

The SUMEX Project - A European Vision on Sustainable Mining

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ABSTRACT

The Horizon 2020 project SUMEX (**S**ustainable **M**anagement in **E**xtractive **I**ndustries) develops a Europe focused sustainability framework for the extractive industry that responds to grand societal challenges for the extractives and beyond. The SUMEX framework underlines that legal compliance with all applicable legislation (local, regional, national and international) as a minimum requirement for companies in the extractive sector is a baseline condition. But even in the EU, considering effective governance of the extractive sector represented by advanced economies and well-developed democratic systems (accountability, transparency and deliberation), legal compliance does by no means equal sustainable management of the sector. Governance systems are very diverse across Europe; hence SUMEX suggests one common framework to describe what sustainable development in the extractive sector should mean in the EU. In alignment with the European Green Deal, concepts of Planetary Boundaries and doughnut economy SUMEX suggests that the industry transitions - from responsible extraction towards a future state of sustainable extraction. The framework addresses this via the sustainability aspects, including milestones until 2050 and contributing towards achieving the United Nations' Sustainable Development Goals in 2030. Sustainability aspects describe key components of sustainable management of the European extractive industry should consider. They represent a set of topics (e.g. valuing social and natural capital, planning beyond the mine life) and goals (e.g. no bribes, zero greenhouse gas emissions). The sustainability aspects consider the European Green Deal and its aspiration to transform the European economy into an inclusive, circular and carbon-neutral economy in 2050. They are a mixture of topics which should be considered as part of responsible mineral extraction in the present. For instance. emergency preparedness and risk management, diversity and anti-discrimination and future aspirations such as. defining the role of extractives in a green economy, carbon neutrality, which the sector needs to address to move towards sustainable

management. In the project's second stage, good practice examples are collected and presented in a digital repository. A massive open online course is used to further advance sustainability in the extractive industry across Europe.

KEYWORDS

Sustainability, extractive industry, mining, SUMEX, European Union

1. Introduction

Today, there is global consent that the concept of sustainability is required to be underlying all of humankind's development to further ensure a decent quality of life within the ecological limits of planet Earth. Yet, when it comes to the operationalisation of sustainability, and despite decades of academic discourse and United Nations (UN) reports, conferences and development goals [1, 2, 3], there are significant gaps still [4]. The European Union, through its Raw Materials Initiative [5] and related initiatives and programmes, including the current Raw Materials Alliance and Raw Materials Act considerations, has been working for some years on again advancing European raw materials production. However, it recognised a need for this to happen sustainably and therefore, amongst many other initiatives, launched a call for proposals in its Horizon 2020 research programme to define what the sustainable management of extractive industries should mean within Europe [6].

1.1 The SUMEX project

SUMEX (**S**ustainable **M**anagement in **E**xtractive industries) is a 36-months project funded by the European Commission that started on 01 November 2020. The project supports the set-up of a European sustainability framework to improve the permitting procedure along the extractive value chain of prospecting, exploration, extraction, processing, closure, post closure activities. In addition to guarantee timely decisions, a transparent governmental regulatory regime, appealing financial and administrative conditions and sustainable natural environmental and social conditions. The main mission of SUMEX is to assist policymakers and other stakeholders in seizing this opportunity.

To foster more but sustainable mineral production in the EU, SUMEX is establishing a sustainability framework for the extractive industry in Europe. It does so by considering the Sustainable Development Goals (SDGs), the European Green Deal, and EU Social License to Operate considerations. It will involve stakeholders from industry, government, academia and civil society backgrounds from all across the EU.

This framework is then applied across the extractive value chain to analyse mineral, as well as relevant economic, environmental and social policy frameworks of the EU, member states and selected regions along five focus areas: These are 1) socio-economic and environmental impact assessments, 2) land use planning, 3) health and safety, 4) reporting official statistics, and 5) permitting processes and relevant policy integration processes. The focus areas facilitate the identification and describe good practices or tools for an open access repository, and which forms the basis for capacity building in the form of a massive open online course (MOOC). The project considers and engages relevant stakeholder groups, with a focus on permitting

authorities, across the EU, providing digital tools and using a series of workshops and webinars. Figure 1 provides an overview of the key components of SUMEX.

