

SUPRIM objectives

Until now, there was no generally or broadly accepted method for assessing potential problems related to the use of natural resources. The purpose of the SUPRIM project was to establish better agreement of the problem definition and to develop a new LCIA method. SUPRIM should lead to the identification of a consistent, empirically verifiable cause-and-effect chain linking flows of natural resources to sustainability impacts.

Along the way, SUPRIM is using new datasets from two real-life

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copper mines to validate the LCIA method. Today, public inventories of resource and energy flows in mining operations (essential for LCA) are outdated, misused or unavailable. To be able to perform a correct assessment of the environmental impacts and evaluate progress in sustainable primary production over time, these inventories need to be improved. That's why the second objective of SUPRIM is to develop specific Life Cycle Inventory (LCI) datasets for two study sites in collaboration with Boliden in Sweden and Cobre Las Cruces in Spain.

A better characterisation of raw materials use in life cycle based sustainability assessment is strategically important for the raw material sector, as it brings the assessment of these material flows to a level sufficiently ready and reliable to be implemented in the market – for example to complement Critical Raw Materials lists, Product Environmental Footprints, or Responsible Sourcing schemes.

By collaboration of world-class universities in mining (Lulea University) and sustainability assessment (Ghent University, Leiden University), together with renowned research institutes (Tecnalia), industrial partners (Boliden, Cobre las Cruces) and a prominent sector organisation (Euromines), the profile of the SUPRIM project is guaranteed. In fact, in 2017 & 2018 SUPRIM has already made key contributions to the Global Guidance for Life Cycle Impact Assessment Indicators and Methods of UN Environment's Life Cycle Initiative. The project partners are therefore convinced of the strategic importance and potential impact of the project.

Product-Oriented Sustainability

Authors: Rodrigo Alvarenga and Jo Dewulf, Ghent University

Sustainability in the metal supply sector can be considered at different scales (e.g., individual mining/smelter projects, corporate level, and national, regional or global sectors). In the past decades, a diverse group of initiatives supported this sector to develop more sustainable practices, from sector-wide assessments (such as the 'Global Mining Initiative' and the 'Mining, Minerals and Sustainable Development Project (MMSD) project'), to project-based Environmental and Social Impact Assessments. These assessments are based on a site-oriented perspective, focusing on impacts over the life of a mining project.

When the metal product reaches the commodity market (e.g., 99.99% copper cathode), it will be processed into final applications, for instance, copper wires (for electricity distribution), batteries for electric vehicles, among others. In many cases, these metal-based final applications are crucial to bring sustainable solutions to society (e.g., renewable energy for electricity and transportation). Nonetheless, there is a societal demand for sustainable sourcing, i.e., ensuring that these sustainable solutions are not harming the environment elsewhere. Hence, to perform sustainable sourcing, several businesses that are downstream of the metal supply sector (e.g., automotive industry) make use of quantitative scientific-based metrics, like Life Cycle Assessment (LCA). These assessments are based on a (consumer) product-oriented perspective, focusing on impacts emanating from the use of a product or unit of service.

These different perspectives for assessments (site-oriented versus product-oriented) have different purposes and scopes of action (Figure 1). Yet, the disconnection of these two perspectives in the metal supply sector has had consequences. One is that LCA has been developed (for a long time) away from expertise of the metal supply sector, allowing issues to arise that can be summarised into two main topics: (A) the assessment of mineral resource depletion or availability in LCA; and

(B) the assessment of the environmental externalities from the metal supply sector in LCA.