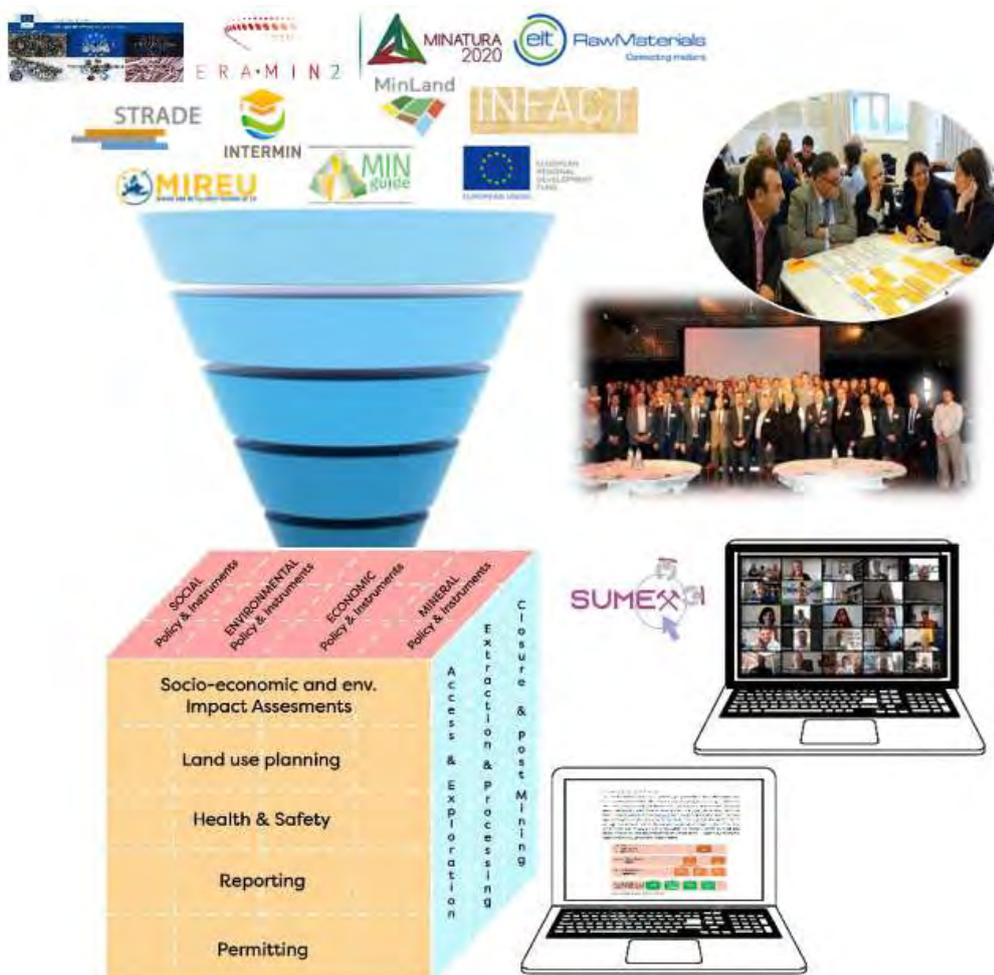


Figure 1: Schematic overview of key components of the SUMEX project [7]

In SUMEX, the experience from other EU projects builds a powerful foundation for addressing the challenge of how best to implement sustainability considerations into the whole raw materials value chain.

The objectives of SUMEX are to

- Strengthen policy coordination and agenda setting along the mineral extraction value chain;
- propose a uniform EU sustainable management in the extractive industries context;
- cluster with other projects to identify good practices and sound practise principles;
- identify good practises and principles for policy strategies and strategic approaches, coordination/integration and approaches and property rights regimes for different institutional systems;
- build a repository with good practises, with a focus on access to land, permitting and policy coordination and integration;
- identify stakeholder learning needs and requirements;
- deploy an open-access MOOC for capacity building across the EU and with all stakeholders.

This article provides an overview of the sustainability framework, the good practise repository and the MOOC. It is to a large extent a summary of the report “SUMEX Deliverable 1.2 - SD criteria: SUMEX Sustainability Framework” [8].

2. SUMEX Sustainability framework

The framework is based on a desktop review of the current academic and industry practise related sustainability discourses. This is complemented by insights from over 70 practitioners in academia, policy and industry gathered from 13 different EU countries, as well as Canada and Switzerland, at a digital workshop, as well as in-depth interviews. Finally, the results of the desk-research as well as practitioner perspectives were synthesised into a framework, including key sustainability aspects and decision-making criteria for the European extractive industry.

SUMEX sees legal compliance with all applicable legislation (local, regional, national and international) as the baseline and minimum requirement for companies in the extractive sector. But even in the EU, with member states with advanced economies, more or less well-developed democratic systems and strong extractive sector governance (i.e. through mining and environmental legislation), legal compliance does by no means equal sustainable management of the sector. In fact, governance systems are very diverse across Europe [9, 10] and hence SUMEX suggests one common standard to describe what responsible extraction should mean in the EU: The project proposes to use the IRMA (Initiative for Responsible Mining Assurance) Standard [11] to describe the criteria that a responsible extractive operation should fulfil today. In addition, SUMEX suggests that the industry to transition (which is mostly aligned with the European Green Deal) from responsible extraction towards a future state of sustainable management, as expressed through the sustainability aspects below, over a time period up to 2050, via the milestone of contributing towards achieving the SDGs in 2030. Some of the goal descriptions contained in the aspects might be relevant earlier than in 2050 and as such action should not be pushed backwards.

2.1 Sustainability aspects

These aspects describe key components of what sustainable management of the European extractive industry should consider. They represent a set of topics (e.g. valuing social and natural capital, planning beyond the mine life) and goals (e.g. no bribes, zero greenhouse gas emissions), which have to be underlined with industry and policy practices to get to such a state. In addition, the sustainability aspects consider the European Green Deal and its aspiration to transform the European economy to an inclusive, circular and carbon neutral economy in 2050. As already stated above, they are a mixture of topics which should be considered as part of responsible mineral extraction in the present (e.g. emergency preparedness and risk management, diversity and anti-discrimination) and future goals (e.g. defining the role of extractives in a green economy, carbon neutrality) which the sector needs to move towards going forward. Figure 2 gives an overview of the sustainability aspects in a temporal context.

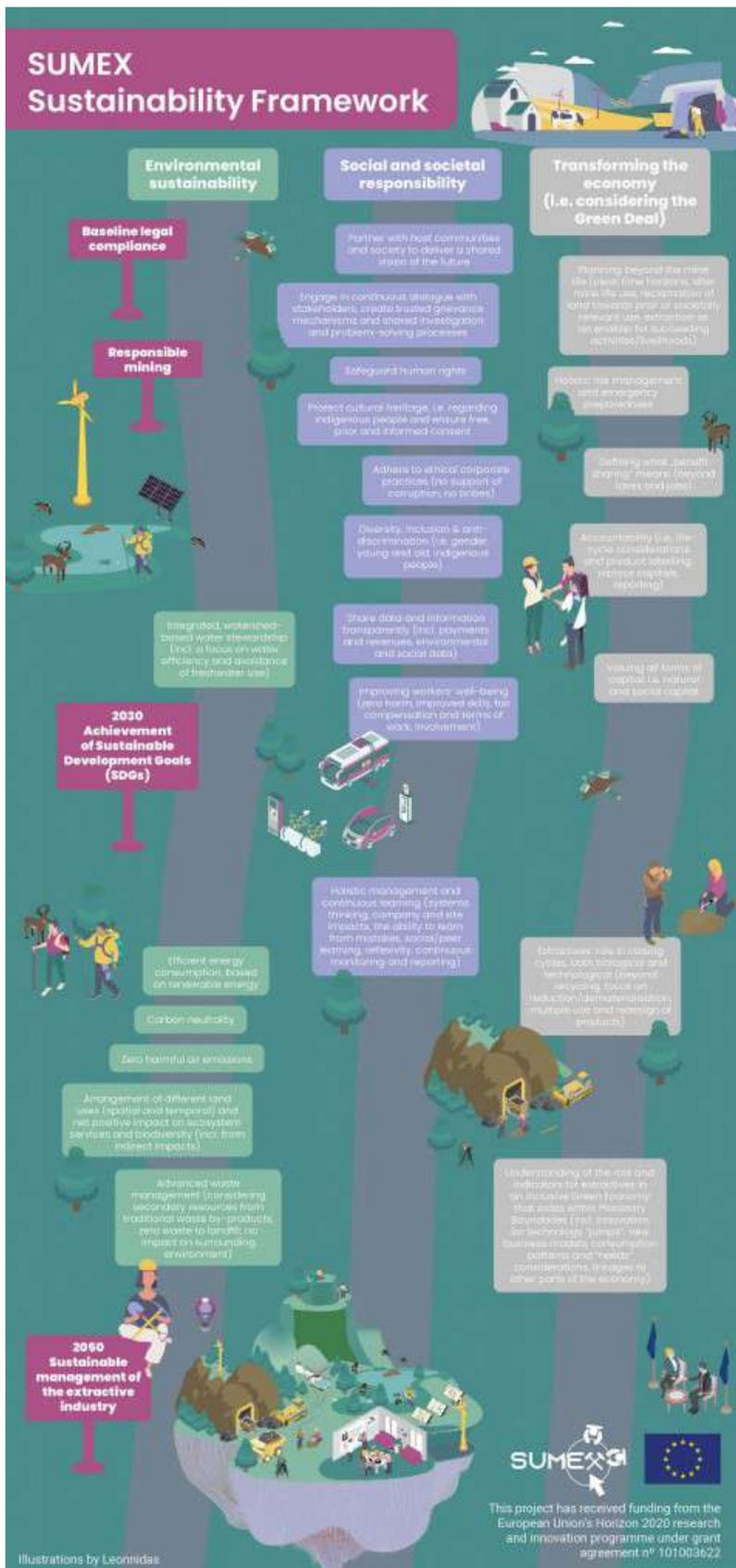


Figure 2: SUMEX Sustainability Aspects. Please click [here](#) for a larger version of the image [8, p. 18]

2.1.1 Environmental sustainability

Our planet has biophysical boundaries, which are e.g. expressed in the concept of Planetary Boundaries [12]. These boundaries describe limits which humankind and its (economic) activities should not trespass. The extraction of minerals has many impacts on the environment, of which we evaluated the main ones (in the context of Planetary Boundaries) and for which the sector will need to find ways how to significantly reduce its impact, often towards zero or even a positive impact.

Mineral extraction and processing often require large amounts of water. Integrated, watershed-based water stewardship means comprehensive and jointly planned management of all water systems, company internal and external ones, where all waters are used as valued resources and water efficiency and avoidance of freshwater use are key [13]. Thus, a flexible, resilient water infrastructure that can respond to various scenarios can be achieved. Equally, the extraction of minerals and processing is energy intensive. Companies need to continuously optimise and innovate their processes to improve energy efficiency. With carbon neutrality, energy consumption needs to be predominantly based on renewable energy. Other harmful air emissions also need to be reduced to zero.

Land use for mineral extraction and its impact on biodiversity and ecosystem services is another important aspect. Land use stakeholders, including the extractive industry, need to work together to collaborate on how to use the land both spatially and temporally; before, during and, considering especially the finite nature of mineral extraction (see above), after the extraction phase. Of particular concern in the context of land use are impacts on biodiversity and ecosystem services. The sector will need to find ways to turn these from being negative towards net positive. This should also consider potential indirect impacts, caused by related industry activities (e.g. additional economic activities due to better transport infrastructure or renewable energy provision). Lastly, due to the transformation to a circular economy, advanced waste management systems will be required. These comprise secondary resources from traditional waste by-products (e.g. waste rock and tailings), the continuous reduction of waste generated and the treatment and/or storage of waste without the need for landfilling and any impacts on the surrounding environment.