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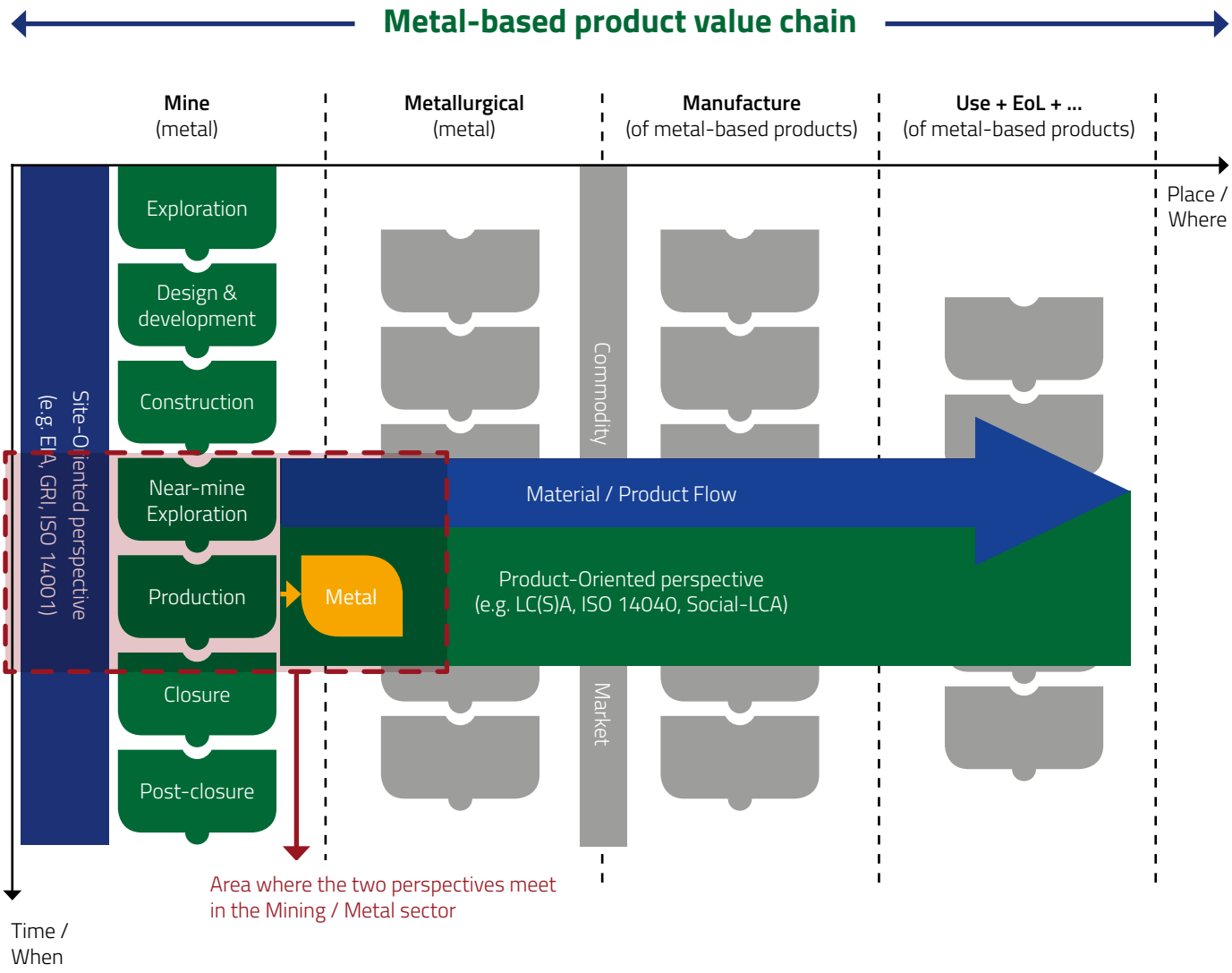

Figure 1: How site-oriented and product-oriented perspectives relate to the metal supply sector (Source: Alvarenga et al. (2019). Towards product-oriented sustainability in the (primary) metal supply sector. Resources, Conservation and Recycling, 145, 40-48)

Topic A has been conventionally assessed in LCA via 'resource-depletion' methods. The use of such methods suffers from several problems, and the SUPRIM project worked on tackling this issue by developing an approach that was created through the involvement of different stakeholders: mining industry, LCA community, and governmental bodies in consensus. You can read more about this in the following section of this newsletter.

Topic B refers to the lack of representative data in LCA Databases for metal production. Many initiatives are now ongoing to increase the quantity and quality of LCA data, including the development of data from commodity associations such as the Nickel Institute, Cobalt Institute, International Copper Association and International Zinc Association.

In the SUPRIM project, we contributed to raising awareness of these discussions via different channels, including an article published in the scientific journal Resource, Conservation and Recycling, entitled "Towards product-oriented sustainability in the (primary) metal supply sector".

Sustainability is a very relevant topic in society nowadays, especially in Europe. In this sense, the support of the metal supply sector to tackle the referred topics (A and B) for product-oriented assessments can result in strengthening the sector towards sustainability, i.e., what today can be perceived as a threat may become a marketing opportunity in the future, e.g. through labels such as 'made in Europe' and guaranteeing sustainable sourcing of the metals embodied in consumer goods.

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Finding consensus amongst LCA and mining communities on key issues to be included in life cycle impact assessment method(s) for abiotic resource use

Authors: Jeroen B. Guinee, Lauran van Oers, Leiden University

Most people might agree that the use of abiotic resources should be managed, but there is continued global debate about the criteria according to which this management should be evaluated. As a consequence, there is a lack of broadly accepted methods for the assessment of abiotic resource use in life cycle assessment (LCA), likely attributable to the lack of a common perspective on resource use, and a common understanding of the potential problem(s) related to the use of resources. This lack of common ground was the starting point of the SUPRIM project aiming to create a common understanding of the perspectives on resource use and problem(s) that could be associated with it amongst various stakeholders. SUPRIM Work Package 2 (WP2) has proposed best modelling options for a selection of the perspectives and problems prioritized during the consensus-finding process.

To achieve this task, the approach taken by the SUPRIM project was to first move away from indicators towards a more strategic, top-level discussion. The approach aims to bring some clarification to the issue in a systematic way, rather than continue the prevalent discussion about concrete modelling approaches on a more detailed level, with criticism of existing methods and discussion on indicators. For this, Leiden University (Faculty of Science, the Institute of Environmental Sciences – CML) in close cooperation with Ghent University (Faculty of Bioscience Engineering, Department of Green Chemistry and Technology) and Euromines developed a stepwise framework consisting of defining an overarching perspective (1), a conceptual level ("Modelling Concept") (2), a practical implementation level (3), and data collection (see Figure 1).