2.1.2 Social and societal responsibility

Different views (locally and globally) can potentially influence the progress of an extractive project. The lack of social acceptance or SLO (social license to operate) can even lead to the project being hindered or failing. Engaging with stakeholders, ranging from the community affected by the extractive operation to broader society, helps achieve active collaboration between the company and society to define and deliver a shared vision of the future [14]. Part of this is the continuous engagement with stakeholders to give them the opportunity to actively participate in the process, deliver procedural and deliberative justice and take an active role in decision-making. Trusted grievance mechanisms and shared investigation and problem-solving processes enable all parties involved to raise critical questions, concerns and complaints without hesitation. It also ensures that the issues raised are addressed in the best possible way. Data and information are shared with stakeholders transparently and timely, where required at a site and not the company level. This includes payments and revenues, as well as data from environmental, health and safety.

Extractive companies adhere to ethical corporate practices, including for example, that corruption and bribery must neither be supported nor tolerated. Human rights (e.g. free and prior informed consent, participation) and cultural heritage must be respected and safeguarded. This, in particular, also includes special consideration of indigenous people like the Sami in Sweden and Finland. Also, diversity and inclusivity at the workplace are supported on one hand and discrimination is eliminated on the other. This refers to

factors such as gender, age, skin colour and origin of the people involved in the extraction project, as well as indigenous people and different cultural or religious groups.

The workers well-being in a company is fundamental. To ensure and improve the objective and subjective well-being of workers, ongoing efforts are made. The basis is a zero-harm culture, health and safety, as well as fair compensation. Continuous improvement of skills and the involvement of workers in the company processes are to be analysed.

As already stated in the Mining, Minerals and Sustainable Development (MMSD) process 20 years ago, the extractive sector needs a culture of continuous learning and engagement with societal actors in order to see the bigger picture of how a site, a company, the sector or its products are embedded in an ever-changing society and environment [15]. It also requires reflexivity and deliberation of a form of learning in the sense of a jointly developed vision and values that guide a theory of action for certain practices [16, 17].

2.1.3 Transforming the economy (i.e. considering the Green Deal)

The European Green Deal [13] intends to transform the European Union's economy towards a green, circular and inclusive one ("leaving no person behind"). Extractives play, and will continue to do so, an essential role in achieving the goals of the European Green Deal, as they are a basic requirement for the transition. However, the extractive sector needs to understand its role in this transition (e.g. which raw materials will be required and which will not be), how to measure this role with indicators as well as what types of improved and innovative technologies with new/modified business models will be required. It also needs to deal with changing consumption patterns (usage instead of ownership) and considerations of "needs" (e.g. what is the role of mineral raw materials for producing luxury items like jewellery in such an economy). A key part of such a green economy will be closed cycles with highly increased material efficiencies, reduced dependency on imports of minerals overall and from irresponsible sourcing practices, and a demand that secondary sources can partly cover. Different loops will be crucial, such as sharing, prolonging, remanufacturing and recycling (see Circular Economy System Diagram of the Ellen Macarthur Foundation). Therefore, circularity will significantly impact the extractive sector well beyond recycling, with a focus on reduction/dematerialisation, multiple uses and redesign of products. Waste products can be re-used as a secondary product for other industrial processes (e.g. full value extraction), which also means closer linkages to other parts of the economy/avoiding enclaves. The sector will need to examine life-cycle considerations regarding its products and product labelling and will be accountable for them.

Natural capital that needs to be considered by the extractive sector are for instance biodiversity and ecosystem services. Social capital refers to relationships and networks between individuals and groups, as well as the resulting ability to secure or maintain resources, knowledge or information. Knowledge of their value, which is not only monetary but also includes ethical, moral or cultural ("values") dimensions, facilitates their inclusion in accounting and reporting systems and decision-making processes and enables natural and social capital to be reflected accordingly. For natural capital in particular, this knowledge is important for conducting an appropriate appraisal of services and benefits to ensure either its restoration or its continuation and sustainable use. As the extractive industry has the potential to generate immense benefits, it is important to define what benefit sharing in the context of a shared vision of the future (see below) means, considering all dimensions of value and, i.e. beyond paying taxes and creating jobs. The question is how these benefits can and should be shared between stakeholders, i.e. since the current "social contract - jobs vs. environmental impacts" will change with ongoing automatisations in the near future.

All of the above are also relevant for planning beyond the life of the mine or quarry. This is straight from the start when planning for the operation begins, to ensure that the extractive company has budgeted the financial resources for the phase after mineral extraction has been completed and considered the full variety of social and environmental aspects. This includes the closure of an operation, required socio-economic transitions to enable succeeding activities/livelihoods and the subsequent land-use. The same goes for risk management, where the extractive sector needs to exert a holistic approach towards risks and opportunities in the context of this transformation but it also needs to do better concerning emergency preparedness to prevent events with catastrophic consequences going forward.

2.2 Decision making criteria

In addition to describing sustainability aspects, the framework also includes evaluation or decision-making criteria to assess a policy's, project's or operation's, etc. sustainability. SUMEX assessed three very different schemes: i) Leverage Points; ii) The Seven Questions to Sustainability; and iii) the Institutional resource regime. They all serve different purposes, as described below; hence, it was decided to include all three of them.

2.2.1 Leverage Points

Approaches, such as the Leverage Points (LP) [18, 19] or Social Tipping Elements [20] are conceptual models to best understand what are the ways to introduce system change with varying degrees of impact. This translates from "shallow", i.e. incremental changes, with only minor leverage on changing a system, to "deep", i.e. transformative and disruptive. Both tipping points and leverage points are points in the respective system at which even small changes can lead to significant change; hence they refer to systems' change processes, in which a system is reorganising (e.g. towards sustainability) and enters a new state. The LP approach provides a tool and lens to assess sustainability interventions and 'sustainable management' measures regarding their potential to initiate change on different levels in a (sub)system. Whilst it has been used as analytical lens in different policy sectors, such as food, food waste and food security, [21, 22] energy systems [23] and environmental management [21], the SUMEX project is first to adopt it to extractive industries, as shown in Figure 3.

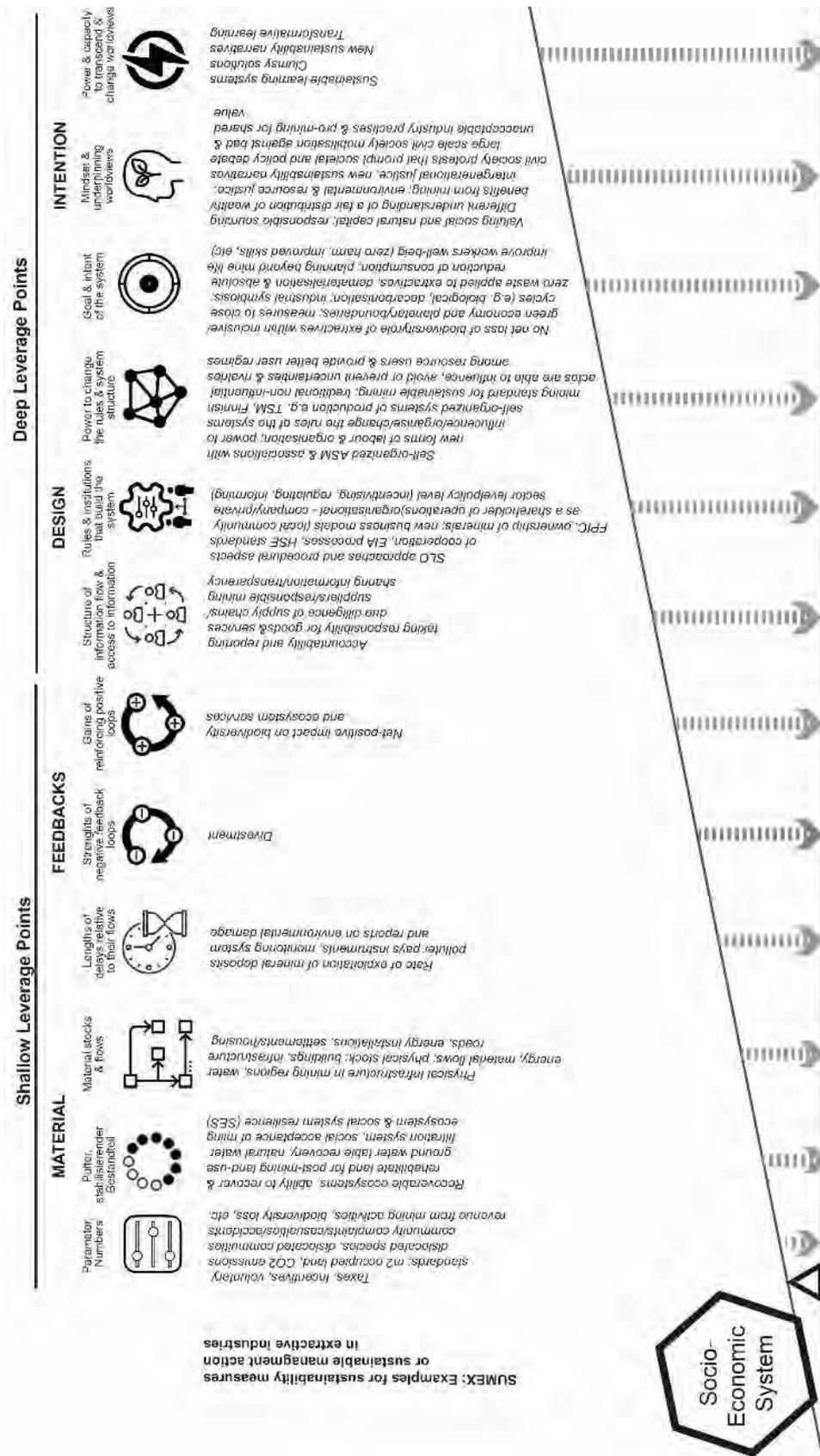
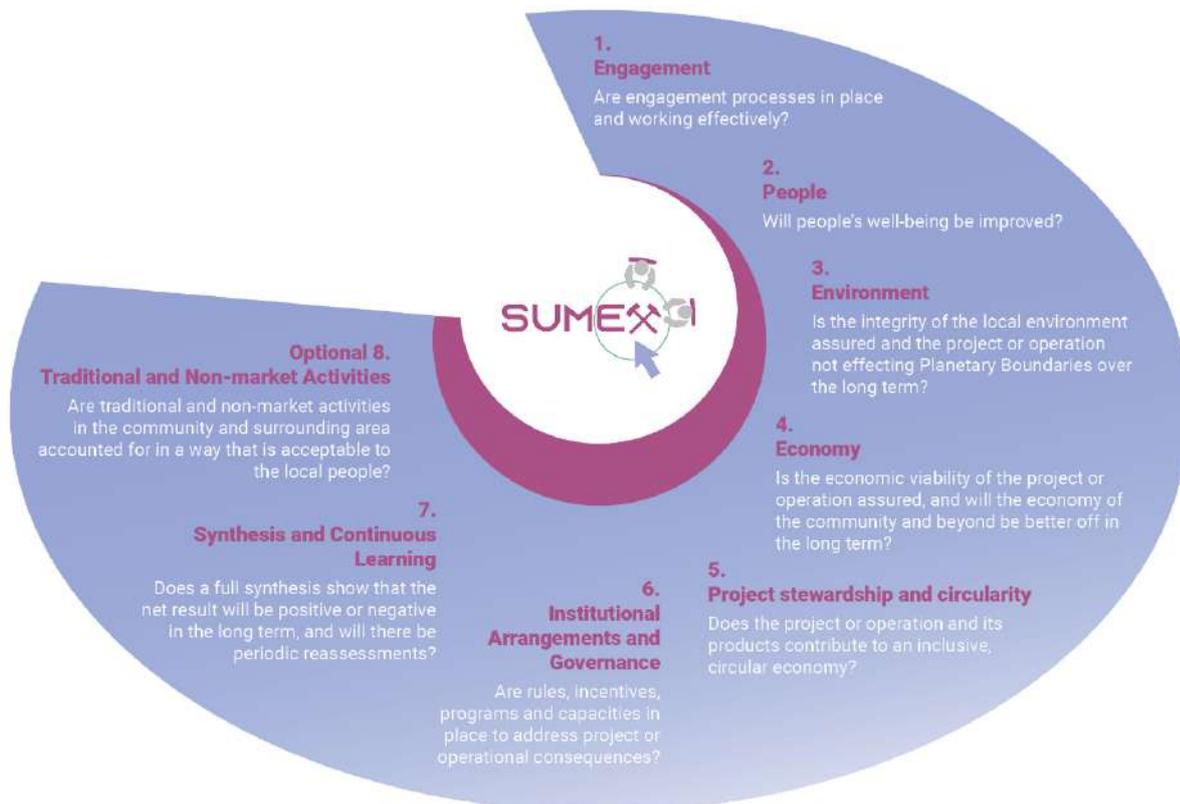