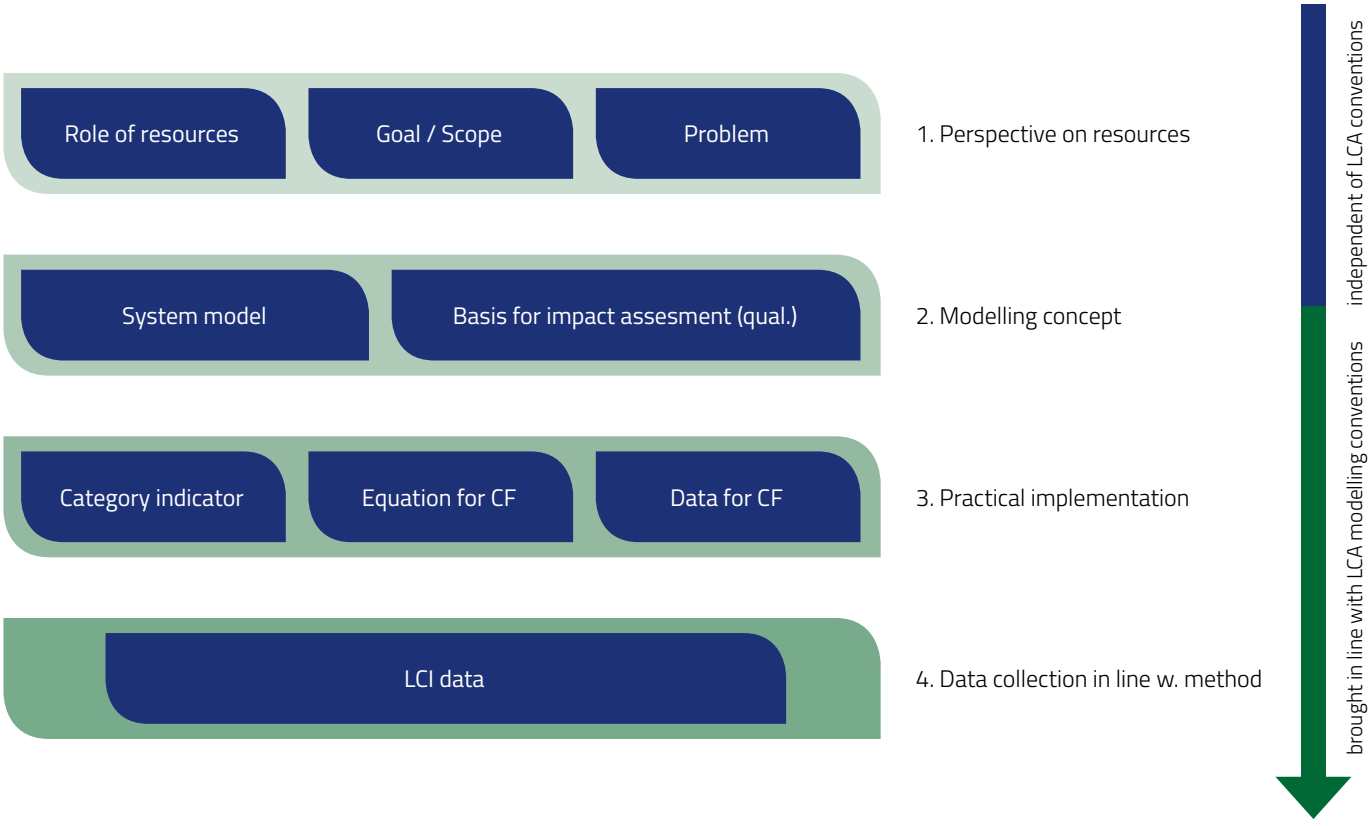

Figure 1: Framework for development and review of LCIA methods on resource use.

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A guided workshop discussion with participants from industry, policy and academia was held in December 2017 at Leiden University to capture the stakeholders' views regarding key aspects of resource management and how they should be considered in life cycle impact assessment for resource use. The workshop focused on the perceived 'role of resources'. The participants were provided with the elaboration of different roles for resources that are currently referred to inside and outside life cycle impact assessment (Figure 2).

Role of resources - applying the criteria

A. abiotic resources are valued by **humans** for their functions used (by humans) in the technosphere, primary production only — e.g. depletion

B. abiotic resources are valued by **humans** for their functions used (by humans) in the technosphere, primary and secondary production — e.g. dissipation

C. abiotic resources are valued by **humans** for their in-situ functions in the environment, primary production only — ecosystem services (non-provisioning)

D. abiotic resources are valued by **humans** for their functions in the technosphere and their in-situ functions in the environment considered useful to humans, primary production only — Combined view

E. abiotic **resources** are valued for their own sake in the environment, regardless of their usefulness in nature or technosphere, primary production only — Intrinsic value

Figure 2: Initial list of perspectives provided as an input at the workshop

It became clear that most participants favoured the Type B perspectives focusing on humans as stakeholders, the technosphere as the system of concern, and primary and secondary production as the production system. The term "Type B perspective" was used on purpose as the workshop discussions focused on the first element of the framework (Fig. 1) only: the "Role of resources".

Consequently, the next task for the SUPRIM consortium was to complete the type B Perspective. Starting from the criteria for the goal and scope definition also communicated to the workshop participants before (Figure 3), a list of 54 possible combinations was compiled:

1. Goal: ensuring availability or ensuring accessibility
2. Resource scope: elements, configurations, or elements and configurations
3. Temporal scope: 5, 25 or >100 years
4. Geographical scope: country, continent or global scope

- What are we concerned with – resources in nature, or in the technosphere? **system of concern**
- Who is interested in/ benefits from the resources? **stakeholder**
- Do we consider primary or secondary production, or both? **production system**

- Can you formulate a specific resource management goal?
- What is the relevant **scope** associated with this goal?
  - **time perspective**
  - **geographical scope**
  - **scope of resource types** (elements, minerals, natural materials ...)
- Which **value perspective** is relevant to your goal (intrinsic or instrumental value)

- Can you name the specific changes/ interventions which prevent us from reaching the goal you specified?
- Are those changes related to **stocks or flows** of resources, to the **availability/ accessibility**, or certain **properties** of resources?

Figure 3: Criteria for the discussion on perspectives during the workshop.

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Following elaborate discussions and a voting procedure, the consortium narrowed these 54 combinations down to four combinations for further elaboration within SUPRIM (Table 1).

Perspective	Availability / accessibility	Resource scope: Elements, configurations or both	Geographical scope: Country, continent or global scale	Temporal scope:
B1	accessibility	elements	global	100 years – infinity
B2	accessibility	Configurations	global	100 years – infinity
B3	accessibility	elements	global	0-25 years
B4	accessibility	Configurations	global	0-25 years

Table 1: Combinations of goal and scope choices within Type B Perspective elaborated in the SUPRIM project.

In this way, the consortium identified four Type B perspectives that were taken to the next steps - Modelling concept and Practical implementation - of the framework (Figure 1). The consortium defined the general problem definition of perspective B as follows: *the potential decrease of accessibility of primary (in Nature) and/or secondary (in Technosphere) resources (elements or configurations) on a global level on the Short Term (ST: 0-25 years) or Long Term (LT: 100 – infinity).* Next, compromising actions were defined as *human-induced actions related to the use of resources resulting in an increase or decrease of accessibility of resources for future generations*, with the change in accessibility of a resource being the net result of all compromising actions that increase or decrease the total of the accessible stock. Due to project related constraints, further discussions and elaborations were mostly limited to elements (perspectives B1and B3). For perspectives B1 and B3, the following *compromising actions* were identified:

a. **Exploration** and feasibility studies continually update the balance between accessible and inaccessible stocks within Nature. Exploration is particularly relevant for the short term.
b. **Occupation in use** is defined as the decrease of accessible stocks within the time horizon considered in the technosphere through competitive use of resources in materials and products, so the resources can't be used in other applications in technosphere at the same time.
c. **Environmental dissipation** is that part of an accessible stock that is emitted to the environment within the time horizon considered.
d. **Technosphere hibernation** and dissipation describe a decreased accessibility of resources due to a hampered recyclability, for whatever reason. Hibernation is that part of a resource that ends up in stocks in the technosphere that are not actually used anymore, but are also not recovered because of lacking economic drivers for this within the Time horizon considered (e.g. unused cables and pipes in the ground). Dissipation in the technosphere is that part of a resource that ends up in technosphere stock in such a low concentration that the resource cannot technically/economically be recovered from that stock for new applications within the time horizon considered.

The consortium argued that exploration is different from environmental dissipation, technosphere hibernation, and occupation in use. Exploration adds to the present stock from which one can extract/use a resource, whereas occupation and dissipation determine the fate of the resource used. In other words: exploration adds to accessibility through increase of the natural stock, while the other compromising actions add to some sort of inaccessibility.

For modelling this change in inaccessibility, 3 different impact categories were consequently distinguished: environmental dissipation, technosphere hibernation, and occupation in use. SUPRIM identified a hierarchy amongst these three compromising actions with decreasing grade of irreversibility. Occupation in use is only relevant for the ST and referring to the problem that a resource cannot be used in two applications at the same time. We recognised that occupation in use is actually the desired 'role of resources' and as such delivers benefits now and for the next generation, however preventing benefits for a second application at the same time. Therefore, even for ST we argue that it would be more correct to not include occupation in use in the impact assessment at all, because LCA is not well suited to capturing such short-term dynamic influences.