Figure 3: Leverage Points Perspective adapted to the subsystem of the extractive industries [8, p. 22]

2.2.2 The Seven Questions to Sustainability

As part of the Global Mining Initiative's (GMI) analytical process called Mining, Minerals and Sustainable Development (MMSD), the North American stream of the MMSD in 2002 published "The Seven Questions to Sustainability - How to Assess the Contribution of Mining and Minerals Activities" [24]. This report "set out to develop an approach to assessing how a mining/mineral project or operation contributes to sustainability". The initiative led to the design of a framework to guide the assessment of whether or not a project or operation's net contribution to sustainability is positive over the long term. For each of the seven components, a question is posed to assess whether the net contribution to sustainability over the long term of a mining/mineral project or operation will be positive or negative. The main reasons why this evaluative framework is considered in SUMEX are its mining origin and the underlying definition of sustainability, based on a value set that is stated as "parallel care and respect for the ecosystem and the people within. From this value set emerges the goal of sustainability: to achieve human and ecosystem well-being together."

When reviewing the seven Questions, it was nevertheless decided to update them – basically to "make them European", i.e. consider the Green Deal, circular economy and Planetary Boundaries. Because of this, the fifth question is replaced with one concerning the circular economy and made the original question, which is about traditional and non-market activities, an optional question to be used, e.g. in the Nordic countries when dealing with the Sami people. Figure 4 shows the updated questions.



Adapted from *Seven Questions to Sustainability: How to Assess the Contribution of Mining and Minerals Activities*, http://www.iisd.org/pdf/2002/mmsd_sevenquestions.pdf

Figure 4: SUMEX's Seven Questions to Sustainability, adopted from MMSD [8, p. 25, 24]

2.2.3 Institutional Resource Regime

Most resources are likely to be subject to a large number of different and often simultaneous uses that compete with each other, sometimes resulting in conflicts. Conflicts arise from rivalries between different users for the same resource (homogeneous rivalry), i.e. different extractive companies competing for access to mineral resources, or between different users for access to different resources in a resource system (heterogeneous rivalry), i.e. competition to access land for extractive purposes vs. construction purposes vs. farming/animal husbandry purposes vs. recreation/ tourism purposes. Sustainable resource management entails managing such rivalries as a condition sine qua non for sustainability. Hence, identifying institutional conditions that facilitate sustainable management is of crucial interest. Institutional Resource Regime (IRR) is a proposed framework for analysing institutional arrangements that regulate individual and/or collective uses of resources [25, 26], with Figure 5 providing an overview.