Finally, equations and practical methods for each of these three impact categories were explored for perspective B1 and B3 and for 2 time horizons. For practical reasons SUPRIM adopted 25 years for short term modelling and 500 years for long term modelling. These two have been taken as two practical extremes of an in-principle continu-

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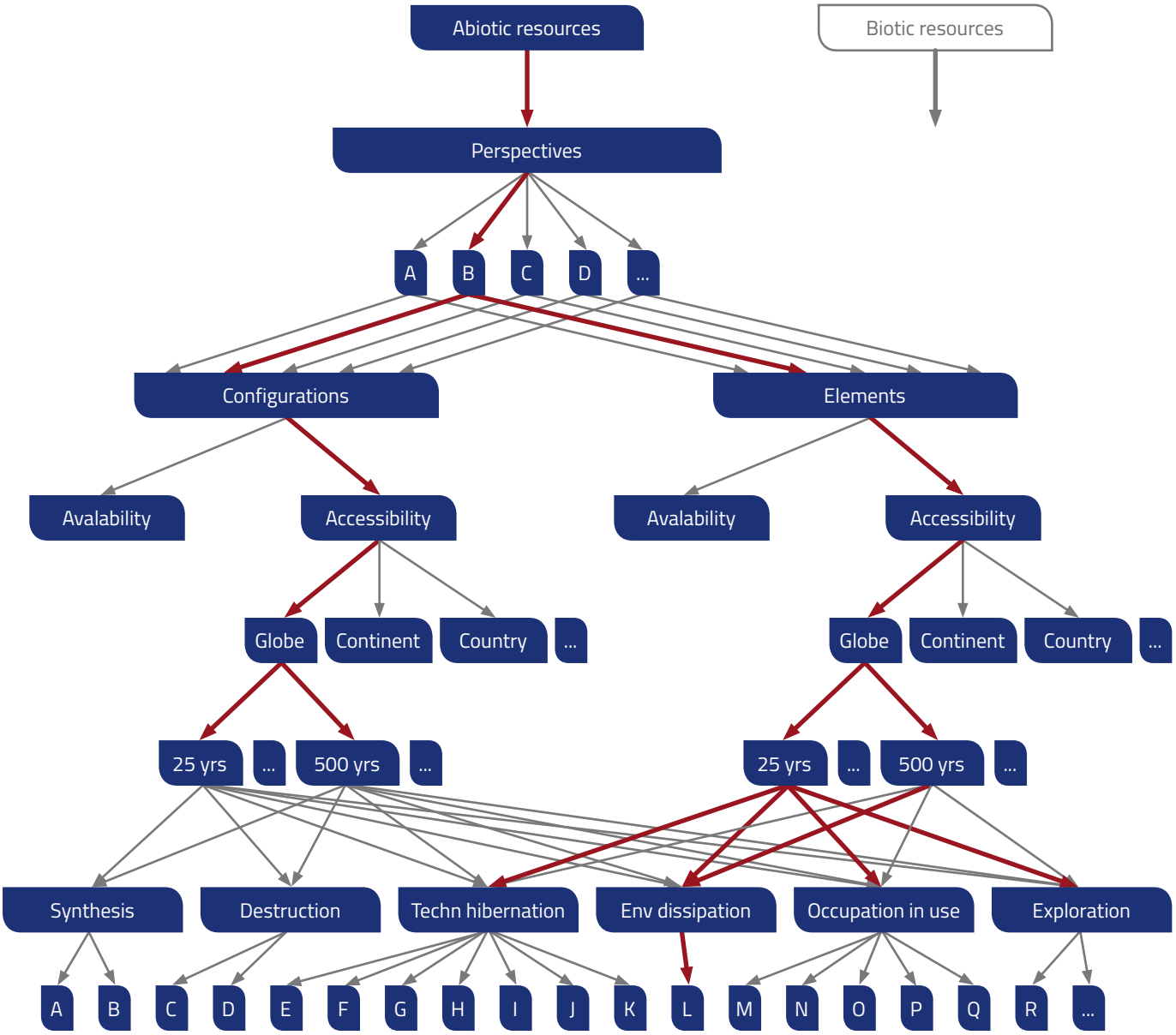
ous time scale. For the moment, SUPRIM was only able to develop a 'proxy' operational set of characterisation factors (CFs) for the impact category environmental dissipation. Theoretically, CFs for environmental dissipation should be based on the cumulative emissions over 500 years of resources extracted at present. Such emissions data are not available and difficult to properly estimate. It was argued that the cumulative emissions to infinity can be roughly approximated by the present extraction of resources, for which adoption of the recently updated Abiotic Depletion Potentials (ADPs) is already an option.

The path that SUPRIM has taken through the framework developing LCIA methods on resource use is just one out of many possible paths (Figure 4). Other paths might be equally possible but should in our view be justified using the stepwise framework developed in SUPRIM (Figure 1).



elaborated method with list of CFs

Figure 4: Map of SUPRIM's progress through the framework developing LCIA methods on resource use. Bold and red arrows indicate the paths taken by SUPRIM.

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Life Cycle Assessment of European copper mining: Aims of the SUPRIM project and difficulties in dealing with geologically complex ore deposits

Authors: Glenn Bark and Tobias Kampmann, Luleå University of Technology

Luleå University of Technology, located in northern Sweden, is one of the leading European universities in mining-related research and education. The strongly applied research is typically conducted in close cooperation with the mining industry and covers the entire life-of-mine, from early-stage exploration to mining, mineral processing, metallurgy, environmental effects, mine closure and remediation, and socio-economic aspects of mining. At Luleå University of Technology, the Division of Geosciences and Environmental Engineering supports the SUPRIM project with scientific expertise in ore geology.

The aim of the project "Sustainable management of primary raw materials through a better approach in Life Cycle Sustainability Assessment" (SUPRIM) is to develop solutions to better address sustainability assessments in the mining sector. The objectives of the SUPRIM project cover development of a new method for life cycle impact assessment (LCIA) that addresses resource availability and generation of life cycle inventory (LCI) datasets through two case studies involving operating European copper mines. A main objective is also to bring the project findings to a broader audience consisting of the LCIA community, mining companies, downstream users, policy and decision makers, as well as academia.

Life cycle inventory (LCI) data from two European copper-producing mine sites, Aitik (Sweden) and Cobre las Cruces (Spain) have been collected and processed through impact analysis. At Aitik, the use of diesel and explosives, the emission of sulphur dioxide, as well as nitrogen

Aitik open pit copper mine, northern Sweden, is one of the world's most effective copper mines. The ore reserve is ca. 1200 Mton, at 0.2 % Cu.

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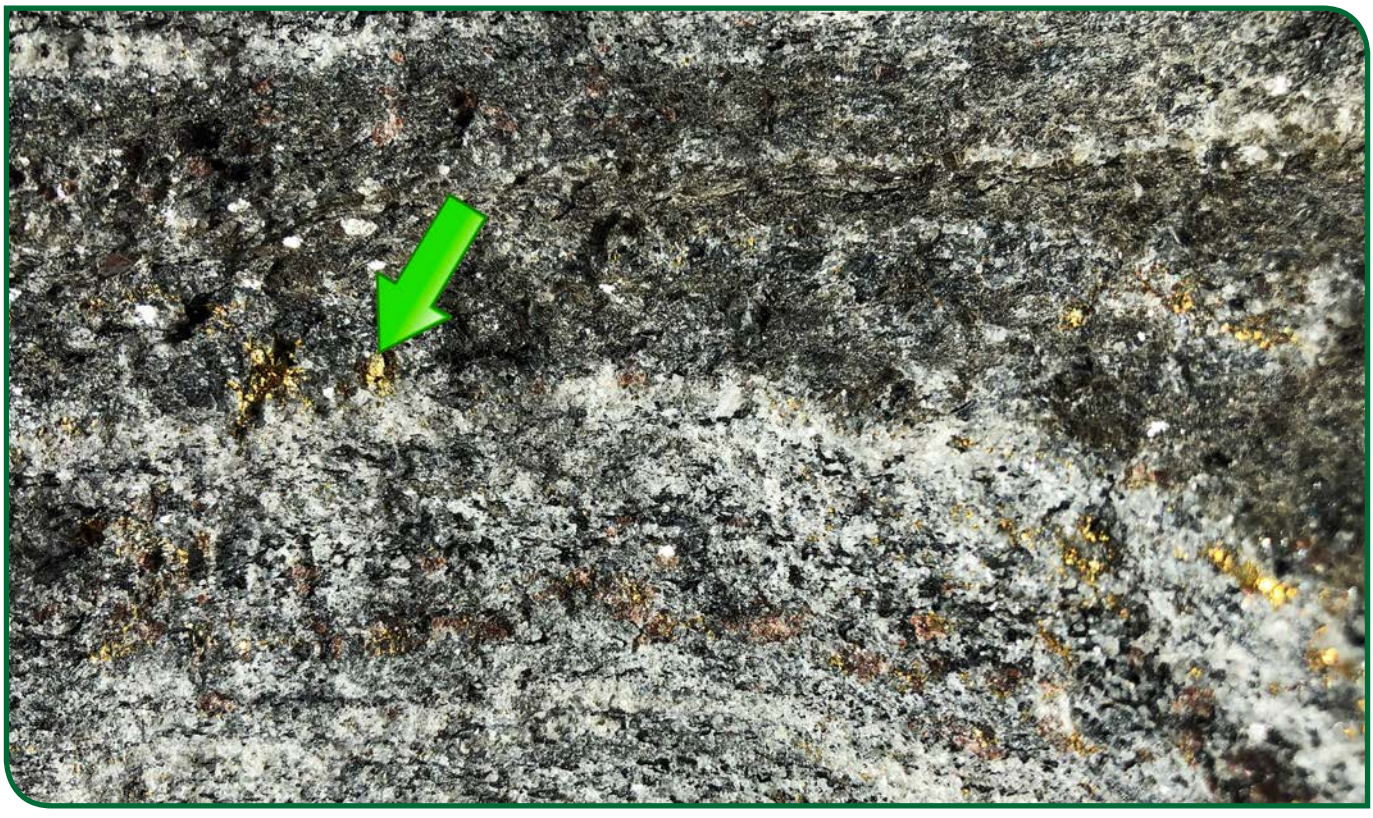
and other emissions in the upstream supply chain of explosives and electricity, have thereby been indicated as potentially significant contributors to the environmental impact. Climate Change, Photochemical Ozone Formation, Acidification, as well as Terrestrial and Marine Eutrophication are among the impact categories that appear to be affected by these environmental flows.