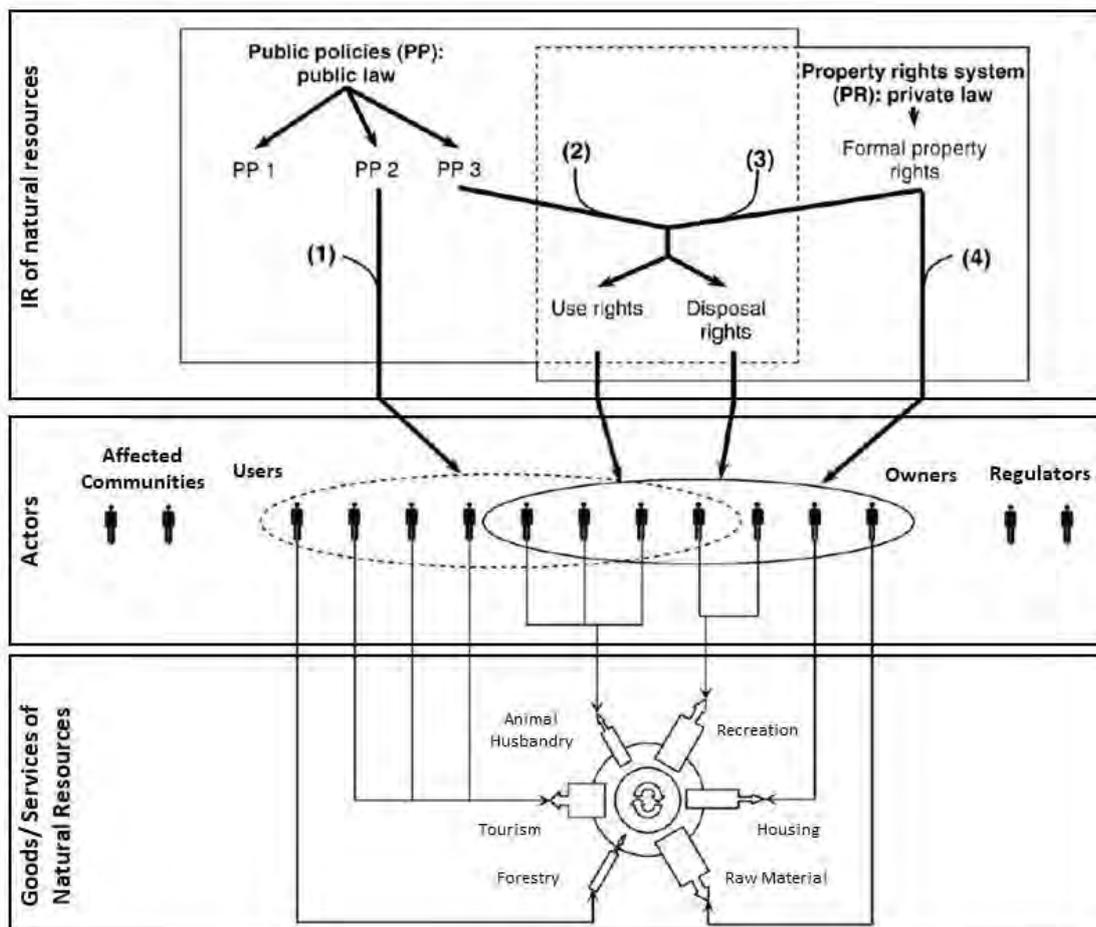


Figure 5: IRR adopted from Gerber et al. [25, 8, p. 27]

For SUMEX, the IRR provides a conceptual framework for in-depth analyses and explanations of key elements depicting the degree of sustainability of natural resource uses in a given institutional setting. One advantage of the framework is that it is analytical and normative (prescriptive) in nature. Hence, it is a guide for conducting analyses of existing regulations around extractive resources whilst providing a usable framework for proposing new institutional regimes that enable more sustainable management of such resources.

3. Good practices and learning actions

The Sustainability framework described in section 2 is used within SUMEX to identify and contextualise policy (mainly from EU and EU member state level projects) and good industry practices. These are further on used to improve the knowledge of European extractive industry stakeholders and are therefore an important driver for the transition towards a sustainable extractive sector in Europe. The final product, the SUMEX Toolkit, provides necessary knowledge and tools for practitioners in companies and public administration willing to engage in a sustainability transition in the extractive sector.

3.1 Knowledge repository

The first part of the Toolkit is an open-access online data repository synthesising and contextualising relevant information on industry and policy good practice and training materials in the form of reports, videos and websites [27]. Some ideas around this knowledge repository include creating a one-stop-shop that is well-structured with user needs centred information access. Against this background, the project team organised a multi-stakeholder consultative process to improve practitioners' general understanding and relevance. Another focus is to design guidance materials by 'making sense of good practice' – a how to best present information that makes sense to people and learn from a good practice example. Furthermore, audio-visual story-telling in the form of webcasts, recorded webinars and videos are a central feature of communicating information. Figure 6 shows a screenshot from the good practice repository.