The main challenges for a successful LCA analysis seem to be a sound communication between LCA practitioners, the mining companies and expert geologists. Finding a common language that everybody understands is difficult. Also, many of the entries in the databases used in commercial LCA software are irrelevant when investigating a single ore deposit, as the global perspective of the databases rarely works well for any one unique case study. So far, there is also little consensus between a geological and an LCA perspective with regards to what constitutes a natural resource.

In the project, Luleå University of Technology's role is to explain and emphasise the geological complexity that any ore deposit on Earth exhibits. Each deposit is unique in character which makes it difficult to simply apply any LCA method to an ore deposit without making significant modifications in the LCA method and/or to introduce over-simplifying assumptions regarding the geological character of the ore deposit. This adds to significant uncertainties regarding the results generated from an LCA analysis of a mine, rendering far-fetching conclusions about the environmental footprint of the mining operation highly questionable, and sometimes misleading. In addition to this, in the Aitik case study ore concentrates from multiple mines end up at the same smelter (Rönnskär) where the concentrates are blended before processing. After smelting, it is impossible to chemically trace the copper product from the smelter back to a specific origin (mine), which would be vital for a complete, representative and useful LCA study.

Our results show that good communication between different stakeholders, such as LCA practitioners and mining companies, is necessary for the successful performance of an LCA study. The establishment of structured ways of communication and organisation, as well as a comprehensive data management strategy based on knowledge of geology and mining, with LCA requirements in mind, will be essential to meet the expected demand for wide incorporation of LCA (or a similar method) in the mining sector. Thorough scientific consultation between LCA practitioners and experts in mining and ore geology will remain a crucial aspect in obtaining representative and meaningful LCA results in this sector.



Rock sample of the copper ore at Aitik. The yellow minerals (green arrow) that occur scattered in the ore are chalcopyrite, which is the main copper ore mineral.

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Bringing SUPRIM results to a broader audience

Authors: Veronika Sochorová and Johannes Drielsma, Euromines

The issues of resource availability and sustainability go hand in hand as major concerns for the future of raw materials in Europe. SUPRIM aims to identify a consistent, empirically verifiable cause-and-effect chain linking flows of natural resources to sustainability impacts.

The specific purpose of the SUPRIM project is to develop a method that can represent in LCA the transition towards a more sustainable management of primary raw materials, and eventually a circular economy. To do so, there are several issues that need to be addressed. These include establishing agreement of how to define inefficient use of resources and development of an LCIA method to quantify it; creating an exemplary LCI dataset based on case studies; validation of the adapted LCIA method; and **bringing this knowledge to a broader audience**.

Who will benefit from SUPRIM?

Customers who benefit from this service include the primary production sector, sustainability managers and practitioners, policy makers and the sustainability assessment community.

For the primary production sector, this creates significant opportunities for improving and presenting progress in sustainable mining. Policy makers like the European Commission and its Joint Research Centre as well as national and regional governments need well-defined indicators to be able to monitor resource efficiency of products and the transition towards more sustainable resource use. This project helps to provide indicators that are based on an improved construction of datasets and methods.

For the sustainability assessment community, benefits will occur at two levels: at inventory level, through the LCI datasets, and at impact level, through the LCIA method. The sustainability assessment community is of course interlinked with the academic community, where researchers and students can use the service provided by the project to perform their own sustainability studies. Sustainability managers and practitioners amongst KIC members will benefit from the service provided by this project in a similar way.

Involving all stakeholders

The first SUPRIM workshop, "Metal and Mineral Resources in LCIA: What's the problem?", took place on 7th and 8th December 2017 and was attended by representatives from industry, industry associations, academia, research institutes and policy support, including partners from the SUPRIM project and invited project-external stakeholders. The inputs from participating stakeholders and the outcomes of the group discussions were valuable and used as a basis for further development of the research conducted in the SUPRIM project.

The second SUPRIM workshop "Industrial stakeholder workshop on an enhanced LCA methodology" was organised on the 11th December 2018 in Brussels. This industrial stakeholder workshop was a unique opportunity for the industry to contribute to the discussion of resource-use in LCA, establishing a better agreement of the problem definition, and assisting to develop an amended LCIA method. A lively dabate with workshop participants provided a number of valuable suggestions on future communication.

Upcoming events

A third workshop in Berlin should provide an opportunity to inform about the preliminary project results. Together with stakeholders, the aim is to review the method and discuss stakeholders' feedback:

Practitioner stakeholder workshop on an enhanced LCA methodology for Resources
Workshop will be part of the Raw Materials Summit
2019, 22nd May 2019 (from 11:00 to 16:30)
Radisson Blu Hotel Berlin
Berlin, Germany

The final project results will be communicated at
Final SUPRIM Conference – How better to account for your primary raw materials in your LCA
22nd October 2019
EIT House in Brussels
Rue Guimard 7, 4th floor, 1040 Brussels, Belgium

Supporting EU EIT Raw-Materials' Objectives

Establishing a reliable assessment methodology together with guidance on data needs is perfectly in line with the key message of EIT RawMaterials and the first strategic objective of the KIC to secure raw materials supply. SUPRIM aims to serve the entire primary raw materials sector going beyond the partners involved in the project. This service will assist in the global transition towards a more sustainable management of primary raw materials, overall transparency and performance of value-chains and hence will contribute to an enhanced appreciation for the SUstainable way that PRIMary raw materials are managed in Europe.

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Project Partners

This project brings together universities, research institute and leading industrial partners in the raw materials sector with a long track record in primary raw materials. Chances of creating impact with project results are maximized by bringing together these different types of partners with a range of specific areas of expertise.

Academia

GHENT UNIVERSITY

Ghent University

The research group of prof. Jo Dewulf (Sustainable Systems Engineering) specialises in life cycle thinking and thermodynamics-based sustainability analysis, going from process level to overall industrial system level. The commonly used techniques are Exergy Analysis (EA), Exergetic Life Cycle Analysis (ELCA), Life Cycle Assessment (LCA) and Life Cycle Sustainability Assessment (LCSA). Methodological improvements have been put into practice through collaborations with several industrial partners, e.g. Galloo, Umicore and others. Through prof. Dewulf's involvement with the European Commission's Joint Research Centre, the group is also working on relevant topics like resource efficiency, resource criticality and circular economy.

Universiteit Leiden
Institute of Environmental Sciences

Leiden University

CML, the Institute of Environmental Sciences (Centrum voor Milieuwetenschappen Leiden) is an institute of the Faculty of Science of Leiden University. The Department of Industrial Ecology is a major player in methods development for sustainability assessment, with a key role in LCA (Life Cycle Assessment); LCSA (Life Cycle Sustainability Analysis); MFA (Material Flow Accounting); dynamic SFA (Substance Flow Analysis); EE-IOA (Environmentally Extended Input-Output Analysis) and combinations of these methods and tools, like hybrid LCA. Among others, CML developed the method for calculating the Abiotic Depletion Potentials (ADPs).

LULEÅ UNIVERSITY OF TECHNOLOGY

Luleå University of Technology

LTU is a leading mining university in Europe. The university carries out research and education along the raw materials value chain and have centres of excellence in mining and metallurgy and also in mineral economics, societal research in relation to mining and exploration activities and have internationally acknowledged research groups in all these areas also including sustainability and LCA of direct relevance for this project. LTU traditionally work in close collaboration with industry in their research and education.

Industry

BOLIDEN

Boliden

Boliden is a leading European mining and smelting company, primarily dealing with base and precious metals. The Boliden mining division have active mines in three European countries, Sweden, Finland and Ireland. The Boliden mining division is furthermore one of the largest exploration companies in Europe. Boliden has in house expertise in exploration, mining, mineral processing, metallurgy, mineral economics, sustainability and environmental issues. Boliden is actively working with sustainable mining and minimising environmental impact of its operations.

CLC
Cobre Las Cruces, S.A.

Cobre las Cruces

Cobre Las Cruces (CLC) is the owner of Las Cruces mine and is a subsidiary company of First Quantum Minerals group. CLC is a mining company with the biggest open pit mine of copper in Europe and a hydrometallurgy plant for mineral beneficiation considered unique around the world. The CLC Hydrometallurgical Plant is very innovative and one of the most technologically advanced in the world for treating copper through the concept "Mine to Metal". The use of optimized applied process technology maximizes the reutilization of water, energy and material resources. CLC uses a sustainable "Clean Technology", avoiding the generation of acid gas typical from conventional copper smelters; liquid effluents are perfectly controlled to meet the most stringent regulations, and process tailings are disposed of in

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dry conditions, so as, tailings ponds are not needed. The main role that CLC can plays in SUPRIM project is providing information, knowledge and expertise about different ways of ore production and treatment.

Association

Euromines

Euromines (www.euromines.org) is the recognised representative of the European metals and minerals mining industry, long-standing supporter of the European Technology Platform on Sustainable Mineral Resources (http://etp-smr.eu) and associate member of ICMM (www.icmm.com). Euromines has made significant contributions the EU's methods for assessing criticality of raw-materials, the EU Raw Materials Scoreboard and the EU Product Environment Footprint. It represents 42 different metals and minerals being extracted in Europe.

Research Institute

Tecnalia

The Circular Economy Team at the Energy and Environment Division addresses the main challenges faced by the industry and society as a result of multiple environmental pressures linked to current human activities. The mission of Tecnalia is to contribute to the design of more sustainable futures through the enablement of a circular economy. In particular, they focus our activities in contributing to the development of innovative metrics and product design tools as support elements towards a transition to a circular economy. The main research focus deals with the monitoring and assessment of existing methods, the development of new indicators, and the implementation of state-of-the-art metrics for a comprehensive characterization of environmental burdens on various sectors. Tecnalia has extensive experience in the application of LCA-based tools. Additionally, they have also developed integrated sustainability assessment indicators at different territorial levels, including cities and regions, most of which have been developed together with other EU RTD partners in the framework of joint research initiatives funded under a number of EU programmes, including FP 6 and 7, H2020, ESPON and IN-TER.

Contact info

Veronika Sochorová (Euromines) · E-mail: sochorova@euromines.be · suprim.eitrawmaterials.eu

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