The screenshot displays a detailed view of a data item in the SUMEX knowledge repository. On the left, a teal sidebar lists five categories: Health and safety, Land-use planning, Permitting processes / policy integration, Reporting official statistics, and Socio-economic and environmental impact assessments. The main content area is divided into three columns:

- Challenge the practice is addressing:** MIREU Tool 5.1 is a Community-Company Environmental Monitoring Plan (CCEMP). It is a negotiated agreement between local communities and the mining company operating in the area. The CCEMP is a sort of a roadmap for monitoring negative environmental impacts of a mining project and it should be created in close collaboration with the local community members and other stakeholders.
- Concrete practice to achieve the expected goal:** The tool is presented through three key points: 1) the company developing the CCEMP in collaboration with stakeholders should decide – first, how to collect and interpret data before and after a certain activity is conducted – and second, what are the actions to take when issues are reported and how the results from the monitoring process will be communicated, 2) creating a committee (consisting of various stakeholders) for environmental monitoring is encouraged and 3) follow-up measures to deal with potential negative environmental impacts should be defined and agreed.
- Expected impact/goal of the practice:** The expected impact of the CCEMP is that companies and local communities will establish functional means of collaboration in order to monitor environmental impacts together.
- Who is the target user group of the practice/intervention or implementing the practice/intervention?** The target group of the practice is companies.

On the right, a metadata table provides the following details:

YEAR	2021
HIPERLINK	View document
SOURCE	MIREU D4.4 SLO Toolbox, Tool 5.1: Community-Company Environmental Monitoring Plan, P.53-54
LEARNING RELEVANCE	Guidelines / guidance document Tool(kit)
LEARNING LIFE-CYCLE	Pre-exploitation / development stage (e.g. feasibility study)
COMMODITY	Unspecified (universally applicable)
PRACTICE TYPE	Industry
ECONOMIC	Accountability Shared vision partnerships Stakeholder engagement
FORMAT	Repository, resource libraries & toolkits
DATA ITEM TYPE	Practice base
SUMEX FOCUS AREA	Socio-economic and environmental impact assessments
SYSTEM CHANGE POTENTIAL	MIREU Tool 5.1 is a Community-Company Environmental Monitoring Plan (CCEMP)

Figure 6: SUMEX knowledge repository: Screenshot of a single data item view [27]

3.2 Digital learning and exchange actions

The second part of the Toolkit refers to a series of online exchange actions that target SUMEX stakeholders who would like to exchange and learn the compiled good practice information. This is implemented by an interactive training and peer-learning course in a Massive Open Online Course (MOOC) format hosted by a professional digital learning provider, Future Learn [28]. The first run of the course took place in November 2022, with another one planned for September 2023.

Against this background, stakeholders, central to the learning actions, will form a group (people and organisations) that will incentivise and facilitate forming a Community of Practice. They play a fundamental part in designing and implementing the SUMEX Toolkit repository and learning component. Figure 7 shows a screenshot of the MOOC [28].



Figure 7: SUMEX MOOC: Screenshot of the course overview [28]

4. Discussion and conclusion

The geographical and institutional focus of the SUMEX project is the European Union; hence the SUMEX Sustainability Framework focuses on aspects relevant to the extraction of mineral raw materials (excluding energy raw materials) within the EU. For extraction activities outside of the EU, other sustainability aspects

might also be relevant, e.g. poverty reduction. Also, aspects of intra-generational resource justice (“Global North vs. Global South”) regarding sourcing practices, due diligence and supply chain need to be considered. Only then could the framework be relevant for raw material producers outside the EU and raw material importers sourcing from outside the EU.

Deep sea mining, a topic which has emerged in recent years in Europe, is outside the scope of the SUMEX project. The illustrated sustainability framework focuses on terrestrial aspects - the extraction of land. Whilst, in theory, the framework could be utilised for deep sea mining, the application of its sustainability aspects would undoubtedly be very different. The current scientific and societal discourse indicates a lack of data and regulations for deep sea mining practices to be done sustainably. Some of the recently defined challenges are not well understood or ill-defined [29, 30, 31] and knowledge from terrestrial extraction is not necessarily transferrable to deep sea mining. It should therefore be governed as a distinct extractive industry type [32].

Given that the extraction of construction materials in Europe is dominated by small and medium sized companies (SMEs), concerns were raised on whether the SUMEX Sustainability Framework should also be applicable to SMEs specifically. The current layout is generic to the degree that it does not differentiate between different companies or size of operations. However, future capacity building, learning and awareness raising actions might more prominently support SMEs in their journey towards sustainable management.

The SUMEX sustainability approach sets out a roadmap for Europe's extractive industries, based on a multistakeholder process for its development. It goes beyond current responsible extraction and regulatory requirements to meet the holistic and inclusive concept of sustainable development up to 2050. This roadmap is guided by i) the current scientific debate on sustainability and ii) the current political debate in Europe, i.e. in relation to the European 'Green Deal' and the transition to an inclusive, green and circular economy. The sustainability aspects describe the issues and overarching goals that the sector should primarily consider in the context of the required change. In addition, the project maps already existing practices and how they perform against the framework and its evaluative criteria. The results are then integrated into digital and physical good practice exchanges and capacity building on sustainability topics in extractive industries.

It remains to be seen whether the sustainability approach developed in SUMEX can impact policy makers and the European extractive industry, especially the large number of small and medium-sized enterprises, to initiate the necessary transformative measures. The announcement of the ICMM (International Council on Mining and Metals) regarding the commitment of member companies to be CO₂ neutral by 2050 [33] indicates that industry leaders are indeed aware of the transformation needed.

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